Point Reyes National Seashore
North District of Golden Gate National Recreation Area

U.S. Department of the Interior
National Park Service

GENERAL MANAGEMENT PLAN AMENDMENT
FINAL ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 2020

NPS cost associated with developing this EIS: $1,472,000

US DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE
GENERAL MANAGEMENT PLAN AMENDMENT
ENVIRONMENTAL IMPACT STATEMENT

Lead Agency: National Park Service

This environmental impact statement (EIS) for a general management plan amendment (GMP Amendment) for Point Reyes National Seashore and the north district of Golden Gate National Recreation Area was prepared for the National Park Service (NPS) to update management guidance for more than 28,000 acres of national park system lands, including all lands currently leased for beef and dairy ranching. The purpose of the EIS is to establish guidance for the preservation of natural and cultural resources and the management of infrastructure and visitor use in the planning area. In this context, the EIS will address the future management of leased ranchlands and tule elk in the planning area.

This EIS presents six alternatives that address the preservation of natural and cultural resources, the management of infrastructure and visitor use, as well as the future management of lands currently leased for beef and dairy ranching and tule elk in the planning area. The EIS analyzes the beneficial and adverse impacts on the human environment (i.e., physical, natural, cultural, and socioeconomic resources) that would result from implementing any of the alternatives considered. NPS has identified alternative B as the preferred alternative in this EIS. Upon conclusion of the EIS and decision-making process, one of the alternatives, or a combination of alternative elements will be selected for implementation and will update guidance for preserving natural and cultural resources, managing infrastructure and visitor use, and, as appropriate, directing specific strategies for managing lease/permits and tule elk for lands in the planning area.

The Notice of Availability for the draft EIS was published in the *Federal Register* on August 8, 2019, for a 45-day public comment period. A summary of and responses to substantive comments received on the draft EIS are provided in appendix P of this final EIS. Where needed, text was changed in this EIS to address public comments. No sooner than 30 days after the US Environmental Protection Agency publishes the Notice of Availability of this final EIS in the *Federal Register*, the National Park Service Regional Director for Interior Regions 8, 9, 10 and 12 will sign the Record of Decision that will document the alternative selected for implementation.

For more information, visit http://parkplanning.nps.gov/POREGMPA or contact:

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EXECUTIVE SUMMARY

This environmental impact statement (EIS) for a general management plan amendment (GMP Amendment) for Point Reyes National Seashore (Point Reyes) and the north district of Golden Gate National Recreation Area (north district of Golden Gate) (collectively referred to as the park) presents six alternatives for establishing updated management guidance for more than 28,000 acres of National Park Service (NPS) lands that constitute the planning area for this GMP amendment, including all lands currently leased for beef and dairy ranching. These alternatives address the preservation of natural and cultural resources, the management of infrastructure and visitor use, as well as the future management of leased ranchlands and tule elk in the planning area. The EIS analyzes the beneficial and adverse impacts on the human environment (i.e., physical, natural, cultural, and socioeconomic resources) that would result from implementing any of the alternatives considered. Upon conclusion of the EIS and decision-making process, one of the alternatives, or a combination of alternative elements will be selected for implementation and will update guidance for preserving natural and cultural resources, managing infrastructure and visitor use, and, as appropriate, directing specific strategies for managing lease/permits and tule elk for lands in the planning area.

BACKGROUND AND ISSUES RELATED TO THE PROJECT

Congress passed legislation authorizing the establishment of Point Reyes National Seashore in 1962 and Golden Gate National Recreation Area in 1972. Much of the land in the planning area was privately owned at the time. The enabling legislation for both park units therefore allowed NPS to acquire lands in the planning area, many of which were active ranches, from willing sellers. As lands were purchased, ranchers could continue beef or dairy operations under either a Reservation of Use and Occupancy (RUO) or a lease. In 1978, Congress amended the enabling legislation for both Point Reyes and Golden Gate by adding specific leasing authority for agricultural lands (16 United States Code [U.S.C.] §§ 459c-5(a) and (b) and 460bb-2(j)). These amendments allow NPS to lease agricultural lands subject to any restrictive covenants deemed necessary and directed NPS to first offer such leases to the person who owned or leased the land prior to its acquisition by the United States. NPS uses these statutory authorities to issue agricultural lease/special use permits (lease/permits) for multi-generational ranching and dairying operations when a rancher's reserved right expires.

In 1980, NPS issued a combined general management plan for Point Reyes and Golden Gate that established management objectives, land management zones, and additional program guidance and direction. Within the land management zoning framework, the 1980 combined General Management Plan for Point Reyes and Golden Gate (1980 GMP) included the Special Use-Pastoral Lands subzone (Point Reyes) and the Pastoral Landscape Management zone (Golden Gate). In 2014, NPS completed an updated GMP for Golden Gate National Recreation Area and Muir Woods National Monument. However, most of that plan did not address management of the north district of Golden Gate that is included in this planning area and had previously been addressed in the 1980 GMP.

In total, 24 families hold lease/permits or RUOs on approximately 18,000 acres of Point Reyes and 10,000 acres of the north district of Golden Gate. Approximately 2,400 animal units (AU) of livestock for beef ranching and 3,325 dairy animals are currently authorized under existing lease/permits. Eighteen lease/permits include residential uses specific to on-site ranch operations. Most active beef and dairy cattle operations occur in the Point Reyes Peninsula Dairy Ranches Historic District and the Olema Valley Dairy Ranches Historic District, which are both listed in the National Register of Historic Places (National Register). The Point Reyes Peninsula Dairy Ranches Historic District consists of 17 tenant-operated dairy ranches established by the Shafter and Howard families beginning in 1857. The Olema Valley Dairy Ranches Historic District includes 19 properties operated by tenants or families beginning in 1856. Together, these districts reflect more than a century of change and modernization in the industry, including the evolution from the original wood frame milking barns to the concrete Grade A sanitary barns of the 1940s.

Two separate free-ranging tule elk herds occur in the planning area—the Drakes Beach herd and the Limantour herd. Tule elk, the smallest subspecies of North American elk, live only in California. Tule elk were extirpated from Point Reyes by the 1860s. Consistent with Congressional direction, 10 tule elk were successfully reintroduced to a 2,600-acre fenced wilderness reserve on Tomales Point in 1978. The 1998 Tule Elk Management Plan/Environmental Assessment (1998 EA) established a free-ranging herd near Limantour Beach beginning with 28 animals in 1999 with an interim management limit of 250 to 350 elk and did not contemplate the expansion of tule elk into the ranchlands. At the end of 2019, the Drakes Beach herd consisted of an estimated 138 animals and the Limantour herd consisted of at least 163 animals (NPS, Press, pers. comm. 2020d).

As a result of litigation and a multi-party Settlement Agreement, NPS agreed to prepare this GMP Amendment and EIS addressing the management of the lands currently leased for ranching in the park. The Settlement Agreement requires NPS to evaluate three alternatives in the EIS—no ranching, no dairy ranching, and reduced ranching. The Settlement Agreement preserves NPS's ability to give full consideration to other potential action alternatives. It also allows NPS to consider agricultural diversification, increased operational flexibility, promotion of sustainable operational practices, succession planning, and similar ranch management practices as part of any action alternative except the no ranching alternative.

PURPOSE AND NEED FOR TAKING ACTION

The purpose of the EIS is to establish guidance for the preservation of natural and cultural resources and the management of infrastructure and visitor use in the planning area. In this context, the EIS addresses the future management of tule elk and leased ranchlands in the planning area. Action is needed at this time to address the management of approximately 28,000 acres of land currently leased for ranching, which is the park's highest priority planning issue. Action is also needed to comply with the terms of the Settlement Agreement approved by the US District Court for the Northern District of California on July 14, 2017, under which NPS agreed to prepare a GMP Amendment addressing the management of lands currently leased for ranching.

DECISIONS TO BE MADE IN THE ENVIRONMENTAL IMPACT STATEMENT

This EIS includes both programmatic and site-specific analyses given the broad range of planning and environmental issues that must be considered as the result of the Settlement Agreement. Decisions regarding the desired conditions and strategies for the preservation of resources and the development of additional visitor amenities, such as trails, day use and overnight accommodations, shuttles, and parking are programmatic in nature. Decisions about management zones illustrate programmatic differences in the management of the planning area from the rest of the park.

The programmatic analysis in this EIS broadly addresses the general environmental issues, impacts, and benefits to establish overall management direction for the planning area. Implementation of some programmatic direction, such as future development to facilitate public use and enjoyment, would require additional project-level planning and compliance to develop and analyze site-specific proposals and cost estimates. Compliance for these projects would tier from the programmatic analysis in this EIS and be consistent with the general direction provided in this EIS.

Actions and strategies that are analyzed in detail in this EIS include elk management options and certain ranch activities such as maintenance of ranch infrastructure, vegetation management, and some diversification activities. Such actions would not need additional compliance and may, in the case of NPS actions, be implemented when the EIS process concludes or, in the case of rancher actions, be implemented when included in a ranch operating agreement (ROA).

RANGE OF ALTERNATIVES

The alternatives considered in this EIS include a no action alternative required by the National Environmental Policy Act (NEPA) and five action alternatives. Three of the action alternatives are required by the Settlement Agreement and two additional alternatives were developed through the public scoping process. The five action alternatives under consideration (alternatives B through F) include programmatic guidance that fulfills the statutory requirements for GMPs and more detailed guidance for future management of elk and leased ranchlands in the planning area. The programmatic guidance in the action alternatives establishes future direction for the preservation of natural and cultural resources, the management of infrastructure for public use and enjoyment, and the establishment of visitor capacity in the planning area. Adopting the programmatic guidance in any of the action alternatives would amend the 1980 GMP by establishing new direction for the planning area.

Alternative A – No Action

Alternative A is the no action alternative required by NEPA and assumes continuation of current management for the planning area. Under alternative A, NPS would continue to follow previous plans and established practices in the planning area. Additionally, NPS would continue to apply the management zoning framework outlined in the 1980 GMP, except as noted below, and would implement current management actions and policies related to ranching activities.

Approximately 17,100 acres of land in Point Reyes would remain in the Special Use-Pastoral Lands zone that identified ranching as a compatible use. Approximately 4,100 acres in the north district of Golden Gate would remain in the Pastoral Landscape Management zone that similarly identified ranching as a compatible use. Approximately 7,600 acres of land in the planning area would retain a zoning classification that is inconsistent with its existing land use. Of these 7,600 acres, the 1980 GMP zoned 2,350 acres of Point Reyes as Natural Environment, Special Use, and Deferred Acquisition zones and 5,250 acres in Golden Gate as part of the Natural Landscape Management zone. While ranching was not identified as a compatible use in those zones, it has been conducted consistently on these 7,600 acres since acquisition by NPS. The inconsistency between the 1980 land management zones and current operations would continue under alternative A.

Under alternative A, NPS would issue new lease/permits to the existing ranch families to continue beef and dairy operations on approximately 27,000 acres with terms of 5 or 10 years. Provisions would be updated to reflect current operations, regulatory requirements, and changes in NPS management. Figure 6 in appendix A displays a map of continued ranching under alternative A. In the planning area, approximately 800 acres have been fenced to exclude cattle from sensitive resources. These exclusion areas are not reflected in the text of current authorizations but would be incorporated into new lease/permits. Additionally, 600 acres in the planning area, including the primary range of the Drakes Beach herd, would remain outside any ranch lease/permit. Appraisals would continue to be conducted to determine current fair market value for each operation.

Under alternative A, actions to reduce the impacts of elk presence on ranches would continue to include hazing, habitat enhancements, and fence repairs. In addition, NPS would undertake a planning process to determine an appropriate population level and methods for managing the free-ranging elk in Point Reyes, in line with the 1998 EA. Although the 1998 EA did not anticipate the presence of elk on ranchlands, it did identify the need to develop long-term management thresholds for the population. Due to the changed conditions since the 1998 EA was completed (e.g., the sustained presence of elk on ranchlands), threshold development and subsequent population management would occur through the initiation of a new planning process that still allows for free-ranging elk in Point Reyes. NPS would recapture and move or lethally remove any elk that leave Point Reyes for Golden Gate lands or non-federal lands, in collaboration with the California Department of Fish and Wildlife.

Alternative B – NPS Preferred Alternative

Alternative B was the proposed action put forth during public scoping and is the preferred alternative. Under alternative B, NPS would amend the 1980 GMP by adopting a new zoning framework and new programmatic management direction for the planning area. NPS would allow for continued multi-generational ranching with terms of up to 20 years and would set a population threshold for the management of the Drakes Beach herd.

Under alternative B, NPS would apply two new management zones, the Ranchland zone and the Scenic Landscape zone, to the planning area. This new zoning would amend the 1980 GMP by replacing the Special Use-Pastoral Lands and Pastoral Landscape Management zones in the planning area with these zones.

Under alternative B, approximately 7,600 acres of land under lease/permit (i.e., 2,350 acres in Point Reyes and 5,250 acres in the north district of Golden Gate) would be included in the Ranchland zone. These lands were not included in the Special Use-Pastoral Lands and Pastoral Landscape Management zones in the 1980 GMP. Ranching activities would only be permitted in the Ranchland zone and would be managed through additional subzoning (Resource Protection, Range, Pasture, and Ranch Core subzones). In total, 28,100 acres would be allocated to the Ranchland zone under alternative B; however, not all 28,100 acres would be under lease/permit. The Scenic Landscape zone would apply to 600 acres in the planning area but not part of any existing ranch lease/permit, including the primary range of the Drakes Beach herd. These lands had been zoned as part of the Pastoral Lands zone in the 1980 GMP.

New opportunities and improvements to facilitate public use and enjoyment in the planning area would be implemented in both the Ranchland and Scenic Landscape zones. NPS would also establish a new framework for managing visitor capacity that establishes indicators and thresholds for the planning area. Both zones would be managed to support the desired conditions for the planning area defined in chapter 1 of this EIS.

NPS would implement a subzoning framework within the Ranchland zone that would maintain ranching and protect park resources. Each subzone would authorize specific activities based on resource management goals and objectives. NPS would issue lease/permits with up to 20-year terms to the existing ranch families to continue beef and dairy operations on approximately 26,100 acres. NPS estimates authorizations would be similar to existing lease/permits, with approximately 2,400 AU of beef cattle and 3,115 dairy animals authorized under alternative B. Each lease would include an ROA that would identify ranch-specific operational details and requirements associated with (1) beef or dairy ranching (as applicable); (2) authorized diversification activities; and (3) maintenance requirements. Proposals for diversification would only be considered if they incorporate the US Department of Agriculture, Natural Resources Conservation Service Conservation Practice Standards (Practice Standards) and mitigation measures for a defined set of Management Activities identified in tables F-11 through F-13 of appendix F of this EIS. NPS would continue to work closely with local agricultural organizations, state agencies, natural resource conservation experts, and stakeholder groups to share information and discuss issues related to ranching.

Most of the ranch complexes are components of the historic districts and contain contributing buildings and other characteristic features that NPS strives to preserve whenever possible. NPS would preserve the ranch complexes in the planning area collaboratively with complex occupants, the Point Reyes Historic Preservation Crew, and other NPS programs. Adaptive use of complexes and buildings would be used as a maintenance strategy if the complexes and buildings are not being used to support ranch operations.

NPS would actively manage the Drakes Beach herd. Based on estimated forage consumption by elk, forage productivity on ranches, and time that elk spend on ranches, as well as NPS's capacity to manage elk, NPS has set a population threshold of 120 adult elk for this alternative. NPS would manage to the population threshold using lethal removal methods. Elk from the Limantour herd would be monitored closely and managed consistent with desired conditions for the planning area. No new elk herds would be allowed to establish in the planning area.

Alternative C

Alternative C would amend the 1980 GMP by adopting the same programmatic guidance and Ranchland and Scenic Landscape zones as presented in alternative B. Ranching operations, including measures to protect resources and opportunities for diversification, would be authorized in the same manner as described for alternative B. The Drakes Beach tule elk herd would be removed.

Application of the Ranchland zone would be the same as alternative B. NPS would issue lease/permits with up to 20-year terms to the existing ranch families to continue beef and dairy operations on 26,100 acres and would implement the subzoning framework described for alternative B. Ranch management and strategies for the management of historic structures and adaptive use of vacant structures would be the same as those described for alternative B. Authorizations for AU would be the same as alternative B.

Under alternative C, NPS would remove the Drakes Beach tule elk herd, totaling approximately 138 individual elk, using agency-managed, contractor-led lethal removal methods. Elk from the Limantour herd would be monitored closely and managed consistent with desired conditions for the planning area. No new elk herds would be allowed to establish in the planning area.

Alternative D

Like alternative B, under alternative D, NPS would adopt new programmatic guidance and a zoning framework that would amend the 1980 GMP. Under alternative D, ranching would be reduced by phasing out grazing-only leases and ranches that have minimal infrastructure over a one-year period. Grazing operations in areas that are outside the two historic districts would also be removed. NPS would authorize the continuation of beef and dairy cattle ranching operations under 20-year lease/permits for the remaining ranches, as described for alternative B. Under alternative D, elk in the planning area would be managed as described for alternative B.

Under alternative D, ranching operations would be phased out over a one-year period on approximately 7,500 acres, leaving 19,000 acres in active ranching. Application of the Ranchland zone and associated subzones would be the same as alternative B on active ranches. The two remaining life estates are part of the approximately 7,500 acres, and after the life estate expires, ranching would be discontinued consistent with the Reservation of Use and Occupancy. For the remaining 19,000 acres in the planning area, NPS would authorize the continuation of beef and dairy cattle ranching operations under the agricultural lease/permit requirements as described for alternative B. The approximately 7,500 acres removed from ranching would be incorporated into the Scenic Landscape zone.

For areas where ranching continues, AU would be authorized consistent with those described in alternative B. With the removal of approximately 7,500 acres of ranching, beef cattle AU authorizations would be reduced by approximately 700 AU. The number of authorized dairy animals would be the same as alternative B. For areas remaining in ranching, NPS would authorize the operations with lease/permits under a subzoning framework like the one described for alternative B.

Alternative E

Like alternative B, under alternative E, NPS would adopt new programmatic guidance and a zoning framework that would amend the 1980 GMP. Under alternative E, the six active dairy ranches would be phased out over a period of up to five years, and ranchers would be eligible to convert dairy operations to beef cattle grazing. NPS would take no action to limit the population growth or geographic extent of free-ranging elk in Point Reyes.

Application of the Ranchland and Scenic Landscape zones would be the same as alternative B. Like alternative B, 26,100 acres would be available for ranching. For areas remaining in beef cattle ranching, NPS would authorize the operations with lease/permits under a subzoning framework like the one described for alternative B. Adaptive use of historic buildings on dairy ranches would be considered to support a change in operational activities to either beef ranching or as an inactive ranch.

AU would be authorized based on the current conditions, as described for alternative B. If all dairy operations converted to beef, approximately 3,115 dairy animals would be removed from the ranched lands, and based on current conditions, initially up to 750 AU of beef cattle would be authorized on these former dairies. Under alternative E, up to 3,150 AU of livestock would be authorized in the Ranchland zone. If an existing dairy rancher did not want to convert to beef ranching, NPS would follow the Succession Policy to determine future use of the ranch and may consider potential conversion of some or all the land to the Scenic Landscape zone.

NPS management of elk would occur only to support other resource protection needs and management goals. New herds would be allowed to continue, regardless of geographic location if they do not move outside Point Reyes. Authorized AU for each ranch would be adjusted as needed to meet residual dry matter (RDM) goals.

Alternative F

Under alternative F, ranching operations would be discontinued, and visitor opportunities would be expanded. The free-ranging elk populations could expand across the planning area. Under alternative F, NPS would adopt new programmatic guidance that would amend the 1980 GMP. NPS would apply the Scenic Landscape zone to the entire planning area, which would replace the zones from the 1980 GMP. This 28,700-acre zone would be managed to support the desired conditions for the planning area defined in chapter 1.

Under alternative F, the maintenance and adaptive use of the developed ranch cores would be prioritized based on the condition and integrity of the existing infrastructure. NPS would use Targeted Grazing on lands in the planning area to meet resource management goals and objectives (e.g., maintenance of disturbance regimes in grasslands).

Under alternative F, there could be additional opportunities for use of some of the vacant ranch complexes to support a higher level of visitation such as a car-camping campground, larger trailhead, and other visitor facilities. Under alternative F, with the removal of ranching operations, NPS would have additional buildings to consider using for park maintenance operations as well as additional structures that could be considered for removal if no appropriate use could be found. Once ranching has been removed, additional implementation planning for visitor use that comprehensively addresses and evaluates trail-based recreation, day use, and overnight opportunities in the park could be needed to reconsider the distribution of visitor opportunities.

Under alternative F, NPS would not limit the population growth or geographic extent of free-ranging elk in Point Reyes. NPS management of elk would occur only to support other resource protection needs and management goals. Until cessation of ranching operations, NPS would consider limited, non-lethal management measures for elk. Once ranching operations cease, development of new herds in Point Reyes would be allowed to establish. Following the cessation of ranching operations, the elk fence at Tomales Point would be removed, consistent with the removal of other boundary fences in the planning area.

ENVIRONMENTAL CONSEQUENCES

This EIS evaluates the impacts on the human environment (i.e., physical, natural, cultural, and socioeconomic resources) that could result from the alternatives under consideration. The analysis used methods and assumptions that follow Council on Environmental Quality and the US Department of the Interior regulations and guidance found in the 2015 NPS National Environmental Policy Act Handbook. The following section provides a general summary of the potential impacts of the alternatives under consideration in this EIS. Detailed analysis is provided in "Chapter 4: Environmental Consequences."

Soils

Under alternatives A, B, C, and D, activities associated with beef and dairy ranching would continue to affect soils because of erosion, compaction, and alteration of soil fertility, primarily from livestock grazing, Forage Production, high-intensity-use areas, and manure spreading. Under alternatives B, C, D, and E, impacts on soils would be reduced compared to existing conditions by establishing formal Practice Standards and mitigation measures for a defined set of Management Activities, and implementing a zoning framework that would ensure more intense land uses occur in areas without sensitive resources, such as soils with high erosion potential, throughout the planning area. Under alternative E, noticeable beneficial impacts would occur compared to existing conditions from the conversion of the six dairy ranches to beef operations, elimination of Manure and Nutrient Management practices, seeding, and Forage Production. Under alternative F, cessation of ranching would eliminate all impacts on soils associated with ranching activities. Impacts from public use and enjoyment and elk management under all the alternatives would be minimal in intensity and limited in scale.

Water Resources

Under alternatives A, B, C, and D, activities associated with beef and dairy cattle ranching would continue to affect watersheds in the planning area, primarily as a result of livestock grazing, and dairy operations (where livestock congregate in high-intensity-use areas and Manure and Nutrient Management). The implementation of a zoning framework under alternatives B, C, D, and E, and specifically the Resource Protection and Range subzones would reduce impacts on water resources compared to existing conditions by only authorizing limited Management Activities, including Targeted Grazing, to meet NPS resource management goals and objectives. More intensive ranching activities, including Manure and Nutrient Management, Forage Production and diversification activities would be authorized in the Pasture and Ranch Core subzones that contain previously disturbed lands and little to no water resources. Through application of the zoning framework and the implementation of Practice Standards and mitigation measures for a defined set of Management Activities, water quality is expected to improve compared to existing conditions. The removal of dairy operations under alternative E would eliminate adverse impacts on surface water quality associated with Manure and Nutrient Management, Forage Production and diversification in the Pasture and Ranch Core subzones. Alternatives D, E, and F would also have beneficial impacts on water quantity from the reduction or elimination of authorized livestock numbers. Under alternative F, impacts on water quality would be noticeable, long term, and beneficial because ranching activities would be phased out across the entire planning area. Under all alternatives, public use and enjoyment and elk management actions could have short-term, adverse impacts on water quality in localized areas in the planning area.

Vegetation, Including Federally Listed Species

Under alternatives A, B, C, D, and E, activities associated with ranching would have adverse impacts on some plant species and beneficial impacts on others. Grasslands make up approximately 60% of the planning area. Grazing would continue a disturbance regime that maintains vegetation structure, species composition, and biomass production. Overall, the general condition of vegetation would remain consistent with existing conditions. The implementation of a zoning framework under alternatives B, C, D, and E, would result in beneficial impacts compared to existing conditions for riparian vegetation and

other sensitive species, through the Resource Protection subzone, and maintenance of grassland habitat including areas that support rare plant species within the Range subzone. More intensive activities, such as diversification and Forage Production would occur in Pasture and the Ranch Core subzones, where there are very few to no sensitive vegetation species or habitat. Under alternatives D and F, vegetation composition would likely change in areas where ranching is removed. In these areas, while the cessation of grazing would eliminate adverse impacts such as high-intensity-use areas, it may also result in an increase in invasive annual and perennial species such as thistles and grasses; a likely decrease in native forb species abundance and richness; shrub encroachment into grasslands; and an increase in vegetative fuels. Eliminating livestock grazing could also adversely affect several federally listed plants that occur in grassland habitats because grazing is the most effective tool for promoting their persistence with respect to competition with other non-native grassland species. On the other hand, impacts on other federally listed plants that occur in certain habitat, such as dune or serpentine habitat, may be beneficial because the potential for cattle to trample individual plants would be reduced. Alternatives E and F would eliminate impacts of Forage Production, manure spreading, and diversification and would reduce high-intensity-use areas compared to existing conditions. Under all action alternatives, actions related to public use and enjoyment would result in minimal disturbance to vegetation but could increase the potential for the introduction and spread of invasive species. Elk management actions under alternatives B, C, and D could result in limited localized impacts because of trampling.

Wildlife, Including Federally Listed Species

Under alternative A, impacts from disturbance associated with ranching activities and altered habitat conditions would be adverse while impacts related to maintaining key habitats such as grasslands and stock ponds would continue to be beneficial. The implementation of a zoning framework under alternatives B, C, and D would limit impacts on wildlife from authorized activities such as diversification and remove grazing from sensitive resources such as riparian areas, surface waters, and federally listed wildlife species habitat. Impacts on wildlife would also continue to be avoided, minimized, or mitigated through the implementation of mitigation measures for authorized activities on ranches. Impacts on wildlife would remain beneficial or adverse, depending on the species. Where cessation of grazing occurs on lands under alternatives D and F, impacts on wildlife related to beef and dairy ranching would cease, including disturbance, trampling, erosion, and nutrient inputs. Ecological succession would occur as grassland habitats transition into shrubland or forested habitats, which would increase habitat for some wildlife but decrease it for others. Alternatives E and F would eliminate impacts of Forage Production, manure spreading, and diversification and would reduce high-intensity-use areas compared to existing conditions. Public use and enjoyment actions under all the action alternatives would generally result in temporary impacts from disturbance and displacement; however, impacts would be limited because development and trails would use existing routes or already disturbed areas.

Tule Elk

Alternatives A, B, D, and E would continue to have beneficial impacts on the elk herd from habitat modifications and adverse impacts from fencing and hazing, consistent with existing conditions. Alternative B would maintain the free-ranging elk herds, while limiting the size of the Drakes Beach herd to 120 individuals through lethal removal. Under alternative C, NPS would lethally remove the Drakes Beach herd, totaling approximately 138 individual elk. Lethally removing the Drakes Beach herd would result in an approximately 45% reduction of free-ranging elk in the planning area and a 2% reduction in the estimated California state-wide elk population compared to existing conditions and would eliminate one of two free-ranging tule elk herds in the national park system. Impacts on the Drakes Beach herd would be significant because it would no longer exist. Overall viability of the tule elk population in Point Reyes or in California would not be affected; however, removal rather than management of an entire elk herd would be unprecedented in the national park system and would be inconsistent with state management of elk on ranchlands outside the park. Under alternative D, population level management of the Drakes Beach herd would continue, though cessation of ranching on approximately 7,500 acres would

have beneficial impacts on elk by removing existing fencing, reducing hazing, and providing additional grazing opportunities compared to existing conditions. Alternative E would reduce impacts from hazing. Alternative F would eliminate impacts on elk related to hazing and fencing and would allow for the free-ranging population to expand across the planning area. Under both alternatives E and F, given the absence of predators and the need to keep elk within Point Reyes, population management would be needed at some point in the future, likely beyond 20 years.

Visitor Use, Experience, and Access

Alternative A would contribute noticeable impacts, either adverse or beneficial, depending on the opportunities that visitors are seeking in the planning area. Alternatives B, C, D, and E would contribute noticeable beneficial impacts by providing a wider range of recreational and educational opportunities in the planning area. Adverse impacts on visitor use and experience could occur as a result of the removal of the Drakes Beach herd in alternative C, and impacts from possible closures during elk management activities in alternatives B, D, and E would be temporary and localized. Alternatives D and E would have some beneficial impacts related to experiencing natural sights and sounds by reducing ranching and closing dairy operations, respectively. However, discontinuing dairy operations in alternative E would result in an adverse impact by removing the opportunity for visitors to observe and experience active dairy ranching in a historic district but would reduce the noise and odors associated with dairy operations. Under alternative F, removing ranching operations would eliminate a unique experience for visitors to experience the role of ranching in California and in the historic districts, resulting in an adverse effect for visitors seeking those opportunities. However, other visitor opportunities related to experiencing natural sights and sounds would be expanded, and there could be additional recreational trail linkages and public opportunities through the adaptive use of ranch complexes no longer used for active ranching, resulting in beneficial impacts for visitors seeking these experiences. Similarly, the potential expansion of the elk population under alternative F would result in long-term, beneficial impacts for visitor use and experience related to observing elk in their native habitat.

Cultural Landscapes, Historic Districts, and Historic Structures

Under alternatives A, B, C, D, and E, continued ranching would be the primary approach to maintain the Point Reyes Peninsula Dairy Ranches Historic District and Olema Valley Dairy Ranches Historic District cultural landscapes including ongoing grazing and occupied ranch structures (the preferred preservation method). Under alternative A, impacts on historic buildings may also be adverse, depending on the level of funding available for deferred maintenance. Alternatives B, C, D, and E would provide revised and clarified cyclic maintenance tasks that are the responsibility of each rancher and better coordination with the park to identify and treat priority needs, thereby reducing deferred maintenance. A formal process for addressing vacant structures, continued occupation of active ranches, and management of the pastoral landscape would also be developed. While alternative E would maintain the pastoral landscape across all 24 ranches, it is anticipated that some dairy infrastructure may become vacant on the six dairies, resulting in potentially adverse impacts on historic structures. Because cattle AU would be adjusted for each ranch to ensure RDM goals are met, the potential expansion of the elk herds over time could result in a noticeable reduction in authorized AU at individual operations, and some ranches may close under this alternative if authorized AU are dramatically reduced. If ranches close, the number of vacant structures would increase. Under alternatives A, B, C, and E, continued cattle grazing of pastures would maintain the existing condition of the low grasslands of the antenna fields at the Marconi/RCA Bolinas Transmitting Station and RCA Point Reyes Receiving Station Historic Districts. Under alternative D, once the life estates expire, grazing would be discontinued on the antenna fields in the Marconi/RCA Bolinas Transmitting Station Historic District causing long-term, adverse impacts on the setting and feeling of the historic district; however, mowing could maintain the low grassland. Under alternative F, no commercial agricultural activities would be permitted in the planning area. Adaptive use is proposed for as many historic structures as feasible; prioritizing ranches that contain the representative buildings and structures typical of the historic ranches. Low-priority structures may deteriorate or be demolished if

in poor condition, potentially resulting in long-term, adverse impacts on those properties and the National Register districts to which they contribute. Loss of grassland habitats that are contributing features of the cultural landscape could cause them to lose the integrity necessary to retain eligibility for listing in the National Register, likely resulting in significant, adverse impacts.

Socioeconomics

Alternatives A, B, C, D, and E would continue to contribute to regional employment and gross regional product in Marin and Sonoma Counties from continued support of employment, incomes, sales, and taxes by ranchers, park spending and projects, and visitation to the park. Ranching under alternatives A, B, and C contributes 0.03% of total regional employment and 0.01% of gross regional product in the study area. Under alternative D, cessation of ranching on approximately 7,500 acres would result in the loss of $500,000 in beef cattle sales and the corresponding loss of 19.5 jobs in the study area. Under alternative E, conversion from dairy to beef operations would result in the loss of $14.1 million in annual revenue and 27 jobs at ranches in the planning area. The cessation of ranching under alternative F would contribute to the loss of approximately $16 million in annual revenue, which constitutes 0.01% of the study area's gross regional product. In addition, 63 direct jobs at ranches in the planning area would be lost, representing less than 0.01% of regional employment. Under all alternatives, visitation levels are not expected to change compared to existing conditions. Therefore, no change to jobs, income, sales, and taxes in the study area are anticipated in the short or long term related to public use and enjoyment.

Air Quality

Under alternatives A, B, C, and D, activities associated with ranching would continue to emit criteria pollutants and greenhouse gases associated with cattle grazing, manure management on dairies, fugitive dust, and mobile source emissions. Implementation of Practice Standards and mitigation measures for defined Management Activities would likely reduce emissions compared to existing conditions. Dairy operations are the primary contributors for ammonia (NH_3), volatile organic compounds (VOCs), and carbon dioxide equivalent (CO_2e) emissions in the park, while beef cattle are the primary contributors to fugitive dust and particulate matter of 2.5 micrometers in diameter or less ($PM_{2.5}$) emission rates. Alternatives B and C would contribute similar levels of pollutant emissions as alternative A. Under alternative D, the reduction in the number of beef cattle would reduce emissions of VOCs and $PM_{2.5}$ by 7 to 10% relative to existing conditions. Under alternative E, the elimination of dairy cattle would result in a reduction of NH_3 (98%), VOCs (57%), $PM_{2.5}$ (43%), and CO_2e (66%) emissions relative to existing conditions. Alternative F would phase out ranching, ending ranching-related emissions of criteria pollutants. Under all alternatives, mobile source emissions would be similar to existing conditions because a change in visitor use levels is not anticipated. While emissions of criteria pollutants and greenhouse gases would vary among the alternatives, these emissions would continue to be a small contributor to overall impacts when compared to emission sources and transport of emissions from outside the planning area.

NEXT STEPS

No sooner than 30 days after the US Environmental Protection Agency publishes the Notice of Availability of this final EIS in the *Federal Register,* the National Park Service Regional Director for Interior Regions 8, 9, 10, and 12 will sign the Record of Decision that will document the alternative selected for implementation.

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CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

This environmental impact statement (EIS) for a general management plan amendment (GMP Amendment) for Point Reyes National Seashore (Point Reyes) and the north district of Golden Gate National Recreation Area (north district of Golden Gate) (collectively referred to as the park) will amend the 1980 combined General Management Plan for Point Reyes and Golden Gate (1980 GMP). It analyzes the impacts that could result from implementing updated management guidance on the more than 28,000 acres of national park system lands that constitute the planning area for this GMP Amendment (see figure 1 in appendix A).

This chapter describes the reasons the National Park Service (NPS) is proposing to take action at this time. The planning area for the GMP Amendment includes all lands currently leased for ranching in the park as well as adjacent lands in Point Reyes where the Drakes Beach tule elk herd currently occurs. Resources outside the planning area may be described if any of the proposed alternatives could potentially affect them.

PURPOSE OF TAKING ACTION

The purpose of the EIS is to establish guidance for the preservation of natural and cultural resources and the management of infrastructure and visitor use in the planning area. In this context, the EIS addresses the future management of tule elk and leased ranchlands in the planning area.

NEED FOR ACTION

Action is needed at this time to address the management of approximately 28,000 acres of land currently leased for ranching, which is the park's highest priority planning issue. Action is also needed to comply with the terms of the Settlement Agreement approved by the US District Court for the Northern District of California on July 14, 2017, under which NPS agreed to prepare a GMP Amendment addressing the management of lands currently leased for ranching.

PARK BACKGROUND

Point Reyes is located in western Marin County in northern California, approximately 30 miles northwest of San Francisco, and within 50 miles of the nine-county San Francisco Bay area, the fifth largest metropolitan area in the United States. Point Reyes encompasses more than 71,000 acres of beaches, coastal cliffs and headlands, marine terraces, coastal uplands, and forests, and includes all tide and submerged lands to 0.25 mile offshore. Western Marin County is primarily rural with scattered, small, unincorporated towns that serve tourism, agriculture, and residents. In addition, Point Reyes administers a portion of the north district of Golden Gate, which is adjacent to Point Reyes, for a combined management area and legislated boundary of more than 86,000 acres.

Point Reyes is bounded to the north, west, and southwest by the Pacific Ocean and to the east by Tomales Bay and the residential communities of Inverness, Inverness Park, Point Reyes Station, Olema, and Dogtown. The town of Bolinas is located south of Point Reyes at the southern tip of the peninsula.

Park Purpose

The general management planning process typically begins with the development of a foundation statement or document that provides basic guidance for planning and management decisions. A foundation document is based on a park's enabling legislation, and core components include a park's purpose, significance, fundamental resources and values, and primary interpretive themes.

Consistent with NPS *Management Policies 2006*, NPS prepared a stand-alone foundation document for Point Reyes that addresses the entire Point Reyes National Seashore. Because the foundation document includes lands outside the planning area for this GMP Amendment, it was developed as a separate but parallel effort. The foundation document was updated based on comments submitted during the public engagement period and is available on the Point Reyes website. The foundation document for Golden Gate was initially developed as part of the Golden Gate GMP process, which was completed in 2014. A stand-alone foundation document for Golden Gate was subsequently published in 2017 and is available on the Golden Gate website.

The foundation document's purpose statement identifies the specific reason(s) why Point Reyes was established and lays the foundation for understanding what is most important about Point Reyes. The purpose statement for Point Reyes is as follows (NPS 2020a):

Established for public benefit and inspiration, the Point Reyes National Seashore preserves a rugged and wild coastal peninsula and surrounding waters, connecting native ecosystems, enduring human history and interpretive, scientific, and educational opportunities.

The foundation document also identified a wide range of fundamental resource values for Point Reyes. Examples include scenic coastal landscapes; diverse habitats for native species, a continuum of more than 5,000 years of human use history ranging from American Indian sites to the two ranching-related historic districts, and many opportunities for inspiration and recreation.

The foundation document's purpose statement for Golden Gate is (NPS 2014a):

The purpose of Golden Gate National Recreation Area is to offer national park experiences to all, including a large and diverse urban population, while preserving and interpreting the outstanding natural, historic, scenic, and recreational values of the park lands.

Like the foundation document for Point Reyes, the Golden Gate foundation document identified fundamental resource values. Examples include a rich assemblage of coastal ecosystems and water resources that support those ecosystems, threatened and endangered species, and park access that provides visitors with a broad range of activities and varied experiences.

DESIRED CONDITIONS

A GMP articulates desired conditions for natural and cultural resource conditions and visitor experiences to be achieved and maintained over time, consistent with NPS *Management Policies 2006*. Desired conditions provide the broadest level of programmatic direction for management and help fulfill the statutory requirements of GMPs. The desired conditions presented below are based on service-wide laws and policies that guide management of the national park system as well as the park's enabling legislation. A list of relevant laws, regulations, and policies that guide development of desired conditions can be found at www.nps.gov/policy.

The desired conditions to be adopted for the planning area are organized around five key areas: preservation of ecological function; preservation of native species, including threatened and endangered species; management of invasive/non-native species; preservation of cultural resources; and public use and enjoyment/visitor experience.

Desired conditions for preservation of ecological function:

- Ecological function, connectivity, and processes persist and thrive in communities, including wetland, grassland, forest, scrub, and dunes.
- Sources of air, water, noise, and light pollution are limited.

Desired conditions for preservation of native species, including threatened and endangered species:

- Habitats and populations of threatened and endangered species, special-status, and rare species persist and are improved.

- Native plant and animal communities persist and thrive.

Desired conditions for management of invasive, non-native species:

- Populations and extent of invasive, non-native species are limited such that they do not, or only minimally, affect ecosystem processes and/or functions.

Desired conditions for preservation of cultural resources:

- National Register of Historic Places (National Register) properties listed or eligible for listing, including contributing buildings, structures, and sites are preserved in a manner that maintains their integrity.
- Historic and prehistoric archeological sites and ethnographic resources are preserved and maintained.

Desired conditions for public use and enjoyment/visitor experience:

- Visitors have opportunities for diverse educational and learning experiences.
- Visitors have opportunities to enjoy expanded connections and greater access to diverse recreation including, but not limited to, hiking and wildlife viewing.

Once an alternative is selected for implementation, NPS would amend the 1980 GMP and replace the management objectives with the above desired conditions for the planning area. The desired conditions would apply to both the lands within Point Reyes and the north district of Golden Gate that are included in the planning area.

ENABLING LEGISLATION

Legislation authorizing the establishment of Point Reyes was enacted in 1962 to preserve "a portion of the diminishing seashore of the United States that remains undeveloped" (16 United States Code [U.S.C.] § 459c et. seq.). Congress established Golden Gate in 1972. Golden Gate's enabling legislation directs NPS "to preserve for public use and enjoyment certain areas of Marin and San Francisco Counties, California, possessing outstanding natural, historic, scenic, and recreational values . . . ." and to "preserve the recreation area, as far as possible, in its natural setting, and protect it from development and uses which would destroy the scenic beauty and natural character of the area" (16 U.S.C. § 460bb *et. seq*.). Language in the enabling acts for both parks (16 U.S.C. 469c-6 and 16 U.S.C. 460bb-3) directs NPS to manage Point Reyes and Golden Gate in accordance with the NPS Organic Act, as amended and supplemented. The Organic Act and related authorities direct NPS to conserve park resources and values and prevent their impairment. They also direct NPS to provide for the public enjoyment of park resources and values.

At the time Point Reyes and Golden Gate were established by Congress, much of the land in the planning area was privately owned. The enabling legislation for both park units therefore allowed NPS to acquire lands in the planning area, many of which were active ranches, from willing sellers. As lands were purchased, NPS allowed the former owners, or in some cases tenants on the property, to continue beef or dairy operations under either a Reservation of Use and Occupancy (RUO) or a lease.

In 1976, Congress amended Point Reyes' legislation to address resource management. The amendment directed that, "[E]xcept as otherwise provided" NPS shall administer Point Reyes without "impairment of its natural values, in a manner which provides for such recreational, educational, historic preservation, interpretation, and scientific research opportunities as are consistent with, and based upon, and supportive of the maximum protection, restoration, and preservation of the natural environment within the area" (16 U.S.C. § 459c-6).

In 1978, Congress enacted legislation for both Point Reyes and Golden Gate providing standardized language for the leasing of land for agricultural purposes (16 U.S.C. §§ 459c-5(a) and (b) and 16 U.S.C. §§ 460bb-2(j)). These amendments allow NPS to lease agricultural lands subject to any restrictive covenants deemed necessary and directed NPS to first offer such leases to the person who owned or leased the land prior to its acquisition by the United States. NPS uses these statutory authorities to issue agricultural lease/special use permits (lease/permits) for ongoing multi-generational ranching and dairying operations when a rancher's reserved right expires.

In early 2019, Congress addressed ranching in a Joint Explanatory Statement regarding House Joint Resolution 31 (the Consolidated Appropriations Act, 2019). The Congressional statement noted that "multi-generational ranching and dairying is important both ecologically and economically" and is "fully consistent with Congress's intent for the management of Point Reyes National Seashore." The statement further noted the conferees "strong support" for NPS's Initial Proposal (presented in the October 2017 initial comment period newsletter) to authorize continued ranching and dairying operations under lease/permits with 20-year terms (House Rep. 116-9 at 720-21 (Feb. 13, 2019)).

RANCHING IN THE PLANNING AREA

Beef and dairy ranching began in the Point Reyes area in the mid-19th century and continues today. At the time Point Reyes was established, Congress allowed ranching and dairying operations to continue by limiting NPS's ability to acquire private ranchlands in an area Congress identified as the "pastoral zone." In 1970, with the support of the area's ranchers, Congress repealed the limitation on eminent domain and allowed NPS to acquire ranchlands from willing sellers. NPS expanded acquisition of ranchlands in Point Reyes' pastoral zone soon thereafter.

As these lands were purchased, sellers could continue beef or dairy operations under one of two arrangements. They could retain an RUO, under which they would forego a portion of the purchase amount in exchange for the right to continue ranching activities for up to 25 years or as part of a life estate. Alternatively, they could sell their ranches in fee and be issued agricultural special use permits at five-year intervals. Some sellers retained an RUO on part of their land and entered into lease/permits for the rest, while others entered into more than one lease/permit with NPS. Ranchlands in the north district of Golden Gate were acquired, leased, and managed in a similar manner. Congress expanded NPS's ability to lease agricultural lands in both parks in 1978. These amendments directed NPS to first offer such leases to the person who owned or leased the land prior to its acquisition by the United States.

NPS has used the statutory authorities found in Sections 459c-5 and 460bb-2(j) of Title 16 of the US Code to issue lease/permits for multi-generational ranching and dairying operations. Consistent with these authorities, NPS has offered initial opportunities to operate under a lease/permit to the person who owned the land or was a rancher on the land immediately prior to its acquisition by the United States. Where these offers have been accepted and lease/permits issued to the individuals described, subsequent lease/permits to continue leasing the same lands have been provided to these same individuals and/or their immediate family members. In the rare instances where a ranch family has relinquished a lease/permit, NPS has offered additional acreage to neighboring ranchers, removed portions of the leased area from ranching for natural resource protection, or in the case of RUO expiration, entered into a lease/permit with the ranch operator. In an effort to support multi-generational ranching, NPS has issued lease/permits to individuals, not business entities. Except for two remaining life estates, all RUOs established on the ranchlands have expired.

Until 2009, the term of lease/permits was limited to five years, consistent with guidance provided in Director's Order 53. The option of a 10-year term for lease/permits was established in a 2009 Delegation of Authority from the NPS Director. Between 2009 and 2012, NPS entered into five lease/permits with 10-year terms. In 2013, at the direction of the Secretary of the Interior, the NPS Director issued a Delegation of Authority authorizing lease/permit terms for up to 20 years and directing NPS to "review

the permit structure to assure that it reflects and protects the interests of the ranch operators while meeting the NPS responsibilities to protect natural and cultural resources."

One of the issues analyzed in this GMP Amendment is the possible issuance of 20-year leases. Until a decision is made through the GMP Amendment process on the future of ranching, the Settlement Agreement (described below) allows NPS to issue interim leases to ranchers who were party to the Settlement Agreement. Currently, 17 interim lease/permits are in place that expire on July 14, 2022, and four, 10-year lease/permits remain in effect. NPS has also issued one-year letters of authorization to operators who do not have a longer-term permit in place and are not signatories to the Settlement Agreement. The two life estates also hold separate lease/permits for areas outside their reserved lands; one holds an interim permit and the other holds a 10-year permit.

In total, 24 families hold lease/permits or RUOs on approximately 18,000 acres of Point Reyes and 10,000 acres of the north district of Golden Gate. Eighteen lease/permits include residential uses specific to on-site ranch operations. All active beef and dairy cattle operations occur in the Point Reyes Peninsula Dairy Ranches Historic District and the Olema Valley Dairy Ranches Historic District, which are both listed in the National Register.

TULE ELK

Tule elk, the smallest subspecies of North American elk, live only in California. Tule elk were extirpated from Point Reyes by the 1860s. Consistent with Congressional direction, 10 tule elk were successfully reintroduced to a 2,600-acre fenced wilderness reserve on Tomales Point in 1978 (Public Law 94-389, 90 Stat. 1189, August 14, 1976). This enclosed herd has grown to one of the largest in California, currently comprising more than 400 animals. Point Reyes is the only unit of the national park system where tule elk reside. The California Department of Fish and Wildlife (CDFW) manages all other tule elk herds in the state.

In 1998, NPS completed the *Point Reyes National Seashore Tule Elk Management Plan and Environmental Assessment* (Tule Elk Management Plan/Environmental Assessment [EA]). The Tule Elk Management Plan/EA authorized the establishment of a free-ranging herd in the Limantour area. After translocation from Tomales Point and a 6-month disease monitoring quarantine, 28 elk were released in 1999 as the free-ranging herd. Understanding that the population would grow, the plan proposed an interim management limit of 250 to 350 free-ranging elk. The management limit served as an estimate of the number of animals that could be successfully maintained, monitored, studied, and as necessary, controlled. The plan also anticipated that these animals would remain in Point Reyes' natural zones near Limantour, in an area buffered from major highways, ranches, and non-NPS lands, and did not contemplate expansion of elk to the ranching areas. Establishing a free-ranging herd here posed the least threat to Point Reyes' operations such as visitation and ranching and "would not result in the displacement of ranching activities."

In 1999, two female elk from the Limantour herd established themselves in the Drakes Beach area, moved back and forth between the two areas, and were joined by a bull in 2001, forming the beginning of the Drakes Beach herd. There are now two independent free-ranging herds in Point Reyes, one near Drakes Beach and one near Limantour. Based on counts in late 2019, the total population of the free-ranging herds is estimated to be 301 elk, at a minimum. The geographic extent of both herds includes ranchlands. The current geographic extent of free-ranging elk herds in the planning area is provided in figure 2 of appendix A.

PLANNING HISTORY, INCLUDING THE SETTLEMENT AGREEMENT

Point Reyes and Golden Gate General Management Plan (1980 GMP)

In 1980, NPS issued a combined GMP for Point Reyes and Golden Gate, which established management objectives, land management zones, and additional program guidance and direction (NPS 1980). The GMP guidance for Point Reyes was also duplicated in a separate stand-alone document in 1980. Management objectives for Point Reyes were established for natural resource management, cultural resource preservation, interpretation, visitor activities, development, and access and circulation. Management objectives for Golden Gate were established for preservation and restoration of natural resources, preservation and restoration of cultural resources, making the recreation area readily available to the broadest variety of park users, provision of a broad variety of park experiences, and consideration of park neighbors.

The 1980 GMP also established management zones to illustrate how the park would be managed and developed in different areas based on management objectives, resource values, and public expectations. The zones for both Point Reyes and Golden Gate included natural zones, historic zones, and special use zones. Within this zoning framework, the 1980 GMP included the Special Use-Pastoral Lands subzone (Point Reyes) and the Pastoral Landscape Management zone (Golden Gate) that were established to permit the continued use of existing ranchlands for ranching and dairying purposes. The 1980 GMP also provided broad management direction and strategies for natural resource management, cultural resource management, visitor use and development, interpretation, and park operations.

In 1997, NPS issued a notice announcing the intention to update the 1980 GMP for Point Reyes (62 *Federal Register* [FR] 53336). Due to delays in starting work on the plan, the 1997 notice was superseded in 1999 by a new notice announcing a renewed effort to update the GMP (64 FR 28008). The process was restarted for a third time in 2000 when NPS decided to include lands in the north district of Golden Gate in the scope of the proposed GMP update (65 FR 5365-02). Although NPS solicited public scoping comments and hosted public meetings in the early 2000s, the process languished. The planning team prepared internal draft EISs for the GMP in 2010 and 2011, but neither was released for public review. Demands associated with other critical management needs, including the controversy and litigation surrounding the Drakes Bay Oyster Company, severely hampered further progress on the GMP.

By 2013, it became clear that the park's highest priority planning need was to provide detailed management guidance for leased ranchlands. (See discussion of the "Ranch Comprehensive Management Plan," below). Because a full GMP update did not address the park's most pressing planning needs, NPS issued a notice terminating this GMP process on October 31, 2018 (83 FR 54775).

Golden Gate National Recreation Area General Management Plan

In 2014, NPS completed a GMP and EIS for the Golden Gate National Recreation Area and Muir Woods National Monument (2014 GMP). The 2014 GMP provided updated direction for Golden Gate and included core components of a foundation document, referred to as foundation statements, including park purpose, significance, fundamental resources, and primary interpretive themes. The relevance of the 2014 GMP to this planning effort lies in the park's purpose statement that articulates the purpose of all lands in Golden Gate. The 2014 GMP did not include the north district of Golden Gate, which is part of the planning area for this proposed action. The GMP Amendment will amend the guidance provided in the 1980 GMP for the north district of Golden Gate.

Ranch Comprehensive Management Plan and Settlement Agreement

In spring 2014, NPS initiated development of a ranch comprehensive management plan to address high-priority management needs associated with the approximately 28,000 acres of active beef and dairy ranching on park lands. The planning effort also addressed the expansion of free-ranging tule elk on lands leased for ranching and other issues, including lease duration, succession, and ranch operational flexibility and diversification.

In February 2016, three environmental groups brought litigation against the ranch planning process, arguing that NPS was required to prepare an updated GMP for Point Reyes and determine whether ranching remained an appropriate use of park lands. The plaintiffs and NPS, together with most ranchers individually, the Point Reyes Seashore Ranchers Association, and Marin County, reached a court-approved multi-party Settlement Agreement on July 14, 2017. Per the settlement, NPS agreed to prepare an EIS for a GMP Amendment addressing the management of the lands currently leased for ranching in the park. The Settlement Agreement requires NPS to evaluate three alternatives in the EIS—no ranching, no dairy ranching, and reduced ranching. These alternatives must not be conditioned on the discretionary termination of lease/permits by ranchers. In addition to addressing elk management and the statutorily required elements of a GMP (see below), the Settlement Agreement preserves NPS's right to give full consideration to other potential action alternatives. It also allows NPS to consider agricultural diversification, increased operational flexibility, promotion of sustainable operational practices, succession planning, and similar ranch management practices as part of any action alternative except the no ranching alternative.

DECISIONS TO BE MADE IN THE ENVIRONMENTAL IMPACT STATEMENT

GMPs are required to include: (1) measures for the preservation of the area's resources; (2) indications of types and general intensities of development (including visitor circulation and transportation patterns, systems, and modes) associated with public enjoyment and use of the area, including general locations, timing of implementation, and anticipated costs; (3) identification and implementation of commitments for visitor carrying capacities for all areas of the national park system unit; and (4) indications of potential modifications to the external boundaries of the national park system unit and the reasons for the modifications (54 U.S.C. 100502). NPS has already conducted an initial boundary analysis and is not proposing any external boundary modifications. This GMP Amendment and EIS address the remaining three elements and will amend the 1980 GMP for the planning area. NPS policies allow for amending an existing GMP, rather than preparing a new one, to address particular park locations or issues, which is the case here.

The scope of this GMP Amendment addresses the park's highest priority planning needs, which include determining the future management of lands currently leased for ranching and the future management of elk herds in this area. Ranchers are operating under interim permits, and guidance is needed to determine whether ranching should be allowed to continue, and if so, under what conditions. The population of free ranging elk continues to expand, and guidance is needed on elk management. Consistent with NPS policies and the Settlement Agreement, this GMP Amendment is accompanied by an EIS.

This EIS includes both programmatic and site-specific analyses given the broad range of planning and environmental issues that must be considered as the result of the Settlement Agreement. Decisions regarding the desired conditions and strategies for the preservation of resources and the development of additional visitor amenities, such as trails, day use and overnight accommodations, shuttles, and parking are programmatic in nature. Decisions about management zones illustrate programmatic differences in the management of the planning area from the rest of the park.

The programmatic analysis in this EIS broadly addresses the general environmental issues, impacts, and benefits to establish overall management direction for the planning area. Implementation of some programmatic direction, such as future development to facilitate public use and enjoyment, would require additional project-level planning and compliance to develop and analyze site-specific proposals and cost estimates. Compliance for these projects would tier from the programmatic analysis in this EIS and be consistent with the general direction provided in this EIS.

Actions and strategies that are analyzed in detail in this EIS include elk management options and certain ranch activities such as maintenance of ranch infrastructure, vegetation management, and some diversification activities. Such actions would not need additional compliance and may, in the case of NPS actions, be implemented when the EIS process concludes or, in the case of rancher actions, be implemented when included in a ranch operating agreement (ROA).

Future modifications to ranching operations either at the rancher's request or to address resource issues would be reviewed for consistency with the EIS to determine whether additional review and compliance is necessary. Additional compliance could include the National Environmental Policy Act (NEPA); the National Historic Preservation Act (NHPA); agency consultation; and federal, state, and local permitting requirements, as appropriate.

ISSUES AND IMPACT TOPICS

NPS identified a range of issues and impact topics to evaluate in this EIS for the GMP Amendment. Several issues were also eliminated from further consideration. Issues and impact topics dismissed from detailed analysis, including dismissal rationale, are provided in appendix C. Issues carried forward for detailed analysis fall under the following impact topics:

- Soils
- Water Resources
- Vegetation, Including Federally Listed Species
- Wildlife, Including Federally Listed Species
- Tule Elk
- Visitor Use, Experience, and Access
- Cultural Landscapes, Historic Districts, and Historic Structures
- Socioeconomics
- Air Quality

CHAPTER 2: ALTERNATIVES

INTRODUCTION

NEPA requires federal agencies to develop a range of alternatives and analyze the impacts that those alternatives could have on the human environment. This chapter describes the various alternatives that were considered when developing the EIS for the GMP Amendment.

As prescribed by NEPA's implementing regulations, this EIS includes the alternative of no action (40 Code of Federal Regulations [CFR] §1502.14). The Council on Environmental Quality (CEQ) defines two options for the no action alternative: (1) continuation of current management and (2) situations where a proposed activity would not take place, such as construction of a new facility. CEQ specifically notes that continuing current management applies to updating a land management plan initiated under existing legislation and regulations where an action will continue, even as new plans are developed. In these cases, the no action alternative represents no change from current management or level of management activity, and the analysis provides a baseline of continuing with the present course of actions (CEQ 1981). Alternative A is identified as the no action alternative and represents the continuation of current management.

Action alternatives carried forward for detailed analysis must (1) meet the purpose of and need for taking action to a large degree, (2) be technically and economically feasible, and (3) show evidence of common sense (CEQ 1981). Action alternatives carried forward for analysis should further NPS's ability to achieve the desired conditions; however, some desired conditions may realize greater progress than others depending on the alternative. "Chapter 4: Environmental Consequences" of this EIS presents the impact analysis for each alternative. Alternatives considered but dismissed from further analysis are discussed at the end of this chapter. Table 7 (also at the end of this chapter) provides a comparison of the alternatives.

The five action alternatives under consideration (alternatives B through F) include programmatic guidance that fulfills the statutory requirements for GMPs and more detailed guidance for future management of elk and leased ranchlands in the planning area. The programmatic GMP guidance in the action alternatives establishes future direction for the preservation of natural and cultural resources, the management of infrastructure for public use and enjoyment, and the establishment of visitor capacity in the planning area. Adopting the programmatic GMP guidance in any of the action alternatives would amend the 1980 GMP by establishing new direction for the planning area. As required for GMPs, the general costs for implementation of each action alternative are provided in appendix D.

Management zoning is a planning tool used during the general management planning process to delineate areas of a park that correspond to specific desired resource and visitor experience conditions. Consistent with NPS *Management Policies 2006*, each area of the park is typically assigned a management zone as part of an approved management plan. Thus, management zoning also helps fulfill the statutory requirements for GMPs related to the preservation of park resources as well as public use and enjoyment. Management zones, which can be common across multiple action alternatives, may be applied differently to the action alternatives to highlight different ways NPS is achieving the objectives of each alternative. The application of management zones forms the basis of the programmatic direction in the GMP alternatives.

This GMP Amendment introduces a new zoning framework for the planning area. Adopting this zoning framework would amend the 1980 GMP by replacing the Special Use-Pastoral Lands and Pastoral Landscape Management zones with two new management zones—the Ranchland zone and the Scenic Landscape zone. The new framework would also amend the zoning in the 1980 GMP for approximately 7,600 acres of land in the Natural Environment, Special Use, and Deferred Acquisition zone and the Natural Landscape Management zone. The amount of land allocated to the Ranchland zone or the Scenic Landscape zone would vary by alternative. The new zones would be managed to support the desired conditions for the planning area defined in chapter 1.

The Ranchland zone would preserve significant historic and landscape features while allowing for the continuation of multi-generational ranching. Multi-generational ranching would be considered a compatible use in the Ranchland zone, consistent with long-standing use patterns and the enabling legislation for both park units. Cultural resources and the surrounding natural resources that are integral to the area would be preserved and interpreted. Visitor enjoyment and opportunities would be enhanced through new programming tied to the zone's resources and uses (e.g., farm stays, lodging), while also providing for enhanced recreational opportunities (e.g., hiking, biking, and camping). Ranching would only be permitted in the Ranchland zone under alternatives B–E (described below), and the acreage allocated to this zone would vary among the alternatives.

Within the Ranchland zone, subzones are delineated to identify a finer level of detail regarding which ranching activities would be allowed under each alternative. These subzones are described in the "Ranch Management" sections for the action alternatives below. Subzoning would promote desired conditions and resource protection objectives by directing where more intensive activities are conducted.

The scenic beauty of the Point Reyes peninsula and Olema Valley was a value that Congress sought to preserve in establishing both Point Reyes and Golden Gate as units of the national park system. In furtherance of this objective, the Scenic Landscape zone would be managed to preserve the landscape in its natural setting and protect it from development and uses that would destroy the scenic beauty and natural values of the area. Significant park resources would be managed to preserve and enhance their fundamental values, protecting and enhancing the outstanding natural and historic features that contribute to the scenic beauty of a large contiguous coastal landscape. Trails, roads, and coastal access points that provide sightseeing and related recreational opportunities would be permitted where consistent with the preservation and restoration of priority resources. This management zone would encompass lands in the planning area that are no longer actively ranched. This zone would apply to varying degrees under the action alternatives and would encompass the entire planning area under alternative F.

RANCHING OVERVIEW

This brief overview is provided to assist the reader in understanding the differences between beef and dairy ranching operations as well as existing guidance for range management. Figure 3 in appendix A displays the existing ranches in the planning area. Eighteen beef operations operate on approximately 21,700 acres. Six dairy operations are authorized to operate on approximately 6,300 acres. Over the last 15 years, all 6 dairies have converted to organic operations. The US Department of Agriculture (USDA) certifies dairy livestock as organic based on the USDA organic regulations under 7 CFR Part 205.

Beef Operations

Management of the 18 beef operations in the park varies. Some of these operations include use of the residential complex and other infrastructure such as barns for hay and storage, while others are grazing-only leases with limited to no use of infrastructure.

Beef cattle are generally allowed to graze on open grassland year-round. Beef ranchers in the park employ continuous, seasonal, rotational, targeted, and high-density, short-duration grazing systems that vary by duration, location, and intensity. Most are cow-calf operations that use forage as the primary feed. They keep a herd of cows to produce calves, which are typically born in the fall and marketed in late spring/summer each year. Some heifer (female) calves are selected to join the breeding herd, or replacement heifers are purchased. Older and unproductive animals are sold. A number of bulls are kept to breed the heifers. In addition, a few "backgrounder" or stocker operations buy weaned calves that graze on pasture during the growing season until they reach a desired weight. These calves are then marketed, typically at the end of the growing season similar to cow-calf operations. Weaned calves or "yearlings" may also be retained to produce grass-finished cattle. Ranchers in the park typically provide fall/winter feed to cattle in upland areas because of winter access constraints and limited forage growth during those seasons. Mineral supplements such as salt licks or molasses are also placed in certain pastures. Holding paddocks and areas such as those surrounding water troughs and feeding areas are

considered heavy use or high-intensity-use areas and are often devoid of vegetation. Beef operations in the planning area do not require manure management systems because cattle are regularly distributed across the landscape. Beef cattle typically consume between 4 to 17.4 gallons of water per day (Le Riche et al. 2017; Stull et al. 2012).

Dairy Operations

Dairies are high intensity operations that require extensive milking, feeding, and waste management infrastructure to meet current production and water quality management standards. A typical dairy includes milking, loafing, and feed barns; structures for milk storage and processing; and often a hospital barn. Dairy operations in the park provide housing for some workers and their families. Between one and eight families are housed at each of the dairy operations.

Dairy cows are milked twice a day, kept near the ranch complex, and fed high-nutrition feeds. Roughly 10%–15% of dairy cows are either dry or non-lactating cows that are not in the milking string. Another roughly 20%–40% are heifers that are raised to eventually replace current milk cows. Like beef operations, dairy cows are typically bred to have one calf per year. Male calves and females not raised to enter the milking herd are sold to the dairy beef market. The dry cows are typically kept and fed in outdoor paddocks and small pastures. Heifers are fed regularly and generally graze in pastures similar to beef cattle. Current minimum organic production standards require dairy cattle to remain on pasture for a minimum of 120 days per year, and animals older than 6 months of age must get at least 30% of their dry matter intake from pasture during the grazing season (US Census of Agriculture 2013). Dairy cattle consume between 21.3 to 63 gallons of water per day (Le Riche et al. 2017; Stull et al. 2012). Dairy operations have additional water needs for the management of the dairy complex, cleaning, and other tasks.

Compared to beef cattle operations, dairies produce large quantities of concentrated manure because of the need to keep dairy cows close to dairy headquarters for milking twice a day. Waste management is required for manure produced in the high-intensity-use areas of cattle concentration, including feeding and loafing areas, the milking parlor, and corrals. Many dairy operations include loafing barns that allow the operator to keep the milking string sheltered through much of the winter, which is important for both manure management and cow health. Loafing barns are covered areas where cows can shelter, particularly during inclement weather. The barns have concrete floors and drainage systems that ensure appropriate containment and make it easier for dairy ranchers to manage manure in these confined areas. Regular manure management includes scraping and storing manure in a manure management system. The barns, milking parlors, and travel lanes between the structures are cleaned by scraping or washing manure into ponds, where the manure slurry is stored. Small pastures where cows are held between milking are typically scraped by a tractor, and the manure is stockpiled. Generally, liquid manure is sprayed or spread on pastures through a pump and irrigation system. Large trucks also spread slurry and solids by driving over pasturelands and distributing manure. These activities are conducted outside the rainy season or during dry periods. Manure management activities on dairies are regulated by the San Francisco Bay Regional Water Quality Control Board (San Francisco Bay RWQCB) to avoid polluting nearby streams and wetlands. Requirements include management plans for facilities, waste storage, nutrient application, and grazing, as well as monitoring and reporting activities.

Range Management

NPS manages ranching in the planning area pursuant to various guidelines and standards. In 1990, NPS adopted the *Range Management Guidelines* (NPS 1990a) in response to countywide concerns about flooding and large-scale erosion control in the early 1980s. NPS has updated and adapted authorizations based on this guidance, applicable regulations, and other best available science. In addition, NPS contracted with the University of California (UC) Berkeley Range Ecology Lab to review existing ranch management practices and make recommendations that NPS could consider as part of this planning process. Collectively, these guidelines set forth standards and best management practices (BMPs) for

ranching operations with the overall goal of administering grazing in the park in a manner that provides for environmental protection and restoration, public recreation opportunities, and a visually aesthetic pastoral scene.

The *Range Monitoring Handbook* (NPS 1990b) outlines monitoring methods to ensure that the standards as set forth in the 1990 *Range Management Guidelines* are met and incorporated into ranch lease/permits. Specifically, it outlines the methodologies used to assess rangeland vegetation species composition (condition and trend) and conduct residual dry matter (RDM) monitoring. Monitoring is designed to determine range carrying capacities, evaluate the effectiveness of current grazing management in maintaining or improving range resources, and provide baseline data on range plant community successional dynamics. NPS established RDM and vegetation species composition monitoring locations in each ranch or pasture unit between 1986 and 1990 based on the concept of representative key areas, a widely used rangeland monitoring concept.

The 1990 guidelines establish a minimum RDM level of 1,200 pounds/acre of herbaceous plant material remaining in the fall to protect the soil resources and optimize vegetative production. Lower levels of cover are permitted in identified high-impact areas, such as water and feeding troughs, corrals, and adjacent to dairies. RDM monitoring is conducted annually. In 2015, NPS worked with the UC Berkeley Range Ecology Lab to review and update the RDM monitoring program. The UC report (Bartolome et al. 2015) examined 25 years of RDM monitoring data and concluded that the minimum 1,200 pounds/acre standard remains appropriate based on the RDM guidelines developed by UC researchers for coastal prairie (Bartolome et al. 2006), but the report also noted that site-specific conditions and management goals may call for adjusting the minimum standard for particular sites. Bartolome et al. (2015) also recommended expanded use of visual RDM mapping across pastures to better inform overall management of the ranched lands. Updated monitoring protocols based on the UC Berkeley Range Ecology Lab review have been in place since 2015. A summary of visual mapping and monitoring data collected from 2015 to 2019 is available in appendix E.

In addition to RDM, NPS previously conducted spring species composition monitoring at key area monitoring locations during multiple, but typically nonconsecutive, years from 1987 to 2011. The coastal grassland section of the *Point Reyes Natural Resource Condition Assessment* (NPS 2019a) evaluates this data set. Currently, vegetation composition monitoring using the 1990 guidelines protocol is limited because the methodology is under review. NPS has also established forage productivity plots on a subset of ranches that are monitored in spring to aid in determination of stocking rates.

Other range management activities include planning, implementation, and monitoring to improve resource conditions, protect water quality, and maintain infrastructure integral to ranch operations. To date, more than 170 activities to improve resource conditions have been implemented in the planning area in partnership with USDA-Natural Resources Conservation Service (USDA-NRCS), San Francisco Bay RWQCB, the Marin Resource Conservation District (Marin RCD), ranch operators, and others (figure 4 in appendix A). These activities have been implemented on a case-by-case basis with some variations in required mitigation measures and BMPs. A majority of the activity types implemented are described in detail below under alternative A and in appendix F.

Regular monitoring of ranches is conducted to ensure compliance with lease/permit conditions and regulatory requirements, and to assess changes that may affect resource conditions (e.g., early detection of invasive species, identification of new areas of erosion). Periodic monitoring is also conducted in association with the implementation of projects, restoration activities, or other requirements. Monitoring has included surveys and mapping of vegetation (including rare plants and invasive species) and assessing riparian conditions.

ALTERNATIVE A – NO ACTION

General Description and Zoning

Alternative A is the no action alternative required by NEPA and assumes continuation of current management for the planning area. Under alternative A, NPS would continue to follow previous plans and established practices in the planning area. Additionally, NPS would continue to apply the management zoning framework outlined in the 1980 GMP, except as noted below, and would implement current management actions and policies related to ranching activities.

Approximately 17,100 acres of land in Point Reyes would remain in the Special Use-Pastoral Lands zone that identified ranching as a compatible use (figure 5 in appendix A). Approximately 4,100 acres in the north district of Golden Gate would remain in the Pastoral Landscape Management zone that similarly identified ranching as a compatible use. Approximately 7,600 acres of land in the planning area would retain a zoning classification that is inconsistent with its existing land use. Of these 7,600 acres, the 1980 GMP zoned 2,350 acres of Point Reyes as Natural Environment, Special Use, and Deferred Acquisition zones and 5,250 acres in Golden Gate as part of the Natural Landscape Management zone. While ranching was not identified as a compatible use in those zones, it has been conducted consistently on these 7,600 acres since acquisition by NPS. The inconsistency between the 1980 land management zones and current operations would continue under alternative A.

Under alternative A, NPS would issue new lease/permits to the existing ranch families to continue beef and dairy operations on approximately 27,000 acres with terms of 5 or 10 years (see figure 6 in appendix A). Provisions would be updated to reflect current operations, regulatory requirements, and changes in NPS management. In the planning area, approximately 800 acres have been fenced to exclude cattle from sensitive resources. These exclusion areas are not reflected in the text of current authorizations but would be incorporated into new lease/permits. Additionally, 600 acres in the planning area, including the primary range of the Drakes Beach herd, would remain outside any ranch lease/permit. Appraisals would continue to be conducted to determine current fair market value (FMV) for each operation.

Preservation of Area Resources

Under alternative A, NPS would continue to follow previous planning guidance, including the 1980 GMP, for programmatic guidance related to the preservation of area resources. The 1980 GMP includes management strategies and objectives for natural and cultural resources. Much of the planning area would continue to fall in the Special Use-Pastoral Lands zone that was established to permit the continued use of existing ranchlands for ranching and dairying purposes on NPS-owned land. Under alternative A, all currently ranched lands in the planning area would continue to be managed as Special Use-Pastoral Lands and Pastoral Landscape Management zones (including approximately 7,600 acres of ranched areas outside these 1980 GMP zones as described above). NPS would also continue to follow the 1998 Tule Elk Management Plan/EA in the manner described below under “Elk Management.”

Public Use and Enjoyment

NPS would continue to follow programmatic planning guidance from the 1980 GMP and subsequent site-specific plans related to facilitating public use and enjoyment of the area. The 1980 GMP includes management objectives for interpretation, visitor activities, development and access, and circulation. Within the Special Use-Pastoral Lands and Pastoral Landscape Management zones identified in the 1980 GMP, NPS can establish trails, roads, and other improvements on ranches, and all trails and roads are open for use by park visitors. Existing lease/permits also include provisions that allow public use of trails on ranchlands. While park visitors are authorized to walk or hike through the various pastures and fields of the ranches, signs are posted near ranch residences encouraging visitors to respect the privacy of occupants.

Visitor Carrying Capacity

Under alternative A, NPS would continue to manage for visitor capacity as part of regular park operations. NPS would respond to individual situations or issues, such as informal parking on road shoulders or trash, on a case-by-case basis but would not have a documented framework for programmatic decision making related to visitor capacity.

Ranch Operations

Agricultural Lease/Special Use Permits

Under alternative A, NPS would issue future lease/permits with terms of 5 or 10 years. When the two remaining life estates expire, immediate family members would be offered a 5- or 10-year lease/permit, consistent with other ranches in the planning area.

Table 1 presents a summary of the current ranch authorizations. The total permitted acreage of an individual ranch includes areas that are not used extensively by cattle because of topography and vegetation cover (e.g., forest and dunes), as well as acres that have been removed from grazing for resource protection. Lease/permits include restrictive covenants to protect resources (e.g., ground disturbance, vegetation removal, and management of livestock and refuse). NPS would continue to review, update, and renew lease/permits as necessary to address resource issues and ensure operations meet regulatory requirements, such as those for water quality.

Animal Units. The animal unit (AU) standard, and the animal unit month (AUM) calculated from it, are administrative necessities for communication, billing, and management of rangelands in the United States and Canada (Society for Range Management 2017). Because the nutritional requirements vary for different classes of livestock, the AU equivalents from the 1990 *Range Management Guidelines* have been used to calculate stocking levels for permit authorizations (NPS 1990a). All beef cattle ranches and one dairy ranch have authorized AU. The remaining five dairies have per head cattle limits in their permits. In most permits, AU are quantified as one mature (1,000 pound) cow with or without a calf up to 1 year old or the equivalent based on the average daily forage consumption of 26 pounds of dry matter per day, with an AUM defined as one AU for a period of one month. The AU, AUM, and equivalents are starting points from which stocking rates may be adjusted based on management goals and objectives and best available data. Lease/permits give NPS the authority to make adjustments to address resource issues (e.g., in response to the results of RDM monitoring). NPS may also update AU equivalents based on best available data and would adopt any changes in industry standards, as appropriate, to meet management goals and objectives. Under alternative A, the lease/permits would continue to identify the total number of authorized AUs (beef operations) or dairy animals, as well as a maximum number of AU allowed to graze at any one time.

Approximately 2,400 AU of livestock for beef and 3,325 dairy animals are currently authorized. In most cases, the dairy animal authorizations are higher than current operations and reflect numbers prior to organic certification. In addition to authorized numbers, table 1 provides self-reported numbers to indicate current operational levels that are below the authorized numbers. Several lease/permits also allow between 5 and 13 AU of traditional livestock other than cattle for personal, non-commercial use, for a total of 121 AU on 15 ranches (e.g., horses and sheep). Under alternative A, 5- or 10-year lease/permits would be reissued authorizing total AU (for beef) and animals (for dairies), including the maximum number allowed to graze at one time. Numbers would continue to be adjusted to reflect current operations based on the ability to meet resource goals and objectives, using applicable industry standards and best available data.

TABLE 1: PERMITTED ACREAGE AND USE ON RANCHES

Map ID[a]	Ranch	Permitted Acres	Permitted AU or Number of Cattle	Permitted Use	Actual Number of Cattle	Current Authorization	Park Unit
1	A Ranch	838	496	**Dairy:** 350 milk cows, 50 dry cows, 90 heifers, 6 bulls Max. 135 AU of dry cows and heifers at one time	**2019:** 200 milk cows, 45 dry cows, 35 heifers	Interim Lease 1715 Nunes/Hemelt	Point Reyes
2	B Ranch	1,257	516	**Dairy:** 475 milk cows, 40 dry cows, 1 bull Max. 120 AU of dry cows and heifers at one time	**2019:** 220 milk cows, 40 dry cows, 220 heifers, 4 bulls	Interim Lease 1713 Mendoza	Point Reyes
3	C Ranch	718	255	**Dairy:** 255 AU per year including the milking string, dry cows, and heifers Max. 100 AU dry cows at one time	**2019:** 200 milk cows, 40 dry cows, 100 heifers, 2 bulls	Interim Lease 1717 Spaletta	Point Reyes
3	D Ranch Pasture A	132	36	Heifers rotated as part of overall operation	Same operation as C Ranch, above	Interim Lease 1717 Spaletta	Point Reyes
4	D Ranch Pastures B and C	581	123 (6 months only)	Beef, dairy heifers		Interim Lease 1715 Nunes/Hemelt	Point Reyes

Map ID[a]	Ranch	Permitted Acres	Permitted AU or Number of Cattle	Permitted Use	Actual Number of Cattle	Current Authorization	Park Unit
5	E Ranch	1,372	201	Beef, dairy heifers		Interim Lease 1715 Nunes/Hemelt	Point Reyes
6	F Ranch	1,510	175	Beef		Interim Lease 1703 Gallagher	Point Reyes
7	ATT	481	35	Beef		Interim Lease 1702 D. Evans	Point Reyes
8	G Ranch	1,151	90	Beef No-till silage: 190 acres		Interim Lease 1709 Lunny	Point Reyes
9	D. Rogers Ranch	382	55	Beef, chickens		10 Year Lease AGRI-8530-1000-1001 D. Evans	Point Reyes
10	M Ranch	1,178	175	Beef		Interim Lease 1707 Grossi/Arndt	Point Reyes
11	H Ranch	1,099	285	Beef Silage: 96 acres		Interim Lease 1701 Evans/Rossotti	Point Reyes

Map ID[a]	Ranch	Permitted Acres	Permitted AU or Number of Cattle	Permitted Use	Actual Number of Cattle	Current Authorization	Park Unit
12	I Ranch	1,076	856	**Dairy:** 500–510 milk cows, 70-80 dry cows, 270 heifers, 6 bulls Max. 325 AU of dry cows and heifers at one time Silage: 552 acres	**2019:** 500 milk cows, 65 dry cows, 270 heifers, 6 bulls	Interim Lease 1710 McClure	Point Reyes
13	L Ranch	1,126	400	**Dairy:** 350–360 milk cows, 40–50 dry cows and/or heifers Max. 70 AU of dry cows and heifers at one time	**2019:** 250 milk cows, 40 dry cows, 150 heifers, 3 bulls	Interim Lease 1714 McClelland/ Mendoza	Point Reyes
14	K Ranch (portion)	566	72	Beef		Interim Lease 1701 Evans/Rossotti	Point Reyes
15	J Ranch	648	756	**Dairy:** 420–450 milk cows, 50–80 dry cows, 250 heifers, 6 bulls Max. 310 AU of dry cows and heifers at one time Silage: 163 acres	**2019:** 400 milk cows, 60 dry cows, 260 heifers, 6 bulls	Interim Lease 1708 Kehoe	Point Reyes
15	K Ranch (portion)	486	37	Heifers rotated as part of overall operation	Same operation as J Ranch, above	Interim Lease 1708 Kehoe	Point Reyes

Map ID[a]	Ranch	Permitted Acres	Permitted AU or Number of Cattle	Permitted Use	Actual Number of Cattle	Current Authorization	Park Unit
16	N Ranch	924	90	Beef		Interim Lease 1711 McDonald/ Lucchesi	Point Reyes
17	Home Ranch Developed Complex	20	0	N/A			Point Reyes
18	Home Ranch	2,660	300	Beef		Interim Lease 1711 McDonald/ Lucchesi	Point Reyes
19	Martinelli Ranch	259	36	Beef			Golden Gate
20	Genazzi Ranch	436	55	Beef		1 Year Letter of Authorization Genazzi	Golden Gate
21	E. Gallagher Ranch	320	35	Dairy heifers		Interim Lease 1705 B. Giacomini/ Stray /Hagan/ Basch	Golden Gate
22	McFadden Ranch	335	35	Beef		Interim Permit 1706 Giammona	Golden Gate

Map ID[a]	Ranch	Permitted Acres	Permitted AU or Number of Cattle	Permitted Use	Actual Number of Cattle	Current Authorization	Park Unit
23	C. Rogers Ranch	229	39	Beef		10 Year Lease AGRI-8530-2600-1203 Rogers	Golden Gate
24	Zanardi Ranch	404	45	Beef		10 Year Lease AGRI-8530-1000-1201 Zanardi	Golden Gate
25	McIsaac Ranch	1,403	135	Beef		Interim Permit 1712 McIsaac	Golden Gate
26	Cheda Ranch	808	60	Beef		Interim Permit 1712 McIsaac	Golden Gate
27	Percy Ranch ROP[a]	240	10	Beef	No stocking rate specified in ROP[a] **2019:** 10 AU	Life Estate Percy	Golden Gate
27	Percy Ranch	447	25	Beef		Interim Permit 1716 Percy	Golden Gate

Map ID[a]	Ranch	Permitted Acres	Permitted AU or Number of Cattle	Permitted Use	Actual Number of Cattle	Current Authorization	Park Unit
28	Stewart Ranch Lupton Ranch Truttman Ranch	2,188	189	Beef		AGRI-8530-1000-1006 extended by Letter of Authorization Wisby	Golden Gate
29	Stewart Ranch Developed Complex	18	0	N/A		AGRI-8530-1000-1006 extended by Letter of Authorization Wisby	Golden Gate
30	R. Giacomini Ranch	1,858	95	Beef		Interim Permit 1704 Giacomini	Golden Gate
31	Niman Ranch ROP[b]	206	45	Beef	No stocking rate specified in ROP[b] **2019:** 45 AU	Life Estate Niman	Point Reyes
31	Commonweal	575	66	Beef		10 Year Lease AGRI-8530-2600-1202 Niman	Point Reyes

[a] Map ID refers to figure 3 in appendix A

[b] ROP – Reservation of Possession. Contain life estates—the number of cattle is not specified on the RUO. Numbers in the table are combined based on self-reporting by ranchers.

Succession. In the rare instances where a ranch family has relinquished a lease/permit, NPS has offered additional acreage to neighboring ranchers, removed portions of the leased area from ranching for natural resource protection, or in the case of RUO expiration, entered into a lease/permit with the ranch operator. This approach would continue under alternative A.

Appraisal Process. Appraisals on individual ranches were last conducted between 2002 and 2010. Under alternative A, the US Department of the Interior Appraisal and Valuation Services Office (AVSO) would continue to conduct new appraisals in accordance with the Uniform Appraisal Standards for Federal Land Acquisitions (version dated 2016) to establish annual, FMV rental rates. In general, appraisals include a building complex and land component and reductions based on maintenance assumptions and other permit conditions. For the land component, these appraisals determined beef cattle grazing based on AUM. Most dairy appraisals were conducted prior to the operations converting to organic. Dairy appraisals evaluate the dairy complex production, including the size of the operation and its condition as well as a separate component with a per acre value for "excess land."

Range Management and Monitoring

NPS would continue to administer and monitor use of grazing lands as described under the "Ranching Overview" section, above. Range management guidelines would be revised and updated based on new science, regulatory requirements, and adaptive management of ranching activities. Under alternative A, NPS would continue to adjust stocking rates based on maintaining a minimum of 1,200 pounds/acre of RDM remaining at the end of the grazing season. Management and regulatory changes would be incorporated into relevant sections of lease/permits.

NPS authorization would continue to be required before ranchers implement any range improvements beyond routine maintenance. Typical activities include changes to cattle management infrastructure (e.g., fencing, watering systems, roads), erosion control measures, and land treatments to manage vegetation. Types of Management Activities are described in more detail below. Many of these activities also require regulatory review by other agencies, including the San Francisco Bay RWQCB, US Army Corps of Engineers, US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the California Coastal Commission. They may also require consultation with the State Historic Preservation Officer (SHPO) and the Federated Indians of Graton Rancheria. Regulatory review would be conducted as needed. NPS currently manages compliance and permit coordination for authorization of an average of 9 ranch activities per year (actual numbers have ranged anywhere from 1 to 24 activities in a given year). NPS would also work with the San Francisco Bay RWQCB to ensure ranches in the Tomales Bay watershed meet all applicable requirements.

Management Activities

This EIS groups common ranch Management Activities into Activity Types. Activity Types are organized into three broad categories throughout the document: Ranch Infrastructure and Water Control Management, Vegetation Management, and Other Management Activities. Review and compliance of all Management Activities are currently conducted on a case-by-case basis, which would continue under alternative A. Reviews are typically linked to a specific proposal or funded project, which can include more than one Management Activity. For a full description of these activities, see appendix F, beginning on page F-5.

Ranch Infrastructure and Water Control Management

Ranch Infrastructure and Water Control Management Activities, including Road Upgrade and Decommissioning, Infrastructure Improvements, Fencing, Livestock Water Supply, Pond Restoration, Waterway Stabilization, and Stream Crossing are part of the regular management and maintenance of ranch operations. Any maintenance projects or new improvements involving ground disturbance or alteration of hydrological regimes would continue to require NPS review and approval, including a review of potential impacts on sensitive species. Under alternative A, in-kind and in-place repair and

maintenance of ranch infrastructure would continue to be the ranchers' responsibility as stipulated in lease/permits.

Road Upgrade and Decommissioning. The purpose of Road Upgrade and Decommissioning is to prevent erosion and protect water quality by making improvements to an existing road network. This may include activities such as re-grading surfaces, installing or repairing culverts, or constructing cross-road drains. In areas where roads have been identified as no longer necessary for ranch or park operations, they may be decommissioned to restore more natural drainage and habitat conditions. NPS has worked with ranchers to implement several Road Upgrade and Decommissioning activities in the planning area; however, a number of roads still have erosion issues and/or are no longer actively used or maintained.

Infrastructure Improvements. The purpose of these activities is to protect areas that are heavily used by ranch operations to (1) prevent erosion or degradation of critical infrastructure, (2) separate clean runoff from potential pollutant sources, and (3) prevent flooding in ranch core areas. Activities could include establishing suitable vegetation to convey surface water at a non-erosive velocity using a broad and shallow cross section to a stable outlet, planting strips of vegetation to filter pollutants, installing roof and covers and roof runoff infrastructure, and placing materials to stabilize a ground surface. NPS has worked with ranchers to install gutters, inlets, culverts, and vegetated/rock-lined waterways around high-intensity-use areas such as corrals in the ranch complex to direct clean rainwater away from these areas.

Waterway Vegetation and Planting. Waterway Vegetation and Plantings are used in areas where added water conveyance capacity and vegetative protection are needed to prevent erosion and improve runoff water quality through infiltration that removes sediment, other suspended solids, and dissolved contaminants in runoff.

Fencing. The purpose of this activity is to help accomplish management goals and objectives by controlling the movement of animals, people, and vehicles. Fencing is used for multiple purposes including managing cattle and creating pastures for better control over the timing and duration of grazing. Specific fences have been installed for purposes such as archeological resource and riparian habitat protection. Existing fencing types authorized in the planning area include barbed wire livestock fencing, electric fencing, and rail fencing. Removal of abandoned fencing would continue to occur on ranchlands. New fencing would continue to require NPS authorization, and NPS would work with ranchers to ensure that new fence installations and replacements consider wildlife-friendly designs.

Livestock Water Supply. The purpose of developing alternative water sources is to help address potential impacts of unrestricted livestock access to streams and wetlands and to provide cleaner, more reliable, and well-distributed drinking water to animals. Most ranches have water developments for cattle consumption, including developed springs, wells, and associated storage tanks and troughs. Many ranches also have aging or abandoned infrastructure. NPS has worked with ranchers to redevelop sources and provide off-stream water to cattle distributed throughout pastures. More recent trough installations have generally required wildlife escape ramps.

Pond Restoration. The purpose of this activity is to improve water availability for livestock, fish, and wildlife and to maintain or improve water quality. Restoration actions include repairs of emergency spillways, alternative pipe outlets for water flow, and removal of accumulated silt to restore a pond's original storage capacity. This activity does not include new instream ponds or activities that would increase the original storage capacity of a pond. NPS has worked with ranchers in the planning area to maintain functioning stock ponds and the habitat they provide for wildlife such as the California red-legged frog (*Rana aurora draytonii*).

Waterway Stabilization. The purpose of this activity is to stabilize a gully or downcutting channel by installing a structure to control the grade and/or stabilize the slope. NPS has typically installed these structures in the planning area in coordination with ranchers to prevent erosion and protect resources.

Stream Crossing. The purpose of this activity is to install a permanent stabilized area or structure across a perennial or intermittent watercourse to provide access for people, livestock, equipment, and vehicles and to protect water quality by reducing potential for delivery of sediment and other pollutants into the water. Stream Crossings include stabilized areas, such as fords, and structures (e.g., bridges and culverts). Sites would be evaluated to determine if a Stream Crossing is necessary and to account for habitat requirements for wildlife species present. Work could include modifications to, or removal of existing crossings. Many Stream Crossings in the planning area have involved slightly shaping and hardening previously used tributary banks with rock and installing cross-stream fencing to direct cattle movement across the waterway.

Vegetation Management

Under alternative A, Vegetation Management activities would continue to be authorized in individual lease/permits as described below, and new practices would be evaluated and incorporated into the lease/permit on a case-by-case basis.

Upland and Riparian Vegetation Management and Planting. This activity supports establishment of perennial or self-sustaining vegetation (e.g., grasses, forbs, legumes, shrubs, and trees) to restore, enhance, or create desired plant communities and fish and wildlife habitats; protect soils, control erosion, reduce sediment, and improve water quality; improve accessibility, quantity, and quality of forage and browse for livestock and wildlife; improve air quality; sequester carbon; and improve soil health. Vegetation Management activities may include seeding, planting container plants or cuttings, maintenance of historic windbreaks, mulching, and minor grading or digging to remove roots and prepare the area for planting. Protection measures may include plant shelters, wire mesh, weed-free mulching around the plant base to inhibit grass and weed growth, temporary erosion control, or preventing wildlife or cattle from accessing newly planted areas until vegetation is successfully established. Seeding techniques include broadcast spread of seed by hand or use of a seed drill. Seeding would also continue to be authorized for Forage Production on 1,000 acres (see below). Seedbed preparation would continue to follow an approved USDA-NRCS or NPS compliance plan.

Mowing. Shrub control and weed management are conducted to maintain or increase areas of grassland habitat available for grazing activities. Coastal California grasslands are disturbance dependent, and even with grazing, some can slowly convert from grassland to shrubland (Ford and Hayes 2007, see chapter 3). Mowing involves the timely cutting, and in some cases removal of, herbaceous vegetation for forage, control of herbaceous weeds, and woody (non-herbaceous) plants, including those that are invasive and noxious. Under alternative A, ranchers would continue to request prior approval and receive written authorization from NPS to conduct Mowing, except for mowing non-native thistles, which is currently authorized in lease/permits. NPS has approved shrub mowing in specific cases, but it is generally only conducted for fence or infrastructure maintenance activities.

Integrated Pest Management. Integrated Pest Management (IPM) is a decision-making process that coordinates knowledge of pest biology, the environment, and cost-effective available technology to prevent unacceptable levels of pest damage while posing the least possible risk to people, resources, and the environment. IPM is a site-specific combination of pest prevention, pest avoidance, pest monitoring, and pest suppression strategies.

NPS addresses pest issues on a case-by-case basis following an IPM policy that helps determine the combination of procedures that are most effective for each pest situation. The decision to incorporate a chemical, biological, or bioengineered pesticide into a management strategy is based on a determination that a product is necessary, and other available options are either not acceptable or not feasible.

The park's IPM Coordinator reviews proposals for the use of a pesticide, herbicide, biological control agent, or genetically modified organism (also known as Pesticide Use Proposals) on a case-by-case basis considering site-specific conditions. In the case of ranching operations in the planning area, requests have been made to NPS to treat non-native, invasive weeds with herbicide. NPS must approve a Pesticide Use

Proposal before a product can be purchased or applied. Under NPS policy, pesticide applications can only be performed by or under the supervision of a certified or registered applicator who is licensed under the procedures of a federal or state certification system. All pesticide applications would continue to be reported to NPS annually under alternative A.

Targeted Grazing. Targeted Grazing prescriptions optimize the timing, frequency, intensity, and selectivity of grazing (or browsing) in combinations that purposely exert grazing/browsing pressure on specific plant species or portions of the landscape. Targeted Grazing differs from traditional grazing management in that the goal of Targeted Grazing is to apply defoliation or trampling to achieve specific resource management objectives, whereas the goal of traditional livestock grazing management is generally the production of livestock commodities (Bailey et al. 2019).

Targeted Grazing can be used to improve or maintain the condition of natural resources such as desired species composition, structure, and/or vigor of plant communities; riparian and/or watershed function; and soil erosion and soil health. NPS, in coordination with ranchers has implemented Targeted Grazing to maintain and enhance rare plant species populations, ensure adequate vegetative cover in riparian areas, and control weeds. Under alternative A, NPS would continue to coordinate with ranchers to meet specific management goals and objectives.

Other Management Activities

Manure and Nutrient Management. The purpose of Manure and Nutrient Management is to protect water and air quality and to improve soil conditions. These activities apply specifically to dairies because they are required under San Francisco Bay RWQCB regulations to manage waste generated from operations. Dairies manage animal manure by accumulating it in storage ponds and then spreading the liquid or slurry on fields by means of trucks or pumping through pipes that drain waste out onto fields. Solids may also be separated and stored or composted and then spread on fields by truck or tractor. While current lease/permits do not specifically identify where manure spreading can or does take place, in general, these fields are either authorized silage areas or uplands. Small-scale collection of manure and other organic material into managed compost piles for use as a soil amendment is also conducted on some beef cattle ranches.

The State of California considers all confined animal facilities other than concentrated animal feeding operations as nonpoint sources of pollution. These nonpoint sources must comply with animal waste discharge standards found at sections 22560–22565 of Title 27 of the California Code of Regulations and with applicable waste discharge requirements or waivers, which include specific requirements intended to protect water quality. These requirements for the park's dairies include compliance with a monitoring and reporting program, and development and implementation of site-specific management plans.

Under alternative A, stored manure or compost generated on the six dairy operations in the planning area would continue to be spread across approximately 2,500 acres within their lease/permit areas during dry conditions and in compliance with state and federal regulations. Not every field is treated every year and of the 2,500 acres where manure spreading could occur, approximately 715 acres are within established dairy silage production areas.

NPS would consider other projects such as methane (CH_4) capture systems, aerobic digesters, and new composting activities on dairy ranches if requested by an individual rancher on a case-by-case basis. Minimal use of commercial fertilizer would occur under alternative A, and the use of commercial fertilizer would not be authorized on rangelands in the park, consistent with current practices.

Forage Production. The purpose of Forage Production is to optimize yield and quality of forage for livestock and promote vigorous plant regrowth. These activities involve seedbed preparation, manure spreading, seeding, and harvest mowing of herbaceous vegetation to provide feed for on-site consumption by livestock. Non-native grasses, such as ryegrass (*Festuca* spp.), oat grass (*Avena* spp.), and vetch (*Vicia* spp.), are typically planted. Forage Production includes harvest mowing to produce silage, haylage, or

hay. Silage is cut earlier in the season than haylage and is wetter; hay is drier and cut later in the season. Once silage is harvested, it is stored in covered piles or bunkers; haylage is baled within several days and wrapped in plastic. Both are allowed to ferment prior to feeding to livestock. Hay is cut and dried on the ground prior to being baled and preserved without fermentation.

Approximately 1,000 acres on four ranches (two beef and two dairy) are currently authorized for Forage Production under lease/permits (see table 1). Under alternative A, Forage Production would continue, consistent with lease/permit language updated as necessary to reflect current USDA-NRCS Conservation Practices or other site-specific considerations under an approved plan. Should ranchers discontinue Forage Production in permitted areas, those acres would be returned to grazing, and the total acreage of Forage Production in the planning area would be reduced. One operation has specific language authorizing no-till haylage practices and generally does not conduct activities on the total authorized area every year. One life estate also contains authorization for silage, but the activity, other than occasional seeding and manure spreading, has not been practiced in recent years.

Diversification

Additional activities have been authorized on a case-by-case basis based on individual ranch requests. One authorized chicken operation allows up to 2,900 birds on pasture seasonally outside the rainy season and up to 1,500 birds on pasture during the rainy season. Horse boarding for approximately 15 to 20 horses, established when operations were under RUO, currently occurs on one ranch. Under alternative A, these activities would continue.

NPS would consider new requests for additional activities on a case-by-case basis. Authorizations for such activities would continue to be subject to NPS discretion, lease/permit terms, and in accordance with overall resource goals.

Ranch Complexes

Most of the ranches in the planning area are components of the Point Reyes Peninsula Dairy Ranches or Olema Valley Dairy Ranches Historic Districts (see appendix G). More than 200 of the contributing resources that make up these historic districts, including residential buildings, barns, Grade A dairies, sheds, other out-buildings, roads, and pasturelands, are located in the planning area, along with additional non-contributing resources. Lease/permit holders and their families, and in some cases ranch employees and their families, occupy contributing and non-contributing residential units on 18 ranches. Most beef operations include outbuildings such as storage barns or sheds and corrals. The building complexes of most dairies also include more modern agricultural structures built to support dairy cattle operations, including milking barns, free-stall or loafing barns, and associated waste management systems. Ranchers are responsible for maintenance of all ranch buildings and infrastructure within the complex, including ranch roads.

Local gas, power, and telephone providers supply ranch utility services, including electricity, internet, and telephone service. Residences are heated by wood or propane. On-site septic systems include holding tanks, and leach lines are used for sewage disposal for the residential structures. Water for domestic use is supplied primarily by springs and wells on individual ranches. For some ranches, NPS or the local municipal system are the water utility provider.

Under alternative A, ranchers would remain responsible for the maintenance of ranch complex infrastructure, including all water, sewer, and electrical systems, as well as the majority of ranch roads. Unless otherwise approved by NPS, regular maintenance activities on contributing historic ranch structures would continue to be completed in a manner consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for Rehabilitating Historic Buildings*. These maintenance activities may include:

- Repair and replacement of exterior siding with in-kind material or compatible substitute material approved by NPS
- Painting of building exterior a minimum of every 15 years
- Repair and replacement of roofs using in-kind or compatible substitute material approved by NPS
- Maintenance (trimming, pruning) of vegetation surrounding buildings to protect building materials and for defensible space
- Repairs to building structural systems following NPS-approved methods and with approved materials
- Pest control activities consistent with the NPS IPM program to prevent deterioration of building materials caused by insects and pests
- Repair of existing windows and doors or replacement with NPS-approved replacements
- Maintenance of gutters, downspouts, and other drainage features designed to convey water away from buildings and the installation of new systems
- Repair and replacement of flooring with in-kind material or compatible substitute material
- Maintenance, repair, and limited replacement of deteriorated interior features
- Maintenance and repair of existing mechanical, electrical, and plumbing systems associated with buildings and upgrade of such systems by augmenting or replacing system components

New Development, Infrastructure Improvements, and Alterations. Ranchers, at their own cost, would continue to submit design plans and any other relevant information to NPS for approval prior to undertaking any improvement or alteration of structures, or for new development/infrastructure, including worker housing. All improvements or alterations to buildings, fences, and corrals would continue to be the responsibility of the rancher with prior written approval from NPS. Improvements or alterations in historic districts would be consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. No new roads or truck trails would be established without prior written permission of NPS. Improvements and alterations must be performed in accordance with applicable laws, including local building codes.

Elk Management

Under alternative A, NPS would continue to work with ranchers and take actions to prevent or mitigate elk damage to ranches. To date, most actions have been taken in the Drakes Beach area. NPS actions have included, and in the future, could include:

- Repairing fences damaged by elk and building elk crossings to allow elk to cross fences without damaging them
- Offering fence materials to ranchers for repairs
- Installing alternative fence designs, particularly around seasonal pastures that would better allow elk movement across fence lines without damage to the fences
- Enhancing habitat, including water enhancements, weed control, or pasture mowing, and targeted grazing to increase herbaceous habitat, focusing on areas frequented by elk but not leased for grazing
- Considering pasture offsets, including identifying access to additional pasture for ranchers to offset forage lost to grazing elk
- Hazing, including using park staff on foot and utility terrain vehicles to push elk in the main herd from active pastures to areas not leased for grazing
- Modifying livestock feeding strategies, redesigning existing infrastructure, or developing new infrastructure that would reduce the likelihood of elk feeding on supplemental forage for cattle

In addition, NPS would undertake a planning process to determine an appropriate population level and methods for managing the free-ranging elk in Point Reyes. As described in chapter 1, the number of free-ranging elk in Point Reyes is currently within the interim management limit of 250–350 animals established in the 1998 EA. Although the 1998 EA did not anticipate the presence of elk on ranchlands, it did identify the need to develop long-term management thresholds for the population. Due to the changed conditions since the 1998 EA was completed (e.g., the sustained presence of elk on ranchlands), threshold development and subsequent population management would occur through the initiation of a new planning process that still allows for free-ranging elk in Point Reyes.

In collaboration with CDFW, NPS would recapture and move or lethally remove any elk that leave Point Reyes for Golden Gate or non-federal lands.

Elk Monitoring and Research

Current monitoring of the elk herds in Point Reyes would continue and would be modified as necessary to better understand herd population dynamics. Elk monitoring includes counts and observations of herd composition (e.g., sex and age class). Weekly location data and global positioning system (GPS) collar monitoring data are currently provided for one female and one bull in the Drakes Beach herd but have included up to three females and two bulls in the past. On all collars, GPS points are collected every three hours. GPS collars would be replaced, as needed. Similar location and group composition data have been collected for animals from the Limantour herd on ranchlands, but GPS collars have not yet been deployed on any animals in this herd.

NPS would continue to keep up to date with elk management research and activities conducted by other jurisdictions and CDFW, including research regarding reproductive control. Additionally, NPS would continue to collaborate with outside partners to better understand elk activity. Most recently, NPS staff have worked with USFWS and the US Geological Survey (USGS) to analyze long-term population data for all three elk herds at Point Reyes (Cobb et al. 2020) and with Sonoma State University and the University of Nevada at Reno on a comprehensive analysis of the elk observation and GPS collar data collected at Drakes Beach (Hughey et al. 2019).

Under alternative A, NPS would continue to have the authority to take action on individual elk that become overly habituated to cattle feed, are repeatedly aggressive toward cattle, or pose a safety risk to ranchers or the visiting public. Actions could include hazing, capture and relocation, or lethal removal.

Disease Testing and Reporting

NPS would continue to perform testing for Johne's disease and chronic wasting disease (CWD) including lethal removal and testing on suspect animals as well as on fresh, available carcasses. NPS would continue to coordinate with CDFW and the NPS Biological Resource Division regarding testing methods and results. If future research determines how the disease is spread, the lease/permits would be updated to include new mitigation measures for limiting disease spread, including new approaches to Manure and Nutrient Management.

ALTERNATIVE B – NPS PREFERRED ALTERNATIVE

General Description and Zoning

Alternative B was identified as the proposed action during public scoping and is the NPS preferred alternative. Under alternative B, NPS would amend the 1980 GMP by adopting a new zoning framework and new programmatic management direction for the planning area. NPS would allow for continued multi-generational ranching and establish a population threshold for management of the Drakes Beach herd.

Under alternative B, NPS would apply two new management zones, the Ranchland zone and the Scenic Landscape zone, to the planning area. This new zoning would amend the 1980 GMP by replacing the Special Use-Pastoral Lands and Pastoral Landscape Management zones in the planning area with these zones (see figure 7 in appendix A). New opportunities and improvements to facilitate public use and enjoyment in the planning area would be implemented in both the Ranchland and Scenic Landscape zones. NPS would also establish a new framework for managing visitor capacity that establishes indicators and thresholds for the planning area.

Like the Special Use-Pastoral Lands and Pastoral Landscape Management zones from the 1980 GMP, multi-generational ranching activities would be considered an appropriate use in the Ranchland zone. Ranching activities would only be authorized in the Ranchland zone. NPS would implement a subzoning framework that would authorize specific activities based on resource management goals and objectives as described in the "Ranch Management" section below. Continued occupancy and use of existing lease/permit areas for multi-generational ranching would occur according to the management strategies identified in table 2 for ranchlands and in support of desired conditions. Of the 28,700 acres in the planning area, the Ranchland zone would include approximately 7,600 acres of land under lease/permit (i.e., 2,350 acres in Point Reyes and 5,250 acres in the north district of Golden Gate) that were not included in the Special Use-Pastoral Lands and Pastoral Landscape Management zones in the 1980 GMP. These areas would be rezoned from the Natural Environment, Special Use, and Deferred Acquisition zone and the Natural Landscape Management zone to the new Ranchland zone. This zoning change is consistent with longstanding use patterns. These lands have been actively ranched before and after their acquisition by NPS and since the completion of the 1980 GMP. In total, 28,100 acres would be allocated to the Ranchland zone under alternative B; however, not all 28,100 acres would be under lease/permit (see "Subzoning Framework," below).

The Scenic Landscape zone would apply to 600 acres that are in the planning area but not part of any existing ranch lease/permit, including the primary range of the Drakes Beach herd. These lands had been zoned as part of the Pastoral Lands zone in the 1980 GMP.

Beef and dairy cattle operations would continue to operate in the Ranchland zone as described in the "Ranching Overview" section. NPS would issue lease/permits with up to 20-year terms to the existing families to continue multi-generational ranching operations on approximately 26,100 acres (see figure 8 in appendix A). Each ranch would be managed pursuant to an agricultural lease/permit and associated ROA, which would be an exhibit to the lease/permit. The ROA would identify ranch-specific operational details and requirements associated with (1) beef or dairy ranching (as applicable); (2) authorized diversification activities; and (3) maintenance requirements.

NPS would continue to work closely with local agricultural organizations, state agencies, natural resource conservation experts, and stakeholder groups to share information and discuss issues related to ranching. Alternative elements specific to alternative B are described below.

Preservation of Area Resources

GMPs are required to articulate measures for the preservation of an area's resources. Table 2 outlines the detailed management strategies that NPS would adopt to achieve the desired conditions related to the preservation of park resources in the planning area. For each desired condition, the table outlines management strategies that NPS would adopt for all lands in the planning area, additional management strategies taken on lands in the Ranchland zone, and additional management strategies taken on lands in the Scenic Landscape zone. Some of these strategies could require further site-specific planning and environmental documentation, including NEPA and NHPA compliance, before individual projects could be implemented. Adopting these management strategies would amend the 1980 GMP by providing revised natural and cultural resource management direction for the planning area.

TABLE 2: STRATEGIES FOR THE PRESERVATION OF AREA RESOURCES

Management Strategies on All Lands in the Planning Area	Additional Management Strategies in the Ranchland Zone	Additional Management Strategies in the Scenic Landscape Zone
Preservation strategies for ecological function		
Desired Condition: Ecological function, connectivity, and processes persist and thrive in communities, including wetlands, grassland, forest, scrub, and dune communities.		
▪ Identify community types, ecological sites, and their extent and distribution. Periodically evaluate for large-scale changes. ▪ Research and evaluate connectivity of ecosystems and flexibility of species niches. ▪ Conduct management actions that promote habitat heterogeneity, connectivity, and species considered ecosystem engineers. ▪ Identify previously damaged or degraded natural systems and restore where possible. ▪ Identify and implement practices that protect soil health and minimize soil erosion. ▪ Continue to seek funding and partnerships to restore structure and process to habitat types such as creeks, wetlands, and coastal dunes. ▪ Implement the Point Reyes National Seashore *Fire Management Plan*, and update the plan as necessary, consistent with federal law and departmental management policies. ▪ Locate and design visitor use improvements to minimize impacts on ecological functions.	Range, Pasture, and Ranch Core subzone* ▪ Incorporate applicable USDA-NRCS Conservation Practice Standards and mitigation measures from appendix F into ROAs. Monitor and enforce rancher compliance with permit requirements, including authorized activities by area, establishment and maintenance of buffer areas, cattle stocking rates, and timing and location of grazing. ○ Monitoring data would facilitate adaptive management to protect valued resources. ▪ Incorporate management actions that promote habitat heterogeneity, connectivity, and species that are considered ecosystem engineers into individual ROAs as appropriate. Resource Protection subzone* ▪ Identify disturbance regimes that may need to be maintained by management. ○ Targeted Grazing could be used to maintain rare and endangered habitat and species. ○ May require increased effort in management, early detection, and additional IPM strategies. *For definitions of subzones, please see “Subzoning Framework” section, below.	▪ Prioritize restoration activities, such as removal of fencing, water developments, roads/crossings, and wildlife barriers/attractants. Conduct habitat restoration in identified areas such as wetlands. ▪ Identify disturbance regimes that may need to be maintained by management. ○ Use Targeted Grazing to maintain rare and endangered habitat and species. Future implementation planning may be needed to determine specific locations. ▪ Increase effort in management and early detection and adapt IPM strategies for areas where ranching is no longer occurring.
Desired Condition: Sources of air, water, noise, and light pollution are limited.		
▪ Follow US Environmental Protection Agency (USEPA), state, and Regional Water Quality Control Board guidelines and regulations to protect water quality. ▪ Continue to monitor and evaluate water quality in the planning area. Use monitoring data to target areas for improvement. Implement practices to reduce impacts on water quality consistent with guidelines and regulations above. ▪ Follow strategies and practices established by NPS Night Sky and Natural Sounds and Air Quality program guidance. ○ Reduce and shield artificial light sources to protect natural night skies and minimize human-caused intrusions to natural soundscapes. ○ Locate and design visitor use improvements to minimize contributions to air, water, and noise pollution. ○ Monitor and minimize noise/unnatural sounds that adversely affect planning area resources or values or visitors’ enjoyment of them. ○ Consider noise pollution in the procurement and use of equipment. ▪ Conduct operations in compliance with federal, state, and local air quality regulations and minimize air quality pollution emissions associated with operations in the planning area.	▪ Incorporate USEPA, state, and Regional Water Quality Control Board requirements into individual ROAs, including implementation of water quality improvement practices, monitoring, Manure and Nutrient Management, and grazing management. Regulations include total maximum daily loads and associated grazing waivers in the Tomales Bay watershed, as well as waste discharge requirements or waivers of discharge requirements for confined animal facilities. ▪ Evaluate lighting on all ranch buildings and noise from farm machinery and equipment to determine best practices and incorporate relevant mitigation measures from appendix F into individual ROAs. ▪ Include authorized ranching activities in ROAs and monitor and enforce rancher compliance with permit requirements. Set and monitor relevant metrics in individual ROAs, such as authorized activities by area, establishment and maintenance of buffer areas, cattle stocking rates, and timing and location of grazing. ○ Monitoring data would facilitate adaptive management to protect valued resources. ○ RDM monitoring would be used to ensure the vegetation cover necessary to minimize soil erosion. ▪ Continue to seek funding and partnerships to implement water quality improvement projects on grazing lands.	▪ Prioritize implementation of water quality improvement practices, water monitoring, and restoration to mitigate for ongoing water quality impacts associated with historical ranch operations.

Management Strategies on All Lands in the Planning Area	Additional Management Strategies in the Ranchland Zone	Additional Management Strategies in the Scenic Landscape Zone
Preservation Strategies for Native Species, Including Threatened and Endangered Species		
Desired Condition: Habitats and populations of threatened and endangered species, special-status, and rare species persist and are improved.		
▪ To protect threatened and endangered species and their habitats, all activities in the planning area—whether undertaken by ranchers and their employees or by NPS—would conform to conditions outlined in Biological Opinions by USFWS and the National Oceanic and Atmospheric Administration. ▪ Prioritize inventory and monitoring of rare and special concern species based on species rankings and/or perceived level of threat using existing data. Inventory and monitoring could help identify population trends, distributions, associations and ecological functions/connectivity. Targeted monitoring related to proposed activities would also occur to determine effects of proposed actions. ▪ Conduct habitat restoration and management, including the removal of non-native plant species where appropriate as defined by the strategies above. If monitoring data indicate threats to sensitive species by invasive plant species encroachment, visitor use, barriers to dispersal or other means, take appropriate actions to protect these species. Non-native species management is addressed further below under the desired conditions of maintaining and enhancing native plant and animal communities and limiting invasive, non-native species. ▪ Continue to seek funding and partnerships to monitor these species and restore habitats.	Range, Pasture, and Ranch Core subzone* ▪ Identify authorized ranching activities and monitor and enforce rancher compliance with permit requirements. ▪ Set relevant metrics in individual ROAs, such as authorized activities by area, establishment and maintenance of buffer areas, cattle stocking rates, and timing and location of grazing. ▪ Monitor relevant metrics to facilitate adaptive management and protect valued resources. Resource Protection subzone* ▪ Implement management actions such as Targeted Grazing, which benefit species in the absence of grazing. *For definitions of subzones, please see “Subzoning Framework” section, below.	▪ Implement management actions such as Targeted Grazing and stock pond maintenance, which benefit species in the absence of ranching.
Desired Condition: Native plant and animal communities persist and thrive.		
▪ Prioritize inventory and monitoring of animal and plant communities or populations based on achieving desired conditions. Monitoring could help identify species diversity, changes in native species populations or community structure, and to develop ecological models to inform management. Long-term declines in native animal and plant communities or populations could trigger management action. ▪ Maintain a viable population of free-ranging tule elk in Point Reyes. Prioritize monitoring tule elk as a species of management concern to identify population trends, movement patterns, and habitat utilization. Monitoring data would be used to determine population thresholds and identify management actions such as habitat improvement. ▪ Restore native species populations that have been severely reduced or extirpated where feasible. ▪ Continue to provide interpretive and educational programs to promote preservation of native species.	▪ Identify authorized ranching activities and monitor and enforce rancher compliance with permit requirements. ▪ Set relevant metrics in individual ROAs, such as authorized activities by area, establishment and maintenance of buffer areas, cattle stocking rates, and timing and location of grazing. ▪ Monitor relevant metrics to facilitate adaptive management and protect valued resources. For example, RDM monitoring would be used to ensure a vegetation cover necessary to promote plant growth remains at the onset of germinating rains.	▪ Identify disturbance regimes that may need to be maintained by management. ▪ Implement management actions such as Targeted Grazing and stock pond maintenance, which benefit species in the absence of ranching. ▪ Increase efforts in management and early detection and adapt IPM strategies for areas where ranching is no longer occurring.

Management Strategies on All Lands in the Planning Area	Additional Management Strategies in the Ranchland Zone	Additional Management Strategies in the Scenic Landscape Zone
Management Strategies for Invasive/Non-Native Species		
Desired Condition: Populations and extent of invasive, non-native species are limited such that they do not, or only minimally, affect ecosystem processes and/or function.		
▪ Use Early Detection and Rapid Response to prevent introductions of non-native species. Monitoring by ranchers, NPS staff, partners, and volunteers would be used to detect and eradicate new infestations of non-native species before they become widespread. ▪ Prioritize non-native species for management based on level of threat to park resources and ability to control. ▪ Use IPM to control invasive species and promote long-term prevention through a combination of monitoring and control methods. o Chemical control would generally be used only in combination with other control methods, selected and applied in a manner that minimizes risks to human health, non-target organisms, and the environment. o Monitoring would be conducted to identify damage and pests and determine what, if any, management is needed. Monitoring would also be used to determine effectiveness and inform adaptive management. o Ranchers, their employees, and NPS would not intentionally introduce invasive non-native species to the planning area.	▪ Ranchers and their employees would comply with individual ROAs to prevent accidental introductions and manage non-native species of concern.	▪ Increase efforts in management and early detection and adapt IPM strategies for areas where ranching is no longer occurring.
Preservation Strategies for Cultural Resources		
Desired Condition: National Register properties listed or eligible for listing, including contributing buildings, structures, and sites are preserved in a manner that maintains their integrity.		
▪ Conform to the *Secretary of the Interior's Standards for the Treatment of Historic Properties* for work done by NPS, ranchers, or ranch employees. ▪ Consider adaptive use of historic structures to support visitor activities, rancher use, or park/partner operations. ▪ Remove or allow to deteriorate in a safe manner non-contributing buildings, structures, and landscape features not needed for ranching or park purposes. ▪ Explore interpretation and educational opportunities that foster an appreciation of the historic districts and help build long-term support for their preservation. ▪ Do not permit telecommunications and utility infrastructure, commercial windmills and other energy infrastructure in the planning area whenever possible because they are inconsistent with the historic district.	▪ Ensure that ranchers maintain historic structures and cultural landscapes consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and guidelines and standards for rehabilitation. o Ranchers would be responsible for routine maintenance such as roofing and painting. NPS would work with ranchers to identify strategies to rehabilitate structures according to the *Secretary of the Interior's Standards for Historic Preservation*. ▪ Use continued grazing as a tool to maintain the characteristics of the historic pasturelands. ▪ NPS staff would collaborate with ranchers to interpret traditional land use and current agricultural practices. ▪ Allow small-scale telecommunications and utility installations for personal use on ranches, with NPS approval and appropriate precautions taken to protect the historic scene such as locating underground or sited close to existing development.	▪ Apply a prioritization process to preserve historic buildings to minimize impacts on historic districts. ▪ Search for and identify adaptive uses of the built environment and management strategies for the landscape to preserve the historic districts. o Targeted grazing and other tools could be used to maintain the characteristics of the historic pasturelands.

Management Strategies on All Lands in the Planning Area	Additional Management Strategies in the Ranchland Zone	Additional Management Strategies in the Scenic Landscape Zone
Desired Condition: Historic and prehistoric archeological sites, and ethnographic resources are preserved and maintained.		
▪ Protect identified archeological resources. Except for professional archeologists working under an approved NPS research permit, NPS and partners working in the planning area would refrain from disturbing archeological sites. o Any discoveries of artifacts or unknown archeological sites would be left undisturbed and reported to NPS cultural resource management personnel. ▪ Continue to preserve archeological sites through active monitoring, stabilization, and maintenance of resource protection infrastructure. ▪ Work collaboratively with Federated Indians of Graton Rancheria to preserve and interpret the Coast Miwok heritage at Point Reyes. o NPS would consult with the Tribe on issues related to archeological and ethnographic resources of traditional or cultural importance, and burial and cultural items consistent with the Native American Graves Protection and Repatriation Act of 1990. ▪ Explore interpretation and education opportunities that foster an appreciation of historic and prehistoric archeological sites and ethnographic resources and help build long-term support for their preservation.	▪ Take measures to stabilize and exclude cattle from archeological sites. ▪ Monitor the condition of known archeological sites and conduct inventories to locate and describe currently unknown sites. ▪ NPS would balance the perpetuation of the historic use with the retention of the tangible evidence that represents the area's ranching history.	▪ Remove resource protection infrastructure if no longer necessary to protect sites from agricultural activities such as grazing.

Public Use and Enjoyment

GMPs indicate the types and general intensities of development associated with facilitating public use and enjoyment of an area. NPS would adopt the strategies and actions described in this section to achieve the desired conditions for facilitating public use and enjoyment and visitor experience in the planning area. These strategies are organized around the following key areas: development of trails and trail-based recreation; development to support day use and overnight accommodations; development to support/enhance interpretation and education; development related to shuttles and parking; and potential use of unoccupied ranch complexes and historic structures. The approaches identified in this section are applicable to both the Ranchland zone and the Scenic Landscape zone. Adopting these strategies and actions would amend the 1980 GMP by providing revised guidance and management direction for visitor use for the planning area.

Many of the specific strategies and project recommendations described below would be accomplished over time and would be subject to available funding. Development proposals, including but not limited to, new trail connections and parking improvements would require additional site-specific review and compliance, including NEPA and NHPA compliance before project implementation could occur.

Development of Trails and Trail-Based Recreation

NPS would strive to improve hiking, biking, and equestrian access in the planning area through enhanced trail connections. Lands in the planning area are generally open to public access, including active grazing areas, but additional route designation and guidance for visitors about trail-based opportunities would facilitate more visitor enjoyment opportunities. Trail opportunities would focus on loop routes, improve connectivity with adjacent public lands, and facilitate north-south connectivity across the landscape.

Most new routes would use existing administrative roads (including ranch roads); new trail construction would be limited. Maintaining these roads to support a multi-use trail network would facilitate increased recreational opportunities for pedestrians, equestrians, and bicyclists. The focus of the trail network in the planning area would be on expanding access for multi-use trails. Trail-based recreation opportunities offering more solitude exist outside the planning area in wilderness areas of the park. However, individual trails in the planning area could be designated for specific uses (e.g., hike only, equestrian and hike only, bike and hike only). Most routes would be minimally maintained for general recreational access and would have a rural, backcountry character. When an existing administrative or ranch road is identified as part of the trail network, the level of service and maintenance would generally be the minimum needed to maintain vehicle access and protect resources. In addition to designated routes, NPS would also consider installing pedestrian crossings (i.e., gates/step overs) through ranch fences to accommodate visitor access to ranchlands. NPS would collaborate with ranchers on the location and/or form of the step-overs or crossings across active ranchlands and on methods to ensure minimal disruption to ranch operations (e.g., self-closing or spring-loaded swing gates with simple signage that would help ensure that gates are closed once people pass through). NPS would develop public information and safety messages to support recreational activities that involve walking through active pastures without defined trail alignments.

To facilitate north/south trail connectivity across the planning area, NPS envisions a mix of established trails and off-trail routes with crossings across ranchlands to provide recreational access. Ranch operations and private housing would be considered when determining the locations of these routes and alignments.

Bicycles would continue to be allowed on public and administrative roads designated for bicycle use. NPS would improve signage to highlight existing opportunities for bicycles, clarify and update information for cyclists to help with trip planning, and evaluate new opportunities for bicycle access primarily using the extensive network of ranch roads. NPS would seek to close existing gaps for bicycle access by using the existing ranch road network to facilitate additional bicycle loops, such as in the area between L Ranch Road and Pierce Point Road. Site-specific implementation planning and compliance associated with providing additional bicycle access would meet the requirements of 36 CFR 4.30.

NPS would also work with adjacent land managers and partners to explore opportunities to facilitate larger, regional trail connections to the planning area from outside the park and improve trail connectivity for pedestrians, equestrians, and bicyclists. Examples of opportunities include connecting the Cross Marin Trail to routes through the park.

Appendix H: Public Use and Enjoyment Detail provides additional information that NPS could consider in implementing programmatic recommendations for public use and enjoyment (e.g., trail routes, trailhead improvements).

Development to Support Day Use and Overnight Accommodations

NPS would look for opportunities to expand day use and overnight accommodations in the planning area, with a focus on previously developed areas, such as former ranch complexes, and would prioritize the adaptive use of historic buildings to support these uses where possible. Implementation of any of the options below would depend on availability of an appropriate location as well as NPS's operational capacity and/or ability to work with partners to support the operation. The "Potential Use of Unoccupied Ranch Complexes and Historic Structures" section describes the process for identifying appropriate uses of structures or complexes that are currently unoccupied or that could become unoccupied in the future. Potential day use and overnight opportunities that NPS would consider in the planning area include:

- Use of one or more vacant complexes as a concession operation (e.g., hostel in the buildings; campground in the pasture; possible yurts, tent cabins, or other similar structures that offer an overnight option between tent camping and commercial lodging)
- New location(s) for administrative or volunteer accommodations (e.g., camping, recreational vehicle hookup, or housing)
- Drive-in and hike-in camping sites with limited services and amenities
- Additional sites for day use activities, such as picnicking, close to roads and other infrastructure (where applicable, these activities would be sited so as not to interfere with grazing)
- An education camp in a ranch complex or other previously developed or disturbed area if a partner were interested and able to create and maintain the facility
- Opportunities for overnight use or other adaptive use at the RCA Receiving Station

Development to Support/Enhance Interpretation and Education

NPS would explore new opportunities, techniques, and contemporary media to interpret park resources and ranching in the planning area and would collaborate with ranchers and other park partners, such as Point Reyes National Seashore Association or park concessioners, on interpretive messaging, programs, and other techniques to share the story of multi-generational ranching in the park. As ranch operations diversify and engage in additional public serving activities, NPS would collaborate with ranchers to identify opportunities to integrate interpretive and educational messaging and programming. Selected waysides could be focused at existing destinations, such as at trailheads and the visitor center, and could also be installed at key pullouts, such as along L Ranch Road.

NPS would preserve and interpret the historic RCA Receiving Station under all alternatives. NPS could cooperate with a non-profit group and could also explore expanded adaptive uses of the facility, including overnight uses, through a park partner or through a request for proposal process.

NPS would also expand interpretation and visitor opportunities around the Naval Radio Compass Station. NPS would consider establishing a trailhead on Sir Francis Drake Boulevard and use of the old road to/through the property as a trail to the site of the former lifesaving station and the naval radio compass facility. NPS would also provide interpretation of these historic resources to enhance the visitor experience. Non-historic structures associated with the property would be removed.

Development Related to Shuttles and Parking

NPS would continue to maintain the existing basic transportation network in the planning area. No new roads or significant changes to circulation patterns are envisioned. Marin County and the State of California would continue to operate and maintain roads under their respective jurisdictions within the planning area. NPS would continue to work with Marin County on maintenance and improvements for Pierce Point Road and Sir Francis Drake Boulevard and would similarly work with the State of California for State Route 1.

NPS may continue to use shuttle or other operational strategies to manage traffic and crowding issues at various locations in the park and would explore additional or expanded shuttle use, or collaborate with the county to expand transit systems, as tools to manage visitor use. NPS would also seek improvements to parking at trailheads to improve visitor safety and facilitate access to trails and park destinations.

Potential Use of Unoccupied Ranch Complexes and Historic Structures

Most of the ranch complexes contain historic buildings, structures, and other character-defining features that contribute to the integrity and significance of the Olema Valley Dairy Ranches Historic District or Point Reyes Peninsula Dairy Ranches Historic District. Several structures and unoccupied ranch complexes are currently vacant. Adaptive use of complexes and buildings would be pursued as a preservation strategy for those contributing historic resources not being used to support ranch operations. To preserve the historic district, NPS would make every reasonable effort to adapt historic buildings and complexes to compatible uses that require minimal alteration of the character-defining features. NPS would ensure that new uses and physical changes to contributing structures, including limited new construction such as minor additions, are made in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

NPS would explore ways to utilize and occupy vacant buildings, for NPS or park partner operational uses, visitor servicing programs, or for use by ranchers on adjacent lands for ranch operations/housing. If ultimately no use can be found for a structure or complex, NPS would consider stabilization and preservation actions such as mothballing. Any activities with the potential to affect contributing structures, buildings, objects, or sites of these historic districts would need to be considered within the provisions of NHPA and in consultation with the SHPO. NPS would also apply this approach to individual structures that may become vacant in the future.

Visitor Carrying Capacity

GMPs are required to identify and include implementation commitments for visitor carrying capacities (also referred to as visitor capacity) for all areas of the system. Visitor capacity is a component of visitor use management defined as the maximum amount and types of visitor use that an area can accommodate while sustaining desired resource conditions and visitor experiences, consistent with the purpose for which the area was established. By establishing and implementing visitor capacities, NPS can help ensure that visitors have the opportunity for a range of high-quality experiences and that resources are protected. NPS is a leading member of the collaborative six federal agency council known as the Interagency Visitor Use Management Council (IVUMC) that provides a consistent approach to visitor use management. A full description of the IVUMC framework and additional resources related to visitor carrying capacity can be found at http://visitorusemanagement.nps.gov/.

Consistent with the IVUMC framework, the desired conditions for preservation of area resources and visitor experiences were used to guide the development of capacity for the planning area. Visitor-caused issues in the planning area were identified and include parking, crowding and congestion, trash, and waste. The discussion of issues helped inform the development of indicators (measurable attributes that can be tracked over time) and thresholds (minimal acceptable condition for each indicator), as well as monitoring protocols, management strategies, and actions that can be taken to help maintain desired conditions.

The following indicators were identified for the planning area:

- number of visitors per year;
- number of incidents of informal parking at key destinations;
- number of documented incidents and visitor complaints related to visitor use;
- number of new and existing dumping sites encountered, and incidences recorded; and
- documented condition assessment changes to cultural resources from visitor-caused actions and disturbances, as defined in the NPS Archeological Site Management Information System.

Thresholds, monitoring protocols, and management strategies can be found in Appendix I: Indicators, Thresholds, and Visitor Capacity Details.

Visitor capacities were then identified for the planning area following the IVUMC framework and by using best practices and examples from other plans and projects across the national park system. Based on these best practices, the planning team used the following process to identify capacity: (1) determine the analysis area, (2) review existing direction and knowledge, (3) identify the limiting attribute, and (4) identify visitor capacity and strategies to implement visitor capacity.

Three key areas were identified, which together compose most of the visitor use areas in the planning area:

1. Key visitor destinations along Pierce Point Road and L Ranch Road
2. North district of Golden Gate lands
3. Key visitor destinations along Sir Francis Drake Boulevard from Pierce Point Road to the end of the planning area (A Ranch)

Visitor capacities identified for these areas generally maintain current visitor use levels, measured primarily by vehicle counts, with some opportunities to increase other types of use such as biking and trail-based recreational experiences. Visitor capacity analysis also illustrates the opportunity to redistribute some visitor use temporally and spatially in the planning area and throughout the park.

Strategies that would be implemented to manage visitor capacity generally involve providing more information to visitors to be able to accurately wayfind and select experiences; expanding the range of visitor opportunities in the planning area; managing access through a broader range of tools; formalizing trailheads and parking; managing large-scale trail-based event requests; and partnering to improve safe multi-use of the roads notably for bicycle access.

Appendix I presents the detailed visitor capacity identification as it relates to the visitor use management framework for the planning area. The appendix includes additional detail describing the rationale and methodology for development of the indicators listed above; associated thresholds; and associated monitoring protocols, management strategies, and actions that can be taken to help maintain desired conditions. The appendix also outlines the future monitoring of use levels and data that will inform NPS if use levels are at or near visitor capacities, along with the adaptive management strategies that would be taken. These adaptive management strategies represent the suite of actions that could be taken to manage visitor capacity if thresholds are approached or exceeded. Not all of these strategies would necessarily be taken or needed to manage capacity. Adopting this visitor capacity framework would amend the 1980 GMP by adding guidance and management direction for managing visitor capacity in the planning area. It also fulfills the statutory requirement for general management plans related to visitor carrying capacity.

Ranch Operations

Subzoning Framework

To ensure protection of natural and cultural resources, streamline the permitting process for typical ranch activities, and provide consistent guidance to ranchers, this alternative adopts a subzoning framework for the 28,100-acre Ranchland zone that would define the Resource Protection, Range, Pasture, and Ranch Core subzones. This subzoning framework was developed based on analysis of topography and existing sensitive resource information. By implementing a subzoning framework, NPS can better ensure resource protection by identifying the most appropriate locations for ranch activities. Appendix J provides the methods used to develop the initial mapping estimates for each subzone. The area of each subzone would differ by ranch, based on site topography and the presence of wetlands, rare plants, and other sensitive resources. For purposes of analysis in this EIS, ranch-specific subzoning maps are provided in figures 9 through 32 in appendix A. NPS may make technical revisions to the zone maps based on additional monitoring, surveys, or on-the-ground field verification efforts (see appendix J). These maps would also continue to be refined in collaboration with ranchers, including delineating the clear boundary of each Ranch Core subzone.

Resource Protection Subzone. The Resource Protection subzone includes lands containing sensitive resources, such as creeks and riparian areas, some threatened and endangered species habitat, and archeological sites. No ranching activities would be authorized in this subzone; however, limited Management Activities, including Targeted Grazing, may be authorized to meet NPS resource management goals and objectives. Under alternative B, the Resource Protection subzone would encompass approximately 2,000 acres comprising approximately 800 acres within current lease/permit boundaries but already excluded from ranching and an additional 1,200 acres that would be excluded from ranching.

Range Subzone. The Range subzone is identified as lands where grazing is compatible with resource protection objectives, but more intensive activities would not be allowed because of the documented presence of sensitive resources, including rare plants, native grasslands, wetlands, riparian/stream/pond habitats, forested areas, and threatened and endangered species habitat or habitat necessary for critical components of threatened and endangered species' life cycles. Additionally, this subzone includes nearly all areas with slopes greater than 20%. The authorized activities in this subzone would be limited to cattle grazing; generally, no Management Activities or diversification would be allowed in the Range subzone, unless they would work toward attainment of NPS resource management goals and objectives. Based on analysis of existing sensitive resource data, approximately 16,900 acres (nearly 65%) of the lands under lease/permit would be identified as Range subzone.

Pasture Subzone. The Pasture subzone is identified as lands where no sensitive resources are known to occur; therefore, a suite of Vegetation Management activities, including seeding and Mowing, may be conducted in addition to grazing. The Pasture subzone includes areas where introduced or domesticated native forage species exist and would be used primarily for the production of livestock. Approximately 9,000 acres (nearly 34%) of the area under lease/permit would be identified as Pasture subzone. Existing levels of Manure and Nutrient Management on dairies (approximately 2,500 acres) and Forage Production (approximately 1,000 acres) would be authorized in the Pasture subzone. Under alternative B, some diversification activities would be authorized in the Pasture subzone as described in the "Diversification" section, below. See the "Ranch Operating Agreements" and "Diversification" sections for details. Generally, construction of permanent buildings would not be authorized in the Pasture subzone.

Ranch Core Subzone. The Ranch Core subzone includes the developed complex of buildings and structures and up to 2.5 acres of disturbed lands located adjacent to the developed complex that do not contain or have the potential to affect sensitive resources. The 2.5 acres would be sited in the most appropriate location on each eligible ranch to minimize adverse impacts. Diversification activities and new infrastructure could be authorized in this subzone on the 18 residentially occupied ranch complexes

that are identified in figure 8 in appendix A. Geographic constraints could limit Ranch Core subzone activities on individual ranches. Approximately 220 acres (less than 1%) of the area under lease/permit would be identified as Ranch Core subzone. The exact location of the Ranch Core subzone would be defined in maps attached to each ROA.

Agricultural Lease/Special Use Permits

NPS would issue agricultural lease/permits with up to 20-year terms to continue multi-generational ranching operations on approximately 26,100 acres. When the two remaining life estates expire, other members of the immediate family would be offered a 20-year lease/permit, consistent with other ranches in the planning area. The lease/permits would constitute the overall authorization for the ranch families to operate on park lands, including general terms and conditions, commitments, and standards for ranching operations.

Ranch Operating Agreements. The lease/permit would require each rancher to enter into an ROA to continue ranching. The ROA would identify ranch-specific operational details and requirements associated with (1) beef or dairy ranching (as applicable), (2) authorized diversification activities, and (3) maintenance requirements. The ROA would also identify USDA-NRCS Conservation Practice Standards (Practice Standards) and mitigation measures that apply to authorized Management Activities (see "Management Activities" section, below, and appendix F). Maps identifying the subzones within each ranch would be attached to the ROA to guide the location of the authorized activities. ROAs would be developed with each rancher and reviewed during an annual meeting with NPS staff. If no changes are made, the existing ROA would be recertified for the following year of the lease term. If NPS approves changes to operational practices or requirements, the ROA would be revised accordingly (subject to applicable compliance as described below) and signed by both parties.

Because this EIS analyzes some ranch activities at a detailed level and others at a conceptual level, only actions analyzed in detail in this EIS would be authorized in a ranch's initial ROA. Actions that are analyzed in detail in this EIS under alternative B are beef and dairy ranching at AUM levels as described under this alternative, diversification activities in the Pasture and Ranch Core subzones as described in table 6, preservation and maintenance activities for ranch buildings as described in appendix G, and 41 categories of Management Activities described below and in appendix F. As part of annual ROA discussions, ranchers could submit proposals for other activities that are compatible with the management zoning and other parameters of alternative B. Depending on the proposal, other types of compliance and permitting requirements could also apply (e.g., NHPA, Endangered Species Act [ESA], building permits, San Francisco Bay RWQCB permits). If approved by NPS following the conclusion of all compliance and permitting processes, the proposed activity would be included in a revised ROA for the ranch.

Animal Units. Under alternative B, each ranch would continue to have a maximum number of AU or dairy animals allowed to graze at one time. AU or dairy animals allowed under a lease/permit would continue to be managed to meet the 1,200 pounds per acre RDM standard and other NPS management objectives. NPS would determine annual adjustments to AU or dairy animals based on the use of a rangeland forage production model (see appendix K), monitoring data, NPS range program manager and rancher expertise, historical information, USDA guidelines, and variation in ground conditions and weather/climate. All dairy ranch lease/permits would be permitted based on the number of dairy animals. Annually, NPS and ranchers would review performance measures, including RDM, to identify grazing levels that would ensure site conditions are maintained to meet the minimum RDM standard. RDM performance standards would remain as described for alternative A. Under alternative B, approximately 2,400 AU of beef cattle and 3,115 dairy animals would be authorized, reflective of current reported dairy operations.

Ranch operators would be authorized to have a limited number of livestock and conduct other activities common within a typical ranch complex (e.g., small family garden, non-breeding pigs, horses for personal use) as an accessory use and defined in the ROA as long as the intent is not for commercial or diversification purposes. The types of livestock that would be allowed for this purpose would be consistent with those authorized in the EIS. If located in the Pasture subzone, the animal unit equivalent (AUE) of these animals would be part of the overall AU, not in addition to the authorized AU. Any confinement of these species would be required to meet the San Francisco Bay RWQCB regulations for waste management and any other applicable regulations.

Succession. In the event an existing rancher decides to discontinue ranching, NPS would follow the Succession Policy to determine future use of the ranch.

Appraisal Process. Under alternative B, new appraisals would be conducted, overseen, and completed by the AVSO.

Range Management and Monitoring

General guidelines and monitoring for range management would be the same as those described for alternative A. The expectations and requirements contained in these guidelines would be incorporated into each ROA and updated and revised as new information becomes available. Additional monitoring requirements specific to authorized activities would also be included in each ROA.

The Management Activities that may be authorized under this alternative are described below. Practice Standards that have been identified as having greenhouse gas (GHG) mitigation and/or carbon sequestration benefits on farms and ranches, often referred to as carbon farming practices (e.g., Range Planting, Tree/Shrub Establishment, Riparian Forest Buffer, and Manure and Nutrient Management, among others) are also indicated in appendix F with an asterisk. The list of Practice Standards is based on the qualitative greenhouse benefits ranking of practices prepared by USDA-NRCS (USDA-NRCS 2019).

Management Activities, Practice Standards, and Mitigation Measures

Management Activities, including Ranch Infrastructure and Water Control Management, Vegetation Management, and Other Management Activities described in alternative A would continue under alternative B but through a more systematic process. A general description of these activities can be found under alternative A, and additional detail is provided in appendix F. All activities would adhere to the general principles identified on pages F-1 through F-4 in appendix F to avoid and minimize the potential for adverse impacts and must fit within the prescribed maximum size limits. Ranchers seeking to undertake a Management Activity would submit a proposal to NPS that would be discussed as part of the ROA process. For authorized Management Activities, the ROA would require ranchers to adhere to the established Practice Standards for that activity. These Practice Standards are technical guidelines for the conservation of soil, water, air, and related plant and animal resources and are described beginning on page F-9 of appendix F. In addition to Practice Standards, specific mitigation measures were developed to avoid or minimize impacts from all ranch Management Activities and are mandatory unless otherwise noted in the ROA. These mitigation measures are listed in tables F-11 through F-13 of the appendix where they are cross-referenced with their associated Practice Standards.

In addition to the established guidance from USDA-NRCS, appendix F incorporates mitigation measures and standards from other environmental compliance documents, such as the Marin RCD Permit Coordination Program (which was established to streamline permitting for many of the activity types listed herein), previous NEPA compliance reviews for park-specific projects, and previous biological opinions from USFWS and NMFS. The Management Activities, Practice Standards, and mitigation measures described in appendix F and analyzed in this EIS were developed to avoid and minimize adverse impacts on park resources and streamline the compliance review for common ranch management activities.

No additional NEPA analysis would be required as long as a covered Management Activity authorized in the ROA is conducted in accordance with all applicable Practice Standards and mitigation measures. Some activities may nevertheless still require additional permitting and review by other agencies before incorporation into an ROA.

Practice Standards and mitigation measures may be revised in the future as new information becomes available that would result in better protection of park resources or as a result of changes in law, policy, or regulatory agencies' standards.

Ranch Infrastructure and Water Control Management

Under alternative B, the types of Ranch Infrastructure and Water Control Management activities contained in table 3 are analyzed in detail in this EIS and could be implemented after inclusion in a rancher's approved ROA. NPS would work with ranchers and relevant external agencies to review proposed Ranch Infrastructure and Water Control Management Activities on an annual basis.

TABLE 3: RANCH INFRASTRUCTURE AND WATER CONTROL MANAGEMENT ACTIVITIES

Activity	Associated Practice Standards[a]
Road Upgrade and Decommissioning	Access Road (560), Trails and Walkways (575), Structure for Water Control (587), and Road Closure and Treatment (654)
Infrastructure Improvements	Heavy Use Area Protection (561), Roof and Covers (367), Roof Runoff Structure (558), and Structure for Water Control (587)
Waterway Vegetation and Planting	Grassed Waterway (412) and Filter Strip (393)
Fencing	Fence (382)
Livestock Water Supply	Spring Development (574), Livestock Pipeline (516), Underground Outlet (620), Watering Facility (614), and Pumping Plant (533)
Pond Restoration	Pond Restoration (378[R])
Waterway Stabilization	Grade Stabilization Structure (410) and Lined Waterway or Outlet (468)
Stream Crossings	Stream Crossing (578)

[a] The number in parenthesis is the USDA-NRCS Conservation Practice Standard number.

The Ranch Infrastructure and Water Control Management activities described in table 3 would be the same as those described under alternative A. Under alternative B, fence repair and maintenance of existing fences in place for ranch operations would continue to be the responsibility of the rancher and would follow NPS defined wildlife-friendly fencing design. NPS would require the removal of abandoned fence on ranchlands to address wildlife and visitor safety. Construction of temporary fencing (i.e., electric fencing) would be authorized under alternative B following NPS approval. Ranch water development systems (i.e., springs, wells, storage tanks, and troughs) would continue to be used for cattle consumption, and repair and maintenance in-place would continue to be the responsibility of the rancher. Troughs would require wildlife escape ramps. Redevelopment of existing water sources and associated distribution infrastructure would be authorized following NPS review and approval. Establishment of new water sources (e.g., new wells) would require separate environmental review and is not analyzed in this EIS.

Vegetation Management

Table 4 contains the types of Vegetation Management activities analyzed in detail in this EIS that could be implemented after inclusion in a rancher's approved ROA.

TABLE 4: VEGETATION MANAGEMENT ACTIVITIES

Activity	Associated Practice Standards
Upland and Riparian Vegetation Management and Planting	Critical Area Planting (342), Range Planting (550), Riparian Herbaceous Cover (390), Riparian Forest Buffer (391), Windbreak/ Shelterbelt Establishment (380), Tree/Shrub Establishment (612), Mulching (484), Conservation Cover (327), and Wildlife Habitat Planting (420)
Mowing	Brush Management, Mechanical (314-A) and Herbaceous Weed Treatment (315)
IPM	IPM (595)
Targeted Grazing	Prescribed Grazing (528)

Under alternative B, seeding would be limited to hand broadcast and no-till seed drill using an NPS-approved seed mix in the Pasture and Ranch Core subzones. A plans and specifications document would detail species and equipment used, as well as monitoring and maintenance requirements, such as regular inspections for invasive species. Seeding would also continue to be authorized for Forage Production on 1,000 acres (see below). Requests for aeration would only be allowed if a need is demonstrated (e.g., via soil test).

Under alternative B, Brush Management would generally be considered in the Pasture and Ranch Core subzones. NPS would consider proposals for Brush Management in the Range subzone under limited circumstances. Brush Management authorizations in any subzone would be conducted outside the bird nesting season. If authorization for Brush Management were granted, ranchers would be responsible for maintenance of desired conditions for the treated area. Mowing undesirable species as a form of weed treatment would be authorized in the Pasture and Ranch Core subzones once reviewed by NPS. NPS would consider proposals for mowing undesirable species in the Range subzone under limited circumstances. There would be no limit to the amount of Mowing, but Mowing would be approved on an individual basis and incorporated into ROAs.

IPM related to Vegetation Management would be the same as described for alternative A and would be authorized in the Pasture and Ranch Core subzones as appropriate. Site-specific management for weed treatments would also be allowed in the Range subzone, depending on rancher requests, park vegetation management goals, and extent of infestation. Manual removal of invasive vegetation would also be considered, where appropriate, in areas where listed species are present.

Targeted Grazing would be conducted as described for alternative A.

Other Management Activities

Under alternative B, the following types of Other Management Activities, completed in accordance with the associated Practice Standards and mitigation measures identified in appendix F, are analyzed in this EIS and could be implemented after inclusion in a rancher's approved ROA (see table 5). Forage Production and Manure and Nutrient Management activities would only be applicable on ranches where these activities are currently authorized.

Manure and Nutrient Management. Dairies would continue to produce large quantities of manure waste that ranchers would be required to manage consistent with state and federal regulations to avoid impacts on water quality and sensitive resources. Application of animal manure and compost generated in the planning area would be allowed in the Pasture and Ranch Core subzone with an approved nutrient management plan and would remain at a level consistent with existing conditions (approximately 2,500 acres, including approximately 715 acres of dairy Forage Production areas, with some pastures not treated every year). Spreading of compost would be restricted to the Pasture and Ranch Core subzones of

operations that have generated the compost on-site. Compost would only be spread on the ranch where it originated. The requirements for park dairies to comply with animal waste discharge standards found at sections 22560 and 22565 of Title 27 of the California Code of Regulations would continue under alternative B. Under alternative B, application of commercially produced compost and fertilizer would not be authorized. NPS would consider other projects such as CH_4 capture systems, aerobic digesters, and new composting activities on a case-by-case basis within the Ranch Core subzone on dairy ranches if requested by an individual rancher.

Forage Production. The methods used to produce silage, haylage, and hay as well as the scale (approximately 1,000 acres) would be the same as described for alternative A and would be authorized in the Pasture subzone. Consistent with alternative A, if ranchers proposed to discontinue Forage Production in permitted areas, those acres would be retired, and the total acreage of Forage Production in the park would be reduced.

TABLE 5: OTHER MANAGEMENT ACTIVITIES

Activity	Associated Practice Standards
Manure and Nutrient Management	Nutrient Management (590), Composting Facility (317), Waste Treatment (629), Waste Separation Facility (632), Waste Transfer (634), and Waste Storage Facility (313)
Forage Production	Forage and Biomass Planting (512), Forage Harvest Management (511), and Residue and Tillage Management/ No-Till (329)

Diversification

New diversification activities could be allowed in specified subzones under alternative B with the use of required mitigation measures specific to each activity (see appendix F). Diversification of ranching activities under alternative B could include new types of livestock, crops, horse boarding, ranch tours and farm stays, and small-scale processing and sale of dairy, meat, and agricultural products produced in the planning area. Diversification activities listed in table 6 would not require additional NEPA compliance provided they are consistent with the prescribed size and location and use all relevant mitigation measures described in appendix F. Proposals for other types of diversification activities would be subject to additional review and compliance. Ranchers would be required to submit a detailed proposal in writing to NPS for review and consideration. All diversification activities would be required to be incorporated into the individual ROA prior to implementation.

Existing diversification activities on ranches would need to conform with the guidance under alternative B (e.g., scale, location, and applicable mitigation measures). Ranchers would not be allowed to harm or harass wildlife or predators to protect crops or livestock. Livestock guardian animals (i.e., dogs, llamas, donkeys) would be allowed with the use of established mitigation measures and a requirement to report any wildlife and visitor conflicts to NPS (see appendix F, table F-14).

The six grazing-only operations that do not include a developed complex or authorized residential use of buildings would not be authorized to conduct diversification activities (F Ranch, Martinelli Ranch, Genazzi Ranch, E Gallagher Ranch, McFadden Ranch, and C. Rogers Ranch).

Ranch Core Subzone. In addition to cattle, livestock species that are analyzed in detail in this EIS and could be allowed in the Ranch Core subzone include chickens, sheep, and goats, as described in table 6. Any confinement of these species would be required to meet the San Francisco Bay RWQCB regulations for confined animal facilities and any other applicable regulations.

Up to 2.5 acres of crops could be allowed in the Ranch Core subzone. NPS, together with the rancher, would identify the most appropriate location in the Ranch Core subzone to minimize adverse impacts. Ranchers would be allowed to fence the 2.5 acres of crops to exclude wildlife. Crops that have the potential to escape or become invasive (e.g., fennel) would not be authorized.

Under alternative B, NPS would consider farm stays and ranch tours that are limited to adaptive use of existing structures and in compliance with applicable codes. Ranch tours could originate in the Ranch Core subzone but could occur in all subzones.

Ranch-specific proposals for small-scale processing of products produced in the planning area, additional animals (e.g., species consistent with the EIS), horse boarding, and irrigated crops in the Ranch Core subzone would be considered on a case-by-case basis and would require additional environmental review. Although NPS would not consider proposals for species dismissed in this EIS (ducks, geese, turkeys, and rabbits), other species not analyzed in this EIS would be considered on a case-by-case basis and would require additional review and compliance. In addition, proposals that exceed the limits for sheep, goats, and chickens in table 6 would also be considered on a case-by-case basis and would require additional review and compliance. Ranchers would be required to submit detailed proposals to NPS and document that resources (e.g., water) are available to support new operational requirements prior to NPS conducting additional review and compliance.

Pasture Subzone. Sheep, goats, and chickens are analyzed in detail in this EIS and could be allowed in the Pasture subzone, as described in table 6. Pasture diversification activities should be located in the vicinity of the occupied Ranch Core subzone on authorized ranches. Construction of permanent infrastructure associated with diversification activities would not be allowed in the Pasture subzone; however, temporary electric fencing would be approved.

TABLE 6: DIVERSIFICATION ACTIVITIES ANALYZED IN DETAIL IN THIS EIS – ALTERNATIVE B

Activity	Size/Scale[a]	Subzones Where Authorized[b]
Chickens	▪ Up to 500 chickens with up to 3 associated mobile huts. ▪ Huts would be of a limited height and in a color that minimizes visual impacts on the landscape and would be moved regularly.	▪ Ranch Core and Pasture
Sheep or Goats	▪ Up to 50 sheep or up to 66 goats (10% of authorized AU or not to exceed 10 AU if authorized AU is greater than 100).[c] ▪ This allocation is part of permitted AU, not in addition. Cattle AU would be reduced to accommodate sheep and goats.	▪ Ranch Core and Pasture
Crops	▪ Up to 2.5 acres, not requiring irrigation[d].	▪ Ranch Core
Farm stays/ Ranch tours[e]	▪ Limited to adaptive use of existing structures.	▪ Ranch Core[e]

[a] All activities must follow applicable mitigation measures provided in appendix F.
[b] Diversification activities are only authorized on the 18 ranches with a developed complex.
[c] For grazing purposes, sheep and goats have AU equivalents of 0.2 and 0.15 AU, respectively (USDA-NRCS 2006a).
[d] Consistent with the agricultural lease/permit, ranchers are not allowed to establish new water rights, but NPS would recognize valid existing water rights.
[e] Ranch tours are anticipated to originate in the Ranch Core subzone but could occur on Ranch Core, Pasture, and Range subzones.

Ranch Complexes

Under alternative B, ranchers would continue to use residential units, barns, and other structures. Occupancy of residential units in the 18 developed complexes would be limited to family members of lease/permit holders, employees of that ranch (and their family), and, with NPS approval, employees of other park ranches. The types of agricultural structures (e.g., loafing barns) and utility services

(e.g., electricity, water) on ranch complexes would be the same as those described for alternative A. Pest control restrictions under alternative B would be the same as those described for alternative A. As a condition of the lease/permit, all ranch worker housing would be maintained in a safe and sanitary condition to ensure the health and well-being of occupants.

Use of Ranch Complexes. NPS and its partners would strive to preserve and maintain the significant physical attributes or character-defining features that contribute to the integrity of the historic districts in the planning area. Most ranch complexes are components of the historic districts and contain historic buildings and other features that NPS would preserve whenever possible. NPS would collaborate with ranchers to preserve ranch complexes (and would include maintenance and upkeep requirements in the ROAs). Maintenance and upkeep could be augmented with support from the Point Reyes Historic Preservation Crew and other NPS stewardship and preservation programs. Appendix G provides a list of preservation and maintenance guidelines for ranch buildings under lease/permit. Adaptive use of individual structures or full ranch complexes may be used as a preservation strategy if they are no longer used to support ranch operations. NPS would review and approve all proposed new uses and associated modifications to ranch complexes and structures to ensure conformance with the EIS and the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Maintenance. Maintenance is an important ongoing activity that would continue to be accomplished in collaboration between NPS and ranchers, as described for alternative A. Ranchers would continue to maintain ranch complex infrastructure, including all water, sewer, and electrical systems, as well as most ranch service roads in a safe condition, using Practice Standards and mitigation measures that limit impacts on sensitive resources; no new roads or trails would be established without prior written permission from NPS. Regular maintenance activities would be the same as those listed under alternative A. Maintenance activities that are not analyzed in this EIS would require additional environmental review.

The overall condition of historic structures is poor to fair (see "Chapter 3: Cultural Landscapes, Historic Districts, and Historic Structures"). A substantial level of investment is needed to address the deferred maintenance needs on many of these structures and to bring them up to a maintainable state. Completion of these one-time investments would then make it easier for ranchers to fulfill ongoing maintenance needs for these facilities.

New Development/Infrastructure Improvements and Alterations. Alternative B allows for improvements and alterations of existing structures, upgrades to worker housing, and new development and infrastructure in compliance with the subzoning framework of this alternative. All such work would be the responsibility of the rancher at their own cost, would require prior written approval from NPS through the ROA process, and would be done in accordance with applicable laws as described for alternative A. All worker housing would comply with local building codes and safety standards. New development would require site-specific review and compliance once a detailed proposal is submitted to NPS. Approved projects would be authorized in an individual ROA. Except in very limited circumstances, development of new structures and minor additions would only be considered in the Ranch Core subzone.

Elk Management

The management of free-ranging elk under alternative B would allow elk in the Point Reyes portion of the planning area but with limited geographic distribution and controls on herd size on areas under lease/permit. No new elk herds would be allowed to establish on areas under lease/permit. A new herd would consist of a group of elk that split from either the Drakes Beach or Limantour herds to occupy a distinctly new home range and where the juveniles and adult females in the splinter group have limited interaction with, or do not return to, their herd of origin. Adult males may move between herds without constituting a new herd.

NPS would take actions to manage the population level of the Drakes Beach herd in Point Reyes and would continue to take actions to reduce conflicts related to the presence of elk on ranches (e.g., hazing); mitigate elk damage to ranch infrastructures; and conduct monitoring, disease testing, and reporting. NPS would establish an additional wildlife technician position that would increase the capacity of the park to implement the monitoring and mitigation efforts to mitigate impacts on ranch operations. These actions would include:

- Pushing elk from active pastures to areas not leased for grazing by using a graduated management response, including standard and aggressive hazing techniques
- Enhancing habitat in the Scenic Landscape zone on areas frequented by elk, including water enhancements, weed control, pasture mowing, and targeted grazing to increase forage for elk off ranch lands. This includes removing non-native plant species that are unpalatable to elk and removing brush that prevents the growth of quality forage on approximately 70 acres in the Scenic Landscape zone.
- Modifying livestock feeding strategies, redesigning existing infrastructure, or developing new infrastructure that would reduce the likelihood of elk feeding on supplemental forage for cattle. For example, NPS would work with the ranchers on options to address issues with hay loss to elk.
- Repairing fences damaged by elk and building elk crossings to allow elk to cross fences without damaging them.
- Offering fence materials to ranchers for repairs.
- Strategically siting pasture fences to exclude elk from specific high value pastures would be considered. NPS would work with park ranchers to identify specific areas on a ranch where such fencing may be most effective.
- Installing alternative fence designs, particularly around seasonal pastures to minimize damage to fences resulting from elk movement across fence lines.
- Continuing elk monitoring within the planning area including at least weekly ground observations and the use of GPS collars. These efforts would be used to determine the amount of time that elk are spending in different areas, allowing the NPS to measure elk response to the actions identified in alternative B and to adapt as appropriate.
- Inspecting areas frequented by elk regularly by NPS for elk impacts to fencing and other ranch infrastructure.
- Meeting regularly with those ranchers most affected by elk to allow for an assessment of which elk management strategies are most effective and what strategies may need more emphasis or adjustment.

In the event of an unforeseen circumstance that causes the herds to completely move from long-established core use areas to other locations in the planning area, NPS would reevaluate the impacts and management approaches set forth in this alternative as needed to ensure maintenance of a viable free-ranging elk population in Point Reyes, which may result in the need for further environmental review.

Population Level Management and Geographic Extent

Under alternative B, NPS would actively manage the free-ranging elk herds in the Point Reyes portion of the planning area. NPS would manage the herds to remain in Point Reyes, in coordination with CDFW. At Tomales Point, NPS would continue to maintain the elk fence that serves as the northern boundary to the planning area, and any elk that leave the reserve would be returned to the reserve. The elk at Tomales Point would continue to be managed as a fenced population in accordance with the 1998 Tule Elk Management Plan/EA.

No new herds would be allowed to establish on the areas under lease/permit in the planning area. A graduated response would be taken to deter establishment of new herds. First, NPS staff would try to haze elk back to their original location. If unsuccessful, NPS would employ more aggressive hazing techniques such as firing bean bag shots at the elk. If hazing does not work, lethal removal of a few individuals, particularly the lead female if she can be identified, could be tried. As a last resort, NPS would move forward with complete elimination of the new herd through lethal removal.

Drakes Beach Herd. NPS would actively manage the Drakes Beach herd to keep it in its existing core area (i.e., between Barries Bay and the C Ranch and B Ranch boundary). The herd would be maintained at a stable and viable population level, consistent with desired conditions for the planning area. Based on estimated forage consumption by elk, forage productivity on ranches, and time that elk spend on ranches, as well as NPS capacity to manage elk, NPS has set a population threshold of 120 adult elk for this alternative (see Becker et al. 2019, appendix K). While the elk population may experience a slight increase each year as a result of spring calving, a population count would be conducted each fall, and if necessary, elk would be removed to reach the population threshold prior to the next spring calving season. Most removals would occur outside the calving and rut seasons, and no reproductively active females or bulls would be lethally removed during the calving and rut seasons. The population threshold is not anticipated to change unless there are long-term or permanent changes to existing conditions. In the event of such a change, NPS would revise the population threshold consistent with the goal to maintain a viable free-ranging elk population, which may result in the need for further environmental review. Male elk that stray from core use areas would be monitored closely, and actions may be taken to mitigate for impacts on ranching operations. Population reduction efforts may target male elk outside the core area if conflicts with ranching operations arise.

NPS would manage the Drakes Beach herd to the population threshold using lethal removal methods or, if practicable, translocation outside the park. Currently, the State does not allow the translocation of elk outside the park because of concerns about spreading Johne's disease. Previous efforts to move elk in or out of the park have been halted because of Johne's disease and/or CWD policies. CDFW's comment letter in response to the draft EIS, dated September 23, 2019, reads in part, "Translocation of elk out of PRNS [Point Reyes] is not a viable option for population management due to the potential for translocation of diseases, short and long-term costs, risk to staff or contractors, and risk to animals." If translocation becomes a practicable option in the future, additional environmental review would be completed at that time to address potential impacts on elk and other resources.

Removals for population management would consider the desired sex ratio needed to maintain the Drakes Beach herd at a reduced number and be consistent with natural conditions of the herd. Between 12 to 18 elk are anticipated to be removed annually using existing NPS staff, qualified volunteers, or other authorized agents to maintain the herd at the population threshold.

Because the elk herd consisted of 138 animals in late 2019 and more calves will be born in spring 2020, initial implementation would require removing more than 18 elk. The total number of elk that would initially need to be removed to reach 120 would depend on the size of the herd at the time of implementation and may take more than one year depending on the resources available to conduct the removals. Elk would be removed using methods that would result in minimal interruptions to park operations, ranchers, and park visitors. NPS would evaluate options to donate meat to the extent possible. Options could include donation of meat to local charitable organizations, the California condor program, tribal groups, or for the purposes of disease testing. Meat donation would occur in collaboration with the appropriate state and federal agencies, including the NPS Office of Public Health, the California Department of Food and Agriculture, USDA, and CDFW. Elk carcasses that are difficult to retrieve would be left in place.

Limantour Herd. Management of the Limantour herd would be based on the concept of not allowing new herds to establish in the planning area using the graduated response noted above. Elk from the Limantour herd would be allowed to wander outside a core area, if they do not establish new herds, and they would be monitored closely and managed consistent with desired conditions for the planning area. While male elk would continue to be present on ranchlands, areas of high elk concentration would be monitored and managed in response to localized resource impacts. In these cases, the graduated management response described above would be implemented, including standard and aggressive hazing techniques and the potential for lethal removal of individual elk. NPS would not allow new female groups to become permanently established on lands under lease/permit in the planning area. NPS would also take management actions if new Limantour female groups from the wilderness area begin spending considerable time on lands under lease/permit in the planning area, particularly during the rut and calving seasons (figure 2 in appendix A). Female groups would be hazed back to the wilderness area, and lethal removal may be needed to prevent the permanent establishment of new herds on lands under lease/permit in the planning area.

Recently a group of 20–24 cows and juvenile elk have occurred for much of the year on the back pastures of Home Ranch. Hazing this group back into the wilderness areas has mostly been ineffective. Consistent with the approach provided above, more aggressive actions would be taken to prevent this group from becoming a new herd, including the potential for lethal removal of this group.

No population-level management would be taken that would threaten the future existence or viability of the Limantour herd, consistent with the goals of the 1998 Tule Elk Management Plan/EA to maintain viable populations of tule elk in Point Reyes and to manage with minimal intrusion to regulate population size, where possible, as part of natural ecosystem processes.

ALTERNATIVE C

General Description and Zoning

Like alternative B, under alternative C, NPS would amend the 1980 GMP for lands in the planning area by adopting new programmatic guidance and applying two new management zones, the Ranchland zone and the Scenic Landscape zone. Under alternative C, ranching would continue the same as described for alternative B (see figures 33 and 34 in appendix A), but the Drakes Beach herd would be removed.

Application of the Ranchland and Scenic Landscape zones would be the same as described for alternative B. NPS would issue lease/permits with up to 20-year terms to the existing ranch families to continue beef and dairy operations on 26,100 acres and would implement the subzoning framework described for alternative B. Ranch management and strategies for the management of historic structures and adaptive use of vacant structures would be the same as those described for alternative B. Authorized AU and dairy animals would be the same as described for alternative B. Alternative elements specific to alternative C are described below.

Preservation of Area Resources

Preservation of area resources under alternative C would be the same as described under alternative B.

Public Use and Enjoyment

Public use and enjoyment under alternative C would be the same as described under alternative B.

Visitor Carrying Capacity

Visitor carrying capacity under alternative C would be the same as described under alternative B.

Ranch Operations

Ranch operations under alternative C would be the same as described under alternative B.

Elk Management

Drakes Beach Herd

Under alternative C, the Drakes Beach herd, totaling 138 individual elk (as of late 2019), would be removed using agency-managed, contractor-led lethal removal methods. In cooperation with CDFW, translocation of a limited number of individuals outside the park would be explored, if practicable. If translocation became a practicable option in the future, additional compliance would be completed at that time to address potential impacts on elk and other resources. Removal of the Drakes Beach herd, which would occur during daylight hours and outside the calving and rut seasons, is anticipated to be a one-time event, occurring over several months. During the removal, portions of roads may be closed for short durations. NPS would evaluate options to donate meat to the maximum extent possible.

Limantour Herd

As described for alternative B, NPS would continue to take actions to prevent or mitigate elk damage to ranches and conduct disease testing and reporting for the Limantour herd. The population level management and geographic extent of the Limantour herd would be managed as described for alternative B. No new herds would be allowed to establish on lands under lease/permit in the planning area.

ALTERNATIVE D

General Description and Zoning

Like alternative B, under alternative D, NPS would amend the 1980 GMP for lands in the planning area by adopting new programmatic guidance and applying two new management zones, the Ranchland zone and the Scenic Landscape zone. Under alternative D, ranching would be reduced, and the Drakes Beach herd would be managed as described for alternative B. Diversification activities would be authorized as described for alternative B.

Under alternative D, ranching operations would be phased out on approximately 7,500 acres. Upon cessation of ranching operations, these areas would be incorporated into the Scenic Landscape zone. These areas generally include grazing-only leases with minimal infrastructure. Grazing-only permits would be phased out over a one-year period except for the two remaining life estates that are part of the approximately 7,500 acres. For areas removed from grazing, the determination regarding the need for and level of Targeted Grazing would be driven by NPS resource management goals and objectives. NPS would identify priority areas for Vegetation Management and develop a restoration plan to identify priority habitat that would need to be maintained to protect sensitive species or communities (e.g., priority California red-legged frog pond breeding habitat or endangered plant populations that benefit from grazing; see table 2 for additional strategies). Upon expiration of the life estates, ranching would be discontinued, and these areas would be incorporated into the Scenic Landscape zone.

The Ranchland zone would include approximately 19,000 acres that remain in active ranching (see figures 35 and 36 in appendix A). NPS would authorize the continuation of multi-generational beef and dairy ranching operations under lease/permits with terms up to 20-years for the remaining ranches and specific AU or livestock numbers would be authorized, as described for alternative B. Approximately 1,700 AU of beef cattle and 3,115 dairy animals would be authorized under alternative D. NPS would manage ranching operations in the Ranchland zone under a subzoning framework as described for alternative B. Alternative elements specific to alternative D are described below.

Preservation of Area Resources

Preservation of area resources under alternative D would be the same as described under alternative B.

Public Use and Enjoyment

Public use and enjoyment under alternative D would be the same as described under alternative B.

Visitor Carrying Capacity

Visitor carrying capacity under alternative D would be the same as described under alternative B.

Ranch Operations

Subzoning Framework

Resource Protection Subzone. Under alternative D, 1,400 acres would be in the Resource Protection subzone comprising approximately 500 acres within current lease/permit boundaries but already excluded from ranching and an additional 900 acres that would be excluded from ranching.

Range Subzone. Under alternative D, approximately 11,600 acres (61%) of the lands under lease/permit would be identified as Range subzone.

Pasture Subzone. Under alternative D, approximately 7,100 acres (37%) of the lands under lease/permit would be identified as Pasture subzone. Manure and Nutrient Management activities on dairies would continue to be authorized in the Pasture subzone.

Ranch Core Subzone. The Ranch Core subzone would be defined as described for alternative B. Once the two life estates expire, the Ranch Core subzone would include 16 ranch complexes.

Management Activities, Practice Standards, and Mitigation Measures

Vegetation Management. Vegetation Management activities on lands under lease/permit would be the same as described for alternative B. For areas removed from grazing, the determination of need and level of Targeted Grazing would be driven by desired management objectives for vegetation communities. Areas removed from grazing may require increased NPS effort in management, early detection, and adaptation of IPM strategies.

Ranch Complex Management

Under alternative D, ranchers would continue to use residential units, barns, and other structures. The types of agricultural structures and utility services on ranch complexes would be the same as those described for alternative A. Plans for adaptive use or the decommission/deconstruction of unoccupied structures or complexes would be developed as described for alternative B.

Elk Management

Under alternative D, elk monitoring and research, disease testing, and reporting of elk would be the same as described under alternative A. Both the Drakes Beach and Limantour herds would be managed as described for alternative B for lands in the Ranchland zone remaining under lease/permit.

An additional 581 acres within the core use area of the Drakes Beach herd would no longer be under lease/permit. If there were long-term or permanent increased use of these acres by the Drakes Beach herd, NPS may revise the population threshold for the Drakes Beach herd, which may require further environmental review.

If new herds formed on lands within the Scenic Landscape zone where ranching has been discontinued in Point Reyes, they would be allowed to continue, and a population threshold would be developed for the new herd, which may result in the need for further environmental review. No new elk herds would be allowed to establish in areas under lease/permit, as described under alternative B.

ALTERNATIVE E

General Description and Zoning

Like alternative B, under alternative E, NPS would amend the 1980 GMP for lands in the planning area by adopting new programmatic guidance and applying two management zones, the Ranchland zone and the Scenic Landscape zone. Under alternative E, the six active dairy ranches in the planning area would cease dairy operations and there would be limited management of the Drakes Beach herd.

Application of the Ranchland zone would be the same as described under alternative B for beef operations. Dairies would be phased out over a period of up to five years, and ranchers would be eligible to convert dairy operations to beef cattle grazing (figures 37 and 38 in appendix A). Depending on the conversion rate of dairy ranches to beef, up to 26,100 acres would be included in the Ranchland zone and would be available for ranching under alternative E. If an existing dairy rancher did not want to convert to beef ranching, NPS would follow the Succession Policy to determine future use of the ranch and may consider potential conversion of some or all the land to the Scenic Landscape zone. For areas remaining in beef cattle ranching, NPS would authorize the operations with lease/permits under a subzoning framework similar to that described for alternative B, including the management of historic structures. The RDM standard would be managed the same as described under alternative B. Adaptive use of historic buildings on dairy ranches would be considered to support a change in operational activities to either beef ranching or as an inactive ranch, as described below.

Specific AU would be authorized based on the current conditions when the ROAs are developed, as described for alternative B. If all dairy operations converted to beef, all dairy animals (approximately 3,115) would be removed from the ranched lands, and based on current conditions, initially up to 750 AU of beef cattle would be authorized on these former dairies. Up to 3,150 AU of beef cattle would be authorized under alternative E.

Elements specific to alternative E are described below.

Preservation of Area Resources

Preservation of area resources under alternative E would be the same as described under alternative B.

Public Use and Enjoyment

Public use and enjoyment under alternative E would be the same as described under alternative B.

Visitor Carrying Capacity

Visitor carrying capacity under alternative E would be the same as described under alternative B.

Ranch Operations

Subzoning Framework

The areas for all subzones would be the same as those described under alternative B. With the elimination of dairy operations, manure spreading and Forage Production would cease in the Pasture subzone.

Management Activities, Practice Standards, and Mitigation Measures

Vegetation Management. Shrub management, which could include Targeted Grazing and mechanical removal (e.g., Mowing), would be authorized only to meet NPS resource management goals and objectives. Weed management would be the same as described for alternative B. Seeding would only be authorized to meet NPS resource management goals and objectives. Aeration would not be authorized.

Other Management Activities. Under alternative E, the need for Manure and Nutrient Management activities associated with dairy operations would be eliminated. Manure spreading on 2,500 acres would cease. Ranchers would be required to decommission manure management infrastructure and restore disturbed areas in coordination with NPS. Application of commercially produced compost and fertilizer, as well as animal manure and compost generated in the planning area, would be not authorized.

Forage Production would not be authorized. The park would work with ranch operators to convert the 1,000 acres of former silage fields to permanent pasture.

Diversification

Diversification activities in the Ranch Core and Pasture subzones, including the commercial chicken and horse boarding operations would no longer be authorized under alternative E.

Ranch Complexes

Under alternative E, ranchers would continue to use residential units, barns, and other structures. The types of agricultural structures and utility services on beef cattle ranch complexes would be the same as those described for alternative A. Adaptive use of unoccupied structures or complexes would be developed as described for alternative B; however, the transition from dairy to beef cattle ranching operations would change the use of some contributing structures, such as milking barns, and some buildings may no longer have a use to support these operations. If several ranch complexes or structures were to become vacant as a result of phasing out dairy ranches under this alternative, NPS would seek to preserve ranch structures that are critical to maintaining the integrity of the historic district. The condition of structures would also be considered in prioritizing maintenance activities.

Elk Management

Under alternative E, NPS would take no action to limit the population growth or geographic extent of free-ranging elk as long as elk do not move outside Point Reyes. NPS would no longer haze elk from ranchlands, and authorized AU for each ranch would be adjusted as needed to ensure RDM goals were being met. NPS would continue to conduct monitoring, disease testing, and reporting and would consider taking action to reduce conflicts related to the presence of elk on ranches (e.g., fence repairs).

Elk population modeling developed by the NPS Biological Resources Division and separately by Cobb et al. (2020) for the Drakes Beach and Limantour herds considered demographic counts since free-ranging elk were established and estimated vital rates, such as recruitment and juvenile and adult survival. Based on these modeling efforts and the expectation that elk would steadily expand their range across Point Reyes, the existing free-ranging elk population at Drakes Beach and Limantour could potentially expand to 2,800 individuals over a 20-year period. Population growth and herd distribution would likely be influenced by continued beef operations in Point Reyes, but the overall impact is unknown. Given the absence of predators and the need to keep elk within Point Reyes, population management would be needed at some point in the future, likely beyond 20 years. Further environmental review may be necessary to determine an appropriate population range for elk and management techniques to maintain elk within that range.

Except for hazing, NPS would continue to take actions described for alternative A to reduce the conflicts related to the presence of elk on ranches (e.g., fence repairs); mitigate elk damage to ranches; and conduct monitoring, disease testing, and reporting.

ALTERNATIVE F

General Description and Zoning

Under alternative F, ranching operations would be discontinued, and visitor opportunities would be expanded. The free-ranging elk populations could expand across the planning area. Under alternative F, NPS would adopt new programmatic guidance that would amend the 1980 GMP. NPS would apply the Scenic Landscape zone to the entire planning area, which would replace the zones from the 1980 GMP (see figure 39 in appendix A). This 28,700-acre zone would be managed to support the desired conditions for the planning area defined in chapter 1.

Under alternative F, maintenance and adaptive use of the developed ranch core would be prioritized for each of the historic ranches based on the condition and integrity of the existing infrastructure. In the Olema Valley Dairy Ranches Historic District, the Giacomini, Zanardi, McIsaac, and Stewart Ranch developed complexes would be high priorities for preservation and potential adaptive use. These ranches have a notable number of the characteristic buildings typical of ranches in the district. The remaining ranches in this district in the planning area would not be preserved unless specific funding or adaptive use opportunities became available. In the Point Reyes Peninsula Dairy Ranches Historic District, 6 ranches would be the highest priorities for preservation and potential adaptive use: B, C, D, Home, I, and L Ranches. The remaining 10 ranches in this district would be lower priorities for preservation. The process for identifying new uses would consider the preservation priority and the framework for the use of unoccupied ranch complexes and historic structures outlined below.

Ranching operations with developed complexes would be phased out over a five-year period, except for the two life estates in the park (see figure 40 in appendix A). Grazing-only operations would be phased out in one year. After the life estates expire, no agricultural activities would be permitted. The agricultural lease/permits, range management, Ranchland zone and subzoning framework, and diversification elements described for the other alternatives would not be applicable under alternative F. Management Activities would occur only to meet NPS resource management goals and objectives, as described for alternative E. The total acres available for ranching would be zero. Elements specific to alternative F are described below.

Preservation of Area Resources

The management strategies identified in table 2 for the Scenic Landscape zone would apply under alternative F. Furthermore, as ranching operations are discontinued, NPS would develop a restoration plan to identify priority habitat that would need to be maintained to protect sensitive species or communities, (e.g., priority California red-legged frog pond breeding habitat or endangered plant populations that benefit from grazing pressure). NPS's capacity to maintain all documented habitat features would be limited.

Public Use and Enjoyment

Once ranching has been removed, under alternative F, additional planning for visitor use that comprehensively addresses and evaluates trail-based recreation, day use, and overnight opportunities in the planning area could be needed to reconsider the distribution of visitor opportunities in the park.

Development of Trails and Trail-Based Recreation

Development of trails and trail-based recreation would be similar to alternative B. Under alternative F, NPS would consider trail linkages that connect new visitor opportunities located in former ranch complexes. The exact locations of additional linkages would depend on the future uses of the ranch complexes and which ranch complexes maintain a public-facing presence, as opposed to NPS or park partner operations use. The overall quantity of trail opportunities would be similar to all other alternatives because it would be driven by NPS capacity to build and maintain these trails.

Development to Support Day Use and Overnight Accommodations

Development to support day use and overnight accommodations would be similar to alternative B, and all ranch complexes would become available for adaptive use, some of which may support visitor opportunities under alternative F. The change in land use could create additional opportunities such as a string of lodging or camping sites connected by trails. NPS would likely evaluate opportunities for additional adaptive uses through a request for proposal process. The overall diversity and quantity of overnight and day use opportunities would be expanded under this alternative.

Development to Support/Enhance Interpretation and Education

Development to support/enhance interpretation and education would be similar to alternative B. Under alternative F, NPS would use a wider range of techniques to interpret the history of ranching in the park, potentially including exhibits in historic structures that are no longer actively used for ranching. A collaborative interpretive plan that tiers from this EIS would be developed for the continued interpretation of ranching history across the landscape following the phase out of ranching.

Use of Unoccupied Ranch Complexes and Historic Structures

The majority of ranch complexes are components of the historic districts and contain contributing buildings and other characteristic features that NPS would strive to preserve whenever possible. NPS would determine preservation strategies for the ranch complexes in the planning area using the approach identified below. NPS would undertake all new uses and associated changes to the structure in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. Adaptive use could include minor additions to existing structures or limited new construction to make a potential adaptive use proposal viable.

NPS would use the following process to determine appropriate adaptive use for vacant ranch complexes or contributing structures:

- NPS would consider if the structure or complex could be used for NPS or park partner operational uses such as employee housing or visitor servicing programs.
- If NPS does not have a viable need and use for the complex or structure, it may issue a request for proposals for adaptive use in ways compatible with park purpose, management zoning, and desired conditions. Stabilization techniques such as mothballing structures may be implemented as a measure to arrest deterioration until a long-term use or treatment is identified.
- If ultimately no use can be found for the complex, NPS would consider demolition of the structures. This consideration would require additional NHPA compliance and would be made in consultation with the SHPO. When considering demolition of historic buildings NPS would consider criteria such as historic significance, building integrity, and feasibility of adaptive use. Every reasonable effort would be made to adapt historic properties to new uses.
- Structures that are non-contributing to the National Register historic district may also be considered for demolition.

By applying the process above, there could be additional opportunities for use of some of the vacant ranch complexes to support a higher level of visitation such as a car-camping campground, larger trailhead, and other visitor facilities.

Visitor Carrying Capacity

Under alternative F, NPS would adopt the visitor capacity framework outlined in alternative B, using the same indicators, thresholds, monitoring protocols, and management strategies. NPS would also manage visitor capacity based on the same three key areas identified in alternative B; however, additional key destinations along Sir Francis Drake Boulevard from Pierce Point Road through the end of the planning area could be considered in the analysis. NPS would apply an adaptive management approach to evaluating visitor capacity levels once all ranching operations were discontinued and new visitor

opportunities were established. Additional visitor capacity likely would be allowed under alternative F; however, visitor capacity is not expected to be significantly different from alternative B. NPS would prioritize gathering updated data based on new uses to determine specific visitor capacity. Once ranching has been discontinued, a future planning effort that comprehensively addresses trail-based recreation and day use and overnight use opportunities throughout the park would be considered as a mechanism to integrate this updated visitor capacity analysis.

Ranch Operations

Under alternative F, NPS would not apply the Ranchland zone, Resource Protection, Range, Pasture, and Ranch Core subzones in the planning area. In the absence of active ranching operations, these zones would not be needed for management.

Grazing Practices

NPS may use Targeted Grazing on lands in the planning area to meet resource management goals and objectives (e.g., maintenance of disturbance regimes in grasslands that contribute to the historic character of the two National Register historic districts). Targeted Grazing would be conducted by contract through NPS. The scale of these operations is anticipated to be on the order of 100 to 200 AU or fewer in the planning area and limited to spring through fall, to avoid the wet season, unless required to meet specific objectives. NPS would identify priority areas for Vegetation Management. Additionally, the NPS would remove non-historic infrastructure including fences, pipes, troughs, and prioritize some former ranch roads for decommissioning to address resource management objectives.

Use of Ranch Complexes

Under alternative F, NPS would implement a strategy to minimize impacts on the Point Reyes Peninsula Dairy Ranches Historic District and the Olema Valley Dairy Ranches Historic District as described above.

Elk Management

Under alternative F, NPS would not limit the population growth or geographic extent of free-ranging elk in the Point Reyes portion of the planning area. Until cessation of ranching operations, NPS would consider limited, non-lethal management measures for elk. Once ranching operations cease, the elk fence at Tomales Point would be removed, consistent with the removal of other boundary fences in the planning area.

Similar to alternative E, the existing free-ranging elk herds at Drakes Beach and Limantour could potentially expand to 2,800 individuals over a 20-year period. Unlike alternative E, however, following the removal of the fence at Tomales Point, elk from this area are expected to expand beyond Tomales Point, introducing an unknown effect on the population parameters and growth rate of the Drakes Beach and Limantour herds. In addition, removal of ranching under alternative F may influence the long-term population growth and distribution of the Drakes Beach and Limantour herds through the elimination of potential forage competition and other factors influencing population parameters in these herds. Similar to alternative E, given the absence of predators and the need to keep elk within Point Reyes, population management would be needed at some point in the future, likely beyond 20 years. Further environmental review may be necessary to determine an appropriate population range for elk and management techniques to maintain elk within that range.

TABLE 7: COMPARISON OF ALTERNATIVE ELEMENTS

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
General Description and Management Zoning						
	NPS would continue to follow previous planning guidance, including the 1980 GMP. The inconsistency between the 1980 land management zones and current ranching operations would continue.	NPS would amend the 1980 GMP by adopting a new zoning framework and new programmatic management direction for the planning area. NPS would allow for continued ranching and provide a population threshold for management of the Drakes Beach herd. NPS would apply two new management zones, the Ranchland zone and the Scenic Landscape zone to the planning area.	Same as alternative B except the Drakes Beach herd would be removed.	NPS would adopt new programmatic guidance and two new management zones, the Ranchland zone and the Scenic Landscape zone would amend the 1980 GMP. Ranching acreage would be reduced, and the Drakes Beach herd would be managed as described for alternative B. Application of the new zones would be the same as alternative B; however, the subzoning would vary. Ranching operations would be phased out over a one-year period on approximately 7,500 acres, which would become part of the Scenic Landscape zone.	NPS would adopt new programmatic guidance and two new management zones, the Ranchland zone and the Scenic Landscape zone would amend the 1980 GMP. There would be limited management of the Drakes Beach herd. Application of the zones would be the same as alternative B. Dairies would be phased out over a period of up to five years, and ranchers would be eligible to convert dairy operations to beef cattle grazing.	Ranching operations would be discontinued, visitor opportunities would be expanded, and the free-ranging elk populations could expand across the planning area. NPS would adopt new programmatic guidance that would amend the 1980 GMP to apply the Scenic Landscape zone to the entire planning area, which would replace the zones from the 1980 GMP.
Preservation of Area Resources						
	NPS would continue to follow previous planning guidance, including the 1980 GMP.	NPS would adopt desired conditions and associated management strategies for preservation of ecological function; preservation of native species, including threatened and endangered species; management of invasive/non-native species; and preservation of cultural resources.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Same as alternative B, except strategies for the Ranchland zone would not apply to this alternative once ranching has been removed.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Public Use and Enjoyment						
	NPS would continue to follow previous planning guidance, including the 1980 GMP.	NPS would adopt the following strategies and actions to achieve the desired conditions for facilitating public use and enjoyment and visitor experience in the planning area for the following key areas: development of trails and trail-based recreation; development to support day use and overnight accommodations; development to support/enhance interpretation and education; development related to shuttles and parking; and potential use of unoccupied ranch complexes and historic structures.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Same as alternative B plus once ranching has been removed, additional planning for visitor use that comprehensively addresses and evaluates trail-based recreation, day use, and overnight opportunities in the planning area could be needed to reconsider the distribution of visitor opportunities in the park available for potential visitor use.
Visitor Carrying Capacity						
	NPS would continue to manage for visitor capacity as part of regular park operations but would not have a documented framework for programmatic decision-making related to visitor capacity. NPS would respond to individual situations or issues on a case-by-case basis.	Strategies that could be implemented to manage visitor capacity generally involve: providing more information to visitors to be able to accurately wayfind and select experiences throughout the park; expanding the range of visitor opportunities in the planning area; managing access through a broader range of tools; formalizing trailheads and parking; managing large-scale trail-based event requests, and partnering to improve safe multi-use of the roads notably for bicycle access.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Same as alternative B, with additional key destinations along Sir Francis Drake Boulevard from Pierce Point Road through the end of the planning area considered. NPS would apply an adaptive management approach to evaluating visitor capacity levels once all ranching operations are discontinued and new visitor opportunities were established.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Ranch Operations						
Subzoning Framework						
	Not applicable.	A Ranchland zone with four subzones: Resource Protection, Range, Pasture, and Ranch Core would be implemented. Subzones would be refined based on field surveys and on-the-ground verification and defined in each ROA. *Resource Protection subzone:* Areas removed from lease/permit grazing activities. Approximately 2,000 acres—comprising 800 acres within current lease/permit boundaries but already excluded from ranching and 1,200 acres that would be excluded from ranching. *Range subzone*: Grazed or potentially grazed lands that support native vegetation, managed as a natural ecosystem. Approximately 16,900 acres of the lands under lease/permit. *Pasture subzone:* Grazed lands outside the Range subzone where no sensitive resources are known to occur. Used primarily for the production of livestock, composed of introduced or domesticated native forage species. Approximately 9,000 acres of the area under lease/permit. *Ranch Core subzone:* The developed complex of buildings and structures on each individual ranch and up to 2.5 additional acres of disturbed land adjacent to the developed complex that do not contain or have the potential to affect sensitive resources. Approximately 220 acres (less than 1%) of the area under lease/permit.	Same as alternative B.	Similar to alternative B for areas that continue to be ranched. All areas removed from ranching would become part of the Scenic Landscape zone. *Resource Protection subzone:* Areas removed from lease/permit grazing activities. Approximately 1,400 acres—comprising approximately 500 acres within current lease/permit boundaries but already excluded from ranching and 900 acres that would be excluded from ranching. *Range subzone:* Approximately 11,600 acres of the lands under lease/permit *Pasture subzone:* Approximately 7,100 acres of the area under lease/permit. *Ranch Core subzone:* Similar to alternative B, however, once RUOs expire, two additional ranches would be removed from ranching.	Same as alternative B.	In the absence of active ranching operations, subzones would not be needed for management, so they would not be applied.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Agricultural Lease / Special Use Permit						
Approximate Acres Available for Rancher Use	27,000	26,100	26,100	19,000	26,100	0
Lease/Permit Term	5 or 10-year lease/permit terms.	Up to a 20-year term.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Not applicable.
Ranch Closures	None.	None.	None.	Specific grazing-only leases/permits on ranches without residential complexes would be phased out over a one-year period. Once RUOs expire, two additional ranches would be removed from ranching.	All dairy operations (6) would be phased out over a five-year period. Dairy ranches would be given the option to convert to a beef cattle ranching operation.	All ranching operations would be phased out. Ranching operations with residential complexes would be phased out over a five-year period. Grazing-only permits would be phased out over a one-year period.
Ranch Operating Agreement	Not applicable.	Approved agreement with annual review required.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Not applicable.
Animal Units (AU)	AU would continue to be based on existing authorizations, approximately 2,400 AU of beef cattle and 3,325 dairy cattle.	Approximately 2,400 AU of beef cattle and 3,115 dairy cattle.	Same as alternative B.	Approximately 1,700 AU of beef cattle and 3,115 dairy cattle.	Approximately 3,150 AU of beef cattle (assuming all dairy ranches convert to beef ranches). Based on the elk population, authorized AU for each ranch would be adjusted as needed to meet RDM goals.	Not applicable.
Succession	Relinquish land to neighboring ranchers, remove portions of the lease from ranching for natural resource purposes, or in the case of RUO expiration, initiate a lease/permit with the longstanding grazing operator.	NPS would follow the Succession Policy to determine future use of the ranch. .	Same as alternative B.	Same as alternative B.	Same as alternative B.	Not applicable.
Appraisal Process	New appraisals would be conducted, overseen, and completed by the US Department of the Interior AVSO.	Same as alternative A.	Same as alternative A.	Same as alternative A.	Same as alternative A.	Not applicable.
Range Management and Monitoring						
RDM Standard	Continue as directed by the 1990 Range Management Guidelines and subsequent updates (minimum RDM level of 1,200 pounds/acre).	Same as alternative A but updated/revised as necessary.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Not applicable.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Mitigation Measures	Continue as identified in the 1990 Range Management Guidelines and subsequent updates, including from other agencies and application of specific measures on a case-by-case basis for individually reviewed and authorized Management Activities.	Establish defined Practice Standards and mitigation measures for ranch Management Activities in a regularly reviewed ROA. Continue as identified in the 1990 Range Management Guidelines and subsequent updates, including guidance from other agencies.	Same as alternative B.	Same as alternative B	Same as alternative B.	Not applicable.
Management Activities, Practice Standards, and Mitigation Measures						
Ranch Infrastructure and Water Control Management	Regular management and maintenance of ranch operation would continue. Review of Management Activities on a case-by-case basis; these include Road Upgrade and Decommissioning; Infrastructure Improvements; Fencing; Livestock Water Supply; Pond Restoration, Stream Crossings and Waterway Stabilization requests.	Following NPS review and approval, the following Management Activities would be authorized subject to Practice Standards and mitigation measures in appendix F: Road Upgrade and Decommissioning; Infrastructure Improvements; Fencing; Livestock Water Supply; Pond Restoration; Stream Crossings; and Waterway Stabilization.	Same as alternative B.	Same as alternative B.	Same as alternative B.	Not applicable.
Vegetation Management	Vegetation Management activities would be authorized in individual lease/permits with new practices incorporated into lease/permit on a case-by-case basis. Management Activities include Upland and Riparian Vegetation Management and Planting, Mowing, IPM, and Targeted Grazing.	Following NPS review and approval Upland and Riparian Vegetation Management and Planting, Mowing, IPM, and Targeted Grazing would be authorized subject to Practice Standards and mitigation measures in appendix F.	Same as alternative B.	Same as alternative B. For pastures removed from grazing, the determination by NPS of need and level of Targeted Grazing would be driven by desired ecological objectives for vegetation communities. Areas removed from grazing may require increased NPS effort in management, early detection, and adaptation of IPM strategies.	Shrub management (e.g., Targeted Grazing and Mowing) would be approved for meeting NPS resource management goals and objectives only.	Not applicable as there would be no ranching operations. However, NPS may use Targeted Grazing on lands in the planning area to meet resource management goals and objectives. Would likely require increased NPS effort in management, early detection, and adaptation of IPM strategies for areas where ranching is no longer occurring.
Other Management Activities - Manure and Nutrient Management	Stored manure or compost generated on ranches would continue to be spread across approximately 2,500 acres within lease/permit areas. Minimal use of commercial fertilizer. The use of commercial fertilizer would continue to not be authorized on certified organic lands and rangelands in the park.	Application of animal manure and compost generated within the Ranch Core and Pasture subzones would be allowed with an approved Nutrient Management plan and would be subject to the mitigation measures in appendix F. Application of commercially produced compost and fertilizer would not be authorized.	Same as alternative B.	Same as alternative B.	The need for Manure and Nutrient Management activities associated with dairy operations would be eliminated. Application of commercially produced compost and fertilizer would not be authorized. Application of animal manure and compost generated in the planning area would be not allowed.	Not applicable.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Other Management Activities - Forage Production	NPS would continue to set the standards for cultivation of ranchlands for Forage Production following Practice Standards. Forage Production would continue to be authorized on 1,000 acres.	Same as alternative A and authorized in the Pasture subzone only, subject to the mitigation measures in appendix F.	Same as alternative B	Same as alternative B	Forage Production would not be authorized.	Not applicable.
Diversification						
Other Livestock	Limited number of livestock species including poultry, pigs, sheep and horses are currently authorized under personal use. One commercial chicken operation would continue to be authorized.	Other livestock would only be authorized on 18 ranches with a residential complex as defined below with required mitigation measures in appendix F. Ranch Core subzone: chickens, sheep, and goats would be authorized. Pasture subzone: Sheep, goats, and chickens would be authorized. This allocation is not in addition to, but part of permitted AU. Up to 500 chickens would be allowed (not to exceed 3 mobile huts on pasture), in the Pasture subzone. Temporary fencing would be allowed, but no permanent fencing or other infrastructure may be constructed. No predator management would be allowed but the use of livestock guardian animals would be allowed following established mitigation measures.	Same as alternative B	Same as alternative B.	No diversification activities would be authorized.	Not applicable.
Crops	None	Ranch Core subzone: Up to 2.5 acres of non-irrigated crops would be allowed in previously disturbed areas that do not contain or have the potential to affect sensitive resources. Mitigation measures are specified in appendix F. Wildlife management to protect crops would not be allowed: however, ranchers would be allowed to fence crops to exclude wildlife. Irrigated crops could be authorized pending additional review and compliance.	Same as alternative B.	Same as alternative B.	Crops would not be authorized.	Not applicable.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Other Uses	Horse boarding on one ranch would continue.	Ranch Core subzone: Commercial horse boarding may be authorized with mitigation measures specified in appendix F after a site-specific proposal and analysis. Potential for farm stays, sale of park-produced agricultural products and ranch tours through adaptive use of existing structures. Scale determined through individual ROAs, taking existing infrastructure into account.	Same as alternative B.	Same as alternative B.	Horse boarding and other uses would not be authorized.	Not applicable.
Ranch Complexes						
Maintenance	Ranchers would continue to maintain ranch complex infrastructure, including ranch roads used by NPS, the public and ranchers. In-residence pest control for rodents using traps would be allowed. Use of poison or bait would continue to not be allowed on park lands	Same as alternative A, but subject to maintenance standards in appendix G, and applicable Practice Standards and mitigation measures in appendix F. A substantial level of investment is needed to address the deferred maintenance needs on many of these structures and to bring them up to a maintainable state. Completion of these one-time investments would then make it easier for ranchers to fulfill ongoing maintenance needs for these facilities.	Same as alternative B.	Same as alternative B.	Same as alternative B.	All maintenance would be the responsibility of NPS or partner organizations. NPS would implement a strategy to minimize impacts on the Point Reyes Peninsula Dairy Ranches Historic District and the Olema Valley Dairy Ranches Historic District by prioritizing specific ranch buildings, structures, and landscapes for preservation based on their relative historic significance and identify opportunities for adaptive use. As appropriate, NPS would evaluate potential for decommissioning/ deconstruction of low priority or substantially degraded structures/ complexes.
New Development, Infrastructure Improvements and Alterations	All improvements or alterations to buildings, fences, and corrals would continue to be the responsibility of the ranch operator with prior written approval from NPS.	All improvements or alterations to buildings, fences, and corrals would be included in the ROA prior to implementation, subject to maintenance standards in appendix G, and applicable Practice Standards and mitigation measures in Appendix F.	Same as alternative B.	Same as alternative B.	Same as alternative B.	All Infrastructure Improvements and alterations would be the responsibility of NPS or partner organizations.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Vacant Complexes	Vacant complexes would remain vacant. As opportunities for use arise, they would be considered on a case-by-case basis.	NPS would preserve the ranch complexes in the planning area collaboratively with complex occupants through guidance in the ROAs, the Point Reyes Historic Preservation Crew, and other NPS programs. Adaptive use of individual structures or full ranch complexes may be used as a preservation strategy if they are no longer used to support ranch operations.	Same as alternative B.	Same as alternative B.	Same as alternative B; however, the transition from dairy to beef cattle ranching operations would change the use of some contributing structures, such as milking barns. If several ranch complexes or structures were to become vacant as a result of phasing out dairy ranches, preservation of structures at ranches would be prioritized.	NPS would implement a strategy to minimize impacts on the historic districts by prioritizing specific ranch buildings, structures, and landscapes for preservation based on their relative historic significance and identify opportunities for adaptive use. As appropriate, NPS would evaluate potential for decommissioning/ deconstruction of low priority or substantially degraded structures/ complexes.
Elk Management						
Geographic Extent of Elk	Would not alter or limit the population level or geographic extent of elk in Point Reyes. Continued fence repair, habitat enhancements, and hazing would occur to reduce elk presence on ranches. Any elk that leave Point Reyes for Golden Gate or non-federal lands would be removed.	Both the Drakes Beach and Limantour herds would be actively managed to remain in their core area. Male elk would be allowed to wander outside of a core area provided they do not establish new herds. Same actions as alternative A to reduce conflict related to elk presence on ranches and keep elk off Golden Gate or non-federal lands.	The Drakes Beach herd would be removed; no management would be required. The Limantour herd would be managed the same as alternative B.	Same as alternative B.	NPS would take no action to limit the geographic extent of elk within Point Reyes. NPS would not allow elk to expand into Golden Gate or lands outside park boundaries. Management of the geographic extent of elk would only occur to support other resource protection and park goals. Except hazing, NPS would take actions similar to alternative A to reduce conflict related to elk presence on ranches.	NPS would not limit the population growth or geographic extent of free-ranging elk in Point Reyes. NPS management of elk would occur only to support other resource protection needs and management goals.

	Alternative A No Action	Alternative B NPS Preferred Alternative	Alternative C	Alternative D	Alternative E	Alternative F
Population Level Management	Elk populations would continue to grow in line with current trends. NPS would undertake a planning process to determine an appropriate population level and methods for managing the free-ranging elk in Point Reyes.	NPS would manage the population of the Drakes Beach herd to a threshold of 120 individuals. If necessary, elk would be lethally removed after a count in the fall and prior to spring calving to reach the population threshold. Elk from the Limantour herd would be allowed to wander outside a core area, if they do not establish new herds, and they would be monitored closely and managed consistent with desired conditions for the planning area. No new herds would be allowed to establish. Hazing techniques would be used to prevent the establishment of new herds. More direct (lethal) action would be a method of last resort.	The Drakes Beach herd would be removed by lethal methods or translocation outside of the planning area if practicable. Removal would be a one-time event, occurring over several months. The Limantour herd would be managed the same as alternative B.	Same as alternative B. If new herds form on lands where ranching has been discontinued, the herd would be allowed to continue.	There would be no population level management toward defined herd sizes. All herds would be allowed to grow without interference. If new herds form, they would be allowed to continue, regardless of geographic location if they do not range outside Point Reyes.	Until cessation of ranching operations, NPS would consider limited, non-lethal management measures for elk. Once ranching operations cease, new herds would be allowed to develop in Point Reyes, and the elk fence at Tomales Point would be removed, consistent with the removal of other boundary fences in the planning area. There would be no population level management, consistent with alternative E.
Monitoring and Testing	Monitoring of elk herds would continue, as would testing for Johne's disease and chronic wasting disease.	Same as alternative A.	Same as alternative A.	Same as alternative A.	Same as alternative A.	Same as alternative A.

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ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

The following alternatives were considered but dismissed from further analysis for reasons explained below.

Complete an Updated Park-Wide General Management Plan

NPS considered expanding the scope of the planning effort to include an updated GMP for the entire park, as suggested by some public comments. Although an effort to create a new park-wide GMP was initiated in the late 1990s, planning priorities for the park have changed since that effort began. The scope of this GMP Amendment addresses the park's highest priority planning needs, which include determining the future management of lands currently leased for ranching and the future management of elk herds in this area. Ranchers are operating under interim permits, and guidance is needed to determine whether ranching should be allowed to continue, and if so, under what conditions. The population of free-ranging elk continues to expand, and guidance is needed on herd management. To address these management issues effectively, NPS needs a plan that provides both programmatic and site-specific guidance. Park-wide GMPs are typically limited to providing broad programmatic direction because of the multiple sites, resources, and public-use issues involved in a park-wide plan. A more focused GMP amendment, by contrast, can also consider and analyze site-specific issues. In the case of Point Reyes, critical issues needing site-specific guidance include management prescriptions for free-ranging elk herds and ranch management practices for alternatives that allow ranching to continue. Other park management issues have been appropriately addressed through other planning efforts, such as the *Accessibility Self-Evaluation and Transition Plan*, the *Sir Francis Drake Boulevard Road Improvement Environmental Assessment/Initial Study*, the *Drakes Bay Oyster Company Special Use Permit EIS*, and the *Fire Management Plan*, in addition to other project plans. The scope of this GMP Amendment is also guided by the court-approved Settlement Agreement, which requires a range of alternatives focused on lands currently leased for ranching. NPS policies allow for amending a GMP, rather than preparing a new plan, to address particular park locations or issues, as part of the periodic review of GMPs.

Ranch Management

Converting Beef Cattle Operations to Dairy Operations

A request for converting beef cattle ranching operations to dairy ranching operations was considered but is beyond the scope of this analysis and was dismissed from further analysis in the EIS. This conversion would require adding infrastructure specific to dairy ranching (e.g., milking barns and nutrient management lagoons) to meet current regulatory requirements, changing operations (e.g., greater confinement of cattle for milking, supplemental feeding, and increased nutrient management), and increasing travel on park roads for dairy operations. These changes could cause additional impacts on resources including, but not limited to, increased trampling and grazing of vegetation adjacent to milking facilities, increased risk of water quality impacts from additional quantities of manure, or a greater risk of invasive plants spreading from a higher disturbance of soils in areas adjacent to milking facilities. Consideration of individual proposals to convert beef cattle ranching to dairy ranching would need to occur under separate planning processes in order to consider site-specific information that would address infrastructure needs, operational changes, and compliance with appropriate regulations (such as water quality).

Management of All Park Lands for the Protection, Restoration, and Preservation of Natural Resources

Commenters suggested NPS should manage all park lands solely for the protection, restoration, and preservation of natural resources. In addition to managing park lands for the protection of natural resources, NPS also must manage cultural resources and provide for visitor use and enjoyment in a manner consistent with applicable legal requirements. As a result, management decisions cannot solely be based on impacts to natural resources. This approach was dismissed from further analysis because it would not address impacts on other resources and values that NPS is mandated to consider.

Moreover, the action alternatives in this EIS that include ranching would implement activities and mitigation measures to minimize impacts on natural and cultural resources while also protecting them. Additionally, alternative F would be similar in nature to an alternative focused on the protection, restoration, and preservation of natural resources on all NPS lands.

Implementing the Proposed Action from the 1980 General Management Plan

The July 2017 Settlement Agreement requires NPS to prepare an amendment to the 1980 GMP. Through this GMP Amendment planning process, NPS is updating the 1980 GMP for lands in the planning area, including the north district of Golden Gate.

In addition, elements of the 1980 GMP are no longer feasible or appropriate because new and different issues and objectives have arisen, and new information is available to inform decision-making (e.g., the presence of National Register historic districts and a free-ranging elk herd in the planning area). Therefore, in the context of this new information and planning objectives, this GMP Amendment revisits management approaches for lands and resources in the planning area based on current information and goals. Implementing the proposed action from the 1980 GMP would not meet the purpose and need for the GMP Amendment and was dismissed from further analysis.

Reduced Ranching—Closure of Ranches Draining Only to Drakes Estero

Commenters suggested a reduced ranching alternative that would close ranches that drain into Drakes Estero as proposed in the 2008 GMP planning process because of water quality impacts related to ranching. As part of this EIS planning process, mitigation measures and activities to protect and improve water quality are prescribed across the entire planning area, so impacts to the watershed that drains into Drakes Estero were not identified as a primary consideration when developing the reduced ranching alternative (alternative D). In addition, alternative D would remove grazing from multiple areas, including some lands within the Drakes Estero watershed, resulting in some reduction of water quality impacts in the Drakes Estero and other watersheds in the planning area. Similarly, alternative F analyzes the removal of all ranching in the planning area, including all ranches that drain to Drakes Estero. As a result, an alternative that only reduces ranching on ranches that drain into Drakes Estero is not sufficiently different to warrant full consideration.

Reduced Ranching—Additional Alternatives or Elements

During public review of the draft EIS, commenters made multiple suggestions for additional reduced ranching alternatives, including retiring A Ranch and extending the Chimney Rock and the Lighthouse visitor and interpretation center to this area, gradually phasing out ranching based on attrition, drastically reducing the number of authorized dairy cattle, expanding the area available for cattle grazing into forested areas, removing cattle from all but one ranch, removing ranching operations where there are the biggest impacts on natural resources, and removing cattle on the east side of Drakes Beach Road. As noted in the 2015 NPS NEPA Handbook, alternatives are distinguished based on differences in their approach to resolving the purpose and need for action and the environmental impacts of implementing them, not on mere differences in cost or technical elements. Specifically, alternatives should represent substantively different options for the decision maker to consider as opposed to simply representing

different designs of a substantively equivalent option. The suggested elements all fit within the existing range of alternatives presented in the draft EIS; therefore, additional alternatives have not been analyzed in the final EIS.

Reestablishing Ranches and Grazing in Areas Where Ranching was Previously Discontinued

Commenters suggested that the EIS consider the reestablishment of ranches and grazing in areas where ranching was previously discontinued including D Ranch, Jewell Ranch, and Wilkins Ranch. However, Jewell Ranch and Wilkins Ranch, are outside the scope of the EIS, which is focused on lands currently under lease/permit. These areas have not been grazed for more than 20 years, and the infrastructure needed for ranching, such as fencing, has been removed. Jewell Ranch does not include any infrastructure and any new activities in that area would require new development. The main residence at Wilkins Ranch is already adaptively used as park housing. Given these considerations, these areas were not included in the planning area for the EIS. D Ranch is in the planning area, and the EIS addresses long-term operations and management at this site. Two-thirds of the grazing lands associated with D Ranch have been allocated to other operations, so the lands are actively used. Elk are regularly on D Ranch; therefore, reestablishment of that ranch would not be consistent with park management goals.

Diversification of Certain Livestock (Ducks, Geese, Turkeys, Rabbits)

Small-scale production of ducks, geese, turkeys, and rabbits for purposes of diversification was considered but would not be authorized because of concerns regarding adverse effects on native wildlife from escaped animals cross breeding with native species (Simberloff 1996; Foufopoulos et al. 2002). Turkeys currently exist as a diversification activity on one life estate as a private property right. Once that life estate expires, turkeys would no longer be an authorized use in that location.

Issuance of Rolling Leases

Commenters suggested that NPS issue "rolling" leases in lieu of leases with 20-year terms. Rolling leases are leases that renew automatically and thus have no fixed termination date. Issuance of rolling leases is not consistent with ranching in a setting as complex as the planning area where environmental and regulatory conditions change over time and lease provisions would need to be updated accordingly. Most lease/permits have multiple ranch family signatories. Having a lease/permit with a fixed expiration date provides an opportunity for family members no longer wishing to remain on the lease to exit the arrangement and for new generations of family to become signatories. Moreover, the 2012 Secretarial Memorandum, 2013 NPS Delegation of Authority to the Regional Director, and recent Congressional guidance direct NPS to consider issuing leases with 20-year terms.

Elk Management

Fertility Control

Contraception. Contraceptive use, particularly pellucida (PZP) and the GonaCon vaccination, to restrict the growth of the elk population was considered but dismissed. The US Environmental Protection Agency (USEPA, the regulatory agency that oversees contraceptive pesticides in free-ranging wildlife) has not approved any product for fertility control in elk. Any application of either PZP or GonaCon vaccines would be in an experimental context. Point Reyes has already engaged in elk fertility control research projects. In conjunction with UC Davis, NPS conducted a research project to investigate the efficacy of PZP immunocontraception and fecal steroid monitoring techniques in elk at Tomales Point (Shideler et al. 2002). One of the main problems with treating elk consistently was animal accessibility and the ability to re-treat enough animals on a yearly basis (this problem would persist regardless of the product available). After this experience, park management decided that because of the topography of the park, accessibility of animals, and availability of vaccines that last one to two years at best (Powers et al. 2014, Carey et al. 2019), the use of contraceptive vaccines did not have sufficient efficacy to justify the effort to deliver the

product (NPS 2015a). Because of these issues, and the fact there are no fertility control products registered for use in elk, this alternative was dismissed.

In the future, a contraceptive agent for use in elk may be approved that would not have adverse behavioral effects, would be effective for many years, and would be able to be administered in a logistically feasible manner; however, until that occurs, contraception is not being considered for use in the park.

Surgical Sterilization. Surgical sterilization is an invasive procedure that requires a veterinarian to remove the ovaries/testes or to conduct a tubal ligation or castration. Facilities appropriate for surgery are not available in the park, and while a temporary or mobile field station or chute system could be set up in the field, the stress of capture and surgery outweighs the benefits of permanent sterility. Sterilization would also have high labor costs because of the large number of animals that would need to be treated to meet population goals. For example, one bull can impregnate multiple females. Furthermore, tule elk are native to Point Reyes and having a breeding population that can respond to influences of natural selection is a desirable outcome. For these reasons, surgical sterilization was not considered as a viable option and was dismissed from further analysis.

Introducing Natural Predators

Commenters suggested that predators such as the gray wolf should be introduced to the park to control the elk population. Gray wolf populations are not known to have ever existed in the San Francisco Bay Area (CDFW 2011; Kovacs et al. 2016). Introducing a non-native predator is contrary to NPS *Management Policies 2006*, would likely create an imbalance of predators and prey in the park (Kovacs et al. 2016), and would be a threat to ranch animals. Introduction of other large carnivores that once occurred in the planning area (i.e., black and grizzly bears) was also dismissed because other threats to their existence, such as human development, would remain on lands surrounding the park. Additionally, while bears may prey opportunistically on elk, they would not serve as a tool for population management, would not meet the goals for elk management, and would introduce new issues into the planning area. For these reasons, the option of introducing predators into the park for elk management was dismissed from further analysis.

Commenters also suggested that mountain lions should be reintroduced into the park to assist in elk management. Mountain lions already exist in the park; therefore, this suggested alternative was dismissed from further analysis.

Translocation in the Park

NPS has considered translocation in the park and conducted tests to determine the efficacy of these methods. Elk that have been translocated from Drakes Beach to Limantour have returned to Drakes Beach. In March 2015, two male elk and one female were captured and moved to Limantour as part of an experiment to understand relocation response. All three animals returned to Drakes Beach over the next year. Translocation of free-ranging elk to Tomales Point has also proven ineffective because the animals either did not survive following release or returned to the location of capture. In February 2017, two female elk were relocated from Drakes Beach to the Tomales Point Elk Reserve; one female left the fenced reserve and returned to Drakes Beach in July 2017; the other died of unknown causes in March 2018. In September 2019, CDFW stated that elk could easily cover the short distances over which they could be moved within the park in a day or less and concluded that the area in the park is too small to biologically justify translocation. CDFW noted that it is not aware of data that indicate short-distance translocations of large, highly mobile ungulates, such as elk, are successful. In contrast, CDFW stated knowledge of several instances where translocated animals returned or attempted to return to their place of origin after being translocated across distances exceeding the extent of the park. Based on the ineffectiveness of this technique, this element was dismissed from further analysis.

Improve Elk Habitat in Wilderness

Commenters suggested that the habitat in the Limantour portion of the Phillip Burton Wilderness is poor, which is why elk have migrated to the planning area. Members of the public suggested that the park should ensure that proper forage and water are available in wilderness areas by manipulating the habitat to make it more desirable for elk. No evidence is available to suggest that forage and habitat conditions in the wilderness area are responsible for the movement of elk onto ranches, and a large majority of the Limantour herd remains in wilderness areas. Cobb et al. (2020) found that of the three elk herds at Point Reyes, the Limantour herd had the lowest productivity. By improving elk habitat in the Limantour area, productivity would likely increase, as could the numbers of elk then moving onto adjacent ranches. The Limantour portion of the Phillip Burton Wilderness is outside the scope of this EIS, and manipulation of natural wilderness is inconsistent with the Wilderness Act. Therefore, this alternative element was dismissed from further analysis.

Complete Removal of Elk from Ranchlands

The option of constructing a fence along the boundary of the Phillip Burton Wilderness to prevent elk from entering ranchlands was considered but dismissed because it would not be effective. Following consultations with wildlife biologists at CDFW and the NPS Biological Resource Management Division, it was determined that elk would get around such a fence by simply following the fence line in either direction.

Additional reasons for dismissing this alternative are the high cost of construction and maintenance of a fence, and impacts on other wildlife, the visitor experience, and wilderness values. A wilderness border fence would have to be constructed on park lands outside the wilderness area to comply with the Wilderness Act. Based on the terrain of the area between the wilderness area and the ranches to the west, fencing along the wilderness boundary would be very costly to build and maintain. Moreover, the fence would not be a full-enclosure fence.

Erecting fencing along the Phillip Burton Wilderness may also push elk outside Point Reyes, potentially affecting neighboring landowners. The fence would be highly visible to park visitors in many locations, interrupt the natural and scenic views of the park landscape, especially near designated wilderness, and disrupt wildlife movement patterns. Similarly, individuals from the Tomales Point herd occasionally enter ranchlands, so complete removal of elk from ranchlands is not feasible. For these reasons, this alternative element was dismissed from further analysis.

Fencing Elk into Specific Geographic Locations

Restricting the D Ranch herd to the Horseshoe Pond area by building a fence along Drakes Beach Road to the cliff was explored. However, elk could travel along a wide beach to move around a fence. Elk have been seen on the beaches, indicating that they would get around a fence that ended at the cliff. Additionally, this option would turn a free-ranging herd into a captive herd at Point Reyes. For these reasons, this option was dismissed from further analysis.

Recreational Hunting

Although the use of qualified volunteers is noted as an option for assisting with elk removals in some of the action alternatives, public hunting was dismissed as an approach to elk removal. Public hunting is prohibited in most national park units. Hunting, however, could be allowed in Point Reyes based on language contained in the Point Reyes enabling legislation that states: “The Secretary may permit hunting and fishing on lands and waters under his jurisdiction within the seashore in such areas and under such regulations as he may prescribe during open seasons prescribed by applicable local, State, and Federal law” (16 U.S.C. Sec. 459c-6(b)). NPS would need to complete a rulemaking process to allow hunting in Point Reyes. Public or recreational hunting differs from the use of qualified volunteers for population management. Hunting is an activity administered by state wildlife agencies through licenses and involves

fair chase and the taking of meat by the individual hunter. Direct reduction through a volunteer program, on the other hand, is a tool used to reduce populations that have exceeded management objectives; it is a controlled and structured activity used to meet specific management objectives and is not implemented for recreational purposes.

A public hunting alternative was not carried forward for further analysis based on factors relating to safety and ranch operations. Drakes Beach is one of the most highly visited areas of Point Reyes. Although some areas could be temporarily closed during hunting efforts, visitor access would be impossible to entirely control given the open terrain in the park. Hunting would also need to occur along the Sir Francis Drake Boulevard corridor, a county road that is frequented daily by ranch residents, milk trucks and other ranch vehicles, school buses, and park visitors. Hunting therefore has inherent safety risks that cannot be mitigated against, unlike a qualified volunteer program. In addition, elk removals would occur on active ranches, creating a safety risk for ranch operators and their livestock and potentially disrupting regular ranch operations. Under a qualified volunteer program, however, NPS could work with ranchers to mitigate safety risks and reduce the likelihood of interfering with ranch operations.

CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

The "Affected Environment" chapter describes existing conditions in the planning area for those elements of the natural and cultural environments that could be affected by implementing the alternatives considered in this GMP Amendment EIS. Impacts on these resources are analyzed in "Chapter 4: Environmental Consequences."

SOILS

Topography

The elevation at the park varies from sea level to 1,407 feet at Mount Wittenberg along Inverness Ridge. The park is home to a variety of landscapes, consisting of low-lying coastal areas, gently rolling grassy hills, forested mountains, and steep coastal bluffs. The park encompasses approximately 86,000 acres in the Coast Range physiographic province (Jennings et al. 1977). Figure 41 in appendix A displays the topography of the planning area, including areas where the slope is greater than 20%.

Soils

Generally, soil issues in the major land resource areas of the Central California Coast Range are erosion, maintenance of soil organic matter content, and low infiltration rates resulting from hydrophobic soils (USDA-NRCS 2006b). Land uses in the planning area may affect soil processes through erosion, compaction, alteration of soil structure and microbial communities, and reduced soil productivity or fertility. Activities associated with beef and dairy cattle ranching operations such as livestock grazing and trailing; tilling/cultivation; seeding; mowing for forage production; and nutrient, brush, and weed management may affect soil processes. Activities like manure spreading alter the natural soil fertility by increasing soil nutrients, such as nitrogen, phosphorus, and potassium (McKenzie et al. 2003). During the winter, erosion hazards could stem from sheet or gully erosive processes on unprotected upland soils and sloped terrace soils (USDA-NRCS 2006b).

Soil Erosion

Natural erosion processes occur in the park's landforms in areas with steep slopes and bluffs, because of instability from faults, erosive and erodible soils, and intense precipitation and wind (Pawley and Lay 2013). Anthropogenic land features and activities, including trails, roads, and vegetation removal, can also modify stormwater runoff patterns, causing soil instability and erosion. Overland runoff can result in gully, sheet, and rill erosion. Two common signs of range degradation include sheet and gully erosion (Sugnet and Bartolome 1983).

Soil characteristics for the planning area were evaluated using data obtained from the USDA-NRCS soil surveys and the Soil Survey Geographic database (USDA-SCS 1985; USDA-NRCS 2014a). The USDA-NRCS web soil survey erosion hazard ratings indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K (USDA-NRCS 2014a). In the planning area, the erosion hazard is slight (erosion is unlikely) for approximately 39% of the area, moderate (some erosion is likely) for 25% of the area, severe (erosion is very likely and erosion control measures for bare soils are advised) for 18% of the area, and very severe (significant erosion is expected) for 13% of the area with the remaining acreage composed of water and other unrated areas (figure 42 in appendix A) (USDA-NRCS 2014a). For the purposes of this analysis, soils in the severe and very severe erosion hazard category are combined into one category of soils with "high" erosion potential. As defined by USDA-NRCS, this erosion hazard rating indicates the hazard of soil loss from off-road and off-trail use if 50% to 75% of the soils were exposed (USDA-NRCS

2014a). Ranch management and monitoring requirements prevent this soil condition from occurring in most of the planning area as discussed below.

USDA-NRCS also evaluates the potential for soil erosion from wind using the interpretation Wind Erodibility Group, which is based on slope, soil types, and wind characteristics. In the planning area, approximately 2% of soils have low susceptibility to wind erosion, 55% are moderately susceptible, and 40% are highly susceptible. Areas lacking sufficient vegetation cover are referred to as high-intensity-use areas and can include livestock trails and concentration areas and agricultural fields. These areas, which comprise less than 1% of the planning area, are susceptible to wind erosion. However, this does not necessarily mean that erosion will occur, but rather that it could occur depending on other factors, including precipitation patterns, soil type and moisture content, and wind speed and direction. Wind fetch is variable and may be more intense during certain times of year and during storm events.

According to NPS mapping of multiple years of aerial imagery, the planning area contains an estimated 150 acres (less than 1%) of bare soil, indicative of high-intensity-use areas such as stock ponds, cattle trails, salt licks, and feeding areas where cattle regularly gather. On beef ranches, high-intensity-use areas are generally dispersed or intermittent compared to dairies, where the cattle travel from grazing areas to milking areas up to twice a day. Cattle trailing results in erosion of the topsoil along pathways between areas (Sugnet and Bartolome 1983). Overall, the six dairies represent approximately 60% (86 acres) of the 150 acres of mapped high-intensity-use areas; outside the developed ranch complexes, individual areas of cattle concentration are typically smaller than 1 acre. Of the soils with high erosion hazard, only 11 acres occur within the estimated 150 acres of high-intensity use areas; with the majority (10.5 acres) located on beef ranches.

NPS addresses priority erosion issues based on available funding and severity of threat to resources. More than 170 management activities to improve resource conditions, including those intended to reduce soil erosion, have been implemented in the planning area during the past 20 years (see appendix A, figure 4). Existing requirements detailed in chapter 2 were also established to protect soil resources and reduce the potential for soil erosion. For example, because properly managed RDM provides a high degree of protection from soil erosion and nutrient loss (Bartolome et al. 2006), the park has maintained a minimum RDM standard of 1,200 pounds per acre of herbaceous plant material that should remain in the fall, with lower levels of cover only permitted in identified high-intensity-use areas described above. Over the past two years, 95% of areas measured by visual mapping surveys by NPS met the RDM standard (appendix E). So, while the potential for high erosion hazard exists on 8,900 acres of the planning area, NPS has observed only a small area (up to 11 acres) where these soils are not protected, indicating that soil erosion is generally not a widespread concern. Furthermore, modeling on California rangelands suggests that soil erosion potential is generally low, and that maintaining moderate to high RDM can effectively mitigate erosion for vulnerable areas (Salls et al. 2018).

Tilling and ground disturbance by heavy machinery have historically been conducted across certain portions of the planning area associated with cultivation and pasture management. Lease/permits currently authorize a maximum of 1,000 acres of Forage Production on which tilling may occur in the planning area; however, this activity is prohibited on slopes greater than 20% because they are more susceptible to erosion and landslides than shallower slopes. Forage Production is not authorized on soils with high erosion potential.

Soil Compaction

Soil compaction increases bulk density by reducing soil pore space, which reduces water infiltration and water-holding capacity, destroys soil structure, decreases soil aeration, and increases the difficulty of root penetration. Once soil has been compacted, precipitation is more likely to run overland rather than percolate through the soil, which can increase runoff and erosion and provide less moisture to plants, affecting plant growth and survival (California Department of Conservation, California Geological Survey 2003). Soil compaction is generally a problem within the first 24 inches of soil, and signs of

compaction can include discolored or poor plant growth, excessive runoff, difficulty penetrating the soil with a firm wire, and lateral root growth with little, if any, penetration of roots into compacted layers (USDA-NRCS 2003). Actual soil compaction at a specific point in time is difficult to predict because it depends on several factors including the amount and type of compaction occurring, soil type, and water content. Furthermore, soil moisture is highly variable across the planning area and is influenced by droughts, storms, and other weather events. Grazing increases soil compaction compared to ungrazed areas (Byrnes et al. 2018); however, maintenance of RDM may reduce compaction. For example, Tate et al. (2004) found that soil surface bulk density was negatively correlated with RDM levels.

The USDA-NRCS web soil survey parameter, Soil Compaction Resistance, uses soil characteristics to describe "the level of the soil's resistance to compaction" (USDA-NRCS 2014a). Low resistance "indicates that the soil has one or more features that favor the formation of a compacted layer, whereas moderate resistance "indicates that the soil has features that are favorable to resisting compaction." Moderate resistance predominantly occurs in soils with upper profiles of sand or sandy loam. According to the USDA-NRCS web soil survey, approximately 58% of soils in the planning area have low resistance to compaction (high compaction potential), 36% of soils have moderate resistance, or moderate compaction potential, and the remaining soils are not rated (figure 43 in appendix A) (USDA-NRCS 2014a). Of the 15,600 acres of soils with high compaction potential in the planning area, 58 acres are likely to be compacted as indicated by the presence of high-intensity-use areas on both beef and dairy ranches. Although evidence of soil compaction is not always readily observable and limited data exist for the planning area, the presence of vegetation growing readily across all but 150 acres (<1%) of the planning area and maintenance of the RDM standard indicate that while some soil compaction may be occurring, it is not occurring at a level detrimental to overall resource conditions.

Authorized Forage Production includes provisions requiring minimum or no tillage, maintenance of adequate residue cover on fields, timely establishment of cover crop prior to winter rains, and avoiding work when soils are wet, which can improve or prevent soil compaction problems (Hamza and Anderson 2005).

Stream Incision/Streambanks/Streambeds

Erosion of streambanks and streambeds occurs in the watersheds throughout the park. Factors such as soil type, slope, vegetation cover, precipitation, presence of livestock, stream channel modification, and water transport and diversion patterns influence the stability of banks and beds. The sediment regime of a waterbody can also affect the amount of instream bank erosion and stream incision. Typically, accelerated stream incision and erosion result from increased surface runoff and sediment transport from human activities such as over-grazing, cultivation (Ansari 2018), logging, channel straightening, and road building (Reckendorf 2009). Prior to implementing restoration measures, some ranches have experienced erosion and sedimentation issues that resulted in streambank instability, headcuts, and rills (UC Cooperative Extension 2011). Projects and restoration activities in the park to address localized stream erosion issues such as these have included Fencing, Waterway Stabilization, and Road Upgrade and Decommissioning (see appendix A, figure 4). Roads and trails in or adjacent to the planning area may concentrate water and discharge to areas at high volumes and rates, leading to headcutting and incision. The "Water Resources" section discusses instream erosion and water quality issues associated with sedimentation.

Soils and Climate Change Predictions

Over time, climate change may affect soils in coastal California, including Marin County and the planning area. Specific changes in the planning area as a result of climate change are difficult to predict. As noted in the *Marin County Climate Action Plan*, Marin County is located in a transition zone. Projections for areas to the north indicate wetter and warmer conditions, while projections for areas to the south indicate drier and warmer conditions, making it particularly difficult to project impacts specific to the planning area (Marin County 2015). Current projections indicate that temperatures will continue to

increase, and Marin County may experience drier summers and wetter winters with heavier rain events (Marin County 2015). An increase in heavier rain events may cause inland flooding, which increases storm surge frequency and stormwater runoff and could increase soil erosion in the planning area, specifically in areas with high concentrated use that are devoid of vegetation. Changes in precipitation patterns could also affect potential for soil compaction by altering soil moisture conditions across the landscape.

WATER RESOURCES

Surface Water

Surface waters in the planning area comprise perennial and intermittent streams, natural lakes and ponds, human-made impoundments including stock ponds, and various wetlands including tidal estuaries and sag ponds. Overall, there are an estimated 54.7 miles of streams, 81.9 acres of ponds, and 1,954 acres of wetlands in the planning area. Streamflow patterns are seasonal with low or no flow in summer and fall, low to moderate base flow in winter, and occasional winter peaks associated with storm events (Pawley and Lay 2013). In addition to these resources, NPS also manages the marine habitats from the shoreline to 0.25-mile offshore of the park (NPS 2012a). The watersheds in the planning area include Tomales Bay (containing the Lagunitas Creek and Olema Creek subwatersheds), Kehoe, Abbotts Lagoon, Drakes Estero, Drakes Bay, and Coastal (Pacific Ocean) Drainages (figure 44 in appendix A). Two Areas of Special Biological Significance (ASBS), Duxbury Reef and Point Reyes Headlands, receive some waters from the planning area. Both areas are designated as State Water Quality Protection Areas (SWRCB 2019a). Tomales Bay has numerous designations, including being named a "Wetland of International Importance" under the Ramsar Convention in 2002 because it supports plants, animals, fish, waterbirds, and other wetland-dependent species including threatened and endangered species. Within the Tomales Bay watershed, Lagunitas and Olema Creek continue to sustain the southernmost stable populations of endangered coho salmon and threatened steelhead.

Surface Water Quality

The main sources of water quality degradation in the planning area are bacteria and nutrient loading from nonpoint sources associated with ranches, dairies, septic systems, and stormwater runoff (Wallitner 2013; Pawley and Lay 2013). The loading rate varies between the different watersheds in the planning area; larger watersheds with higher peak flow rates and associated runoff contribute most of the water quality constituents of concern to surface waters such as Tomales Bay (Carson 2013). Accumulation or high levels of nutrients in surface water can cause algae to grow faster than ecosystems can handle, while pathogenic bacteria can pollute surface water, contaminate groundwater, and spread disease. Sediment loading from erosion and degradation associated with natural processes, ranch and dairy activities, land development and disturbance, stream channel alteration, and stormwater runoff also affect many of the surface waters. Sediment loading can cause a variety of impacts, including turbid water, which can prevent aquatic species from seeing food, vegetation growth, and disrupt the natural food chain (Wood and Armitage 1997). Nutrients, pathogens, and contaminants are often bound to suspended or settled sediment particles in rivers, streams, or lakes and could constitute additional pollutant sources (Pachepsky and Shelton 2011; Thompson and Goyne 2012; Walling, Well, and Russell 1997). Historic and ongoing land uses, including historical logging, agriculture and livestock activities, road construction, and stream channel modification, have led to the loss of pollutant and stormwater attenuation capacity, altered drainage patterns, and increased sediment inputs to water resources (NPS 2001a).

Section 303(d) of the Clean Water Act authorizes USEPA to assist states, territories, and authorized tribes in listing waterbodies that do not meet water quality standards and the pollutants that impair them. Placement on the list requires the development of a total maximum daily load (TMDL). A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point or planning tool for restoring water quality. The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) designates beneficial uses and water quality objectives for waters of the state, including

surface waters and groundwater. The Basin Plan lists numeric and narrative objectives for water quality. Most of the freshwater quality parameters (e.g., bacteria, pH, temperature, turbidity, dissolved oxygen, and nitrate) have established objectives put in place by the San Francisco Bay RWQCB or USEPA (San Francisco Bay RWQCB 2013). Specific conductance does not have an established water quality objective but can be compared to ecological objectives drawn from scientific literature (e.g., Wallitner and Pincetich 2017). TMDLs are amended to the Basin Plan as they are established.

As potential sources of nonpoint source pollution, livestock grazing and dairy operations in the planning area are regulated through waste discharge requirements, waiver of waste discharge requirements, or prohibitions in the Basin Plan.

The San Francisco Bay RWQCB regulates confined animal facilities, which are operations "where animals are confined and fed in an area that has a roof or is devoid of vegetation, generating solid and liquid manure wastes that may be collected and disposed of on land." The primary types of confined animal facilities in the region are dairies; horse facilities; and egg, chicken, and/or turkey production facilities. The RWQCB's confined animal facilities regulatory framework includes a Conditional Waiver of Waste Discharge Requirements for existing dairies (enrolled in 2015) and General Waste Discharge Requirements for all types of confined animal facilities not currently enrolled under the conditional waiver that are located within certain watersheds. This program requires structural and non-structural management measures for all confined production areas, land application areas, and grazing operations, as well as a site-specific monitoring program. These requirements apply to all dairies operating in the planning area and are subject to public comment and periodic update (San Francisco Bay RWQCB 2019).

Tomales Bay Watershed. The Tomales Bay watershed encompasses almost 140,800 acres. Tomales Bay itself is an approximately 12-mile-long flooded valley, covering 6,912 acres straddling the San Andreas Fault. Most of the freshwater delivered to Tomales Bay originates in two major subwatersheds: Lagunitas Creek and Walker Creek. The Lagunitas Creek watershed, which includes drainage from Olema Creek, represents 52% (73,216 acres) of the overall Tomales Bay watershed and delivers about 65% of the freshwater input to Tomales Bay (Carson 2013). Approximately 10% of the freshwater input to Tomales Bay is delivered by the small drainages that line the east and west shores of the bay. These small drainages represent 13% (18,304 acres) of the overall Tomales Bay watershed area. Approximately 93% of the Tomales Bay watershed is located outside the planning area and includes the Walker Creek watershed to the northeast of Tomales Bay. The Walker Creek watershed encompasses 49,280 acres, represents 35% of the Tomales Bay watershed area, and contributes 25% of the freshwater delivery to Tomales Bay (Carson 2013).

Combined, the ranches in the planning area cover just over 7% (10,000 acres) of the total Tomales Bay watershed, including Lagunitas Creek (3,900 acres), Olema Creek (5,200 acres), and direct drainage to Tomales Bay (1,060 acres). None of the developed dairy complexes are in the Tomales Bay watershed.

Monitoring studies in the 1990s covering Tomales Bay, Lagunitas Creek, and Olema Creek observed exceedances of San Francisco Bay RWQCB's fecal indicator bacteria criteria primarily affecting shellfish harvest, which occurs on state-managed tidelands in the bay as well as elevated levels of nutrients, suspended solids, and turbidity in the watershed, especially associated with stormwater runoff following high-intensity storm events (Crunkilton 2000 as cited in Wallitner 2013; NPS 2004a; Wallitner and Pincetich 2017; Carson 2013; Wallitner 2016). As a result of these studies, the San Francisco Bay RWQCB listed Tomales Bay and its major tributaries, including Lagunitas Creek and Olema Creek, as impaired for nutrients, pathogens, and sedimentation/siltation under section 303(d) of the Clean Water Act (SWRCB 2010). Sources of nutrients and potentially pathogenic bacteria include animal waste, human waste from failing septic or treatment systems, boat discharges, fertilizers, and decomposing organic material (Carson 2013). Sources of materials that lead to sedimentation/siltation include soil disturbance associated with the San Andreas Fault zone, historical logging activities, and historical and current agricultural practices.

In 2005, the Tomales Bay Watershed pathogen TMDL was developed in response to monitoring that showed exceedances of the bacteria numeric standard for the uses of shellfish harvesting and recreation (Ghodrati and Tuden 2005). A TMDL for sediment in Lagunitas Creek and an implementation plan to achieve the numeric sediment targets was completed in 2014 (San Francisco Bay RWQCB 2014). As part of these efforts, a Conditional Waiver of Waste Discharge Requirements for Grazing Operations in the Tomales Bay Watershed was developed to outline control measures and operational practices to reduce bacterial input to the watershed from grazing lands, in particular from stormwater runoff (San Francisco Bay RWQCB 2018). The current five-year grazing waiver was renewed in October 2018 and implements the Tomales Bay Pathogen TMDL and the Lagunitas Creek Sediment TMDL (San Francisco Bay RWQCB 2018). Ten park ranch operations report under this conditional waiver. A TMDL for nutrients will be developed along with ongoing management efforts in the Tomales Bay watershed (San Francisco Bay RWQCB 2017).

Nitrate monitoring on Lagunitas and Olema Creeks from 2007 to 2012 generally returned low nitrate values, with the most upstream site having the lowest values and the highest values at a downstream site (Carson 2013). Other than several high values recorded in inner Tomales Bay and Olema Creek, most nitrate samples were below the 0.30 milligram/liter ecological threshold reported in Roche et al. (2013) for limiting eutrophication of streams (Carson 2013; Wallitner 2013; Wallitner and Pincetich 2017; Wallitner 2016). Most of the samples with the highest individual nitrate values for Olema Creek were collected during storm events (Wallitner and Pincetich 2017). Nitrate has been monitored at long-term sites in the Tomales Bay watershed by the NPS Inventory and Monitoring program since late 2006. No samples have exceeded the drinking water standard of 10 milligrams per liter, and fewer than 5% of samples have exceeded 1.0 milligrams per liter.

The 2005 Tomales Bay TMDL staff report showed that of the watersheds in the planning area, Lagunitas and Olema Creek contributed some of the lowest fecal coliform bacteria loads to the bay. Overall, the Olema Creek subwatershed was the second smallest fecal coliform contributor to Tomales Bay, with just 1% of overall fecal coliform. The top three contributors of fecal coliform to the Tomales Bay watershed were the lower Walker Creek and Lower and Upper San Geronimo subwatersheds (Ghodrati and Tuden 2005), which are all outside the planning area.

Long-term trend analysis in the Olema Creek watershed indicates average fecal coliform bacteria concentrations were reduced by 95% over the 19-year period from 1999 to 2017 (Lewis et al. 2019). Although the general, long-term fecal coliform bacteria trend was downward, increases in precipitation during rain events (cumulative 24-hour and 5-day) were associated with temporary increases in fecal indicator bacteria concentrations during those events. Turbidity monitoring in the Olema Creek watershed from 2009 to 2017 indicates that approximately 90% of samples collected at long-term monitoring stations were below a threshold of 25 nephelometric turbidity units, with most samples above this threshold occurring during storm conditions (NPS unpublished data). Short-term watershed assessment monitoring (January 2016 to May 2018) in the watershed showed spatial and temporal changes by season (i.e., storm, winter baseflow, or summer baseflow). For all sample periods, an increase in fecal coliform bacteria and *E. coli* concentrations was observed moving from upstream to downstream. The highest concentrations were recorded during storm periods, whereas the lowest concentrations were observed during the winter baseflow period (Voeller et al. 2018).

The long-term 95% decrease in fecal coliform bacteria concentrations from 1999 to 2017 was concurrent with the implementation of Management Activities such as Livestock Water Supply, Fencing, and Stream Crossings intended to reduce pathogen, sediment, and nutrient loading to local streams throughout the watershed. This includes approximately 40 actions in the Olema Creek watershed, which cumulatively provided increased managerial control of livestock access to more than 28 kilometers of Olema Creek and nearby tributaries (Lewis et al. 2019). During approximately the same time period, more than 170 Management Activities intended to improve water quality have been implemented across the planning area (see figure 4 in appendix A). Additionally, between 1996 and 2012, NPS established approximately

780 acres of cattle exclusion adjacent to critical coho salmon and steelhead habitat, which were removed from lease/permits and are not in the planning area, which also likely resulted in benefits to water quality. The effectiveness of these types of Management Activities at reducing pollutants of concern is consistent with findings from other studies (e.g., Line et al. 2000; Line 2003; George et al. 2011; Kay et al. 2018).

Results from monitoring in the Lagunitas Creek watershed are summarized in various reports but no long-term trend analysis has been conducted to date. Review of data that have been collected by NPS indicates that more than 86% of Lagunitas Creek watershed samples (stations LAG2 & LAG3) analyzed for *E. coli* between 2007 and 2014 were below the San Francisco Bay RWQCB single-sample statistical threshold value for water contact recreation (320 cfu/100 milliliters; SWRCB 2019b). Almost 90% of samples collected at these Lagunitas Creek watershed stations between 2009 and 2014 were below a threshold of 25 nephelometric turbidity units (NPS unpublished data).

Other activities that have been implemented in the Tomales Bay watershed include Riparian Vegetation Management and Planting and instream restoration to improve threatened and endangered species habitat. In 2007–2008, NPS and the Point Reyes National Seashore Association implemented an approximately 613-acre Giacomini Wetlands Restoration Project in the southern end of Tomales Bay. The project principally focused on conversion of a former dairy ranch into tidal wetlands by restoring natural hydrologic tidal and freshwater processes to promote restoration of hydrologic and ecological functions. The location of the Giacomini wetland at the confluence of Lagunitas Creek, Olema Creek, and Tomales Bay allows these waters to spread out over the restored marsh plain, resulting in improved ecological habitat and water quality for Tomales Bay. Compared to baseline conditions at the beginning of the Giacomini Wetlands Restoration Project, dissolved oxygen levels increased 16%, while nitrate, ammonia (NH_3), phosphate, phosphorous, and fecal coliform bacteria levels decreased at least 23% (Parsons and Ryan 2015).

Drakes Bay, Drakes Estero, Kehoe Drainage, Abbotts Lagoon Watersheds, and Coastal Drainages. NPS programs and other sampling efforts have observed high concentrations of total suspended solids and nutrients in Drakes Bay and Drakes Estero watersheds (NPS 2004a; Pawley and Lay 2013). Surrounding land uses such as ranches and pastures for dairies and other livestock operations contribute nutrients and sediment to Drakes Bay and Drakes Estero (NPS 2004a). Occasionally high fecal indicator bacteria counts have been observed in some drainages (Pawley and Lay 2013). Potential pollutant sources in these watersheds include stormwater runoff from pasture and grazing land, sewage systems, wildlife, and boat discharges in the tidal and marine environment (outside the planning area) (California Department of Public Health 2011). All ranches operate consistent with the San Francisco Bay RWQCB regulations for beef and dairy operations in these watersheds.

NPS began a water quality monitoring effort in these watersheds in 1990 with a main goal of allowing NPS to identify and address water quality impacts specific to agricultural, recreational, and operational use (see Ketcham 2001). Multiple reports (Cooprider 2004; Pawley and Lay 2013) documenting water quality conditions in the Abbotts Lagoon and Kehoe watersheds and the coastal drainages of Point Reyes rely on data collected from 1998 to 2005. In water years 1999–2000, USGS conducted a focused water quality assessment of the Abbotts Lagoon watershed. The study determined that tributaries draining dairy operations or dairy grazing land had the highest nutrient levels or loading rates especially following storm events (USGS 2005).

Data collection in Kehoe Creek between 1998 and 2005 has shown elevated levels of fecal indicator bacteria, nutrients, and sediment with stormwater runoff from nearby dairy operations and pastureland contributing to the observed quantities (Cooprider 2004; NPS 2004a; Pawley and Lay 2013). High fecal indicator bacteria counts during this period were also observed in the Abbotts Lagoon watershed—many from samples collected adjacent to dairy operations (Cooprider 2004; Pawley and Lay 2013). Water quality data collection continued in these watersheds through 2013. NPS conducted a comprehensive analysis of the entire available water quality data dataset from 1999 to 2013 as part of this planning

process to aid in determining more recent water quality conditions (appendix L). Limited monitoring has been conducted in these watersheds since 2013.

Appendix L summarizes 30 Management Activities such as exclusion Fencing along drainages and Infrastructure Improvements that were implemented on beef and dairy operations upstream of monitoring stations concurrent with sampling during 2000-2013 to address water quality concerns identified by initial monitoring. These activities included the installation of a new waste storage facility, and other infrastructure improvements to control runoff at both I Ranch and J Ranch dairies, as well as construction of a new loafing barn at I Ranch between from 2004 to 2006. Prior to the installation of the loafing barn at I Ranch, no shelter was available for the cattle during the winter. This project allowed for the closure of a 40+ acre high-intensity use area that contributed to runoff in the winter and development of a manure management system for the ranch.

Analysis of water quality data collected from 1999 to 2013 in the Abbotts, Kehoe, and Drakes Estero watersheds found that fecal indicator bacteria concentrations (after accounting for variation in rainfall) declined at all 13 water quality stations that were downstream of Management Activities implemented on grazed lands during the monitoring period, while a monitoring station in the Drakes Estero watershed with little grazing influence and no Management Activities implemented showed a slight positive trend. Prior to 2007, only 6% of samples met single-sample numeric water quality objectives for fecal indicator bacteria, however 38% met those objectives from 2007 to 2013. Approximately 84% of turbidity samples collected at these stations from 2010 to 2013 were below a threshold of 25 nephelometric turbidity units; only one station exhibited persistent high turbidity values, but this was likely due to regular ponding of water at the sampled culvert inlet (appendix L).

The primary sources of pollution to the Duxbury Reef and Point Reyes Headlands ASBS in the planning area are urban, road, and stormwater runoff (SWRCB 2017). In collaboration with the state and Marin County, NPS and ranchers have also implemented numerous Management Activities in ASBS watersheds to address runoff from grazing lands, including Fencing to establish more than 300 acres of seasonally grazed areas (see appendix A, figure 4).

Groundwater

The complex geologic environment of the park and associated vertical and horizontal fractures result in aquifers with connections to surface waters (NPS 2007a). Surface water can recharge groundwater through the fractures (McClelland 1963). The hydrologic connection between alluvial groundwater resources and surface water allows for the recharge of groundwater resources through streambed infiltration and the replenishment of surface resources. These connections also allow pollutants in surface water to contaminate groundwater. Infiltration of precipitation recharges shallow groundwater resources in both upland areas and valleys (Marin County Department of Public Works n.d.). This groundwater then recharges surface waters during the drier summer months. Groundwater seeps often serve as the "headwaters" for many of the smaller drainages in the planning area. Perched groundwater tables with shallow subsurface flows also occur in some of the grasslands/ranchlands adjacent to the dunes (Baye 2008, as cited in NPS 2009). There is a distinct difference in groundwater and spring location and performance between lands in the planning area east of the San Andreas Fault (on the North American Plate—north district of Golden Gate lands) and lands west of the San Andreas Fault (on the Pacific Plate—Point Reyes lands).

Multiple springs, seeps, and wells in the planning area are used for cattle watering and private potable water supply (NPS 2012a; Pawley and Lay 2013). Many of these wells likely use water stored in shallow alluvial aquifers throughout the area (NPS 2007a). These groundwater resources likely have limited storage capacities or yields and are adequate only for uses requiring small quantities of water (McClelland 1963).

Groundwater Quality

Local septic systems and stormwater runoff from surrounding beef and dairy operations can affect groundwater resources. Failing septic tanks located on slopes, close to high water tables associated with streams, and close to fractured granite would have a greater impact on groundwater quality by contributing nutrients (Valentino 1989). Nonpoint source pollution can transport animal wastes into local surface water and groundwater during the wet season. Although dependent on site conditions, microbial pathogens on the surface can infiltrate into groundwater through the unsaturated zone (USDA-NRCS 2012). During the drier summer months when surface water levels are lower, groundwater can contribute a relatively larger amount of freshwater and associated nutrients or potentially pathogenic bacteria to receiving water sources. Shallow groundwater and surface water can mix in the area of sediment and porous space beneath stream beds, which can allow pollutants to enter groundwater (Stocker et al. 2016).

Most San Francisco Bay RWQCB groundwater water quality objectives are in narrative form; however, some have numeric criteria. Narrative objectives require the maintenance of high-quality groundwater and prohibit pollutant concentrations that adversely affect beneficial uses including agricultural, municipal, and domestic water supply. These objectives also prohibit exceedances of water quality standards for surface water that is hydrologically connected to groundwater (San Francisco Bay RWQCB 2013). Groundwater numeric criteria differ based on the beneficial use. Of the wells sampled by the SWRCB's Division of Water Quality Groundwater Ambient Monitoring and Assessment Program, no wells in Point Reyes were found in violation of nitrate thresholds (GAMA Program 2020). Overall however, limited groundwater quality data is available for the planning area.

Water Quantity (Surface Water and Groundwater)

Generally, livestock operations in the region withdraw more from surface water sources than groundwater sources (USGS 2010). In 2010, approximately 1 million gallons of water per day were withdrawn in Marin County for livestock use, while groundwater withdrawals accounted for 0.45 million gallons per day (USGS 2010). The ranches in the planning area use both surface water and groundwater as the water source for livestock production operations with some of this water supplied by NPS. Managed resources including stock ponds, spring developments, and wells are used as sources for ranch operations and distribution of water to pastures. Overall, water necessary for ranch operations is available year-round. During drought years, water supply on a handful of ranches was limited resulting in emergency measures to tap surface water to meet water demand. The use of surface water in California requires a water right administered by SWRCB. Exceptions to this include the use of a small amount of surface water for either domestic, irrigation, or commercial livestock watering purposes, which only require registration of the use. State water rights only allow surface water use for beneficial and reasonable purposes, including domestic and stock watering. NPS holds and maintains water rights for ranch operations in the planning area. In some cases, NPS provides water to ranches from existing water systems, similar to a utility system, and operators are billed for the water used. Ranchers using water rights are responsible for reporting annual storage and use to NPS for water rights reporting. Residential water on ranches is supplied by a variety of sources, including local springs, wells, municipal utilities, and the NPS as identified above. Dispersed residential use is limited. The 18 ranches in the planning area are home to approximately 188 people. Residential water uses varies significantly across the state. In 2016, the average residential water use per person in the San Francisco Bay region was 64 gallons per day (gpd) (Legislative Analyst's Office 2017). Overall, based on the number of people living in the planning area, total residential use is approximately 12,350 gallons per day, or 4.5 million gallons per year.

The amount of water required by cattle depends on multiple factors, including environmental temperature, humidity, precipitation, body weight, breed, feed intake, pregnancy, milk production, type and water content of feedstuff, and the physical characteristics of the water itself (i.e., temperature) (Stull et al. 2012). Beef operations primarily use water for livestock consumption, whereas dairy operations use water for livestock, barn and equipment cleaning, and other minor uses (table 8). Dairy operations that are

provided water by NPS have used amounts of water ranging from a low of approximately 1,200 gpd to a high of 11,000 gpd, not including water from other sources such as ponds (NPS, Ketcham, pers. comm. 2018a). Overall, based on the number of permitted cattle in the planning area (table 1) and the water usage values presented in table 8, the beef operations use approximately 12,000 gpd to 34,800 gpd, and the dairy operations use approximately 75,914 gpd to 175,695 gpd, for a total water usage of approximately 32 million gallons (98 acre feet) to 77 million gallons (236 acre feet) per year.

TABLE 8: WATER REQUIREMENTS PER ANIMAL FOR BEEF AND DAIRY OPERATIONS

Type of Livestock Operation	Drinking Water Use (gpd) Average Air Temperatures (60°F)	Other Use (gpd)	Total Water Usage (gpd)
Beef	5.0–14.5	N/A	5.0–14.5
Dairy	7.9–30.0	15–23	22.9–53.0

Sources: Le Riche et al. (2017); Stull et al. (2012)

Water Resources and Climate Change Predictions

Over time, climate change may affect water resources in coastal California, including Marin County and the planning area. A projected increase in temperature could result in increases in extreme heat conditions, inland flooding, rising sea levels, and a shift in water demand and supply (Marin County 2015). Drought, flooding, and water supply could be altered in the planning area; however, all ranches in the planning area are at an elevation where sea level rise would not have a direct impact. Specific changes in water resources in the planning area as a result of climate change are difficult to predict. Current projections indicate that temperatures will continue to increase, and Marin County may experience drier summers and wetter winters with heavier rain events (Marin County 2015). An increase in heavier rain events may cause inland flooding, which increases storm surge frequency and stormwater runoff and could potentially increase pollution in surface waters. As noted in the *Marin County Climate Action Plan*, Marin County is located in a transition zone. Projections for areas to the north indicate wetter and warmer conditions, while projections for areas to the south indicate drier and warmer conditions, making it particularly difficult to project impacts specific to the planning area (Marin County 2015).

VEGETATION, INCLUDING FEDERALLY LISTED SPECIES

Vegetation communities in the planning area are displayed in figure 45 in appendix A. Estimated percentages of vegetation community types based on park GIS data derived from analysis described in Schirokauer et al. (2003) are provided in table 9. The information presented in the "Wetlands" section below is based on a combination of National Wetland Inventory data and field-verified mapping conducted by NPS because these sources provide a more recent and accurate source for wetlands information than Schirokauer et al. (2003).

Wetlands

California's wetlands have high ecological diversity and provide a wide variety of ecosystem services. Since European settlement, wetlands have been greatly reduced and altered by agricultural conversion, urban development, and other land use activities (Duffy et al. 2016; Grewell, Callaway, and Ferren 2007). The planning area contains 1,954 acres of wetlands, which represents approximately 54% of the 3,625 acres of wetlands mapped in the park. The planning area contains three distinct wetland types—palustrine (inland and nontidal), estuarine, and lacustrine (lake).

Palustrine wetlands make up 94% of the wetlands in the planning area (see figure 46 in appendix A). Palustrine wetlands are diverse, including freshwater marshes, seasonal wetlands, wet meadows, floodplain wetlands, seeps, and sag ponds, and can be dominated by various species including small-fruited bulrush (*Scirpus microcarpus*), rush (*Juncus balticus*), slough sedge (*Carex barbarae*), water parsley (*Oenanthe sarmentosa*), seep monkeyflower (*Erythranthe guttata*), floating marsh pennywort (*Hydrocotyle ranunculoides*), spikerush, (*Eleocharis macrostachya*), California bulrush (*Schoenoplectus californicus)*, cattails (*Typha* spp.), broadfruit bur-reed (*Sparganium eurycarpum*), and Pacific reedgrass (*Calamagrostis nutkaensis*).

Estuarine wetland areas support a variety of vegetation, including pickleweed (*Salicornia* spp.), rush (*Juncus lescurii*), saltgrass (*Distichlis spicata*), salt marsh daisy (*Jaumea carnosa*), gumplant (*Grindelia stricta*), arrowgrass (*Triglochin maritima*), California sea lavender (*Limonium californicum*), Pacific cordgrass (*Spartina foliosa*), and bulrush (*Bolboschoenus martimus*). Estuarine wetlands account for slightly less than 6% of the wetlands in the planning area. For palustrine and estuarine vegetation, the mix of species depends on site-specific factors. Lacustrine and other wetlands occur on only 3.1 acres and account for less than 0.2% of the planning area.

As noted above, NPS established approximately 780 acres of cattle exclusion areas in riparian forest and floodplains adjacent to critical coho salmon and steelhead habitat. These areas were removed from lease/permit authorizations and are not in the planning area. Additionally, in collaboration with ranchers in the planning area, NPS protected a range of palustrine and estuarine wetlands, such as floodplain wetlands, seeps, freshwater marsh, and estuarine marsh by using Management Activities, including Fencing to control the timing and duration of grazing to improve water quality and ecological function.

TABLE 9: VEGETATION TYPES IN THE PLANNING AREA

Vegetation Type	Percentage of Planning Area
Herbaceous Wetlands[a]	**4%**
Riparian Forests/Shrublands	**1%**
Grasslands	**60%**
Coastal Prairie	4%
Annual Grassland	44%
Agricultural Pasturelands	12%
Coastal Dunes	**2%**
Coastal Scrub	**18%**
Evergreen Forests and Woodlands[b]	**14%**
Bishop Pine/Douglas-Fir/Coast Redwood Forest	6%
Hardwood Forest	8%
Other[c]	**2%**

[a] Based on detailed field mapping, NPS identified wetlands in all vegetation classification areas described in Schirokauer et al. (2003). The EIS relies on information presented in the "Wetlands" section above because it is the most accurate data available.

[b] A detailed description of Evergreen Forests and Woodlands can be found in appendix C.

[c] Other includes areas mapped as barren, disturbed or built-up, as well as water, beaches or mudflats.

Riparian Forests/Shrublands

Woody riparian habitat, a critical wildlife resource, especially for birds, is used by a wide variety of species (Pawley and Lay 2013). The planning area contains 220 acres of riparian forest/shrublands, which represents approximately 11% of the 1,976 acres of riparian forest/shrubland in the park. Riparian forests and shrublands in the planning area are dominated by broad-leaved deciduous trees or shrubs, including red alder forest, mixed willow forest, and arroyo willow forest. In the red alder forest, red alder (*Alnus rubra*) dominates the canopy with California bay (*Umbellularia californica*) often present in substantial cover. Arroyo willow (*Salix lasiolepis*) may form a subcanopy to the alder. The understory is usually moderate to dense. Berry species, including salmonberry (*Rubus spectabilis*), thimbleberry (*Rubus parviflorus*), and California blackberry (*Rubus ursinus*) along with red elderberry (*Sambucus racemosa*), are the common shrubs. Hedgenettle (*Stachys* spp.), sedges, rushes, small-fruited bulrush, and ferns (swordfern [*Polystichum munitum*], lady fern [*Athyrium filix-femina*]) dominate the herbaceous layer (NPS 2004b, 2006b; Pawley and Lay 2013). Other forested riparian areas are dominated by mixed willow forest, represented in the planning area by yellow willow (*Salix lutea*), often associating with other willows (NPS 2004b, 2006b). Arroyo willow in its shrub form stands between 16 to 23 feet high and strongly dominates the canopy. Other taller willows or alder may be present in small numbers. The understory is usually extremely dense because of the thicket-forming growth habits of this species. Shrubs such as berry species are commonly found interspersed through the understory. California wax myrtle (*Morella californica*) or poison oak (*Toxicodendron diversilobum*) may be present. Sedges, rushes, and small-fruited bulrush, along with hedgenettle, beeplant (*Scrophularia californica*), and ferns dominate the herbaceous layer (NPS 2004b, 2006b; Pawley and Lay 2013). As noted above, NPS excluded nearly 780 acres of riparian and wetland habitat from ranch lease/permits in association with coho salmon and steelhead habitat protection and enhancement projects. Those protected riparian and floodplain areas are adjacent to, but outside the planning area and are not included in this analysis.

These 220 acres of streamside forests and shrublands make up approximately 1% of the planning area. Within the 1%, mixed willow forest makes up approximately 79% of riparian forest/shrubland areas, while red alder forest makes up 21%. Protection of riparian areas in the planning area has focused on watersheds known to contain salmonids, and currently most of the perennial systems are fenced to exclude grazing. Riparian recovery in some of these areas has been dramatic, with full closeout of the overstory canopy in a period of 5 to 10 years where limited vegetation previously existed along the riparian corridor. For streams in the planning area, exclusion efforts have prioritized those with the most evident impacts, such as lack of streamside vegetation, erosion, and frequent cattle use. Some unfenced intermittent systems remain, however, and in some fenced locations, the riparian habitat is dominated by brush rather than riparian trees (NPS, Ketcham, pers. comm. 2018a). Overall, riparian systems in and adjacent to the planning area are in good condition and support populations of endangered coho salmon and threatened steelhead, with exclusion efforts over the past decades limiting cattle access to the majority of sensitive habitat areas.

Grasslands

Grasslands (also referred to as coastal grasslands) make up 60% of the planning area (44% annual grasslands, 4% coastal prairie grasslands, and 12% agricultural pastureland). These 17,255 acres of grassland represent 79% of the 21,718 acres of grasslands in the park. On the Golden Gate lands of Olema Valley, westward-facing slopes with intermixed forest and scrub are predominantly California annual grassland, dominated by naturalized, non-native annuals. Ranches exposed to high winds and seasonal fog on the extreme end of the Point Reyes Peninsula have a wide variety of coastal prairie sub-types, from high terraces and bluffs to wet, lowland prairie (Schirokauer et al. 2003). This variable vegetation type is dominated by non-native or native grasses, much of which is grazed by cattle, and may have up to 15% shrub cover (NPS 2004b; NPS 2006b; Schirokauer et al. 2003). Point Reyes' recent Natural Resources Condition Assessment (NRCA) includes an analysis of 51 plots in Point Reyes' grazed grasslands monitored from 1988 through 2013. The analysis found that ryegrass, a non-native grass, was the most

common species during the sampled period. Two other non-native grasses, common velvetgrass (*Holcus lanatus*) and purple false brome (*Brachypodium distachyon*) increased, while California oatgrass, a native perennial bunchgrass, decreased. However, the analysis did not include any ungrazed paired comparison plots and was not fully representative of the park's grasslands (NPS 2019a).

In the planning area, grasslands intergrade with several shrub and forest community types. Control of woody vegetation is a common management concern for conservation of coastal grassland habitat (Ford and Hayes 2007; Pawley and Lay 2013). Coastal scrub frequently encroaches on coastal grasslands where grazing and fire are absent; complete conversion of grasslands to coyote brush-dominated coastal scrub can take place within 15 to 25 years (Ford and Hayes 2007). When this occurs, habitat values necessary for native plant and animal species that use grasslands are lost, and forage available for both domestic and wild grazing animals is reduced. Both grazing and prescribed burning can limit coyote brush encroachment into coastal grasslands, but the effectiveness of management techniques depends on grazing intensity, frequency of fire, and environmental conditions (Ford and Hayes 2007). Of the 51 plots analyzed in the NRCA, coyote brush occurred in about half of the plots. It increased in cover on 10 plots, 6 of them to a major degree, and decreased in cover on 8, although in some plots, cattle grazing had ceased. However, the plots did not capture the full range of ecological sites and vegetation (NPS 2019a).

Coastal Prairie. California's coastal prairie is patchily distributed from the Oregon border to San Luis Obispo County. This grassland plant community is generally only found within several miles of the coast where summer drought is moderated by oceanic cooling (Ford and Hayes 2007; Eviner 2016). Native perennial grasses are often the dominant plants, although forbs can constitute a significant proportion of the species richness (Hayes and Holl 2003). Compared with other grassland types of the western US, the coastal prairie contains almost double the number of species (Stromberg, Kephart, and Yadon 2001). Across all of California, agriculture, development, introduction of non-native plants, and anthropogenic changes to nutrient cycles, hydrological cycles, and disturbance regimes such as fire and grazing have noticeably reduced and altered the coastal prairie (Ford and Hayes 2007). Ranches in the Point Reyes portion of the planning area encompass large portions of the coastal prairie ecotype, and although coastal prairie makes up only 4% of the vegetation communities in the planning area, this represents almost two thirds of coastal prairie in the park.

Perennial bunchgrasses dominate pristine coastal prairie in the planning area. Pacific reedgrass is the most common native grass in the planning area along with tufted hairgrass (*Deschampsia cespitosa*), California oatgrass (*Danthonia californica*), meadow barley (*Hordeum brachyantherum*), California brome (*Bromus carinatus*), and purple needlegrass (*Nassella pulchra)*. Native grasses are often found in association with annual non-native grasses, coyote brush (*Baccharis pilularis*), California blackberry, and a variety of native and non-native herbs (NPS 2004b, 2006b).

California Annual Grassland. This vegetation type makes up 44% of the planning area; most of the grasslands in the north district of Golden Gate consist of this type. California annual grassland is composed primarily of naturalized non-native annual grasses and forbs. Ford and Hayes (2007) note that patches of California annual grassland occur in areas of coastal prairie, probably because of the history of agriculture. In the planning area, these annual grasslands have existed for decades as part of the ranching landscape and are largely dominated by the same suite of naturalized non-native species found elsewhere in California, such as soft chess (*Bromus hordeaceus*), oats (*Avena* spp.), ripgut brome (*Bromus diandrus*), barley (*Hordeum* spp.), flax (*Linum* spp.), and filaree (*Erodium* spp.). Non-native annual grasses and forbs such as these have dominated this type of grassland since before the park was established, and native plants typically make up only a very small percentage of the total cover. Despite this, native plants make up a significant proportion of the species richness; the majority of these native species are likely to be annual forbs. California annual grassland exhibits considerable spatial and temporal variation at many scales. Annual rainfall amount and pattern, temperatures during the growing season, diverse soil chemistry and texture, topographic variation, and land-use history, among other

variables, largely determine plant species composition, biomass production, and dominance relationships (Jackson and Bartolome 2002; Eviner 2016).

Agricultural Pasturelands. Pasturelands is an agricultural vegetation type reflecting a higher intensity of use, distinguished from grazed grasslands and other grazed, naturally occurring vegetation types in the planning area (Schirokauer et al. 2003; Pawley and Lay 2013). Agricultural pasturelands are predominantly composed of non-native species, including seeded grass and legume forage species, with invasive non-native members of the mustard family (Brassicaceae) and thistles (Asteraceae) patchily abundant (Pawley and Lay 2013). Pasturelands were defined by Schirokauer et al. (2003) as areas enclosed to graze cattle or horses, managed to produce forage for cattle, or fields used for other agricultural purposes.

Coastal Dunes

Point Reyes protects some of the "last remaining high quality coastal dune habitat in the United States," which provides habitat for 11 federally listed plant and wildlife species (NPS 2015b). Sixty percent of the park's coastal dunes are now dominated by two non-native species—European beachgrass (*Ammophila arenaria*) and iceplant (*Carpobrotus edulis*). Overall, these two species represent roughly 50% and 25%, respectively, of all coastal dune vegetation (NPS 2004b, 2006b, 2015b). In areas where these two species dominate, they form dense monocultures with few or no other species present (NPS 2004b, 2006b). The two non-native species also alter natural dune physical processes by impeding sand movement and changing sand deposition patterns (NPS 2015b). Under normal conditions, coastal dunes are constantly changing as sand is transported by wind and waves, typically resulting in distinct foredune and backdune communities. European beachgrass and iceplant stabilize the dunes, homogenizing habitat values (NPS 2015b).

The remaining 25% of the coastal dune vegetation is composed of remnant patches of the native plant community, primarily dune sagebrush (*Artemisia pycnocephala*), coast buckwheat (*Eriogonum latifolium*), dune lupine (*Lupinus chamissonis*), and goldenbush (*Ericameria ericoides*), sometimes with intermixed, light to moderate cover of the two non-native species, European beachgrass and/or iceplant. Total vegetation cover with native dune habitats such as dune mat and dune scrub is often low and interspersed with bare sand (NPS 2004b, 2006b; Pawley and Lay 2013).

Because of the direct and indirect impacts of these invasive species on federally listed and other rare species, NPS began a large-scale coastal dune restoration program starting in 2001. Since then, NPS has removed approximately 269 net acres of invasives from approximately 524 acres of coastal dunes (NPS, Parsons, pers. comm. 2019b). Restoration used manual removal, mechanical excavation, and herbicide treatment methods (NPS 2015b). Where herbicide has been used to treat European beachgrass and iceplant, NPS implemented several measures to avoid impacts on existing native habitats and ranchlands, such as establishing buffers to organic pastures, using manual removal or mechanical excavation in buffer areas and strict observation of climatic restrictions on spraying during windy or wet days (NPS 2015b).

Approximately eight ranch operations abut coastal dunes; some the dunes contain finger-shaped parabolic features formed by wind and colonized by various species over time. Coastal dunes make up approximately 611 acres, or 2% of the planning area, which represents approximately 28% of the 2,217 acres of coastal dune habitat in the park.

Coastal Scrub

Along the central California coast, coastal scrub and coastal prairie co-occur in a "continuum of herbaceous to dense woody shrub cover" (Ford and Hayes 2007). Approximately 97% of coastal scrub in the planning area is dominated by coyote brush (Schirokauer et al. 2003). Coyote brush scrub is highly diverse and variable, ranging from fairly low, open areas where it mixes with grasses to tall, dense multi-species shrubland (Schirokauer et al. 2003). Coyote brush scrub can be roughly equally divided in the planning area between open and dense variations. In its more open variation, coyote brush commonly is

associated with non-native and native grasses (see "Grasslands" section above) and California blackberry. It may also be found in association with sedges and rushes. In its taller, denser variation, poison oak is the most commonly associated shrub, often at fairly high cover. Coffeeberry (*Frangula californica*), thimbleberry, California blackberry, and California sagebrush (*Artemisia californica*) are other common associates in dense coyote brush scrub (NPS 2004b, 2006b; Pawley and Lay 2013).

Approximately 2% of coastal scrub in the planning area is dominated by a diverse list of shrub species that includes coffeeberry, California wax myrtle, salmonberry, yellow bush lupine (*Lupinus arboreus*), hazel (*Corylus cornuta*), and blue blossom (*Ceanothus thyrsiflorus*) (NPS 2004b, 2006b, 2014b). Chaparral accounts for less than 1% of the coastal scrub type (Schirokauer et al. 2003). Manzanitas (*Arctostaphylos* spp.), primarily Eastwood manzanita (*Arctostaphylos glandulosa*), and chamise (*Adenostoma fasciculatum*) are the dominant shrubs (Schirokauer et al. 2003; NPS 2006b).

Coastal scrub comprises 5,267 acres, or 18% of the planning area, which represents approximately 30% of the 17,708 acres of coastal scrub habitat in the park.

Plant Biomass

Grazing animals consume plant biomass and damage it through trampling; therefore, grazed vegetation typically has lower levels of biomass, although compensatory growth of grazed plants can mitigate the loss of biomass to varying degrees (Jackson and Bartolome 2007). In grasslands dominated by non-native, highly productive annual grasses, using grazing animals to remove biomass can benefit native plants (and the wildlife species that rely on them). Hayes and Holl (2003) and Johnson and Cushman (2007) suggest that reduced biomass in grazed plots in their studies likely accounted for the higher levels of native annual forbs in the grazed plots.

Non-Native Vegetation

California's grasslands have been invaded by non-native species, with 300 of the state's 1,100 established non-native plant species occurring in grassland ecosystems (Zavaleta et al. 2016). Although less likely to be dominated by non-native species, many areas of coastal prairie contain significant cover of non-native perennial grasses and annual species. Common velvetgrass is the dominant non-native perennial grass in the planning area. Dominant non-native annuals include Italian ryegrass (*Festuca perennis*) (can be biennial), brome fescue (*Festuca bromoides*), and soft brome (*Bromus hordeaceus*) (NPS 2019a).

Invasive Plants. As described above, the California annual grassland is dominated by naturalized non-native annual grasses and forbs but continues to undergo further invasion by species such as medusahead (*Taeniatherum caput-medusae*) and purple false brome, both of which are known to occur at Point Reyes. Other invasive species threats to ranchlands in the planning area include Scotch broom (*Cytisus scoparius*), woolly distaff thistle (*Carthamus lanatus*), fertile capeweed (*Arctotheca calendula*), rosy sand crocus (*Romulea rosea* var. *australis*), and potentially stinkweed (*Dittrichia graveolens*). Patches of thistle and/or poison hemlock (*Conium maculatum*) can come to dominate locally disturbed areas or the edges of riparian zones. Also noted above, coastal dunes at Point Reyes have been substantially altered by two invasive, non-native species—European beachgrass and iceplant—that affect dune sand dynamics, species composition, and habitat values. In addition, in areas where these species are removed, new, "secondary" invaders often appear to usurp newly established bare ground or open space: these include European searocket (*Cakile maritima*), New Zealand spinach (*Tetragonia tetragonoides*), European black nightshade (*Solanum nigrum*), and other annual grasses and forbs such as ripgut brome, brome fescue, common groundsel (*Senecio vulgaris*), and sow thistle (*Sonchus arvensis*) (Parsons et al. 2019).

The NRCA found that the "total number of invasive plant species and the number of new introductions are high enough to warrant significant concern" in the park, and these species are spread through multiple pathways including, the "predictable (e.g., road, trail, and riparian corridors), sudden (e.g., long-distance dispersal through cargo containers and air freight), and unexpected anthropogenic pathways (e.g., weed seeds in restoration planting mixes)" (NPS 2019a). Livestock can have both positive and negative effects on invasive species control (Spiegal et al. 2016). Livestock grazing can be an effective management tool for some invasive plant species—one of the few that can be deployed at the landscape scale (Spiegal et al. 2016). Conversely, livestock production has been implicated in the introduction of weeds into uninfested areas because seeds of invasive species can adhere to the coats of livestock and fall off elsewhere (e.g., Chuong et al. 2016), pass unharmed through the digestive system of livestock, and be deposited with feces in other areas or contaminate hay fed to livestock. Weeds can also be introduced via seed mixes, supplemental feed, imported soils, and equipment used in ranch operations. Additionally, concentrated livestock use can increase exposed soil, providing favorable germination sites for weeds.

Special-Status Plants

The park's database includes 48 special-status plant taxa present in the planning area. Many of these plant taxa are state-listed or considered rare by organizations such as the California Native Plant Society (CNPS 2019). Non-federally listed species are monitored and/or mapped opportunistically, typically in association with NPS projects being conducted in the vicinity. An active rare plant program in the early 2000s attempted to map the rare plants in Point Reyes: these maps are amended as possible with updated information from more recent mapping efforts. Actions taken could possibly affect special-status plants, depending on the location and extent of the action. Table M-1 in appendix M provides a detailed list of these species and their preferred habitat.

Federally Listed Plants

Nine plants listed as threatened or endangered under the ESA are found in the planning area. A list of federally threatened and endangered species was obtained from USFWS (2018a). Table M-2 in appendix M lists the federally listed plant species, subspecies, or varieties that could occur in the planning area, including their status, habitat, and whether they are analyzed further due to potential impacts from actions considered in the EIS. Potential impacts on the following seven federally listed plants are analyzed further: beach layia (*Layia carnosa*), Marin dwarf flax (*Hesperolinon congestum*), showy Indian clover (*Trifolium amoenum*), Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*), Sonoma spineflower (*Chorizanthe valida*), Tiburon paintbrush (*Castilleja affinis* spp. *neglecta*), and Tidestrom's lupine (*Lupinus tidestromii*). A detailed description of each taxon, including its legal status, habitat requirements, ecology, monitoring efforts, and status in the planning area can be found in the "Evaluated Species Information" section of the USFWS Biological Assessment (BA) (appendix N).

Vegetation and Climate Change Predictions

Climate change may alter the temperature and annual rainfall amounts in the planning area, although these changes are difficult to project. Changes in habitats and ecosystems could result from changes in temperatures, precipitation, and the potential competition from colonizing species (Marin County 2015). Current projections indicate that temperatures will continue to increase, and Marin County may experience drier summers and wetter winters with heavier rain events (Marin County 2015). As noted in the *Marin County Climate Action Plan*, Marin County is in a transition zone. Projections for areas to the north indicate wetter and warmer conditions, while projections for areas to the south indicate drier and warmer conditions, making it difficult to project impacts specific to the planning area (Marin County 2015). Impacts could include loss of wetland habitats from drought and encroachment of trees and scrub into coastal prairie (Bagne, Ford, and Reeves 2012). Drought also has the potential to increase the risk of wildfire, which would affect all vegetation in the location where a fire occurs.

WILDLIFE, INCLUDING FEDERALLY LISTED SPECIES

The planning area hosts diverse terrestrial and aquatic ecosystems that support many mammals, birds, fishes, reptiles, amphibians, and invertebrates. Elk are addressed as a standalone impact topic. These species rely on a number of habitat types that are described in the "Vegetation" section.

Federally Listed Wildlife

The planning area provides habitat for several animals listed as threatened or endangered under the ESA, including critical habitat for some species. A list of federally threatened and endangered species was obtained from USFWS (2018a) and NMFS (2018). Listed marine animals (e.g., whales, seals, sea lions, sea turtles, and abalone) may use marine habitat adjacent to the planning area but are not included in this analysis because actions considered in the EIS would not affect these species. Table M-3 in appendix M lists the wildlife species, subspecies, or distinct population segments that were analyzed for known or likely occurrences and designated critical habitat in the planning area. Park staff further refined this list to identify only those species that could be potentially affected by actions considered in this EIS, based on knowledge of species' occurrences and prior consultation with USFWS and NMFS (NMFS 2004; NPS 2001b; USFWS 2002a). Seven animals could potentially be impacted, including: one amphibian (California red-legged frog); one bird (western snowy plover [*Charadrius alexandrines nivosus*]); three fishes (coho salmon [*Oncorhynchus kisutch*], steelhead [O*ncorhynchus mykiss*], and Chinook salmon [*Oncorhynchus tshawytscha*]); and two invertebrates (Myrtle's silverspot butterfly [*Speyeria zerene myrtleae*], and California freshwater shrimp [*Syncaris pacifica*]). Information about known occurrences in the planning area is provided below under the respective species group headings. A detailed description of each taxon, including its legal status, habitat requirements and ecology, and status in the planning area can be found in the "Evaluated Species Information" section of the BAs for USFWS and NMFS, appendix N and O, respectively.

One amphibian and two anadromous fish [coho salmon and steelhead] have designated critical habitat in the planning area (USFWS 2018b) (figure 47 in appendix A). Critical habitat is designated immediately adjacent to the planning area for two species (northern spotted owl [*Strix occidentalis*] and western snowy plover) (figure 48 in appendix A). The park was excluded from the 2012 critical habitat designation for the northern spotted owl because management actions in the planning area already promote the subspecies' conservation (FR 77 71876). Because actions considered in this EIS would not affect northern spotted owl habitat in the planning area, it is not analyzed further.

Special-Status Wildlife

Numerous animals in the planning area are considered "special status" because of concerns about population declines, range retractions, or small population sizes, which increase a species' susceptibility to risk of extinction. Special-status species or subspecies include animals that are (1) listed as threatened or endangered under the California Endangered Species Act (CNDDB 2018); (2) listed by CDFW as a species of special concern, sensitive species, or watch list species (CDFW 2018a); (3) protected by California statute as fully protected species (CDFW 2019); or (4) listed by USFWS as birds of conservation concern (USFWS 2018a). Further declines of a special-status species could qualify it for state or federal threatened or endangered status.

Park biologists compiled and reviewed a list of special-status species to identify those that could be potentially affected by actions considered in the EIS. The California Wildlife Habitat Relationship System was also consulted (CDFW 2014). Table M-3 in appendix M lists 29 special-status wildlife species known to occur in the planning area, including 1 amphibian, 18 birds, 3 fishes, 6 mammals, and 1 reptile species. The table describes their status and preferred habitat type(s). Several species of invertebrates in the planning area are listed on the CDFW (2018a) "Special Animal List" and are tracked by the California Natural Diversity Database because they are rare, restricted in distribution, or declining throughout their range. This list includes several invertebrates found in coastal dunes, such as the globose dune beetle

(*Coelus globosus*), sandy beach tiger beetle (*Cicindela hirticollis gravida*), and bumblebee scarab beetle (*Lichnanthe ursina*). Other sensitive invertebrates tracked by the California Natural Diversity Database, such as the monarch butterfly (*Danaus plexippus*) and Point Reyes blue butterfly (*Icaricia icarioides parapheres*), are generally found in the planning area where an abundance of nectar sources (i.e., flowering forbs) is available near water.

Mammals

Approximately 40 mammals are found in the planning area, including both native and non-native, domestic species (NPS 2012b). Common native mammals are the Columbian black-tailed deer (*Odocoileus hemionus columbianus*), coyote (*Canus latrans*), gray fox (*Urocyon cinereoargenteus*), American badger (*Taxidea taxus*), bobcat (*Lynx rufus*), brush rabbit (*Sylvilagus bachmani*), black-tailed jackrabbit (*Lepus californicus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and several species of bats, rodents, and shrews (NPS 2018b). Most species use grasslands, shrublands, or pastures to complete a portion of their life history, and the proposed actions could affect these species through disturbance, competition for resources, and habitat alteration. Some species are adaptable to agriculture and human activities (e.g., coyotes and raccoons), while others are not. Ranching and development could affect small mammals such as California meadow voles (*Microtus californicus*), black-tailed jackrabbits (*Lepus californicus*), Botta's pocket gophers (*Thomomys bottae*), and western harvest mice (*Reithrodontomys megalotis*). Some mammals are attracted to agricultural fields for the forage they provide, such as Columbian black-tailed deer. Black-tailed deer could occasionally compete with livestock for habitat; however, they generally occur at low densities, and unlike cattle, they are browsers and have a mixed diet of grasses and forbs, shrubs, and trees. Fences in the planning area can affect the movement of deer and other large mammals and cause injury. The planning area is adjacent to beaches used by elephant seals (*Mirounga angustirostris*) throughout the year and occasionally other marine mammals such as harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*). The elephant seal population is increasing along Drakes Beach, and animals occasionally enter the B Ranch area during the pupping season. Mammals also include the limited number of animals that ranches are authorized to keep for personal noncommercial use (e.g., pets or livestock guardian animals), consisting of non-native species such as horses, cats, and dogs. Domestic cats are a major predator of birds and small mammals.

Birds

Point Reyes hosts the greatest avian diversity of any national park unit in the United States and nearly half of the bird species of North America, with around 490 species recorded from approximately 60 bird families (NPS 2004b, 2018c). This diversity can be explained by the park's latitude, its diverse habitats, and its location along the Pacific Flyway (NPS 2018c). Many birds use the planning area for a portion, or all of their life history, particularly during spring migration and summer nesting. Ground-nesting species, such as the California horned lark (*Eremophila alpestris actia*), savannah sparrow (*Passerculus sandwichensis*), grasshopper sparrow (*Ammodramus savannarum*), song sparrow (*Melospiza melodia*), western meadowlark (*Sturnella neglecta*), California quail (*Callipepla californica*), and northern harrier (*Circus cyaneus*), could be susceptible to impacts from cattle grazing and Vegetation Management (e.g., plowing and harvesting). Agricultural activities that affect songbird populations could also affect the foraging of American peregrine falcons (*Falco peregrinus anatum*), which nests at Point Reyes, and merlins (*Circus cyaneus*). Several other special-status raptors rely on grassland habitats, including the burrowing owl (*Athene cunicularia*), white-tailed kite (*Elanus leucurus*), and ferruginous hawk (*Buteo regalis*) (table M-3 in appendix M), and could be affected by habitat alteration from livestock grazing and Vegetation Management. Additionally, agricultural activities and human use in the planning area attract some birds via food sources, habitat alteration, or livestock presence, such as common ravens (*Corvus corax*), brown-headed cowbirds (*Molothrus ater*), tricolored blackbirds (*Agelaius tricolor*), Brewer's blackbirds (*Euphagus cyanocephalus*), European starlings (*Sturnus vulgaris*), and American crows (*Corvus brachyrhynchos*), among others. Nest parasitism by brown-headed cowbirds or competition with

non-native European starlings for cavity nesting sites could negatively affect other native birds. Ravens are nest predators of the federally threatened western snowy plover, which nests on beaches adjacent to the planning area (table M-4 in appendix M).

Fish

Fish that could occur in the planning area include 14 species that are freshwater, 3 estuarine (mix of fresh and saltwater), 10 anadromous (migrate up rivers from the sea to spawn), 3 catadromous (migrate down rivers to the sea to spawn), and 2 amphidromous (move between fresh and salt water but not to spawn) (NPS 2007b, 2018d). Freshwater streams in the planning area are characterized by naturally low species diversity (NPS 2004b). The three-spined stickleback (*Gasterosteus aculeatus*; anadromous), prickly sculpin (*Cottus asper*; catadromous), and California roach (*Hesperoleucus symmetricus*; freshwater) are the predominant fish species in perennial streams. Three federally listed anadromous fish that could occur include coho salmon, steelhead (an anadromous rainbow trout), and Chinook salmon (table M-4 in appendix M). The Lagunitas Creek watershed supports one of the largest remaining spawning populations of the Central California Coast coho salmon evolutionarily significant unit (Carlisle, McNeill, and Reichmuth 2018). Steelhead from the Central California Coast distinct population segment occur in the planning area in the Lagunitas and Olema Creek watersheds and in tributaries to Drakes Estero. Chinook salmon from the California Coastal evolutionarily significant unit are sporadic visitors to the Lagunitas Creek watershed; only a few adults have been observed in 12 of 17 years (MMWD 2018). Other special-status fish in the planning area could include the Pacific lamprey (*Lampetra tridentatus*) and western river lamprey (*Lampetra ayresii*), which are both anadromous and ecologically similar, and the riffle sculpin (*Cottus gulosus*), a freshwater species residing in cold, clear headwater streams (table M-3 in appendix M). Historical logging, development, and grazing in the planning area have negatively affected fish habitat as a result of sedimentation, loss of habitat complexity, and diminished riparian ecosystem function (NPS 2001b). Major perennial streams that are habitat for federally listed fish in the Tomales Bay watershed (Lagunitas and Olema Creeks) either do not have adjacent grazing or have been fenced to exclude cattle. However, agricultural activities contribute to habitat degradation and reduced water quality and quantity for fishes (see "Water Resources" section).

Reptiles and Amphibians

A dozen species of reptiles could occur in the planning area (NPS 2007c, 2018e). The western pond turtle (*Clemmys marmorata*), a California species of special concern, uses freshwater ponds and backwater areas of large streams in the planning area. Four lizard species occur in almost every habitat, except the dampest, most interior forests and tidal salt marshes, and eight snake species could occur in the planning area (NPS 2007c, 2018e). These species typically prefer riparian areas, shrublands, grasslands, and rock outcrops (California Herps 2016). Amphibians in the planning area, found in and near streams and ponds, include six species of salamanders and four species of frogs and toads (NPS 2018f), including the non-native bullfrog. Although extirpated or greatly reduced throughout its range in California, the federally threatened California red-legged frog is still locally abundant in the planning area. Several populations inhabit the park, and the NPS has recorded 136 known occurrences[1] in the park, primarily associated with stock ponds (NPS 2019a). Also, the coast range newt (*Taricha torosa torosa*), a subspecies of the California newt (*Taricha torosa*), is a special-status species found in the planning area. Development and agricultural activities could affect habitat suitability and water quality for reptiles and amphibians.

[1] Occurrences document the areas surveyed for threatened and endangered animals in which a species is, or was, present. In many cases, an occurrence represents several observations of multiple individuals or multiple visits at a given location.

Invertebrates

Thousands of aquatic and terrestrial invertebrates inhabit the planning area. Limited information about the diversity and distribution of these species is available. Numerous flying insects are important pollinators of native plants, which could be affected by livestock grazing and Vegetation Management activities. Other aquatic invertebrates, including numerous insects, are important indicators of water quality and support aquatic food webs that could be affected by runoff from agricultural activities. Two federally endangered invertebrates are known to occur in the planning area, the Myrtle's silverspot butterfly and California freshwater shrimp (table M-4 in appendix M). Surveys of Myrtle's silverspot butterfly showed occurrences on 13 ranches, all which support livestock operations (Adams 2004). California freshwater shrimp are found in Lagunitas Creek and lower Olema Creek. No additional federally listed invertebrate species are known to occur in the planning area (table M-3 in appendix M).

TULE ELK

Tule elk are mixed grazers and browsers; they feed on both ground-level herbs and grasses and on woody shrubs and trees. In Point Reyes, elk predominantly favor non-forested habitats, such as open grassland and coastal scrub, eating a variety of plants that include grasses, coyote brush, willow (*Salix* spp.), bush lupine, plantain (*Plantago* spp.), and miner's lettuce (*Claytonia perfoliata*). Depending on gender, adult tule elk have an estimated AU equivalent of 0.26 to 0.47 at Point Reyes, based on weights collected in 2015–2016 (Bernot and Press 2018; NPS, Press, pers. comm. 2019c). Bulls are typically much larger than cows.

Elk breed in a polygamous mating system where males compete during the rut or breeding season for dominance. The result is that the dominant bull mates with many females, accomplished through forming a reproductive herd or harem. Thus, only 15% to 25% of males breed compared with 90% of females over their lifetime (NPS 1998a). Elk mating season, the rut, is prolonged and lasts from July to October.

Currently, coyotes and mountain lions are the only predators of elk in the park. However, coyotes and mountain lions only occasionally target individual elk and therefore do not help regulate overall elk population growth.

Current Status and Distribution of Elk in the Park

Elk currently occur in three distinct herds in Point Reyes, two of which are located in the planning area: the Drakes Beach herd and the Limantour herd (appendix A, figure 2). The Tomales Point herd, located outside the planning area, is composed of descendants of the 10 individuals introduced to the park in 1978. A 3-mile-long fence spanning the peninsula from the Pacific Ocean to Tomales Bay generally isolates the Tomales Point herd from adjacent dairy ranches. They are contained in the 2,600-acre Tomales Point Tule Elk Reserve and do not interact with ranching operations, except for a few male elk that occasionally escape the reserve. The Tomales Point herd consisted of 439 animals at the end of 2019 (NPS, Press, pers. comm. 2020d).

The Drakes Beach herd consisted of an estimated 138 animals at the end of 2019 (NPS, Press, pers. comm. 2020d). The main herd and male bachelor groups spend time on A, B, C, D, and E Ranches, as well as in surrounding areas where no cattle grazing occurs (figure 2 in appendix A). The core use area for the Drakes Beach herd straddles the east and west sides of Drakes Beach Road and is located mostly in the ranchlands. A male bachelor group of bull elk regularly occurs at the northern end of the core area near the top of Drakes Beach Road, while larger female/juvenile groups are located on parts of C Ranch and in areas closer to Drakes Beach. Individual male elk or small groups regularly wander toward the Point Reyes headlands and other surrounding areas.

NPS monitors the presence of elk on ranches through visual observations and the deployment of GPS collars on individual animals. The GPS collars, first deployed in the fall 2012, have only been used for the Drakes Beach herd and collect location data every three hours throughout the day and night. Because elk are herd animals, the GPS data collected from a single animal often represent the movements of a large group of elk.

The larger main herd of elk at Drakes Beach consists of adult females, calves, yearlings, some immature males (spikes), and an occasional bull or two. The main herd is most cohesive during the fall and winter following the rut and comprises as many as 80 elk. During the spring calving period and the summer rut, the animals that form the main herd disperse into smaller groups and are more widespread through the core area, from the center area of C Ranch to the east toward Drakes Estero. The female groups spend more time at the southern end of Drakes Beach Road and thus more time in areas not permitted for grazing (Bernot and Press 2016, 2018). On average, initial GPS collared females from November 2012 to October 2014 spent 60.1% of time throughout the year in areas not permitted for cattle grazing (Bernot and Press 2016). The ranch most affected by the main herd is C Ranch, with female GPS collars showing 19.5% of time spent on this ranch year-round during the same period (Bernot and Press 2016). However, the use of C Ranch by the main herd is not evenly distributed throughout the year. Use increases during the summer and fall compared to other times of year (Bernot and Press 2016, 2018). NPS has conducted hazing to push the Drakes Beach herd off active ranch lands to reduce time spent and forage consumed by elk on ranches. During initial hazing efforts, the elk were hazed in the morning but often returned by evening. Through repeated efforts, hazing has been more effective at keeping elk away from C Ranch for longer periods. Hazing has not been very effective for bachelor groups.

Male elk in the Drakes Beach herd spend most of the year on ranches. The larger bachelor group at the top of Drakes Beach Road regularly crosses the road at sunset and sunrise, spending nights on C Ranch and days to the east of Drakes Beach Road on E Ranch and D Ranch. As such, males spend the most time on C Ranch and D Ranch. Similar to the main herd, there are seasonal patterns in how the male elk are distributed. Following the rut, a group of approximately 12 bull elk move to A and B Ranches for several months. Another group moves to E Ranch, spending the most time on the ocean side of Sir Francis Drake Boulevard, between the road and the dunes backing South Beach. The males consolidate into the largest groups when the bulls are in velvet during the late winter and spring. Males are most evenly distributed across the ranches and non-ranching areas in the core use areas during the summer, which is likely explained by the rut when males form the female groups into separate smaller harems distributed throughout the core use area.

A recent study using the GPS collar data confirmed NPS findings that male elk in the Drakes Beach herd tend to spend more time on ranches than females (Hughey et al. 2019). Elk data analyzed through 2018 demonstrated that females spent an average of 60% of time in areas not permitted for cattle grazing compared to 13% of time for males. The analysis also confirmed seasonal patterns of elk distribution in the Drakes Beach herd (e.g., elk use C Ranch less during April to June and more from July to October). Overall habitat selection appeared to be most consistently correlated with low elevation habitat on gentle, south-facing slopes, near ponds. However, biotic factors related to forage productivity and livestock production had the largest effect on elk habitat selection overall, which suggests that cattle play a noticeable role in determining the distribution of elk in this system (Hughey et al. 2019).

Habitat modifications for the Drakes Beach herd have included two projects. The first, a water project at D Ranch, was completed in 2013 and is ongoing; it provides reliable water sources for elk away from ranches. The second, mowing portions of D Ranch, began in spring 2018 to control invasive wild radish and poison hemlock that degrade the suitability of habitat for elk. Mowing these weeds is intended to improve forage availability for elk and create shorter stature grassland habitat that elk may prefer.

Based on field observations, the Limantour herd consisted of at least 163 animals in early 2020 (NPS, Press, pers. comm. 2020d). This herd is distributed across a larger geographic area than the Drakes Beach herd. The range of the Limantour herd includes designated wilderness areas extending south beyond Coast Camp and adjacent ranchlands to the north. Four separate core use areas exist within the herd's range, two of which are occupied by males and are located wholly or partially on ranchlands. Approximately 50 adult males spend time on ranch lands at any one time, with most concentrated use on Home Ranch, N Ranch, D. Rogers Ranch, and, to a lesser extent, in surrounding areas with no cattle grazing, particularly on the western slope of Mount Vision. A smaller group of six to eight males extends up to H and I Ranches and occurs occasionally on L and M Ranches. The male elk are known to cross Sir Francis Drake Boulevard at only one location, traveling through the bishop pine forest above N Ranch and then across Schooner Creek and Sir Francis Drake Boulevard to D. Rogers Ranch. Spread across these seven ranches, bull elk from the Limantour herd consume an estimated equivalent of between 19 and 24 AU (NPS, Press, pers. comm. 2020b). Most males return to the wilderness areas to join the female groups during the rut from summer into fall.

Female/juvenile groups generally remain in the wilderness areas northeast and southwest of Limantour Road, particularly the Glenbrook and Muddy Hollow Drainages, and rarely cross onto ranchlands. A small group of eight elk (six females and their calves) has moved far south to near Glen Camp. In recent years, female groups have moved farther upslope of the Inverness Ridge, extending up to and beyond the Laguna and Muddy Hollow Trailheads. Rather than being concentrated in large groups like at Drakes Beach, the female groups are usually broken up into many smaller groups distributed across a large area. During the summer rut, it is common for one or two small harems to occasionally move to the Drakes Head area of Home Ranch. In addition, a group of 20 to 24 females, spikes, and juveniles occurs regularly during the winter in the back and center portions of Home Ranch. Hazing of the Limantour herd has occurred at Home Ranch when small female groups are present on the ranch. The female groups have not traveled far onto the ranch, but the hazing efforts have been only partially successful in returning the animals to the adjacent wilderness area to the south.

Elk occurring on ranches have the greatest effect on cattle fences and the availability of forage, with less of an effect on the consumption of supplemental feed. Because elk move together in large herds and tend to follow established routes of travel, fences are usually crossed in the same areas repeatedly. Fences that are old and in poor condition, too tall for elk to easily jump over, or do not have wires spaced properly for elk to pass through become damaged by repeated elk crossings and even come down entirely at places. While male elk on the D. Rogers Ranch pass easily over a single-strand electric fence, C Ranch has had more difficulty maintaining single-strand electric fences when the main herd occurs there. Male elk can also damage fences by using wooden posts as antler rubs. NPS has also received reports of occasional infrastructure damage to water pipes. Competition for forage between elk and cattle is possible if they occur together in the same space and time and limited forage is available. As a result, elk can have economic impacts on individual ranches from infrastructure impacts, such as fence replacement, and possibly the need to purchase additional supplemental feed.

Seasonal patterns of elk use in the Drakes Beach area, particularly by the main herd, reduce the likelihood of competition for high quality forage during the growing season because elk use of ranches is more concentrated following the peak growing seasons of winter and spring. All the ranches where elk occur adhere to the RDM monitoring standards, although localized impacts where elk and cattle occur regularly have been noted. Ranchers provide additional feed to cattle in the pastures, such as hay and alfalfa. This occurs regularly on pastures occupied by dairy cattle, and seasonally (typically fall-winter) for beef cattle operations. While elk have occasionally been seen consuming this supplemental feed, it has not yet been identified as a significant or widespread problem. Elk have occasionally been known to feed from the hay racks on C Ranch. More commonly, the male group that moves to E Ranch following the rut feeds regularly on alfalfa placed for cattle adjacent to Sir Francis Drake Boulevard. Male elk have also been observed at the supplemental feed placed for cattle on pasture A of D Ranch, where C Ranch runs its

heifers. NPS has no quantitative information on how much supplemental feed is consumed by elk each year that would otherwise be consumed by cattle or how much additional feed is purchased by ranchers each year to replace what is consumed by elk. Ranchers have not reported instances of elk from the Limantour herd consuming cattle feed. NPS has received reports of bull elk goring dairy cattle in the Drakes Beach area. Behavioral differences between dairy cattle and elk and the possibility of unexpected encounters, particularly at night, lends validity to these reports despite the absence of any real-time observations of a goring incident.

Elk Herd Health

Several diseases have the potential to affect wildlife in the park. Johne's disease and CWD are two diseases currently of concern for ungulates, including elk. Johne's disease, caused by the bacterium *Mycobacterium paratuberculosis* is an incurable diarrheal wasting disease of livestock and wild ungulates. The most common source of *Mycobacterium paratuberculosis* is feces or manure. Ingestion of food tainted by manure containing the microbe is the most common way animals become infected (USDA-APHIS 2008). Proper manure management practices are important for limiting the spread of Johne's disease among wild and domestic ungulates (USDA-APHIS 2010).

Prior to the establishment of the free-ranging herd in 1999, individuals in the Tomales Point herd were infected with Johne's disease through contact with other infected animals or contaminated soil, probably from cattle, black-tailed deer, or non-native deer (Riemann et al. 1979, as cited in NPS 1998a; Jessup et al. 1981, as cited in NPS 1998a). In fall 2015, the presence of Johne's disease was confirmed in individual elk from the Drakes Beach herd following the implementation of a testing program for the park's free-ranging elk (Bernot and Press 2016).

CWD, a fatal neurologic disease, infects cervids such as deer, elk, and moose. Although CWD has not been discovered in California or neighboring states, it has the potential to spread to California's deer and elk populations. California has implemented legislation and other policy actions to minimize the risk of introducing CWD. Based on these policy measures and geographic factors limiting the likelihood of CWD spreading to California, CDFW has determined that California is at relatively low risk for CWD (CDFW 2018b); therefore, it is unlikely to affect the park's elk populations.

Limitations on Population Size

Overall, the population trend among elk herds in the planning area seems to be steadily increasing among both the Drakes Beach and Limantour herds (Cobb et al. 2020). Forage availability, closely tied to annual precipitation, is likely the most important determinant of elk herd growth patterns in the park. A recent modeling study based on elk data from Point Reyes showed that annual herd growth varied across herds as a function of differences in elk vital rates, which in turn responded uniquely to annual changes in density and climate (Cobb et al. 2020). Contrary to expectations, density-dependence had a measurable effect on herd growth at Drakes Beach despite the herd not being confined in any way. As expected, there was no evidence of any density-dependent effects in the Limantour herd. Productivity was noticeably lower in the Limantour herd than the Tomales Point and Drakes Beach herds, possibly due to lower quality available elk habitat and increased rates of predation in the Limantour area (Cobb et al. 2020).

Other regulating factors, such as inbreeding, disease, and trace element deficiencies, have all been documented in the Point Reyes elk herds. Point Reyes' elk are believed to be among the most inbred in California, having lost an estimated 80% of their retained genetic variability (McCullough, Fisher, and Ballou 1996, as cited in NPS 1998a). Copper and selenium deficiencies have been previously reported in the Tomales Point elk (Gogan, Akenson, and Jessup 1989) and were more recently documented in the Drakes and Limantour herds (Bernot and Press 2016). These deficiencies can negatively affect many aspects of the overall health of elk, including decreased resistance to disease, poor production, muscle damage, and developmental problems (Bernot and Press 2016). The extent to which these stressors affect current herd growth patterns is unknown.

VISITOR USE, EXPERIENCE, AND ACCESS

The park contains a rich assemblage of natural and cultural features close to a major urban population, offering myriad recreational opportunities and enhancing the importance of the special qualities for which it was protected. The park is located within 40 miles of the San Francisco metropolitan area and hosts approximately 2 to 2.5 million visitors annually (NPS 2018g). Visitation has remained relatively stable over the past decade, with the recent low recorded in 2010 with 2.1 million visitors and the peak recorded in 2013 with 2.6 million visitors (NPS 2018g). Annual visitation figures are available on the NPS website. According to visitor surveys conducted by Sonoma State University (Ferry and LaFayette 1997; Fungi 1999), most visitors to the park spend 2 to 6 hours engaging in various activities, depending on the season. Common activities include hiking, visiting the beach, going to the visitor centers, sightseeing, whale watching, and bird-watching (Ferry and LaFayette 1997; Fungi 1999).

The main roads through the planning area that facilitate visitor access include Sir Francis Drake Boulevard, Pierce Point Road, and State Route 1. Although these roads are in the park and planning area boundary, they are not NPS roads. Marin County manages and maintains Sir Francis Drake Boulevard and Pierce Point Road, and the State of California operates and maintains State Route 1. NPS works collaboratively with these agencies on maintenance and improvements.

Visitor facilities and recreational opportunities in the planning area include scenic driving, hiking and biking trails, equestrian use, and the Kenneth C. Patrick Visitor Center. Many visitors to the park travel through the planning area to reach other park destinations, such as Drakes Beach, Tomales Point, and the Point Reyes lighthouse. While the roads used for traveling to these park destinations fall outside the planning area, visitors still enjoy the scenic quality of the planning area landscape while traveling along them. The planning area includes several designated hiking and biking trails that encompass a range of habitat types from wooded mountains to sandy beaches. Visitors bring horses to ride on designated horse trails, and horses are available for rent from commercial stables (NPS 2006b). Other visitor activities in the planning area include photography, wildlife viewing, birding, and interpretive opportunities. Unlike other areas of the park, no overnight visitor accommodation is available in the planning area.

The highest visitation to the park typically occurs from June to August, primarily on weekends (NPS 2018g). A survey conducted in 2005 indicated that 100% of visitors were *satisfied overall with appropriate facilities, services, and recreational opportunities* (University of Idaho Cooperative Parks Studies Unit 2005). Additionally, 91% of respondents indicated that outdoor recreational opportunities were *very good*, and 82% of respondents indicated that opportunities to learn about nature, history, and culture were *very good*.

Nature study and wildlife viewing, including the viewing of elk, are important activities in the planning area. The park remains the only national park system unit where tule elk can be found (NPS 2018h), and elk viewing opportunities in the planning area are most prevalent along Drakes Beach Road.

Other wildlife viewing is also popular in the planning area. Nearly 40 species of land mammals and at least a dozen species of marine mammals may be seen throughout the park, many of which can be observed in the planning area, including elephant seals. Birding is a very popular activity in the park and planning area. Visitors also enjoy viewing and photographing livestock on the ranches. These unique and plentiful wildlife and livestock viewing opportunities bring many visitors to the park and the surrounding area.

Visitors often use the ranchlands for walking, bird watching, and other passive recreational activities. Ranching operations can also diminish the visitor experience. For instance, visitors have encountered cattle on trails and roadways in the park, and visitors have noted concerns regarding electric fencing, interactions with cattle, and manure management (NPS 2014a).

CULTURAL LANDSCAPES, HISTORIC DISTRICTS, AND HISTORIC STRUCTURES

The planning area includes portions of two ranching historic districts—Olema Valley Dairy Ranches Historic District, listed in the National Register on April 9, 2018, and the Point Reyes Peninsula Dairy Ranches Historic District, listed in the National Register on October 29, 2018 (figure 49 in appendix A). Two other historic districts are also located in the planning area—Marconi/RCA Bolinas Transmitting Station Historic District and RCA Point Reyes Receiving Station Historic District, both listed in the National Register on February 23, 2018. The Percy, Niman, and Martinelli Ranches are in the planning area but are not within the boundaries of any of the historic districts. NPS has also documented the Olema Valley Dairy Ranches Historic District, Point Reyes Peninsula Dairy Ranches Historic District, Marconi/RCA Bolinas Transmitting Station Historic District, and RCA Point Reyes Receiving Station Historic District as cultural landscapes and manages them according to NPS *Management Policies 2006* and the Cultural Resource Management Guidelines (NPS 1998b, 2006a). A cultural landscape is a setting that humans created in the natural world and includes intertwined patterns of things both natural and constructed: plants and fences, watercourses and buildings. Cultural landscapes range from formal gardens to cattle ranches, from cemeteries and pilgrimage routes to village squares (NPS 1998b).

Olema Valley Dairy Ranches Historic District

The Olema Valley Dairy Ranches Historic District occupies 14,127 acres in the western portion of the park and is mainly located in the north district of Golden Gate. Dairies in the Olema Valley were established in 1857. The 19 ranches in the historic district fall within two different valleys/watersheds—Olema Valley and Lagunitas Creek. Olema Valley encompasses the west-facing slopes from Bolinas Ridge to Olema and Pine Gulch Creeks. The ranches at the north end of the district are located east of Olema Valley on the east and west slopes of Bolinas Ridge, between Lagunitas Creek to the north and Samuel P. Taylor State Park to the southeast. Ranches that range in size from approximately 250 acres to more than 1,600 acres are located throughout the two areas of the historic district.

The following 13 individual ranches retain historic buildings and structures within their ranch building core and pasturelands that are contributing resources to the overall historic district:

- Cheda Ranch
- Hagmaier Ranch (not in the planning area)
- Giacomini Ranch
- Lupton/Five Brooks Ranch
- McFadden Ranch
- McIsaac Ranch
- Randall Ranch
- Rogers Ranch
- Stewart Ranch
- Teixeira Ranch (not in the planning area)
- Truttman Ranch
- Wilkins Ranch (not in the planning area)
- Zanardi Ranch

Six ranches do not contain extant buildings but still contain contributing resources, such as roads, windbreaks, and pasturelands that contribute to the historic district:

- DeSouza Ranch
- Edwin Gallagher Ranch
- Genazzi Ranch
- Jewell Ranch (not in the planning area)
- McCurdy Ranch (not in the planning area)
- Neil McIsaac Ranch

Overall, the Olema Valley Dairy Ranches Historic District has 157 contributing resources, including 97 buildings, 19 sites, and 41 structures. There are 28 non-contributing buildings and 1 non-contributing structure in the district. Typical buildings, structures, and landscape features at each ranch in the district

include ranch houses (both single-family residences and bunkhouses for workers), creameries, milking barns, horse and hay barns, Grade A dairies, pastures, fences, corrals, and windbreaks clustered together in ranch cores nestled among large pastures. While upgrades occurred over time, the older buildings, such as milking barns, were left in place and oftentimes converted to new, compatible uses. New buildings and structures were located within the historic core and therefore, were compatible with the existing development pattern. Despite individual variations, the extant ranch cores maintain a common spatial organization, setting, and location. The result is a significant, intact vernacular cultural landscape; collectively the ranches in the historic district convey the vast scale and remoteness of ranching life at the western edge of Marin County (NPS 2018i).

The Olema Valley Dairy Ranches Historic District continues to convey its historical significance as an agricultural ranching environment, exhibiting key characteristics of the late 19th and early 20th-century dairy ranches that flourished here. The physical condition of the district remains much as it did during the latter portion of its period of significance, which spans from 1857 to 1958. The district exhibits the characteristics of late 19th/early 20th century dairy ranches in northern California and conveys the historic character of the ranching landscape by retaining contributing buildings and structures and those cultural landscape characteristics that make up the ranch setting, including circulation, natural systems and features, spatial organization, land use, and vegetation. Ranch complexes were sited to take advantage of the flat portion of the property, often surrounded by rolling hills and natural drainages, which provided easy access to water and grasslands for grazing. The ranch complexes are composed of vernacular-style residential buildings, agricultural barns, and outbuildings, and ornamental vegetation, windbreaks, and fruit and nut trees. Outside the developed area, fences and roads divide pastures composed predominantly of pastures and coastal grasslands interspersed with native forests. The ranch complex and pastures are connected by ranch roads that maintain their historical alignments and connect the ranches to the greater district by intersecting with regional roads.

Condition assessments prepared by NPS indicate that most structures in the working ranch complexes are in fair condition (table 10) and that both structural elements (e.g., foundations, roofs and walls) as well as windows, doors, and exterior finish elements range from poor to fair. Condition assessments for the Giacomini, McIsaac, Stewart, and Zanardi Ranches, completed in 2018, indicate that the residences are generally in fair condition. The condition of outbuildings and barns range from poor to good.

TABLE 10: CONDITION OF RANCHES IN THE OLEMA VALLEY DAIRY RANCHES HISTORIC DISTRICT IN THE PLANNING AREA

Ranch	Condition	Year of Assessment	Source
Cheda Ranch	Poor	2014	NPS (2014c)
Hagmaier Ranch	Fair	2011	NPS (2011a)
Giacomini Ranch	Fair	2018	NPS (2018j)
Lupton/Five Brooks Ranch	Fair	2014	NPS (2014d)
McFadden Ranch	Fair	2011	NPS (2011b)
McIsaac Ranch	Fair	2018	NPS (2018j)
Randall Ranch	Fair	2018	NPS (2018j)
C. Rogers Ranch	Fair	2011	NPS (2011c)
Stewart Ranch	Fair	2018	NPS (2018j)
Teixeira Ranch	Good	2014	NPS (2014e)
Truttman Ranch	Fair	2011	NPS (2011d)
Wilkins Ranch	Fair	2011	NPS (2011e)
Zanardi Ranch	Fair	2018	NPS (2018j)

Point Reyes Peninsula Dairy Ranches Historic District

The Point Reyes Peninsula Dairy Ranches Historic District, which was listed on the National Register under criteria A and C, comprises approximately 22,237 acres of coastal prairie and coastal scrub areas on the northern end of the peninsula. The ranches in the Point Reyes Peninsula Dairy Ranches Historic District were established in 1857, becoming one of the earliest suppliers of dairy products to the San Francisco area. Two families—the Shafters and Howards—owned almost the entire peninsula and created 31 dairies that were leased to tenants, organizing the ranches into an alphabet system. Ranch size ranged from 800 to 2,200 acres, and boundaries often followed the rolling topography of the headlands and riparian corridors. Seventeen ranches form the Point Reyes Peninsula Dairy Ranches Historic District. The Home Ranch, located on the east shore of Drakes Estero, was the first to be built in 1857 and served as a model for the remaining tenant ranches, which were built predominantly between the early 1860s and early 1870s.

Fourteen ranches retain historic buildings, structures, and pasturelands that are contributing resources to the overall historic district:

- A Ranch
- B Ranch
- C Ranch
- D Ranch
- E Ranch
- G Ranch
- H Ranch
- I Ranch
- J Ranch
- L Ranch
- M Ranch
- W Ranch (not in the planning area)
- D. Rogers Ranch
- Home Ranch

Three ranches do not contain extant buildings in their historic ranch core but still contain contributing resources such as roads, windbreaks, and pasture lands that contribute to the historic district:

- F Ranch
- K Ranch
- N Ranch

The extant ranch cores convey over a century of change in the California dairy industry from the 1850s onward, including the evolution of dairy farming from the original wood frame milking barns to the concrete Grade A barns of the mid-1930s to 1940s (NPS 2018k). While most of the dairy operations in the Olema Valley Dairy Ranches Historic District were converted to beef production in the 1960s and 1970s, many of the ranches in the Point Reyes Peninsula Dairy Ranches Historic District maintained dairy operations. Thirteen ranches still operate within the historic district in the headlands of the Point Reyes peninsula and Tomales Point.

The Point Reyes Peninsula Dairy Ranches Historic District has 160 contributing resources that include 107 buildings, 17 sites, and 36 structures and 155 non-contributing resources that include 127 buildings, 1 site, 26 structures, and 1 object. When established in the mid-19th century, typical buildings, structures, and landscape features at each ranch included the main residence, creameries, horse barns, fences, corrals, and windbreaks clustered together in ranch complexes nestled among large pastures and coastal grasslands. These initial building types reflect the distinctive, mild climate of the California coastline. As the dairy industry evolved, additional building types were added to each ranch, including milking barns when cows were no longer milked outdoors, hay barns when ranchers began to supplement the grazing on pastureland with additional feed, and Grade A dairy buildings when regulations required strict sanitary conditions for collecting and storing milk. The new buildings and structures were located within the historic core and are therefore compatible with the existing development pattern. They also continued to display a continuity of design as they were commissioned by the Shafter-Howard family. While upgrades

occurred over time, the older buildings (i.e., the milking barns) were left in place and converted to new compatible uses. Windbreaks of blue gum eucalyptus (*Eucalyptus globulus*) and Monterey cypress (*Cupressus macrocarpa*) protect ranch cores and other structures from ocean winds. Eucalyptus trees were also historically used as a boundary marker between the Shafter and Howard properties. This feature remains intact. The main road, Sir Francis Drake Boulevard, connects all the ranches between the tip of the peninsula to Inverness Ridge. A secondary road, Pierce Point Road, branches off the main road to provide access to the northern part of the peninsula.

The overall spatial distribution of the system of ranches in the Point Reyes Peninsula Dairy Ranches Historic District illustrates the evolution of the dairy industry over a 100-year period. The history of the dairy industry is reflected in the landscape of the historic district by the remaining ranch complex developments, infrastructure, grazing lands, cattle, and continuing ranching land use that has shaped the cultural landscape of the district. The pastoral qualities of the landscape, the rolling hills covered by pastures and coastal grasslands, a climate that provides an extended summer grazing season, and water sources continue to characterize the historic district and allow for the maintenance of beef and dairy cattle ranching practices today. Many of the buildings, roads, windbreaks, and other supporting features constructed between 1857 and 1956 are intact and continue to sustain the vernacular ranching landscape (NPS 2018k).

The ranches in the Point Reyes Peninsula Dairy Ranches Historic District are in poor to good condition (table 11). NPS prepared condition assessments for A, B, C, D, G, I, J, and Rogers Ranches were completed in 2018. All buildings surveyed in this assessment, except the shed and historic residence on the D Ranch, were found to be in fair to good condition. Historic residences on all the other ranches are generally in fair to good condition. The condition of outbuildings and barns range from fair to good.

TABLE 11: CONDITION OF RANCHES IN THE POINT REYES PENINSULA DAIRY RANCHES HISTORIC DISTRICT IN THE PLANNING AREA

Ranch	Condition	Year of Assessment	Source
A Ranch	Fair	2018	NPS (2018j)
B Ranch	Fair	2018	NPS (2018j)
C Ranch	Fair	2018	NPS (2018j)
D Ranch	Poor	2018	NPS (2018j)
E Ranch	N/A	Not assessed	
G Ranch	Fair	2018	NPS (2018j)
H Ranch	N/A	Not assessed	
I Ranch	Good	2018	NPS (2018j)
J Ranch	Good	2018	NPS (2018j)
L Ranch	Fair	2004	NPS (2004c)
M Ranch	Good	2004	NPS (2004d)
W Ranch	N/A	Not assessed	
D. Rogers Ranch	Good	2018	NPS (2018j)
Home Ranch	Fair	2018	NPS (2018j)

Marconi/RCA Bolinas Transmitting Station Historic District

The Marconi/RCA Bolinas transmitting station was listed in the National Register under criteria A and C on February 23, 2018, for its role as the first station in the continental United States to transmit wireless messages across the Pacific Ocean and its mission revival architectural style (NPS 2018l). The 422-acre historic district is located 1-mile northwest of Bolinas on a bluff overlooking the Pacific Ocean in the southernmost part of the planning area. The district has eight contributing buildings, two contributing sites including a large antenna field, three contributing structures, and five noncontributing buildings and structures. The general landscape of the district is characterized by low grasslands that were maintained historically by grazing. Fencing separates the main compound of buildings and access road from the surrounding landscape. Areas adjacent to buildings have Monterey cypress, Monterey pine, and eucalyptus windbreaks. The antenna field, which is a contributing site in the district, contains antenna tower bases, wood H-frames, antenna poles, concrete foundations, downed poles, and guy wire anchors situated within the characteristic low grasslands that continue to be maintained by grazing. Most of the buildings in the district are being used by a park lessee, Commonweal.

RCA Point Reyes Receiving Station Historic District

The RCA Point Reyes Receiving Station was listed in the National Register on February 23, 2018, under criterion A as "one of only two known extant examples of a shortwave radio station from the early era of shortwave radio communications in the United States" and criterion C as exhibiting the distinctive characteristics of Art Deco architecture (NPS 2018m). Located in the gently rolling coastal grasslands, the open landscape of the 160-acre district contains a cluster of three Art Deco style buildings situated at the end of a quarter-mile-long access road. Other contributing resources include an antenna field, entrance road/allée, and a transformer vault. Noncontributing resources include a utility building, water tank, and satellite pads built in the 1970s and 1980s. The antenna fields in the district are currently used for grazing just as they were historically to maintain the vegetation. The Maritime Radio Historical Society collaborates with Point Reyes in preserving the station and has revived the broadcast of the former RCA coast station, KPH. The entrance road/allée, a contributing resource of the district, has recently become a visitor destination for photographing the scenic tree-lined entry road referred to as the Cypress Tree Tunnel.

SOCIOECONOMICS

Changes to ranching practices in the park may affect socioeconomic conditions in the planning area and the surrounding region. The regional economic context for these potential impacts is described below. The study area for the socioeconomic existing conditions assessment includes both Marin and Sonoma Counties in California because these counties encompass the area within which the primary impacts from the alternatives could be felt. Information about San Francisco County is also assessed because of its proximity to the study area and the economic relationship that ranches in the study area may have to this county. While these counties contain several larger cities, including San Rafael, San Francisco, Santa Rosa, Petaluma, and their surrounding areas, the planning area is located in a predominantly rural area away from the large urban areas. For the purposes of this assessment, the communities of Inverness, Point Reyes Station, Tomales, Dillon Beach, Nicasio, Woodacre, Lagunitas-Forest Knolls, San Geronimo, and Olema have been identified as gateway communities to Point Reyes based on proximity to Point Reyes and potential economic ties to the planning area. Note that quantitative information for Olema was not available at the time of this assessment; therefore, these communities are not presented below. Marin County is approximately 530 square miles; national park system land accounts for 25% of land ownership in the county (Headwaters Economics 2018). Information about the state of California is presented where appropriate for comparison. Unless stated otherwise, all dollar values below have been adjusted using Consumer Price Index to 2018 dollars (US Bureau of Labor Statistics 2018).

Population

Much of Marin County's population resides in the eastern portion of the county in San Rafael and the surrounding area. Much of western Marin County is rural with low population densities in primarily agricultural or forested lands that are scattered, small, and unincorporated. Towns in western Marin County primarily serve the tourism and agriculture industries and local residents. Sonoma County's population is larger than that of Marin County with most of its population residing in the center of the county around Santa Rosa, away from the Pacific coast.

Based on US Census Bureau data, Marin County had 259,358 residents between 2012 and 2016, a 5% increase from 2000. The population of San Francisco County was 850,282, and the population of Sonoma County was 497,776 between 2012 and 2016. Census Tract 1321 (population 1,956) contains the southern portion of the planning area near Bolinas, California; Census Tract 1322 (population 1,672) contains most of the planning area, including Drakes Bay; and Census Tract 1330 (population 2,877) includes Point Reyes Station and other ranches in the north district of Golden Gate (US Census Bureau 2000, 2016).

Gateway Communities

Gateway communities are identified as those cities and towns that are geographically close to the planning area and derive some measurable economic benefit from tourism and related activities in Point Reyes. These communities are generally located within several miles of the planning area. Gateway communities differ from other communities in Marin County and the state of California largely because of their relationship with the planning area. Some of these communities have a history of tourism, while others are a stop for travelers en route to destinations in or around the planning area. Historically, a number of these communities rely on agriculture and tourism and act as bedroom communities for larger cities in Marin and surrounding counties. Specifically, the National Parks Conservation Association notes that the village of Point Reyes Station would not be able to attract the volume of people that it does without the existence of Point Reyes (Bay Area Economics 2006). Lagunitas-Forest Knolls and Woodacre are the largest gateway communities to the planning area. The population of Lagunitas-Forest Knolls has declined by 17% since 2000, while the population of Woodacre increased by 11% over the same period. Point Reyes Station and Inverness are located closest to the planning area and experienced a 30% and 24% decline in population from 2000, respectively (US Census Bureau 2000, 2016). Point Reyes Station has the largest commercial district among the gateway communities around the park and is an attraction for bicyclists, motorcyclists, and other visitors, especially on the weekends (West Marin Chamber of Commerce 2019). Marin and Sonoma County are also the "epicenter of California's lively artisanal cheese movement," and Point Reyes Station in particular is a popular destination for cheese tasting in California (New York Times 2013).

Employment

An assessment of average employment in the study area at the sector level over the last 10 years reveals that approximately 49% of local employment is concentrated in industries that have increased employment since 2007. Employment in three industries—educational services, health care and social assistance, and accommodation and food services—in Marin County have grown at a faster rate than either national employment across all industries or national employment in the same industry.

The professional, scientific, and technical industry is the largest sector by number of jobs in both Marin and San Francisco Counties, responsible for 13% and 18% of total jobs in each county, respectively. The next largest industries in Marin County are the health care and social assistance industry at 11%, retail trade at 9%, and real estate and rental and leasing at 8%. Employment in farming, which makes up less than 1% of all jobs in Marin County, decreased by 14% between 2010 and 2016, while employment in farming in Sonoma County represents 2% of all jobs and remained relatively unchanged between 2010 and 2016. The number of jobs in the accommodation and food services sector is about 50% higher in Sonoma County than in Marin County (US Bureau of Economic Analysis 2016a, 2016b).

Unemployment rates in Marin County, Sonoma County, San Francisco County, the state of California, and the San Francisco-Oakland-Hayward metropolitan statistical area follow a similar pattern. This pattern was particularly notable in 2010, when unemployment peaked in all areas. With the onset of the economic recession in 2008 through 2013 to 2014, each of these counties, California, and the San Francisco-Oakland-Hayward metropolitan statistical area generally followed the same upward and downward fluctuation in unemployment. All geographies demonstrated a decrease in unemployment since 2010. Throughout this period, Marin County had the lowest unemployment as a percentage of the overall labor force, indicating it was particularly resilient to the impacts of the recession compared to the other areas (US Bureau of Economic Analysis 2017).

Tourism and Travel

Direct travel-related spending in the state of California in 2016 totaled $133 billion, generating $11 billion in local, state, and federal tax revenues and supporting 2.5% of California's gross domestic product in 2016 (Dean Runyan Associates 2016). Visitors who reside outside the state of California generated 60% of this spending. Of the $5.3 billion in sales in Marin County in 2015, 5.4% ($289 million) were generated by nonresidents to the county. In 2016, visitors to Marin County spent $872 million directly supporting 7,190 jobs and $75 million in tax revenues, $39 million of which went to local governments in Marin County (Dean Runyan Associates 2016). Travel-related spending included gas, lodging, food services, retail, auto rental, transportation, and recreation by visitors from outside the state. Nearly 1.1 million jobs are supported in California as a result of travel-related spending. Travel and agriculture are two of the most important export industries in the North Coast region of California, which includes Marin and Sonoma Counties (Dean Runyan Associates 2013).

The *National Park Service Visitor Spending Effects Report* shows that almost 2.5 million people visited Point Reyes for recreation in 2018 and that these visitors spent $107 million in gateway communities near the park. Visitor spending has remained steady over the past 5 years, ranging from an estimated $106 million to $108 million per year between 2015 and 2018. In 2018, visitor spending supported 1,150 jobs in the local area and had an aggregate benefit to the local economy of $134 million. According to the report, most park visitor spending was for hotels (28.2%), followed by restaurants (22.4%), gasoline (14.9%), groceries (14.6%), retail (7.9%), and recreation industries (6.93%). Though visitor spending on recreation industries increased in 2018, the number of recreation visitors to Point Reyes decreased by 2.5% (NPS 2019d).

Grazing, Ranching, and Agricultural Activity in Marin County and in the Planning Area

In 2017, the latest year for which data is available from the US Census of Agriculture at the time of writing, Marin County was home to 343 farms with an average size of 408 acres, and each farm operation was valued at $2.4 million.[2] The market value for all agricultural products sold in the county totaled $95.3 million; most (88%) of the market value was in livestock, poultry, and their products.[3] In 2017, 144 farms with cattle and calves were located in the county, generating $10.8 million in sales, and

[2] In the 2017 agricultural census report form, each farm operation reported its best estimate of the current market value of land and buildings owned, rented from others on the operation, and rented or leased to others. The value of the operator's dwelling and other buildings are included in the estimate if they are used for farm operations (US Census of Agriculture 2019d).

[3] Market value of agricultural products sold includes a farm operation's direct sales of agricultural products and the value of shares received from other entities associated with the operation, such as partners, landlords, or contractors. Estimates of agricultural product market value do not include taxes, product production expenses, or income from federal farm programs or other farm-related services (US Census of Agriculture 2019d).

31 farms had dairy-producing cows that generated $62 million in sales.[4] Thirty-eight farms sold poultry and eggs in 2017; these farms had $1.5 million in sales that year (US Census of Agriculture 2019a, 2019b).

The number of cattle and calf operations in Marin County decreased slightly from 155 in 2012 to 144 in 2017, with the number of beef cattle remaining relatively stable at between 36,000 to 41,000 during this period. This reflects a decrease in average beef cattle herd size of 5% over this period. The number of dairy operations decreased from 48 to 31 over the same period (2012–2017) in Marin County.[5] Over the same period, the number of cattle and dairy ranches in the park remained stable (US Census of Agriculture 2019c). According to *Marin County Livestock and Crop Reports* published between 2010 and 2017, total dairy milk production in the county has been declining for the past eight years, from 1.7 million hundredweight in 2010 to 1.0 million hundred weight in 2017. Total dairy milk sales in the county were approximately $35 million in 2017, a 15% increase since 2010, after adjusting for inflation. Production of beef cattle in Marin County has remained relatively steady over this same period. There were 14,563 cattle sold in 2010 and 14,398 cattle sold in 2017. This value dropped to as low as 13,056 in 2013 and peaked at 15,894 in 2011. Total cattle sales were worth $11 million in 2017, the latest year that the county's livestock and crop report was published (Marin County Department of Agriculture, Weights and Measures 2010, 2011, 2013, and 2017).

Park staff assessed the number of residents and employees on ranches in the planning area in spring 2019. According to the assessment, 40-full time and 1 part-time, non-ranching family employees work on dairy and cattle ranches in the planning area. An additional 23 full-time employees are also part of ranching families in the planning area. Ranching operations support 63 direct full-time jobs in the planning area. In total, 188 full-time residents live on ranches in the planning area. This includes full- and part-time employees, ranchers and their families (NPS, Voeller, pers. comm. 2019e).

An assessment of the economic impacts of ranching operations in the planning area was undertaken using an IMPLAN analysis. Ranching in the planning area supported $1.6 million in beef cattle sales and $14.0 million in dairy sales in 2017. One commercial chicken operation supported 2,000 laying hens and 900 broilers, which were assumed to bring in approximately $124,000 annually in egg and meat poultry sales when in operation. In total, all sales from ranches in the planning area directly support 63 full time jobs in Marin County, while indirectly supporting 27 additional jobs in Marin County from the purchase of goods and services by ranches in the planning area from other businesses in Marin County, such as truck transportation and silage purchases.[6] An additional 7 jobs in Sonoma County are supported as a result of ranch operations in the planning area making purchases of goods and services in Sonoma County. Finally, another 15 induced jobs are supported through the household spending of workers who are either directly or indirectly supported by sales of beef and dairy products on ranches in the planning area. In total, these jobs support $6.6 million in labor income in Marin County and $350,000 in labor income in Sonoma County. Beef and cattle ranching in the planning area represents 15% of total cattle ranching, by sales, in Marin County, while dairy production in the planning area represents 41% of dairy

[4] In the 2017 agricultural census report form, each farm operation reported its best estimate of the current market value of the gross market value of all agricultural products sold or removed from the place in 2017 regardless of who received the payment (US Census of Agriculture 2019d).

[5] As defined by the North American Industry Classification System, establishments primarily engaged in milking dairy cattle are considered as part of the dairy cattle and milk production industry. Establishments primarily engaged in raising cattle (including cattle for dairy herd replacements) are considered the beef cattle ranching and farming industry (US Census of Agriculture 2019d).

[6] The actual number of jobs supported by ranching sales is likely greater as some workers at ranches may not be counted in the identified IMPLAN sector and some of the actual jobs are part-time.

production, by sales, in the county. Poultry and egg production in the planning area represents less than 1%, by sales, of poultry production in the study area, when in operation.

AIR QUALITY

Regulatory Framework

National Ambient Air Quality Standards

USEPA sets National Ambient Air Quality Standards (NAAQS) for six air pollutants (referred to as criteria pollutants): sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), particulate matter of 10 micrometers and 2.5 micrometers (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), and lead. Nitrogen oxides (NO_x) and volatile organic compounds (VOCs) are regulated as precursors to O_3 (i.e., they undergo atmospheric reactions that form O_3). In California, NH_3, VOCs, NO_x, and SO_2 are considered precursors to $PM_{2.5}$.

The primary NAAQS are set at levels considered protective of human health (these levels are not necessarily protective of ecosystems). Areas that exceed the design value NAAQS are designated as nonattainment. Marin County is in marginal nonattainment status for O_3 (both the 2008 and 2015 standard) and moderate nonattainment status for the $PM_{2.5}$ 2006 standard. As such, the state regulatory agency, the California Air Resources Board (CARB), must develop plans to bring the area back into attainment. Federal agencies undertaking any federal action in a nonattainment area must demonstrate that project-related emissions will not impede the state's ability to bring the area back into compliance with the NAAQS, called a conformity determination. A conformity applicability analysis was completed for this project, and the emissions were below the *de minimis levels*.

Class I Areas and Protection of Air Quality Related Values

The 1977 amendments to the Clean Air Act established Class I areas to give special air quality and visibility protection to national parks and wilderness areas. There are 48 units of the national park system with Class I areas. Golden Gate is not a Class I area. Class I status provides the park with an additional measure of protection for park air quality (criteria pollutant ambient concentrations) and resources sensitive to air pollution (called air quality related values [AQRVs]), such as visibility, plants, animals, soils, water and ecosystems. NPS has an "affirmative responsibility" under the Clean Air Act to protect the air quality and AQRVs in the park. Ammonia emissions were estimated for in-park activities because as a precursor to PM, NH_3 emissions can contribute to visibility impairment and to harmful ecosystem impacts from excess nitrogen deposition. Potential impacts from NH_3 emissions are the result of numerous complex atmospheric reactions and processes. As such, emissions of these pollutants do not represent a one-to-one relationship with air resource impacts such as deposition and visibility impairment but serve as a proxy for the magnitude of in-park emission sources relative to other regional emission sources (e.g., mobile sources, refineries, power plants). Such comparisons can assist land managers in determining the scope of in-park emissions.

Environmental Context

Climate and Meteorology

California is divided into air basins defined partly by meteorological and topographical characteristics. Point Reyes, located along the western side of Marin County, is in the San Francisco Bay Area Air Basin. Because the area is within approximately 6 miles of the coastline, it is exposed to large concentrations of sea salt, a natural cause of haze (CEPA 2009). Point Reyes is a Class I park, and air quality is generally good because of the prevailing westerly marine flows. However, during periods when atmospheric conditions displace the east Pacific high-pressure system, offshore air flows from the San Francisco Bay area can degrade the air quality of the park. This mainly occurs during the late summer and early fall, when the major atmospheric systems undergo a seasonal change. During this time, a general haze often

affects visibility in the park (NPS 2019a). In addition, conditions in the late summer when fire risk is highest can result in long periods of smoke that affect visibility and air quality in the park.

Ozone

O_3 occurs naturally in the earth's upper atmosphere where it protects the earth's surface against ultraviolet radiation (USEPA 2012). However, it also occurs at the ground level (i.e., ground-level O_3) where it is created by a chemical reaction between NO_x and VOCs in the presence of sunlight (USEPA n.d.). O_3 precursors are emitted from both anthropogenic and natural source types, including power plants, industry, motor vehicles, oil and gas development, forest fires, and other sources (Beitler 2006).

O_3 is one of the most widespread pollutants affecting vegetation in the United States. (USEPA n.d.). Considered phytotoxic, O_3 can cause significant foliar injury and growth defects for sensitive plants in natural ecosystems. Specific defects include reduced photosynthesis, premature leaf loss, and reduced biomass; prolonged exposure can increase vulnerability to insects and diseases or other environmental stresses (USEPA 2017a). Plant species occurring in the park are at low risk of O_3 damage (Kohut 2004, 2007). The O_3 W126 index (named after portions of the equation used to calculate it) measures cumulative O_3 exposure over the growing season in "parts per million-hours" (ppm-hrs) and is used for assessing the vegetation health risk from O_3 levels (USEPA 2014). NPS's Park Conditions and Trends assessment of vegetation health risk at the park is rated "good" based on 2011–2015 data and the estimated W126 metric of 1.9 ppm-hrs (W126 levels below 7 ppm-hrs are considered "good condition," 7–13 ppm-hrs are considered "moderate condition," and greater than 13 ppm-hrs are considered "significant concern").

At high concentrations, O_3 can aggravate respiratory and cardiovascular diseases in humans through reduced lung function, increased acute respiratory problems, and elevated susceptibility to respiratory infections (USEPA 2016). Visitors and staff engaging in aerobic activities in the park (e.g., hiking, biking, maintenance/physical labor), as well as children, the elderly, and people with heart and lung diseases are especially sensitive to elevated O_3 levels. The NAAQS for O_3 is 70 parts per billion (ppb) for the three-year average of the fourth highest daily maximum 8-hour average O_3 concentration. NPS policy considers O_3 concentrations exceeding the NAAQS as "significant concern," concentrations of 55–70 ppb as "moderate concern," and concentrations below or equal to 54 ppb as "good condition." NPS's Park Conditions and Trends rates human health risk from ground-level O_3 as moderate concern at the park based on 2011–2015 data showing an estimated O_3 level of 55.6 ppb (NPS 2018n). The nearest O_3 monitoring site is in San Rafael, where the 2015–2017 design value computed by USEPA was 58 ppb (USEPA 2017b). No trend information is available for O_3 concentrations because there are not sufficient on-site or nearby monitoring data.

Visibility

Air pollution, especially PM, influences a visitor's ability to view scenic vistas and landscapes at parks (NPS 2018o). The Clean Air Act sets a visibility goal of no manmade air pollution in Class I areas. PM is a complex mixture of extremely small particles and liquid droplets that become suspended in the atmosphere. It largely consists of acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles (USEPA 2018a). In coastal areas, salt spray also contributes to PM and can affect visibility (Lewis and Schwartz 2004). Two particle size classes are of concern: $PM_{2.5}$ –fine particles found in smoke and haze, which are 2.5 micrometers or less in diameter; and PM_{10} –coarse particles found in wind-blown dust, which have diameters between 2.5 and 10 micrometers (USEPA 2012). Fine particles are a major cause of reduced visibility (haze) in many national parks and wilderness areas (USEPA 2012). $PM_{2.5}$ can either be directly emitted from sources (e.g., forest fires) or can form when gas emissions from power plants, industry, and/or vehicles react in the air (USEPA 2018a). Particulate matter can either absorb or scatter light, causing the clarity, color, and distance seen by humans (i.e., visibility) to decrease, especially during humid conditions when additional moisture is present in the air.

Visibility conditions are assessed in terms of a Haze Index, a measure of visibility (termed deciviews [dv]) that is derived from calculated light extinction and represents the minimal perceptible change in visibility to the human eye (NPS 2013). A visibility monitor is located in the park at the North District Ranger Station (IMPROVE network monitor ID: PORE1, CA). Conditions measured near 0 dv are clear and provide excellent visibility. As dv measurements increase, visibility conditions become hazier (NPS 2013). Visibility on mid-range days is defined as the mean of the visibility observations falling within the 40th and 60th percentiles (Taylor 2017). A visibility condition estimate of <2 dv above estimated natural conditions indicates a good condition, estimates ranging from 2–8 dv above natural conditions indicate moderate concern, and estimates >8 dv above natural conditions indicate significant concern (Taylor 2017). NPS's Park Conditions and Trends assessment rates visibility as moderate concern based on 2011–2015 estimated visibility on mid-range days of 4.3 dv above estimated natural conditions (NPS 2018n). Natural visibility conditions are those estimated to exist in a given area in the absence of human-caused visibility impairment. Estimated annual average natural condition on mid-range days equals 9.7 dv at Point Reyes.

Visibility trends are computed from the Haze Index values on the 20% haziest days and the 20% clearest days, consistent with visibility goals in the Clean Air Act and Regional Haze Rule, which include improving visibility on the haziest days and allowing no deterioration on the clearest days (Taylor 2017). For 2006–2015, the trend in visibility at the park improved on both the 20% clearest days and the 20% haziest days. Visibility on the haziest days improved from 26.9 dv in 1989 to 19 dv in 2015, while visibility on the clearest days improved from 10.6 dv in 1989 to 8.1 dv in 2015 (NPS 2018n). Fine sea salt is the largest natural contribution to haze at the park. Human-related contributions include ammonium nitrate and ammonium sulfate. Data specifically identifying the contribution of emission sources in the park compared to long-range transport emission sources from elsewhere in the region are not available.

$PM_{2.5}$ can be transported from sources hundreds of miles away to contribute to visibility problems at remote locations (San Joaquin Valley Air Pollution Control District 2018). During periods of southerly winds, the planning area may experience concentrations of PM from sources in the San Francisco Bay area (NPS 2018n). Local sources of PM include campfires, entrainment of dust from vehicle movement over unpaved roads, wildland and prescribed fires, and NH_3 from agricultural sources. Regional scale wildfires (in the Sierra and Central Valley) have affected park visibility and air quality for more than one to weeks the last two to three years.

Nitrogen and Sulfur Deposition

Sulfur and nitrogen are emitted into the atmosphere primarily through the burning of fossil fuels, industrial processes, and agricultural activities (USEPA 2012). While in the atmosphere, these emissions form compounds that may be transported long distances, eventually settling out of the atmosphere in the form of pollutants such as particulate matter (e.g., sulfates, nitrates, ammonium) or gases (e.g., NO_2, SO_2, nitric acid, NH_3) (NPS 2008, USEPA 2012). Atmospheric deposition can be in wet (i.e., pollutants dissolved in atmospheric moisture and deposited in rain, snow, low clouds, or fog) or dry (i.e., particles or gases that settle on dry surfaces as with windblown dusts) form (USEPA 2012). Deposition of sulfur and nitrogen can affect ecosystems through the acidification of water and soils, excess fertilization or increased eutrophication, changes in the chemical and physical characteristics of water and soils, and accumulation of toxins in soils, water and vegetation (NPS 2019f). Deposition levels in a region are an indicator of risk for ecosystem effects from sulfur and nitrogen pollution—higher deposition levels increase the risk of harm to sensitive species. As noted in the "Existing Emission Sources in the Planning Area" section below, the majority of pollution deposited in national parks (including Point Reyes) originates from sources outside park boundaries, but in-park sources, including NH_3 emissions, can contribute to cumulative deposition loadings. At the national level, NPS assesses current conditions in

parks using total deposition estimates from the National Atmospheric Deposition Program.[7] This estimate combines measured wet deposition with atmospheric chemical models to predict deposition outside monitoring sites. Based on the most recent data, nitrogen deposition in Point Reyes ranges from 2.9 kilograms of nitrogen per hectare per year (kg-N/ha/yr) on the north side of the park to 5.7 kg-N/ha/yr on the south side of the park (National Atmospheric Deposition Program 2017).

To understand risk to the ecosystem, NPS compares atmospheric deposition values to critical loads of lifeforms known to occur in the park. A critical load is the threshold of deposition below which no harmful effects to the ecosystem are expected to occur. According to the NPS Inventory and Monitoring program, ecosystems in the park were rated as having high sensitivity to nutrient-enrichment effects relative to other parks monitored by the program (NPS 2019f). Nitrogen deposition may disrupt soil nutrient cycling and affect biodiversity of lichen communities and some plant communities (Geiser et al. 2019, Pardo et al. 2011). Continuous deposition through time, even at rates below an annual critical load, can accumulate and lead to the increased vigor of invasive species.

Ecosystems in the park were rated as having moderate sensitivity to acidification effects relative to all Inventory and Monitoring parks (NPS 2019f). Acidification effects can include changes in water and soil chemistry that affect ecosystem health. Sulfur deposition in Point Reyes ranges from 1.1 kilograms of sulfur per hectare per year (kg-S/ha/yr) to 2.3 kg-S/ha/yr with no defined gradient (National Atmospheric Deposition Program 2017). Point Reyes has five tree species that are at risk due to the elevated sulfur deposition: black locust (*Robinia pseudoacacia*), canyon live oak (*Quercus chrysolepis*), shore pine (*Pinus contorta*), Douglas fir (*Pseudotsuga menziesii* var. *menziesii*), and California box elder (*Acer negundo* var. *californicum*) (NPS 2019f). Otherwise, sulfur deposition is not expected to impact Point Reyes resources at current levels because conditions are considered to be "good" according to NPS Air Resources Division standards (Taylor 2017).

No trend information is available for nitrogen and sulfur deposition because there are not sufficient on-site or nearby deposition monitoring data.

Existing Emission Sources in the Planning Area

Estimated air pollutant emissions from ranching were calculated for beef and dairy cattle at existing levels. As shown in table 12, existing ranching activities are estimated to generate emissions of NH_3, VOC, and $PM_{2.5}$ emissions as well as carbon dioxide equivalent (CO_2e) GHG emissions. NH_3 emissions from ranching activities were considered in this analysis because NH_3 contributes to overall deposition levels, and nitrogen deposition is a concern for the park. However, most deposition sources likely affecting the park come from sources outside park boundaries, including mobile sources, power plant and industrial sources, and regional farming operations (see discussion of CARB 2015 emission inventory for Marin County below).

Mobile source (vehicles) emissions were also calculated for visitors. Emissions pathways associated with ranching that were quantified include:

- **Enteric emissions** directly from the digestive system of cattle (CH_4 and VOC emissions are a byproduct of the digestive system of ruminants).
- **Livestock waste emissions.** Manure (urine and feces) decomposition, and its application on the land can produce emissions of VOC, NH_3, nitrous oxide, and CH_4.
- **Fugitive dust emissions.** Cattle movement over the land can generate dust (particulate matter) emissions under certain soil, vegetation and weather conditions.

[7] https://nadp.slh.wisc.edu/

TABLE 12: ANNUAL EMISSIONS FROM RANCHING AND MOBILE SOURCES UNDER EXISTING CONDITIONS (TONS/YEAR)

Activity	NH_3	VOC	$PM_{2.5}$	CO_2-Equivalent (metric tons per year)
Ranching/Livestock Emissions	104.9	46.9	0.671	24,601
Mobile Source Emissions*	0.27	0.56	1.6 (including dust)	3,734

* Note that the mobile source emission estimate is based on travel within the park only, and additional emissions would occur external to the park (available information is insufficient to accurately quantify these external emissions).

For context and comparison to ranching-related emissions, mobile source emissions were estimated based on 2018 traffic data. The traffic data includes visitors, park employees, and others using the park road system. Traffic was assumed to travel the full length of each roadway in the park (travel from outside the region and outside park boundaries was not included). For this order-of-magnitude estimate, traffic was assumed to consist of entirely gasoline passenger vehicles and park roadway traffic speeds were assumed to be 25 miles per hour. January morning meteorology was assumed. USEPA's MOVES model was used (national scale run option using default data for Marin County) to develop general emission rates for NH_3, VOCs, $PM_{2.5}$, and CO_2e. Fugitive road dust emissions were also estimated. CO_2e emissions from mobile sources within the park boundary were estimated at 3,734 metric tons/year, which is approximately 15% of the emissions due to ranching. Mobile source contributions to NH_3 and VOC are on the order of 1% or less relative to ranching related emissions. $PM_{2.5}$ emissions from ranching and mobile sources are of a similar relative magnitude.

CARB prepared a 2015 emissions inventory for Marin County that includes a breakout of farming-operation emissions. The inventory indicates that countywide NH_3 emissions from all source categories is 949 tons per year. Farm operations account for the majority of NH_3 emissions in Marin County, at 628 tons per year NH_3, or 66% of total Marin County NH_3 emissions. As shown in table 13, the NH_3 emissions estimated for ranching in the planning area represent approximately 11% of the total county-level emissions (from all source categories), and 17% of county emissions from farming operations.

VOC emissions for the park were compared to the CARB inventory's Reactive Organic Gases and represent 21% of county-level farming operation emissions. However, because agriculture is a relatively small component of overall VOC emissions, the VOC emissions estimated for ranching in the park are only 1.3% of total county VOC emissions (major sources of VOCs include industrial sources, solvent use and motor vehicles/equipment).

TABLE 13: POINT REYES LIVESTOCK EMISSIONS COMPARED TO CARB 2015 MARIN COUNTY FARMING EMISSIONS INVENTORY (TONS/YEAR)

	Point Reyes Livestock Emissions	Total Marin County Emissions	Marin County Farming Operations Emissions	Point Reyes Livestock Emissions as % of County Total Farming Operation Emissions	Point Reyes Livestock Emissions as % of County Farming Operation Emissions
NH_3	104.9	949	627.8	11.1%	16.7%
VOC	46.9	3,504	226.3	1.3%	20.7%

Air Quality and Climate Change

Marin County first identified measures to reduce GHG emissions in 2006. Human activities are generally acknowledged to have increased generation of GHGs in the atmosphere, which amplifies the warming of the earth (Center for Climate and Energy Solutions 2019). As a result, Marin County implemented strategies to reduce GHGs with specific strategies for five areas, including agriculture. In the 2015 *Marin County Climate Action Plan*, the county set a target to reduce community emissions to 30% below 1990 levels by 2020 (Marin County 2015). Specific voluntary goals for the agriculture strategy area include methane capture and energy generation at dairies, carbon farming, and promotion of the sale of locally grown foods and/or products (Marin County 2015). Additionally, California Senate Bill Number 1383 (SB No. 1383) requires CARB, in consultation with the Department of Food and Agriculture, to adopt regulations to reduce methane emissions from livestock manure management operations and dairy manure management operations. Multiple carbon farming techniques, including range planting, tree/shrub establishment, and riparian forest buffer either already occur in the planning area or are proposed Practice Standards and mitigation measures contained in appendix F. A change in climate may also increase the potential for wildfires. As noted above, wildfires adversely affect air quality in the park, and an increase in the number of wildfires could increase the periods of poor air quality in the planning area.

Additional context on the overall existing GHG emissions from various sectors in Marin County is provided by the Marin County's 2019 *Interim Community Greenhouse Gas Emissions Assessment* (Marin County 2019). The data show on-road transportation is the single largest emission sector (157,523 metric tons of CO_2e [$MTCO_2e$] in 2017), followed by agriculture (118,665 $MTCO_2e$). Although not directly comparable because of methodology differences, the Point Reyes ranching GHG emissions estimate (24,601 $MTCO_2e$) represents approximately 21% of countywide agricultural emissions and 6% of total emissions in the county. Mobile source emissions occurring within the boundaries of the park (3,734 $MTCO_2e$) represent only about 2.3% of on-road transportation sector emissions countywide. However, note that additional mobile source emissions attributable to activity in the park would occur outside park boundaries.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This "Environmental Consequences" chapter analyzes the beneficial and adverse impacts that would result from implementing any of the alternatives considered in this EIS. The resource topics presented in this chapter correspond to the descriptions of existing conditions in "Chapter 3: Affected Environment." As required by the CEQ regulations implementing NEPA, this chapter provides a comparison of the environmental consequences for each alternative.

GENERAL METHODOLOGY FOR ASSESSING IMPACTS

The following analysis evaluates direct, indirect, and cumulative impacts on the human environment (i.e., physical, natural, cultural, and socioeconomic resources) from EIS alternatives. The approach includes the following elements:

- Focusing the analysis to the greatest extent possible on management changes and associated issues that could have meaningful impacts on the resources or values being evaluated
- Using analysis methods and assumptions that follow CEQ and US Department of the Interior regulations and guidance

The potential for significant impacts from actions being considered in the alternatives is assessed and described in each resource topic as applicable. Alternative elements, such as the length of lease/permits, that would not affect individual resource topics are not analyzed further.

GENERAL ASSUMPTIONS FOR ASSESSING IMPACTS

For purposes of this analysis, the following assumptions were used with regard to actions that are anticipated to occur should 20-year lease/permits be issued. These assumptions apply globally to alternatives B, C, and D. Under alternative E, no diversification on any ranches or activities related to dairy ranches would occur; therefore, those assumptions would not apply. None of the assumptions pertaining to ranch operations would apply to alternative F. Assumptions are listed by Management Activity with associated USDA-NRCS Practice Standards. As noted in chapter 2, one project can routinely include multiple USDA-NRCS Practice Standards (see appendix F). When appropriate, assumptions are provided for the total number of actions over the life of the plan as well as the maximum annual number of projects anticipated.

- *Public Use and Enjoyment.* Development efforts would occur over the next 20 years and would require additional site-specific planning and compliance for new trail connections and parking areas. The analysis discusses potential impacts programmatically.
- *Management Activities.* The analysis assumes a total number of individual projects that would occur over the 20-year lease/permit term as well as in any given year, when applicable. Over the entire lease/permit term, the total number projects would be similar to what has been implemented in the past; however, more projects may be requested and completed in the first few years of implementation if a ranching alternative is selected because ranchers have been postponing projects pending the outcome of the planning process.
    - Road Upgrade and Decommissioning—20 Access Road projects, up to 10 Trail and Walkways, 40 Structures for Water Control, and 5 Road Closure and Treatment projects over the 20-year lease/permit term. NPS anticipates up to 3 Road Update and Decommissioning projects annually.

- Infrastructure Improvements—10 Roof and Covers projects over the 20-year lease/permit term, with additional roof runoff structures developed as needed, associated with all buildings. Heavy use area protections are a regular practice associated with troughs and feeding areas, as well as corrals and heavily travelled lanes in the ranch complex.
- Waterway Vegetation and Planting—Up to 25 Grassed Waterways and 12 Filter Strip projects over the 20-year lease/permit term.
- Fencing—Approximately 20% of the 340 miles of existing fencing would be replaced, 24 miles of fence would be installed for the Resource Protection subzone, and an additional 35 miles of new fence would be constructed to improve livestock management over the 20-year lease/permit term. NPS anticipates up to 5 Fencing projects annually.
- Livestock Water Supply—Up to 25 Spring Developments, 40 Livestock Pipelines, 30 Watering Facilities, and 24 Pumping Plants over the 20-year lease/permit term.
- Pond Restoration—Up to 25 Pond Restoration projects over the 20-year lease/permit term.
- Waterway Stabilization—Up to 40 Grade Stabilization Structure (headcut repair) and 20 Lined Waterway projects (drainage ditch stabilization) over the 20-year lease/permit term. NPS anticipates up to 4 Waterway Stabilization projects annually.
- Stream Crossings—Up to 16 Stream Crossing projects over the 20-year lease/permit term. NPS anticipates up to 3 Stream Crossing projects annually.
- Upland and Riparian Vegetation Management and Planting—Up to 40 Critical Area Planting projects, 50 Riparian Forest Buffers, and up to 24 Windbreak/Shelterbelt Establishments over the 20-year lease/permit term. Range planting would be evaluated on a site-specific basis in the Range subzone.
- Mowing—Mowing undesirable species as a form of weed treatment would be authorized in the Pasture and Ranch Core subzones once reviewed by NPS. There would be no limit to the amount of Mowing, but Mowing would be approved on an individual basis. Between 4 to 8 Brush Management and Herbaceous Weed Treatment requests are anticipated annually.
- IPM—Ongoing and would continue annually based on presence of species and site-specific evaluation.
- Targeted Grazing—Authorized as necessary to meet NPS management goals and objectives.
- Manure and Nutrient Management—All associated USDA-NRCS practices would occur on up to 6 dairies annually, across up to 2,500 acres, of which, 715 acres are also part of the 1,000 acres of authorized Forage Production. Waste transfer projects are assumed at up to 12 projects annually.
- Forage Production—Assumes Forage and Biomass Planting, Forage Harvest Management, and Residue and Millage management would occur on up to 1,000 acres annually where authorized.

- *Diversification.* Diversification activities would only be authorized on the 18 ranches with a ranch complex. Diversification activities that are of the same size, scope, and intensity as described in table 6 are fully analyzed in this EIS. One chicken operation at a level up to 2,900 chickens is authorized under an existing lease/permit but is not currently operating. Alternative A assumes the operation starts again as authorized.
- *Ranch Complexes.* Maintenance on ranch buildings would be a requirement for ranchers and would occur annually.

ASSESSING IMPACTS USING COUNCIL ON ENVIRONMENTAL QUALITY CRITERIA

According to CEQ's NEPA regulations (40 CFR 1500–1508), the term "significant" is based on the criteria of context and intensity (40 CFR 1508.27). Specific methodologies and assumptions used to assess impacts are provided at the beginning of each impact topic. Significance was determined by comparing the impacts of the alternatives under consideration to the current condition of the resources as described in Chapter 3, "Affected Environment." Where impacts are likely to be significant, a significance determination is made. If significance is not addressed in the discussion, it means that significant adverse impacts on that resource are not expected when compared to current conditions.

Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend on the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

Intensity. This refers to the severity or magnitude of an impact. CEQ identifies 10 factors to be considered in evaluating the intensity of an impact. For more information, see 40 CFR 1508.27(b).

CUMULATIVE IMPACTS

CEQ NEPA regulations require the assessment of cumulative impacts in the decision-making process for federal projects. A cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). A cumulative impact analysis must consider the overall effects of the direct and indirect impacts of the proposed action, when added to the impacts of past, present, and reasonably foreseeable actions on a given resource. All alternatives, including the no action alternative, consider cumulative impacts.

Cumulative impacts were determined by combining the impacts of each alternative with the impacts of other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other past, ongoing, or reasonably foreseeable future projects and plans in the area of analysis that would affect the same resources that could be impacted by direct and indirect impacts of the alternatives. Past actions are those actions that have occurred or have ongoing impacts that are occurring. Past actions that no longer have ongoing impacts are captured in the description of the existing condition in chapter 3. Reasonably foreseeable future projects are those that are not yet undertaken but are sufficiently likely to occur in the future. Following the CEQ guidance, past actions were included, "to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the agency proposal for the actions and its alternatives may have a continuing, additive, and significant relationship to those effects" (CEQ 2005). Past, present, and reasonably foreseeable actions that could contribute to cumulative impacts on the alternatives are provided in table 14, followed by a full description of each project.

TABLE 14: CUMULATIVE PROJECTS

Cumulative Project	Resources Affected
Coastal Dune Restoration	Water Resources, Vegetation, Wildlife, Visitor Use, Air Quality
Lagunitas Creek Salmonid Habitat Restoration Project Activities	Water Resources, Vegetation, Wildlife, Visitor Use, Air Quality
Fire Management Program	Soils, Water Resources, Vegetation, Wildlife, Visitor Use, Air Quality
Cultural Resource Preservation Maintenance Projects	Soils, Vegetation, Visitor Use, Cultural Resources, Socioeconomics, Air Quality

Cumulative Project	Resources Affected
Road Improvement Projects at Point Reyes National Seashore	Soils, Water Resources, Vegetation, Wildlife, Visitor Use, Socioeconomics, Air Quality
Pacific Gas & Electric Company Fire Prevention Projects	Water Resources, Vegetation, Wildlife, Visitor Use, Socioeconomics, Air Quality
Corvid Management	Wildlife, Visitor Use
Invasive Plant Management	Water Resources, Vegetation, Wildlife, Tule Elk, Visitor Use, Socioeconomics
Marin RCD Grant Program	Water Resources, Vegetation, Wildlife
California Senate Bill Number 1383	Air Quality

Cumulative Project Descriptions

Coastal Dune Restoration

The park's coastal dune habitat is seriously threatened by the rapid encroachment of two non-native plants: European beachgrass and iceplant. Native coastal dunes provide habitat for up to 11 federally listed plant and wildlife species that are threatened by both physical and ecological changes associated with the presence of invasive plants. NPS has restored up to 600 acres of coastal dunes at Point Reyes to benefit native coastal dune ecosystems, natural dune processes, and federally listed and other special-status species that live in or use these ecosystems. Habitat is restored by removing highly invasive, non-native plants that have greatly altered dune structure, natural processes such as sand movement, vegetation communities, and habitat function for native plants and animals uniquely adapted to this coastal environment.

The coastal dune restoration projects are expected to have beneficial, direct effects on special-status species and native dune plants. The projects have the potential to reverse the loss of several federally listed species. One of the primary objectives of the project is to restore habitat for the federally threatened western snowy plover and federally listed plants, including Tidestrom's lupine and beach layia. Dune restoration projects are ongoing, with annual work in progress. Dune migration has occurred on ranchlands in one restored area. Subsequently, the buffer between treatment areas and pasturelands has been increased. Dune migration is a natural process that occurs on some non-restored areas and is likely to continue in the future.

Lagunitas Creek Salmonid Habitat Restoration Project Activities

Multiple entities are focused on habitat enhancement and restoration in the Lagunitas Creek watershed to support endangered coho salmon. Lagunitas Creek supports the southernmost stable population of coho salmon along the Pacific coast, and overwintering habitat for juvenile fish is the primary limiting factor on salmonid populations in the creek. The Marin Municipal Water District implemented the Lagunitas Creek Winter Habitat and Floodplain Enhancement Project during the summers of 2017 and 2019 at nine sites to enhance winter habitat and floodplain function. During the summers of 2018 and 2019, the Salmon Protection and Watershed Network initiated floodplain restoration and riparian habitat enhancement on NPS lands in the Jewell and Tocaloma areas of Lagunitas Creek. This reach of Lagunitas Creek has been identified as an opportunity to restore high value off-channel habitat for juvenile salmonids. Revegetation and adaptive management efforts will be underway at all these restoration sites for the next several years.

Fire Management Program

In July 2004, the park completed a *Fire Management Plan and Environmental Impact Statement for Point Reyes National Seashore and for the Northern District of Golden Gate National Recreation Area* (NPS 2004). The plan provides a framework for all fire management activities within the parks, including suppression of unplanned ignitions, prescribed fire, and mechanical fuels treatments. It is intended to guide the fire management program for the next 10 to 15 years. In accordance with NPS policy, the plan is responsive to the parks' natural and cultural resource objectives, reduces risk of fire to developed facilities and adjacent communities, and provides for public and staff safety. Up to 3,500 acres annually could be burned or mechanically treated over the next decade as a result of the plan. Some of the Fire Management Units identified in the plan are in the planning area. Prescribed burning could occur in the future in the planning area for resource management (e.g., invasive species control).

In 2018, NPS signed an agreement with Marin County to transfer most wildland fire operations and response actions to the county. Under this agreement, Marin County will continue to implement mechanical treatments, maintain defensible space, and conduct prescribed fire burns to reduce the risk in the Wildland Urban Interface consistent with the *Fire Management Plan*.

Cultural Resource Preservation Projects

Cultural resource preservation projects have been completed in the Olema Valley and the north district of Point Reyes over the last several years, and these investments are expected to continue in the future. Preservation projects typically focus on the needs of a single building or a group of buildings requiring a similar treatment. Typical treatments include stabilization of a building's internal framing or foundation, siding repair and replacement, roofing projects, exterior painting, and repair or replacement of windows and doors.

Road Improvement Projects at Point Reyes National Seashore

NPS in cooperation with the Federal Highway Administration (FHWA), Central Federal Lands Highway Division, is repairing 22 miles of road and adjacent parking areas in the park. This program includes four separate road projects—Limantour Road, Lighthouse Road, Chimney Rock Road, and Pavement Preservation on various spur roads and parking areas. The project includes upgrading road and parking surfaces and drainage features, installing new signs, striping the roads and parking areas, downsizing a beachside parking area, and improving accessibility at two parking areas. The purposes of the project are to provide safe driving surfaces for all travelers on national seashore roads, reduce the possibility of road failures, and reduce maintenance costs.

Most construction work will be limited to the existing road and parking area prisms and drainage ditches. Work on the culverts, drainage ditches, pullouts, and road approaches may disturb vegetation and soil associated with wetlands outside the existing roadway. However, construction boundaries will be established at these sites to help minimize the size of disturbed areas. Equipment and material staging and storage as well as construction vehicle turnarounds will be confined to the road or parking areas. Construction activities will be scheduled to avoid affecting sensitive species. Other BMPs will also be employed to help avoid or minimize impacts.

FHWA, Central Federal Lands Highway Division, in cooperation with Marin County and NPS, prepared the *Supplemental Environmental Assessment/Subsequent Initial Study (SEA/SIS) for Sir Francis Drake Boulevard Road Improvements* located in the park. Since issuance of the 2015 Finding of No Significant Impacts/Mitigated Negative Declaration, improvements have been proposed and evaluated under the SEA/SIS, including replacing the existing culverts under Sir Francis Drake Boulevard at Schooner Creek with a single-span bridge, and restoring and stabilizing approximately 710 feet of Sir Francis Drake Boulevard that has severely eroded. To compensate for permanent wetland impacts as a result of roadway improvements, part of the parking lot at Drakes Beach will be restored to a wetland, and two ponds will be constructed within Home Ranch to provide California red-legged frog aquatic breeding habitat. Parking at the Drakes Beach lot will be reduced by approximately 70 to 80 spaces, but NPS plans to

encourage greater use of other lots by expanding shuttle stops and developing pay kiosks at these remote locations. The SEA/SIS meets the Central Federal Lands Highway Division's obligations as the lead agency for this project under NEPA and Marin County's obligations under the California Environmental Quality Act. The project begins at the intersection with Pierce Point Road and continues south and west to the intersection with Chimney Rock Road. Construction began in April 2020, and activities are expected to take two years to complete.

In 2017, FHWA prioritized a similar project for Pierce Point Road for Marin County under the Federal Lands Access Program. This project will substantially improve Pierce Point Road in the next 5 to 10 years.

Pacific Gas & Electric Company Fire Prevention and Infrastructure Management Projects

Pacific Gas & Electric (PG&E) manages multiple power line corridors through the park and planning area. In February 2020, NPS executed a Special Use Permit for PG&E maintenance activities on transmission and distribution lines in the park. PG&E is responsible for identifying maintenance needs and project activities and coordinating with park staff to avoid or minimize impacts. Implementation activities include extensive monitoring and access maintenance, pole and equipment replacement, and vegetation management around the lines and for access to poles. Review of proposed activities are coordinated through NPS staff. NPS has documented effects of regular access along these corridors, including ground disturbance and invasive vegetation.

Corvid Management at Point Reyes National Seashore

Corvids, particularly ravens, have been documented to prey on threatened snowy plovers. NPS has coordinated with ranchers to limit raven access to supplemental feed and shelter, such as the large barns that help support a large raven population on the outer peninsula. Specifically, the park has supported debris removal and worked with ranchers to install covered feed bins and redesigned weaning huts to reduce corvid access to cattle feed. As appropriate, NPS places exclosures around snowy plover nests to keep the ravens and other nest predators out. The park also discourages raven activity in plover nesting areas by erecting bald eagle decoys and raven effigies to scare ravens away, and removes ravens hunting within and near plover nesting areas when necessary. In addition to these efforts, NPS also maintains seasonal beach closures, pet restrictions, and runs an educational volunteer docent program during the nesting season to support the snowy plover.

Invasive Plant Management

A recent NRCA reviewed the status of invasive plants on Point Reyes-administered lands, including management prioritization (NPS 2019a). Many invasive plants occur in the planning area (the document notes 74 in the pastoral zone), although some low-priority species are considered widespread and well-established in their respective plant communities. The NPS San Francisco Bay Area Network Inventory & Monitoring Program has an ongoing Invasive Plant Species Early Detection Program. Established in 2008, the program surveys roads and trails in the planning area for invasive plants, eradicates small new infestations, and develops annual priority lists by park (https://www.nps.gov/articles/invasive-plant-species-priority-lists.htm).

The NPS Invasive Plant Species Early Detection Program is not able to survey most ranch areas; however, the Point Reyes' range program, vegetation management branch, Habitat Restoration Program, and ranchers watch for new invasives and map and manage certain park infestations. Relevant control techniques are employed within an IPM framework, and treatments are monitored for effectiveness and to document other potential effects, often in collaboration with other weed management professionals. Current activities surrounding Invasive Plant Species Early Detection Program priority 1 invasives in the planning area include researching control methods for rosy sand crocus on two ranches, and treatment of fertile capeweed on two ranches, woolly distaff thistle on two ranches, Scotch broom on one ranch, medusahead on one ranch, and yellow glandweed (*Parentucellia viscosa*) on one ranch. European

beachgrass and iceplant control in the dunes adjacent to several ranches along the great beach is ongoing, as described above and in chapter 3.

Marin Resource Conservation District Grant Program

Marin RCD's Permit Coordination Program, adopted in 2004, provides California Environmental Quality Act coverage for restoration projects that benefit water quality in the boundaries of specified watersheds in Marin County. From 2004 through 2014, the Permit Coordination Program incentivized 300 environmentally beneficial restoration projects on ranches outside the planning area by reducing costs and the timeframe of the environmental compliance process. The Permit Coordination Program continues to cover projects that minimize adverse impacts on water quality from ranch operations outside the planning area (Marin RCD 2018).

California Senate Bill Number 1383

Approved on September 19, 2016, California Senate Bill Number 1383 (SB No. 1383) requires CARB, in consultation with the Department of Food and Agriculture, to adopt regulations to reduce methane emissions from livestock manure management operations and dairy manure management operations, as specified. This bill requires the regulations to take effect on or after January 1, 2024, if CARB, in consultation with the Department of Food and Agriculture, makes certain determinations.

SOILS

Methodology and Assumptions

The potential for soil erosion and compaction was analyzed using information in the web soil survey (USDA-NRCS 2014b). To simplify the discussion of the existing conditions, generalized soil associations are used and summarized. The erosion hazard of the dominant soil map unit components within each generalized soil association are identified using "slight," "moderate," and "high" ratings, as described in chapter 3.

Impacts on soil resources are evaluated based on the changes in land management of each alternative within the zoning framework compared to existing conditions. To assist in analysis and in the decision-making process, the erosion hazard map was overlaid onto the zoning framework map to identify areas where changes in land management would result in the potential for beneficial and adverse impacts on soil characteristics compared to existing conditions.

The analysis of impacts on soils assumes the mitigation measures described in appendix F would be implemented to minimize adverse impacts. The area of analysis is the planning area.

Ranch tours and farm stays would have negligible impacts on soils because most activities associated with these types of diversification would be located in the Ranch Core subzone, which is highly developed, and would involve passive activities like walking, which already occurs throughout the planning area. Therefore, they are not analyzed further.

Alternative A

Public Use and Enjoyment

Impacts on soils from visitor activities in the planning area (e.g., continued use of existing trails for hiking, running, biking, and horseback riding) could adversely affect soils from localized erosion and compaction (Pickering et al. 2010). These impacts would be limited to specific locations on formally designated trails but would also include potential impacts from unauthorized off-trail use to the extent that they exist. Visitors can walk across and through ranchlands, but this activity does not increase soil erosion potential due to low concentration and density of use.

Ranch Operations

Grazing. Under alternative A, grazing by approximately 2,400 AU of beef cattle and 3,325 dairy animals would continue to directly and adversely affect soils in the planning area over the long term. Grazing and grazing-related activities, such as livestock trailing and trampling, would continue to dislodge soil particles and cause erosion. Livestock trampling and general ranch activities can also cause soil compaction. As noted in chapter 2, NPS established standards and BMPs for environmental protection and rangeland monitoring protocols, including RDM monitoring, to ensure that current grazing management is limiting impacts on soil resources. The implementation of standards and practices, including the minimum RDM standard, deferring grazing on seasonally vulnerable areas, and excluding livestock from damaged or especially vulnerable areas, would continue to reduce the potential for soil erosion in the planning area. As noted in chapter 3, over the past two years, 95% of the ranch areas surveyed met the RDM standard, indicating that overall, soils in the planning area are being managed to reduce erosion potential. This condition would continue under alternative A. NPS has worked with ranchers to locate feeding areas away from steep slopes and sensitive areas on a case-by-case basis and would continue to do so under alternative A, limiting potential soil erosion from grazing activities.

The most severe impacts on soils would be limited to the high-intensity-use areas—approximately 150 acres, or less than 1% of the planning area. These high-intensity-use areas include outdoor paddocks, watering areas (around troughs and ponds), feeding areas, salt licks, and cattle trails, and would continue to be more susceptible to erosion because they are typically highly compacted and lack vegetation (NPS, Voeller, pers. comm. 2019e). On dairy ranches, the 86 acres of high-intensity-use areas would continue to contain high amounts of manure waste or nutrient-laden sediments, which can affect soil fertility, as described in detail below under "Other Management Activities." Because of the lack of vegetation, these areas are subject to erosion of nutrient-laden sediments and compaction, which would continue under alternative A.

Activities conducted in high-intensity-use areas in the developed complex must comply with the lease/permit terms, applicable laws, and regulations that include mitigation measures intended to reduce soil erosion. Organic dairy operations must also comply with a monitoring and reporting program, develop and implement site-specific management plans, and locate concentration areas to minimize impacts on adjoining lands, as noted in chapter 2. These mitigation measures and regulatory requirements would continue to minimize soil erosion. The acreage of high-intensity-use areas would likely not change under this alternative, and erosion and compaction would continue in areas of concentrated use. Impacts on soil resources within high-intensity-use areas would continue to be long term and adverse but would be limited to approximately 150 acres, or less than 1% of the planning area.

Ranch Infrastructure and Water Control Management. This category of Management Activities consists of the following Activity types: Road Upgrade and Decommissioning, Infrastructure Improvement, Fencing, Livestock Water Supply, Pond Restoration, Waterway Stabilization, and Stream Crossings (see appendix F and table F-1). These activities would continue to be approved on a case-by-case basis under alternative A. NPS would also continue to prioritize these types of activities based on available funding and severity of threat to resources. A subset of these activities, including the installation of Stream Crossings and Fencing, would allow for to better management of livestock uses and reduce impacts on sensitive resource areas and waterways.

Ranch Infrastructure and Water Control Management activities are designed to reduce overall erosion; however, certain construction actions would result in temporary soil erosion in disturbed sites. Erosion and sedimentation control measures would be required during construction to prevent soil loss and polluted runoff. Installation and repair of Fencing and Water Development projects would continue to cause short-term, adverse impacts on soils from ground disturbances and vehicle traffic, including all-terrain/utility vehicles, trucks, and, at times, heavier equipment to access and maintain the infrastructure. These impacts would be very localized and minimal across the planning area. Long-term benefits include

reduced potential for soil erosion. Road Upgrade and Decommissioning as well as installation of Fencing could also help reestablish native vegetation, which would reduce the potential for soil erosion.

Vegetation Management. This category of Management Activities includes Upland and Riparian Vegetation Management and Planting, Mowing, and Targeted Grazing (see appendix F and table F-1). These activities would continue under alternative A, and new management proposals would be evaluated on a case-by-case basis. Seeding of vegetation would continue to be implemented in approved areas for erosion control, and Targeted Grazing would be used to improve or maintain soil health and reduce soil loss from erosion. Upland and Riparian Vegetation Management and Planting to establish vegetation would provide long-term benefits on soils including stabilization from erosion. The use of heavy equipment on the areas where Mowing or IPM occurs could cause soil compaction from the weight of heavy equipment but likely would not increase the potential for soil erosion because it does not expose bare soils. Weed treatment using IPM could result in temporary, localized areas with increased bare soils and erosion potential from the removal of invasive vegetation. Soil disturbances from Targeted Grazing could increase the short-term likelihood of erosion and compaction, but combined with other actions, including the Vegetation Management activities noted above, the overall impacts on soils would continue to be minimal and beneficial in areas where these targeted activities reduce erosion over the longer term.

Other Management Activities. Manure and Nutrient Management activities on up to 2,500 acres and Forage Production on up to 1,000 acres would continue under alternative A. Manure would continue to be spread in approximately 715 acres of Forage Production fields, but some would also be spread in pasture and rangeland. Manure would continue to be spread during non-rainy or non-saturated conditions to minimize erosion and runoff potential but would alter soil fertility in areas where it is spread. While it would be beneficial to Forage Production, impacts on soils from manure spreading would continue to be long term and adverse on approximately 2,500 acres, or 9% of the planning area because manure spreading alters the natural soil fertility by increasing soil nutrients, such as nitrogen, phosphorus, and potassium (McKenzie et al. 2003). In addition, vehicle use related to manure spreading would continue to compact soils in these 2,500 acres.

Under alternative A, Forage Production on up to 1,000 acres would continue to involve seeding, manure spreading, harvesting, and, at times, soil aeration or tillage, although lease/permits call for no or minimum tillage, and many ranchers are no longer using widespread tilling practices. Forage Production activities, especially tillage, increase soil disturbance that leads to soil erosion, and regular travel to and through fields by heavy equipment causes soil compaction. The 1,000 acres where Forage Production would continue to be authorized do not contain soils with severe or very severe erosion potential; however, Forage Production would occur on up to 465 acres of soils with low resistance to compaction. In some instances, carefully managed soil aeration, including tillage, can reduce compaction and result in decreased erosion potential. However, following strategies like minimum or no tillage, increasing soil organic matter with cover crops or residue, and avoiding work when soils are wet can improve or prevent soil compaction problems (Hamza and Anderson 2005). Forage Production would continue subject to current NPS management guidance, with established standards for cultivation, including no tilling on slopes greater than 20%, establishing 200-foot buffers between tilling and waterbodies, no tillage on land classified as highly erodible, minimum tillage on all fields, leaving an adequate crop residue, and establishing a cover crop prior to heavy winter rains. These mitigation measures would minimize soil erosion and compaction but impacts on soils from Forage Production would remain long term and adverse in these 1,000 acres.

Diversification. Grazing and the accumulation of manure waste from up to 121 AU non-cattle livestock for personal, non-commercial use would continue to affect soil resources on 15 ranches in the same way that cattle in grazing lands and high-intensity-use-areas do. When the commercial chicken operation is active, chicken manure would adversely affect soil on that single ranch operation because of its high nutrient content and concentration of heavy metals (Gerber, Opio, and Steinfeld 2007). Impacts on soils

would be long term and adverse but would be limited in extent across the planning area because these activities are authorized in limited numbers and on a small portion of the planning area.

Ranch Complexes. Under alternative A, ranch complex management would continue to be performed in accordance with applicable planning, building, and environmental laws. Construction and other maintenance activities could disturb soils during construction; however, these short-term activities occur in already disturbed locations, limiting impacts on sensitive soils. Implementing mitigation measures, including adherence to soil and erosion control measures during ground-disturbing activities, would continue to minimize these impacts.

Elk Management

Under alternative A, continued elk management would have minimal impacts on soils in the planning area. Repairing fences and constructing elk crossings, enhancing habitat, modifying livestock feeding infrastructure, elk hazing, and conducting elk counts and observations could cause soil disturbances that lead to erosion and compaction. These short-term, adverse impacts would be localized in the planning area, occurring only in the vicinity of the Drakes Beach and Limantour herds.

Cumulative Impacts

Past, present, and reasonably foreseeable actions that would affect soil resources include fire prevention, road improvement, and cultural resource restoration projects. Fire prevention projects involve prescribed burning and vegetation clearing to help prevent large wildfires. In most cases, fire management and prescribed fire activities would not be conducted on ranchlands in the planning area because the existing grazing regime reduces fire risk in those areas. While impacts on soils from prescribed burning and vegetation clearing would be short term and adverse, fire management would reduce the potential for long-term impacts from wildfires, including severe soil erosion and sedimentation to waterways (Wohlgemuth et al. 2019). As such, fire prevention projects would benefit soils by reducing wildfire risk.

Road improvement and cultural resource restoration projects may temporarily disturb soils outside the existing roadway or building footprint, but these areas of disturbance would be reclaimed following project completion. Soil disturbance would increase erosion and runoff until vegetation stabilizes the surface; standard road construction mitigation measures would be employed to help minimize soil erosion. Impacts on soil resources from road improvement and cultural resource restoration projects would be short term and adverse, but over the long term, these projects typically stabilize soils and have beneficial impacts.

The ongoing salmonid restoration projects in Lagunitas Creek focused on winter habitat and floodplain enhancements would continue to have temporary, adverse impacts from increased sedimentation during construction activities (i.e., access routes through the riparian ecosystem). However, mitigation measures would be implemented to reduce the erosion potential of soil resources. In the long term, the reconnection of Lagunitas Creek to existing floodplains would reduce flooding and have beneficial impacts on soil resources.

Overall, these past, present, and reasonably foreseeable future actions have and would continue to have beneficial cumulative impacts. Alternative A would continue to contribute noticeable long-term, adverse impacts on soils across the planning area from localized erosion and compaction, primarily from livestock grazing on 27,000 acres; 1,000 acres of Forage Production; 150 acres of high-intensity-use areas; and altered soil fertility from manure spreading on up to 2,500 acres. When the incremental impacts of alternative A are combined with the impacts of past, present, and reasonably foreseeable actions, the overall cumulative impact on soils would remain adverse, with the incremental impacts of alternative A contributing most of the impacts. Overall, soil conditions would remain roughly the same as existing conditions.

Alternative B

Public Use and Enjoyment

Expansion of hiking, biking, and equestrian trails could have adverse impacts on soils from localized erosion and compaction where new development occurs. Additional parking lots and new overnight camping areas to enhance public enjoyment opportunities would also result in potential for soil impacts. Locations for new visitor serving facilities would be identified through a future planning process that would seek to determine locations best suited to such development. Site-specific mitigation measures to reduce impacts on resources including soils would be identified through the planning process. Overall, erosion from the implementation of these actions would be minimal because new trail construction would be limited or would use existing administrative roads, and new development would be implemented to minimize soil erosion and compaction.

Ranch Operations

Under alternative B, impacts from grazing would be roughly the same as described under alternative A. However, the implementation of the zoning framework would ensure that more intense land uses would occur in areas without sensitive resources throughout the planning area. As part of the zoning framework, approximately 1,200 acres would be removed from ranching and included in the Resource Protection subzone, resulting in long-term, beneficial impacts on soils in those locations due to the exclusion of ranching activities. Implementation of the Range subzone would ensure that steep slopes and areas with sensitive resources would be used only for grazing. In addition to the zoning framework, NPS would require ranchers to adhere to Practice Standards and mitigation measures for a defined set of Management Activities as detailed in appendix F, tables F-11 through F-13, and discussed in the subsections below that are expected to reduce overall impacts on soils. Overall, the Management Activities, including site-specific monitoring, would directly benefit soil resources compared to existing conditions because intense uses would be located in areas less prone to erosion, fewer acres would be subjected to impacts from livestock grazing, and standardized mitigation measures would be required for all ranch activities.

Grazing. Under alternative B, the general distribution of AU and dairy animals across ranches would be the same as under alternative A. Approximately 72% of existing high-intensity-use areas, or 108 acres, would be in the Pasture and Ranch Core subzones, where soil disturbance that can result in sedimentation is located away from the majority of surface waters. Approximately 28% of high-intensity-use areas, or 42 acres, would be in the Range subzone. These 42 acres are mostly associated with cattle congregating at watering troughs, stock ponds, feeding areas, or gates, and trailing along steep slopes.

Under the zoning framework in alternative B, the total acres of high soil erosion potential soils would be located in the following zones: 170 acres removed from grazing in the Resource Protection subzone, 7,940 acres limited to grazing-only impacts in the Range subzone, and 790 acres in the Pasture subzone. In the Pasture subzone, buffers and limited slopes would minimize the potential for soil erosion to reach the level of concern for this resource. The areas with low soil compaction resistance would be zoned in the following manner: 450 acres removed from grazing in the Resource Protection subzone, 11,000 acres limited to grazing-only impacts in the Range subzone, and 3,790 acres in the Pasture subzone. Continued adherence to the RDM standard would help maintain the current soil condition. Impacts from grazing on soils in the Range and Pasture subzones would be similar to those described under alternative A.

Ranch Infrastructure and Water Control Management. As noted under alternative A, most Ranch Infrastructure and Water Control Management activities are intended to reduce long-term impacts from ranching by minimizing erosion and sedimentation in heavily used areas. These projects would continue to have short-term impacts on soils associated with temporary ground disturbance during construction. Implementation of Ranch Infrastructure and Water Control Management activities would be required to be designed according to the associated Practice Standards and size limitations described in appendix F. They would also be required to adhere to the mitigation measures identified in table F-11. The specific

size limitations for each Ranch Infrastructure and Water Control Management project are provided in tables F-2 through F-9 in appendix F.

Anticipated long-term benefits of specific activities such as Fencing and Livestock Water Supply include improved grazing distribution on grasslands and decreased cattle residence time in areas with sensitive resources, especially in the Resource Protection subzone where all ranching activities would be excluded. Installation of up to 24 miles of fence would eliminate the potential for erosion and compaction in the Resource Protection subzone associated with regular grazing and benefit soils.

Infrastructure Management, Waterway Stabilization, and Pond Restoration activities could continue to result in short-term impacts on soils associated with temporary ground disturbance during construction, followed by long-term benefits, as described under alternative A. Required Practice Standards and mitigation measures described in appendix F, table F-11, would reduce potential for short-term impacts on soils during any construction period.

Vegetation Management. Under alternative B, impacts on soils from Vegetation Management activities would be similar to those described for alternative A, but soil disturbance would be reduced by authorizing only hand broadcast seeding and use of a no-till seed drill. All Vegetation Management activities would be implemented according to the associated Practice Standards and size limitations described in appendix F and would be required to adhere to mitigation measure identified in table F-12. In conjunction with other site-specific mitigation measures (i.e., time of year and grazing restrictions), the intensity of the soil impacts from these activities would be reduced compared to existing conditions. Seeding activities on high-intensity-use areas could improve soil retention and reduce compaction and erosion potential. Compared to existing conditions, long-term, adverse impacts on soils would be reduced.

Other Management Activities. As described for alternative A, impacts on soils from Manure and Nutrient Management would continue to occur on approximately 2,500 acres. However, approved locations for manure spreading would be limited to the Pasture subzone. In consultation with ranchers, NPS would ensure manure spreading is conducted in locations that would minimize potential impacts on sensitive resources and would avoid such activities on 77 acres of high-intensity-use-areas with exposed soils in the Pasture subzone. While the number of acres affected by manure spreading would be similar to that identified in alternative A, implementation of manure spreading in designated areas under an approved plan that determines nutrient spreading rates and incorporates the Practice Standards and size limitations described in appendix F and mitigation measures identified in table F-13 would result in better protection of sensitive resources and soils and reduce impacts compared to existing conditions.

Under alternative B, Forage Production would adhere to the associated Practice Standards and size limitations described in appendix F and would be required to adhere to mitigation measures identified in table F-13, resulting in better protection of sensitive resources and soils and reduced impacts compared to existing conditions.

Diversification. Impacts on soils from up to 50 sheep and 66 goats per ranch (limited to 18 ranches) in the Pasture and Ranch Core subzones would be similar to the impacts from cattle, described above. Sheep and goat authorizations would be in place of, not in addition to, cattle authorizations, and ranchers would be required to meet RDM standards in the Pasture subzone. Given the smaller size of these animals, soil compaction on up to 7,310 acres in the planning area could be less than in areas where cattle graze, depending on location, season, and intensity of use. As a result, impacts on soils from this diversification activity would not likely increase compared to existing conditions. Ranchers would be required to adhere to the mitigation measures related to non-cattle livestock included in table F-14 in appendix F.

As described under alternative A, chicken manure could adversely affect soil because of its high nutrient content and concentration of heavy metals (Gerber, Opio, and Steinfeld 2007). Conversely, like cattle manure, chicken manure can be beneficial to crop and Forage Production if used as a fertilizer at appropriate application rates by supplying nutrients, improving soil structure, improving water-holding capacity, and reducing erosion (Rodic et al. 2011). While there could be up to 9,000 chickens in the

planning area, impacts would be spread out across the 7,310 acres of the 18 ranches with a residential ranch complex. Additionally, mobile huts would be moved regularly, reducing impacts in a given area. Because chickens would only be authorized at locations with limited highly erodible soils (only 9% of the Pasture subzone contains soils with high erosion potential) and housed in low-density operations across a larger area, adverse impacts on these soil processes and characteristics would be limited.

Crop cultivation could increase the potential for soil erosion for a short period of time after tilling, which loosens soil making it more susceptible to erosion. However, soil aeration in areas with highly compacted soils can be beneficial by breaking up compacted soils. The use of fertilizer for crop cultivation would alter soil fertility in areas where it is applied; however, fertilizer would be limited to manure or compost generated on-site. Non-irrigated crops would only be authorized in the Ranch Core subzone, which includes previously disturbed soils. By limiting crops to 2.5 acres or a maximum total of 45 acres in the Ranch Core subzone and requiring mitigation measures described in appendix F, tables F-11 through F-14, adverse impacts on soils from crop cultivation in the planning area are expected to be minimal. Irrigated crops are not addressed in detail in this EIS because of the many variables involved. While additional review and compliance would be required for irrigated crops, it is anticipated that impacts on soils would be similar to those described above.

If authorized, horse boarding operations concentrate animals in a small area and may result in additional impacts on soils from compaction, disturbance, and manure. Because they are also considered Confined Animal Operations by the state, horse boarding operations would be subject to state permitting and associated mitigation measures to reduce such impacts. Future proposals would need to identify the location and structural improvements necessary to contain and manage manure and runoff from animal concentration areas so as not to adversely affect soil fertility or cause soil erosion. If new structures were required, they would result in soil disturbance, compaction, and the potential for soil erosion; however, these impacts would likely occur in a previously developed area. Mitigation measures described in appendix F, tables F-11 through F-14, would be required to minimize the impacts of horse boarding operations.

Ranch Complexes. Under alternative B, impacts on soils related to ranch complex management would be the same as those described for alternative A.

Elk Management

Under alternative B, impacts from nonlethal elk management actions would be the same as those described for alternative A. However, under alternative B, trampling and vehicle use related to annual removal activities would increase the potential for localized soil erosion and compaction to occur. Possible removal activities in the Limantour herd could have similar impacts.

Cumulative Impacts

The impacts on soil resources from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would continue to contribute noticeable long-term, adverse impacts on soils in the planning area from localized erosion and compaction, primarily from livestock grazing on 26,100 acres; 1,000 acres of Forage Production; 150 acres of high-intensity-use areas; and altered soil fertility from manure spreading on approximately 2,500 acres. However, implementation of the zoning framework and application of Practice Standards and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13) would reduce the intensity of adverse impacts on soils across the planning area compared to existing conditions. Expansion of the trail network for public use would cause localized soil erosion and compaction in limited areas. Elk management activities would result in localized short-term soil impacts. When the incremental impacts of alternative B are combined with the impacts of past, present, and reasonably foreseeable actions, the overall cumulative impact on soils would be adverse, with the incremental impacts of alternative B contributing most of the impacts. However, soil conditions would improve compared to existing

conditions from the implementation of the zoning framework and application of Practice Standards and mitigation measures.

Alternative C

Under alternative C, all public use and enjoyment and ranch operation actions would have the same type and intensity of impact as described for alternative B.

Elk Management

Under alternative C, the Drakes Beach elk herd would be removed from the park using lethal removal methods. This removal would have the same types of impacts described under alternative B but could create a higher level of ground disturbance in the localized area of the Drakes Beach herd from the one-time activities associated with the removal of the entire herd. These impacts would cease after the removal actions were completed. Impacts on soils from elk management activities related to the Limantour herd would be the same as those described for alternative B.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. The incremental impacts of alternative C would be the same as those described for alternative B; however, the added ground disturbance from the removal of the Drakes Beach elk herd would contribute additional short-term impacts on soils in limited areas. When the incremental impacts of alternative C are combined with the impacts of past, present, and reasonably foreseeable actions, the overall cumulative impact on soils would be adverse, with the incremental impacts of alternative C contributing a majority of impacts. However, soil conditions would improve compared to existing conditions from the implementation of a zoning framework and application of Practice Standards and mitigation measures.

Alternative D

Under alternative D, public use and enjoyment and elk management activities would have the same type and intensity of impact as described for alternative B. If new herds were to establish on lands removed from ranching, limited and dispersed impacts on soils from elk management and monitoring would likely occur, including trampling and vehicle use as described under alternative A.

Ranch Operations

Under alternative D, 7,500 acres would be removed from ranching activities in the planning area, including 18 acres of high-intensity-use areas. While the total number of cattle across the planning area would be reduced, the same intensity of impacts from grazing and Management Activities as described under alternative B is expected on the 19,000 acres where ranching would be authorized. Impacts from diversification activities would be the same as those described under alternative B.

Soils on the 7,500 acres removed from ranching would benefit from the elimination of grazing, which would reduce soil erosion and compaction. Targeted Grazing could be used in these areas as a management tool to meet NPS resource management goals and objectives but would not occur across the entire 7,500 acres at the previous scale or duration. An additional 900 acres would be removed from lease/permits and added to the Resource Protection subzone. No grazing would be authorized in these locations, eliminating impacts on soils from ranching activities. Alternative D would remove livestock grazing from approximately 2,940 acres (33%) of soils with high erosion potential and 2,670 acres (30%) of soils with high compaction potential compared to existing conditions.

Overall, changes in ranch operations under alternative D would result in long-term, beneficial impacts on an additional 8,400 acres of soils in the planning area compared to existing conditions from the removal of ranching activities. The type and intensity of soil impacts on the remaining 19,000 acres would be similar to those described for alternative B.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative D would contribute noticeable long-term, adverse impacts on soils across the planning area from localized erosion and compaction from livestock grazing on 19,000 acres; 1,000 acres of Forage Production; 132 acres of high-intensity-use areas; and altered soil fertility from manure spreading on approximately 2,500 acres. However, implementation of the zoning framework, application of Practice Standards, and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13) would reduce the intensity of adverse impacts on soils across the planning area compared to existing conditions. Alternative D would also contribute meaningful beneficial impacts on soils compared to existing conditions on 8,400 acres where any ranching-related soil impacts would cease with the closure of existing operations. Expansion of the trail network for public use would cause localized soil erosion and compaction in limited areas. Elk management activities would result in localized short-term soil impacts.

When the incremental impacts of alternative D are combined with the impacts of past, present, and reasonably foreseeable actions, the overall cumulative impact on soils would be adverse, with the incremental impacts of alternative D contributing a majority of the impacts. However, soil conditions would noticeably improve compared to existing conditions from the implementation of a zoning framework, application of Practice Standards and mitigation measures, and, in large part, from cessation of ranching activities on 8,400 acres.

Alternative E

Under alternative E, actions related to public use and enjoyment would have the same type and intensity of impact as described for alternative B.

Ranch Operations

Under alternative E, impacts on soils from dairy ranching would be eliminated from the planning area. The 3,115 dairy animals could be replaced by approximately 750 AU of beef cattle, resulting in an estimated 3,150 total AU in the planning area. The overall reduction in total livestock associated with the conversion of dairy ranching to beef ranching would have long-term, beneficial impacts on soils by reducing high-intensity-use areas, the potential for erosion, and compaction. The total area available for ranching would be approximately 26,100 acres, the same as for alternative B. On beef ranches, the type and intensity of impacts from grazing would be the same as described under alternative B. The intensity of impacts on soils across the planning area would be reduced, especially on the 6,200 acres that would be converted from dairy ranching to beef ranching. Conversion of dairy ranches to beef ranches would reduce erosion and result in more dispersed and decreased levels of manure deposition associated with the lower number of grazing animals. Overall, the six dairies contain approximately 60% (86 acres) of the 150 acres of high-intensity-use areas under existing conditions, which would be reduced under alternative E as dairies convert to beef operations. Impacts from Management Activities are expected to be similar to those described under alternative B; however, there may be more project requests as ranches convert from dairy to beef operations.

The elimination of 1,000 acres of forage production fields under alternative E would reduce soil disturbance, compaction, and erosion and runoff potential once other vegetation is established and would result in noticeable, long-term, beneficial impacts on soils. Similarly, because dairies would be eliminated, there would be no need for manure and nutrient management, and adverse impacts from manure spreading on 2,500 acres would cease. This action would have long-term, beneficial impacts on soil fertility as regular inputs of high nutrients are removed.

Ground-disturbing activities such as tilling and aeration associated with ranch Management Activities would not be authorized, which would likely have some beneficial impacts on soils by reducing erosion potential. However, seeding highly disturbed areas and soil aeration in areas with highly compacted soils can be beneficial by improving plant establishment, increasing water infiltration, reducing compaction and thus reducing erosion, and could be authorized to meet NPS resource goals and objectives. No diversification activities or other livestock would be authorized. As a result, impacts from the authorized 121 AU of additional livestock and the commercial chicken operation would cease, and soils would benefit.

Elk Management

Under alternative E, NPS would not manage the population and geographic extent of elk in Point Reyes, except to support NPS resource protection needs and management goals. Impacts on soil from limited management of elk herds would be the same as described for alternative A, with a slight reduction in the type and intensity of impacts because hazing would no longer be used as a management tool.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative E would contribute noticeable long-term, adverse impacts on soils across the planning area from localized erosion and compaction, primarily from livestock grazing on 26,100 acres. However, the zoning framework and Practice Standards and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13) would reduce the intensity of adverse impacts on soils across the planning area. Alternative E would have noticeable beneficial impacts compared to existing conditions from the conversion of the six dairy ranches to beef operations, and elimination of manure spreading, Forage Production, and non-cattle livestock authorizations. Expansion of the trail network for public use could cause localized soil erosion and compaction in limited areas. Elk management activities would result in localized short-term soil impacts. When the incremental impacts of alternative E are combined with the impacts of past, present, and reasonably foreseeable actions, the overall cumulative impact on soils would be adverse, with the incremental impacts of alternative E contributing most of the impacts. Overall, soil conditions would improve compared to existing conditions from the implementation of a zoning framework, application of Practice Standards and mitigation measures, and conversion of dairy ranches to beef operations.

Alternative F

Public Use and Enjoyment

Impacts from the expansion of hiking, biking, and equestrian trails; parking lots; and overnight camping areas would be similar to those described for alternative B but could affect a larger percentage of the planning area because expanded visitor opportunities would be considered in areas previously used for ranching. Maintenance of existing infrastructure or adaptive use of historic buildings could result in limited short-term disturbance and potential impacts to soils. In areas of new construction, disturbance and the increased potential for erosion could result in short-term impacts on soils. Visitor use would likely be expanded into new locations within the planning area.

Ranch Operations

Alternative F would remove ranching and eliminate all ranching-related impacts in the planning area. The removal of livestock grazing under alternative F would result in noticeable, long-term benefits on soil resources compared to existing conditions. Targeted grazing would be used only to meet NPS resource management goals and objectives and would have minimal impacts on soil resources compared to existing conditions. The soil surface on livestock trails and other heavily used areas within the planning area would stabilize once vegetation was reestablished (Sugnet and Bartolome 1983), and soil compaction would decrease once plant roots penetrate the soil and increase soil porosity and water infiltration. However, severely compacted soils in the 150 acres of high-intensity-use areas may require active

restoration such as mechanically breaking up compacted layers. Removing Forage Production and ceasing manure spreading would have long-term, beneficial impacts on soils, as described under alternative E. In many areas, erosion, runoff, and compaction would return to natural conditions once vegetation is established; however, site assessments would be necessary to identify areas where additional restoration or stabilization activities would be required to facilitate natural soil conditions. Site-specific restoration needs to maintain priority habitat and protect sensitive species or communities would be addressed in a subsequent restoration plan. Soil nutrient levels would become more conducive to the establishment of native vegetation communities (McKenzie et al. 2003) but could require years or decades to return to natural conditions. Overall, the removal of ranching from the planning area would eliminate impacts on soils from these activities and would be noticeable and beneficial.

Elk Management

Impacts on soils from limited elk management under alternative F would be similar to those described for alternative E. Once ranching is phased out, no hazing and little elk management would occur, reducing the overall type and intensity of adverse impacts from elk management.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative F would contribute meaningful, long-term, beneficial impacts from the cessation of ranching, which would generally allow soil conditions to slowly return to natural conditions. Soil conditions would improve in areas of manure spreading, Forage Production, and high-intensity-use areas compared to existing conditions. Some site-specific treatments may be necessary to stabilize or restore heavily impacted or eroded sites. Expansion of the trail network for public use, adaptive use of facilities, or new construction to support visitor use opportunities could cause localized soil erosion and compaction across the planning area. Elk management activities would result in localized short-term soil impacts. When the incremental impacts from alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impacts on soils would be beneficial, with the incremental impacts of alternative F contributing most of the impacts.

WATER RESOURCES

Methodology and Assumptions

Each of the proposed alternatives would affect water quality and quantity in the planning area and vicinity, including changes in pollutant loading (i.e., pathogens, nutrients, sediment, and other pollutants), flow patterns, infiltration, and changes in amounts of water use.

Beef and dairy cattle ranching activities; livestock grazing and trailing; manure deposition; use of roads and trails; developed areas; and restoration, conservation, and construction activities all affect pollutant loading. These activities can lead to changes in erosion of soils, water infiltration, and stormwater runoff; changes in nutrient levels; disturbance to surface waters; and releases of other agricultural and mechanical pollutants (e.g., pesticides, herbicides, oil and gas, effluents and leachates, organic material). Elements of ranching operations that could result in changes in pollutants include livestock grazing and trailing, manure deposition and storage, tillage, forage and crop production, use of fertilizers, weed and shrub management, nutrient management, and cleaning of ranch facilities.

Surface water and groundwater are used throughout the planning area for ranch operations and residential uses. Dairy operations use more water than beef operations. Water used at beef operations is primarily for drinking water for livestock and residential use, whereas water used at dairy operations is for drinking water for livestock, barn and equipment cleaning, and other minor uses, including residential use. Attributes of each of the alternatives with the potential to affect water use include the number of ranches, type of operations (dairy or beef), acreage of ranching, amount and type of diversification, and number and type of livestock.

Analysis of water resource impacts is based on review of existing data, studies, reports, and information that is publicly available and/or provided by NPS. Water quality information included water quality standards and local water quality conditions. Impacts are qualitatively assessed in terms of the potential for change in water quantity and use; water quality impacts were quantified to the extent possible. The analysis of impacts on water quality considers the change in the nature of the operations by alternative as well as mitigation measures that would be implemented to minimize adverse impacts on water resources. Water quantity information included data on general beef and dairy cattle water use requirements and water use by ranches in the planning area. Publicly available sources concerning groundwater quality and quantity in the planning area are limited to nonexistent; therefore, analysis of groundwater impacts was based on general knowledge of activities that affect groundwater and professional judgement.

The area of analysis includes the watersheds in the planning area, portions of which extend outside both the planning area and the park boundaries and considers, as appropriate, downstream effects on waterbodies and resources outside the planning area, including wilderness areas.

Alternative A

Public Use and Enjoyment

Impacts on water from visitor activities in the planning area include the use of existing trails for hiking, running, biking and horseback riding, which can adversely affect water resources from soil erosion and sedimentation (Pickering et al. 2010); however, these impacts are minimal because there are few formalized trails and there would be no new ground disturbance. Visitor use of ranchlands would not affect water resources.

Ranch Operations

Grazing. Under this alternative, levels of grazing would be similar to existing conditions, and impacts on water quantity would not noticeably change.

The 800 acres of exclusion areas established by NPS and ranchers over the last 10 to 20 years within the planning area would continue to protect approximately 111.6 acres of wetlands including 4.8 acres of ponds and 6.2 miles of streams from direct impacts from cattle. These areas would be removed from future lease/permits under this alternative. Additional miles of streams would continue to be protected by the topography of the ranches, which prevents direct cattle access in certain locations. Cattle would continue to access other areas, which would be subject to direct disturbance leading to nonpoint source pollution. Cattle are attracted to the shade, green vegetation, and water provided in riparian zones and tend to concentrate in riparian areas; therefore, they would continue to cause direct and indirect damage to riparian vegetation in certain locations (Spiegal et al. 2016). Overuse by cattle can degrade riparian areas by reducing vegetative cover, affecting water quality, and damaging creek banks (Bush 2006). As identified in chapter 3, since the mid-1990s, NPS has worked with ranchers to exclude cattle from 780 acres of riparian habitat and remove these areas from lease/permits and are not in the planning area.

Cattle grazing, especially in the coastal grasslands, would continue to result in lower vegetation height and create more areas of bare ground compared with ungrazed sites, which can increase soil erosion and affect surface water (Hayes and Holl 2003; Skaer, Graydon, and Cushman 2013). Adherence to the existing RDM standard as identified in the "Soils" section of chapter 3 would continue to limit potential for soil erosion and nutrient loss associated with low or no vegetative cover across a majority of the planning area, minimizing potential for adverse impacts on surface water and groundwater quality due to pollutant loading from areas meeting the standard.

Continued identification and implementation of projects and Management Activities by NPS, ranchers, and partners to address water quality concerns would limit the timing and duration of grazing in specific areas. Management Activities (e.g., exclusion fencing) would promote water filtration in stream buffer areas and riparian vegetation uptake functions. Impacts on water quality would be indirect, long term, and beneficial compared to existing conditions as a result of reduced sedimentation and pollutant

(e.g., nutrient and pathogen) loading to surface water and groundwater. Continued range program monitoring would allow NPS to take actions to minimize or reduce impacts from livestock use, grazing, or other ranch activities. Such actions include changes to livestock numbers, grazing locations and schedules, exclusion fencing, erosion control, Infrastructure Improvements, and Livestock Water Supply. Fencing would continue to be used to limit the timing and duration of cattle grazing near streams and sensitive areas, which reduces or eliminates direct deposition of wastes. In addition, fencing can limit potential erosion and compaction of susceptible soils and allow for recovery of riparian vegetation in areas that have a history of cattle use. These practices would have a beneficial impact on water resources compared to existing conditions by limiting sediment and nutrient runoff.

Under alternative A, adverse impacts on watersheds from ranching in the planning area would continue to be addressed on a case-by-case basis. As detailed in chapter 3, Lewis et al. (2019) analyzed 19 years of water quality data collected at long-term monitoring stations in the Olema Creek watershed and documented a decreasing trend (estimated 95% reduction) in concentration of fecal indicator bacteria over time. The observed reductions were concurrent with the implementation of projects intended to improve water quality on ranchlands, including establishing or expanding exclusion areas with Fencing, creating hardened Stream Crossings and providing off-stream Livestock Water Supply (Lewis et al. 2019).

Approximately 7% (10,000 acres) of the Tomales Bay watershed includes ranches in the planning area, consisting of 3,900 acres in the Lagunitas Creek subwatershed, 5,200 acres in the Olema Creek subwatershed, and 1,060 acres with direct drainage to Tomales Bay. None of the developed dairy complexes are in the Tomales Bay watershed. Beef and dairy grazing in these areas would continue to contribute potential pathogens, nutrients, and sediment/siltation that affect Tomales Bay overall (Ghodrati and Tuden 2005; Carson 2013). However, as noted in chapter 3 under "Water Resources," monitoring data from the 2005 Tomales Bay TMDL demonstrated that subwatersheds in the planning area (Lagunitas and Olema Creek) contributed some of the lowest fecal coliform loadings to the larger Tomales Bay watershed. The Lagunitas (Upper and Lower) and Olema Creek subwatersheds were ranked as the 5th, 6th, and 8th contributors, respectively, out of nine total subwatersheds that drain to Tomales Bay (Ghodrati and Tuden 2005). The Olema Creek subwatershed was identified as contributing only 1% of the overall fecal coliform load to Tomales Bay (Ghodrati and Tuden 2005). While nutrients and sediments are mobilized from the active grazing lands, the monitoring results in the Tomales Bay watershed drainages in the planning area indicate minimal impacts on these watersheds. Fewer than 5% of nitrate samples have exceeded 1.0 mg/L since 2006 (NPS unpublished data), and Tomales Bay Watershed Council sampling between 2008 and 2012 observed relatively low nutrient levels and no samples with nitrate as N over the drinking water standard (Carson 2013). Similarly, measured indicators of sedimentation have largely been below thresholds of concern. Turbidity monitoring in the Olema Creek watershed from 2009 to 2017 and in the Lagunitas Creek watershed from 2009 to 2014 indicates that approximately 90% of samples collected at long-term monitoring stations were below a threshold of 25 nephelometric turbidity units, with most samples collected above this threshold occurring during storm conditions (NPS unpublished data).

Similarly, analysis of water quality data collected from 1999 to 2013 in the Abbotts, Kehoe, and Drakes Estero watersheds found that fecal indicator bacteria concentrations (after accounting for variation in rainfall) declined at all 13 water quality stations that were downstream of Management Activities implemented on grazed lands during the monitoring period, while a monitoring station in the Drakes Estero watershed with little grazing influence and no Management Activities implemented showed a slight positive trend. Prior to 2007, only 6% of samples met single-sample numeric water quality objectives for fecal indicator bacteria, however 38% met those objectives from 2007 to 2013. Approximately 84% of turbidity samples collected at these stations from 2010 to 2013 were below a threshold of 25 nephelometric turbidity units; only one station exhibited persistent high turbidity values, but this was likely due to regular ponding of water at the sampled culvert inlet (appendix L).

A variety of organizations, including the NPS Inventory and Monitoring Program, NPS range program, Tomales Bay Watershed Council, and San Francisco Bay RWQCB would continue to conduct water quality monitoring. Ranch operations in the Tomales Bay watershed and all dairies would remain subject to meeting Waiver Waste Discharge Requirements or Conditional Waivers required by the San Francisco Bay RWQCB (see chapter 3). Recent analyses of water quality data from sites on the Point Reyes Peninsula (appendix L) and fecal coliform trends in the Olema Creek watershed (Lewis et al. 2019) demonstrate a long-term improvement (i.e., decreasing levels of constituents of concern) in water quality in the planning area. Under alternative A, while continued grazing at current levels would have ongoing impacts to water quality in terms of contribution of sediments, nutrients, and pathogens, it is anticipated that these impacts would continue to be reduced over time with sustained regulation and further active implementation of Management Activities on a case-by-case basis.

Ranch Infrastructure and Water Control Management. Construction and maintenance of ranch infrastructure, including Road Upgrade and Decommissioning, Infrastructure Improvements, Waterway Vegetation and Planting, Fencing, Livestock Water Supply, Pond Restoration, Waterway Stabilization and Stream Crossings could temporarily disturb ground surfaces and result in an increased potential for sediment and other pollutant loading. Pond Restoration would involve an additional short-term impact by disturbing sediments in ponds. These projects are designed to improve conditions for park resources. Therefore, while projects could have short-term impacts, construction would be limited in duration and scale, and implementation would have long-term benefits on water quality. Operation of heavy equipment and motorized vehicles during implementation of these Management Activities could also increase the potential for accidental releases of fuel, oil, or other agricultural and mechanical pollutants. However, the use of mitigation measures would minimize and/or avoid these impacts. Long-term impacts from each Ranch Infrastructure and Water Control Management project are detailed below.

Road Upgrade and Decommissioning treatments provide long-term stabilization for eroding roads or drainage infrastructure, reducing erosion and providing associated benefits to water quality. Decommissioning or relocating road sections reestablishes original landscape contours and native or other vegetation suitable for the former road site, providing additional stabilization and reducing erosion potential. Applying best practices when maintaining ranch roads would continue to minimize the potential for sedimentation and transport of other pollutants. Ranch roads with erosion issues would continue to be assessed and addressed on a case-by-case basis but could continue to deliver sediment until repaired. Where implemented, Road Upgrade and Decommissioning projects result in relocation and improvement of existing access roads, with potential relocation to provide a setback from a stream corridor or to use low slopes and natural contours to minimize disturbance of drainage patterns.

Infrastructure Improvements, Stream Crossings, and Fencing projects manage livestock uses and limit cattle access to waterways or keep runoff from entering areas where livestock occur. Long-term benefits include reduced potential for soil erosion and delivery of pollutants to waterways, with associated benefits to water quality. Stream Crossings would ensure fish passage where appropriate, reduce sources of nutrient and bacteria loading, and reduce disturbances that result in turbidity by limiting waterway access to the direct vicinity of the crossing, which may include elevating the crossing above the waterway via culvert or bridge. Stream Crossings are typically implemented in combination with exclusion fencing to direct livestock to the crossing. In cases where stream systems are perennial, the design approach would ensure appropriate maintenance of fish passage. Additional short-term impacts could include temporary dewatering. In most cases, the crossings are in intermittent systems and would occur on sites that are already disturbed. Potential long-term impacts may also include changes to wetlands and stream morphology in the vicinity of the crossing, but mitigation measures would limit the potential impacts. New Stream Crossings would be implemented on a case-by-case basis and be designed with enough flow capacity to convey the design flow without altering existing stream flow characteristics. Streambanks at each crossing would be protected using erosion reduction BMPs (e.g., riprap). Developing Livestock Water Supply can decrease cattle residence time near streams, particularly under cool weather conditions (Rawluk et al. 2014; Malan et al. 2018). Spring Development may have short-term impacts on wetland

water levels and sediment disturbance during installation of piping and/or other water collection infrastructure. Pond Restoration would involve an additional short-term impact by disturbing sediments in ponds. Installing Fencing that excludes or limits livestock access to streams and wetlands, and developing new or redeveloping existing water infrastructure would continue to be implemented on a case-by-case basis, would reduce the direct disturbance of water sources by livestock, and is expected to decrease sediment, nutrient, and bacteria loading to waterways.

Waterway Stabilization and Waterway Vegetation and Planting activities would reduce potential for soil erosion; less sedimentation would benefit water quality. Long-term impacts on water resources could occur with the installation of permanent stabilizing materials such as rock, including changes to stream morphology. Waterway Stabilization and Planting, which can include structures, waterways, filter strips, sediment basins, and similar practices would continue to be implemented on a case-by-case basis to manage the flow of water and reduce pollutants entering surface waters.

Vegetation Management. Vegetation Management activities, including Upland and Riparian Vegetation Management and Planting, Mowing, IPM, and Targeted Grazing would continue to be approved on a case-by-case basis and subject to mitigation measures that minimize or prevent adverse impacts associated with these practices. Using herbicides and biocides on cultivated or rangeland areas for purposes of weed management would continue as necessary, consistent with NPS IPM regulations and procedures. Compliance with these regulations and procedures, applicable handling and disposal laws, and the use of appropriate herbicide application methods (e.g., restrictions on spraying during windy or wet days) would minimize or prevent adverse impacts on surface water and groundwater quality.

Mowing is not anticipated to affect water quality. Seeding and aeration activities as well as Upland and Riparian Vegetation Management and Planting, would initially disturb the ground surface but would ultimately provide soil stabilization, stormwater filtration, and uptake functions and result in beneficial impacts on water quality by reducing sedimentation and pollutant (i.e., nutrient and pathogen) loading to surface water and groundwater. Weed removal through IPM could also result in short-term ground disturbance. Site-specific impacts on water resources from Targeted Grazing could include those described under “Grazing”; however, Targeted Grazing would be limited in duration and focused on specific locations to achieve NPS resource management goals and objectives, which include minimizing impacts on water quality. Similarly, Upland and Riparian Vegetation Management and Planting would initially disturb soils and increase the potential for erosion but would provide long-term benefits to water quality, as described above.

Other Management Activities. Generally, dairy operations would continue to contribute higher levels of bacteria, nutrients, and sediments to surface and groundwater resources than beef ranches because dairy operations typically have high stocking densities where concentrated daily use leads to soil surfaces devoid of vegetation and the need to manage manure. However, conditions are expected to improve over time with continued regulation and implementation of Management Activities (see appendix L). Dairies would continue to spread manure over approximately 2,500 acres with spreading occurring on a portion of this acreage annually. As noted in chapter 3, the San Francisco Bay RWQCB confined animal facilities regulatory framework includes a Conditional Waiver of Waste Discharge Requirements for existing dairies (enrolled in 2015) that requires structural and non-structural management measures for all confined production areas, land application areas, and grazing operations, as well as a site-specific monitoring program.

Forage Production would continue to occur on approximately 1,000 acres in the planning area. Existing mitigation measures such as limiting manure spreading to dry periods, preventing the use of steep or sensitive lands and habitats (i.e., stream riparian zones), and requiring vegetated buffers would continue to minimize potential for runoff and sedimentation of water resources from these activities.

Diversification. Diversification activities would continue to be authorized on a case-by-case basis. One authorized chicken operation (currently inactive) allows up to 2,900 birds on pasture seasonally outside the rainy season and up to 1,500 birds on pasture during the rainy season, both limited to specific upland areas. One ranch has a small horse boarding operation within the developed complex. These activities could result in long-term, adverse impacts on water quality due to increased potential for pollutant loading to water resources from animal and operational wastes. When active, the free-ranging chicken operation incorporates stream buffers and other mitigation measures to limit impacts on water quality. Horse boarding, which is subject to regulation by the San Francisco Bay RWQCB as a Confined Animal Facility, involves the collection of manure waste and storage in piles. Managing horse manure piles and in some cases the drainage surrounding the buildings would continue to minimize potential adverse impacts. Keeping and feeding horses in small outdoor pastures or paddocks would have impacts similar to those described for cattle concentration areas.

Daily water usage for chicken operations varies by flock age, but on average, a flock of 1,000 birds consumes approximately 2,048 gallons of water over a 42-day period (Tabler et al. 2017). Assuming a flock size of 2,900 birds, the authorized chicken operation would use approximately 141 gallons per day (51,611 gallons of water per year). The average horse intakes 5 to 10 gallons of water per day (PennState Extension 2014). The current horse boarding operation with up to 10 horses would consume approximately 100 gallons per day. The level of water use associated with the single chicken operation and single horse boarding operation would contribute little impact on water quantity in the planning area.

Ranch Complexes. Concentrated uses associated with cattle operations in the ranch complex (including milking dairy cows, feeding and watering livestock, and cleaning ranch facilities and equipment) increase the potential for runoff from hardened or compacted surfaces and for water to come into contact with animal wastes or other pollutants. Although mitigated by Ranch Infrastructure and Water Control Management and Manure and Nutrient Management systems on dairies as described above, this concentrated use would continue to result in long-term, adverse impacts on surface water and groundwater quality from the loading of nutrients, pathogens, sediment, and other pollutants to surrounding water resources. Utilization of surface water and groundwater for ranch operations and residential use would continue to result in long-term, adverse impacts on water quantity. Ranch complex management, including repair, rehabilitation, and maintenance of ranch roads; improvements and alterations to historic or non-historic structures, fences, and corrals; and new development/infrastructure would be performed in accordance with applicable planning, building, and environmental laws. Construction and other activities could disturb ground surfaces and result in an increased potential for sediment and other pollutant loading during construction. Using heavy equipment and motorized vehicles during construction or other ranch activities could also increase the potential for accidental releases of fuel, oil, or other agricultural and mechanical pollutants. However, the use of mitigation measures would minimize and/or avoid these impacts. Adverse impacts from storing fuels, herbicides, and other chemicals in the ranch complex and associated structures are not anticipated because they would be guided by applicable regulations.

Elk Management

Current elk management actions such as habitat improvements and periodic hazing would continue and would not affect overall water quality or water quantity.

Cumulative Impacts

The ongoing salmonid restoration projects in Lagunitas Creek focused on winter habitat and floodplain enhancements would continue to have temporary, adverse impacts from increased sedimentation during construction activities (i.e., access routes through the riparian ecosystem). However, mitigation measures would be implemented to reduce adverse impacts. In the long term, the reconnection of Lagunitas Creek to existing floodplains would reduce flooding, enhance salmonid habitat, promote water filtration, and improve water quality resulting in long-term, beneficial impacts on surface and groundwater.

Large-scale wildfires can affect water quality during active burning (e.g., ash falling on surface water resources) and for months and years (e.g., long-term runoff) after the fire has been contained (USGS 2018). The fire management program for Point Reyes and the north district of Golden Gate and the new NPS agreement with Marin County for wildland fire operations and response would include prescribed fire and mechanical treatments to minimize the chance for large wildfires in the park. Both techniques would remove vegetation and organic matter on the surface and expose the soil to erosive processes, which could temporarily increase the potential for soil erosion and associated sedimentation of surrounding surface waters. Although impacts on water quality would be short term and adverse from mechanical and prescribed fire treatments, these short-term impacts would be outweighed by the long-term, beneficial impacts of avoiding large scale wildfires. Short-term effects on water quality would also be minimized or prevented through guidance and the implementation of mitigation measures provided in the *Fire Management Plan*. Similarly, PG&E fire prevention projects would remove overhanging tree limbs and shrubs directly above and around power lines and remove dead, dying, and falling trees from the ground surface around the power lines. PG&E operations, including using equipment to access poles and lines could result in some short-term, localized impacts on water quality.

Road improvement projects, including repairs to Sir Francis Drake Boulevard and all paved park roads, parking areas, and drainage features could disturb vegetation and soil associated with wetlands outside the existing roadway, resulting in short-term, adverse impacts on water resources from disturbance and pollutant loading. However, improving the road facilities that affect the most sensitive riparian and aquatic habitats would have long-term benefits on water quality in these localized areas.

Invasive plant management in the park could involve vegetation clearing, which could affect water resources. Compliance with the NPS's IPM regulations and procedures and applicable state pesticide regulations would dictate appropriate herbicide application methods to minimize any adverse impacts on water quality. as such, herbicide treatments are not likely to enter surface waters by spray drift and runoff, and therefore not likely to adversely affect water quality.

From 2004 to 2014, the Marin RCD's Permit Coordination Program resulted in 300 environmentally beneficial restoration projects that minimized adverse impacts on water quality from ranch operations outside the planning area (Marin RCD 2018). The planning and implementation of these projects through the Marin RCD is ongoing. Additional activities, including ranching and general development within watersheds, but outside the planning area have, and would continue to contribute adverse impacts on water quality. Overall, these past, present, and future actions, primarily ranching and development outside the planning area, have and would continue to result in adverse cumulative impacts.

Alternative A would continue to contribute adverse impacts on water resources in the planning area from beef and dairy cattle ranching, nutrient management, and water use consumption related to ranching activities. When the incremental impacts from alternative A are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on water resources would continue to be adverse, with the incremental impacts of alternative A contributing slight to noticeable impacts, depending on the watershed. The primary driver of cumulative impacts would continue to be actions related to ranching and development outside the planning area. While the Tomales Bay watershed would remain impaired under the Clean Water Act, activities in the planning area under alternative A would continue to be a small contributor to that impairment, as described in chapter 3 and above.

Alternative B

Public Use and Enjoyment

Development of new or expanded trails and roads, trailheads, and parking lots would be considered under alternative B. Ground disturbance and associated soil exposure would be limited because most trails would use existing administrative routes, and any potential accommodations for day and overnight use would reuse existing ranch complex buildings and previously disturbed areas and would be required to ensure sufficient waste storage capacity. Mitigation measures would be implemented during construction

to minimize impacts from stormwater, erosion and sedimentation, and hazardous materials. Therefore, new development related to public use and enjoyment would result in short-term, adverse impacts on water quality during construction. Long-term impacts are not anticipated.

Visitation levels under alternative B are not expected to increase compared to alternative A. Therefore, additional impacts to water quantity (i.e., reduction in water levels) as a result of these actions are not expected.

Ranch Operations

Under alternative B, while adverse impacts on water resources like those described for alternative A would continue, NPS would implement a zoning framework of Resource Protection, Range, Pasture, and Ranch Core subzones within the Ranchland zone to better protect water resources by directing more intense uses to areas with the least resource sensitivity. Activities in the 2,000-acre Resource Protection subzone would be limited to Targeted Grazing, thereby protecting additional water resources. However, impacts from regular grazing would continue in 1,200 acres of the Resource Protection subzone until Fencing is installed. More intensive ranching activities, including diversification activities and Manure and Nutrient Management, would be limited to the Pasture and Ranch Core subzones, thereby minimizing or avoiding direct impacts to water resources. However, these subzones contain previously disturbed lands and little to no water resources.

Water quality monitoring would continue as described in chapter 3, and ranch operations in the Tomales Bay watershed and dairies would remain subject to meeting San Francisco Bay RWQCB Waste Discharge Requirements and Conditional Waivers. The number of cattle and the type and intensity of impacts on water quantity would remain consistent with existing conditions. In addition to the zoning framework, Practice Standards and mitigation measures for a defined set of Management Activities, as detailed in appendix F, tables F-11 through F-13, would be implemented for all ranching activities discussed in the subsections below, which would reduce overall impacts on water quality from ranching activities in the planning area. Mitigation measures specific to each Management Activity would be incorporated into individual ROAs, and adherence to mitigation measures would be a condition of lease/permits. Overall, the zoning framework, Management Activities, Practice Standards, and mitigation measures would result in some direct benefits on water resources compared to existing conditions because intense uses would be restricted to areas less prone to erosion and away from surface waters, limiting the potential for impacts from pollutant laden runoff. While water quality improvements in the Tomales Bay watershed would occur as a result of management zoning and continued implementation of Management Activities to address water quality impacts, they would not affect the overall TMDL listing for Tomales Bay.

Grazing. As part of the zoning framework, approximately 1,200 acres would be removed from ranching and included in the Resource Protection subzone protecting approximately 171.5 acres of wetlands including 0.9 acre of ponds and 5.9 miles of streams by preventing direct access and deposition of fecal matter by livestock that enter stream channels. These 1,200 acres, plus the existing 800 acres of exclusion areas under alternative A, would protect a total of 283 acres of wetlands including 5.7 acres of ponds and 12.1 miles of streams from direct impacts from cattle. Except for very limited Targeted Grazing identified through the ROAs, no activities would be authorized in the Resource Protection subzone, reducing the potential for pollutants to directly enter surface waters. The exclusion areas would provide the same protection, filtration, and uptake functions as described for alternative A, but the acreage of exclusion areas on ranchlands under alternative B would increase from 800 to 2,000 acres, resulting in long-term, beneficial impacts on water quality compared to existing conditions from reduced nonpoint source pollution to surface water and groundwater.

Under alternative B, cattle would have direct access to most ponds (for drinking water), as well as accessible wetland and riparian habitat areas that remain outside exclusion zones. The Range subzone would contain nearly 99% of the remaining surface water resources in the lands still available for ranching, but only grazing and limited Management Activities to meet NPS resource goals and objectives would be allowed in the Range subzone under this alternative. As described under alternative A, grazing in the Range and Pasture subzones would continue to result in potential loading of nutrients, pathogens, sediment, and other pollutants to surrounding water resources through stormwater runoff and result in the use of surface water and groundwater. Range management guidelines, including adherence to the 1,200 pounds/acre RDM standard, would minimize adverse impacts on water resources by maintaining vegetation cover, which limits erosion potential.

Ranch Infrastructure and Water Control Management. Impacts on water resources associated with Road Upgrade and Decommissioning, Infrastructure Management, Waterway Vegetation and Planting, Fencing, Livestock Water Supply, Pond Restoration, Waterway Stabilization and Stream Crossings would be the same as those described under alternative A. However, these activities would occur on a more frequent basis in the first few years of implementation to address specific identified concerns and would be required to incorporate Practice Standards and mitigation measures (see assumptions at the beginning of chapter 4). Ranch water systems (i.e., springs, wells, storage tanks, and troughs) would continue to be used to provide water for livestock and domestic use, and repair and maintenance in-place would continue to be the responsibility of the rancher. Redevelopment of existing water sources and associated distribution infrastructure would be authorized following NPS review and approval, but the overall quantity of water consumed is expected to be similar to alternative A. Stream crossings would generally be limited, and other activities to prevent the need for a stream crossing would be evaluated first.

Implementation of a number of Ranch Infrastructure and Water Control Management Activities are intended to reduce erosion or runoff of pollutants to surface waters (e.g., Road Upgrade and Decommissioning, Infrastructure Management, Waterway Vegetation Planting, and Waterway Stabilization), while others (e.g., Fencing, Stream Crossings and Livestock Water Supply) can reduce direct cattle access to water resources. Overall, standardization and proactive coordination and implementation of these activities would reduce impacts on water quality compared to existing conditions through application of Practice Standards and mitigation measures for Management Activities (see appendix F, table F-11), as well as specific size limitations for each project (see tables F-2 through F-9 in appendix F). These limitations include considerations and requirements intended to minimize erosion and runoff of pollutants.

Vegetation Management. Vegetation Management activities would continue to affect surface water and groundwater quality as described under alternative A. Under alternative B, Practice Standards and mitigation measures would minimize or prevent any short-term, adverse water quality impacts from implementation of these activities (appendix F, table F-12), including measures that minimize ground disturbance and provide for temporary erosion control where needed. Vegetation Management activities in the Pasture subzone, established to avoid sensitive resources, would not have the potential for direct short-term impacts on water resources. The Upland and Riparian Vegetation Management and Planting activities often intended to establish cover in heavily disturbed areas or those lacking adequate vegetation would reduce potential for nonpoint source pollution over the long-term.

Other Management Activities. The type of impacts on water quality associated with Manure and Nutrient Management would continue to be regulated by the San Francisco Bay RWQCB. Manure and Nutrient Management would be limited to up to approximately 2,500 acres in the Pasture subzone, consistent with current conditions. Tables F-10 and F-13 in appendix F provide the size limitations and specific mitigation measures for all Manure and Nutrient Management activities. Forage Production and Manure and Nutrient Management would be prohibited in the Range subzone, where most water resources are located, which would decrease the potential for pollutant loading to surrounding water

resources. As a result, water quality impacts are expected to be reduced under alternative B compared to existing conditions.

Diversification. Under alternative B, sheep and goats would be limited to the Ranch Core and Pasture subzones and they would not be authorized in the Range subzone where 99% of the water resources are located. Potential impacts on water resources related to sheep and goats in these subzones are not expected to be any greater than the impacts of cattle under existing conditions because the total authorized AU in the planning area would not increase, the density of these non-cattle livestock would not exceed 10 AU or 10% of AU for any operation, and the RDM standard would not change. Ranchers would be required to comply with applicable regulations and mitigation measures related to diversification (see table F-14 in appendix F), further reducing the potential for additional impacts to water quality.

Impacts on water resources related to the authorization of up to 9,000 chickens distributed across the planning area would be minimized by restricting their density (no more than 500 chickens per authorized operation) and location (limited to the Ranch Core and Pasture subzone as described above) thereby avoiding direct access and impact to water resources. This activity could result in long-term, adverse indirect impacts on water quality from the increased potential for pollutant loading to water resources similar to those described under alternative A, particularly from animal concentration in the Ranch Core subzone. However, the requirement for mitigation measures to be incorporated into the ROA would minimize potential impacts on water quality. When compared to existing conditions, where one operation of up to 2,900 chickens is authorized, alternative B could result in up to 18 ranches with chickens. However, the total number and density of chickens per ranch would be far less (500 chickens) than what is currently authorized, reducing the concentration of impacts in any one location.

Changes to impacts on water quantity are not anticipated from other livestock diversification because a limited number of animals would be involved, and the total authorized AU would not increase.

Up to 2.5 acres of non-irrigated crops on individual ranches could increase the potential for nonpoint source sediment and/or nutrient loading to water resources; however, restricting these activities to previously disturbed land that does not have the potential to impact resources and implementing mitigation measures (table F-14) would minimize or prevent adverse impacts. Non-irrigated crop production would not affect water quantity because additional water would not be necessary. Irrigated crops are not addressed in detail in this EIS because of the many variables involved. Any future proposals for irrigated crops would be reviewed on a case-by-case basis, and would need to address the proposed crop, the type of irrigation system, and the total volume of water needed, and demonstrate that there is sufficient capacity to meet proposed water demand.

Other diversification uses, including farm stays, ranch tours, and sales of local agricultural products produced in the planning area in the Ranch Core subzone are not anticipated to affect water quality conditions within the planning area. These activities could increase water usage to some extent, resulting in long-term, adverse impacts on water quantity from increased groundwater pumping. These activities are limited to adaptive use of existing structures, which would limit the number of people and activities that could be accommodated and the amount of water that would be needed. Rancher proposals for farm stays, ranch tours, and farm sales would have to document that any additional water needed to support theses uses would not cause unacceptable impacts to water resources and that septic systems are adequate to support the proposed level of use.

Horse boarding activities in the Ranch Core subzone could affect water quality and water use at the ranch level. Site-specific review and compliance would be required for horse boarding to address these issues. This activity would require the containment, storage, and handling of manure and contaminated bedding materials and could increase the potential for pollutant loading. Similarly, small-scale processing of dairy and meat products and irrigated crops could result in long-term, adverse impacts on water quantity from increased water usage, and water quality due to contamination or runoff from the proposed uses. Ranchers would need to demonstrate that additional water needed to support these activities would not have

unacceptable impacts on water resources. Should these activities be authorized, they would require all relevant mitigation measures outlined in appendix F, table F-14. These requirements would minimize or prevent adverse impacts.

Ranch Complexes. The Ranch Core subzone includes approximately 5.2 acres of wetlands including 0.1 acre of stock pond and 0.1 mile of streams. Construction and activities that have the potential to affect wetlands that exist in the Ranch Core subzone would be limited to improvements to meet NPS resource management goals and objectives (e.g., culvert replacement, relocation of Controlled Crossings, Targeted Grazing). Under alternative B, direct disturbance to waterways or deposition of pollutants to surface waters within ranch complexes would be similar to existing conditions. Any proposed diversification activities would be required to develop additional structural controls to manage waste and protect water quality. Necessary improvements would be identified and prioritized through ROAs.

Ranch complex management, including actions related to cultural resources and historic structures, would have the same short-term, adverse impacts on water resources from the increased potential for sediment and other pollutant loading during construction, demolition, and other activities as alternative A. In addition to being performed under the same applicable laws as described for alternative A, the maintenance, improvement, and alteration to historic and non-historic structures and new development/infrastructure actions would be subject to the Practice Standards and mitigation measures as described in appendix F, tables F-11 through F-13, and incorporated into individual ROAs. New buildings would generally be restricted to the Ranch Core subzone to reduce the potential for impacts related to pollutant loading and runoff from additional impervious surfaces. Any new permanent proposed buildings would have to undergo separate environmental review and be approved by NPS.

Elk Management

Non-lethal elk management actions such as hazing and habitat improvements would continue as described under alternative A (e.g., fence repair and construction of elk crossings) and would not affect water quality or quantity. The lethal removal of 12 to 18 individuals from the Drakes Beach herd annually also would not affect water quality or quantity under alternative B.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would continue to contribute adverse impacts on water resources in the planning area from beef and dairy cattle ranching, Manure and Nutrient Management, and water consumption related to ranching activities. However, implementation of a zoning framework would restrict more intensive activities to the Pasture and Ranch Core subzones, and the Resource Protection subzone would reduce direct disturbance from livestock grazing to protect water resources. Application of Practice Standards and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13) would also reduce the intensity of adverse impacts on water resources across the planning area compared to existing conditions. New development related to public use and enjoyment would result in short-term, adverse impacts on water resources during construction. When the incremental impacts of alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on water resources would be adverse, with alternative B contributing slight to noticeable impacts, depending on the watershed. The primary driver of cumulative impacts would continue to be actions related to ranching and development outside the planning area. While the Tomales Bay watershed would continue to be impaired under the Clean Water Act, alternative B would be a small contributor to that impairment, and ongoing implementation of Management Activities as described above, would continue to reduce pollutant contributions to the Tomales Bay watershed incrementally over time. Overall, water quality would improve compared to existing conditions.

Alternative C

Actions under alternative C would be the same as those described for alternative B except for elk management. Removal of the Drakes Beach herd would be a one-time event, occurring over approximately six months. This action would not adversely affect water quality or quantity. Therefore, the direct, indirect, and cumulative impacts of alternative C would be the same as those described for alternative B.

Alternative D

Impacts related to public use and enjoyment and elk management under alternative D would be the same as those described under alternative B.

Ranch Operations

Alternative D would remove grazing impacts associated with approximately 750 AU of cattle across 7,500 acres, or 27% of the ranched lands in the planning area and add 900 acres of resource protection exclusion areas to the Resource Protection subzone. Overall, 8,900 acres in the planning area, including 690.2 acres of wetlands, including 20.5 acres of ponds and 23.5 miles of perennial stream would be excluded from grazing, which is 17.2 miles of perennial stream, 578.7 acres of wetlands, including 15.8 acres of ponds, more than is currently protected under existing conditions. For the 19,000 acres that would remain under lease/permit, implementation of the zoning framework and associated guidance for Management Activities would result in impacts similar to those described for alternative B. Ranching operations would continue to be required to meet the 1,200 pounds per acre RDM standard; however, the total number of livestock on the landscape would be reduced by 700 AU, which would reduce overall impacts on watersheds in the areas where ranching is removed compared to existing conditions.

As described for alternative B, monitoring studies show that water quality in the planning area has improved over time as NPS, partners, and ranchers implement Management Activities, establish buffers, and treat problematic sites (Carson 2013; Parsons and Ryan 2015; Wallitner 2016; NPS 2017a; Voeller et al. 2018; Lewis et al. 2019; appendix L). Based on observed trends in water quality constituents of concern and the actions proposed under alternative D, it is anticipated that water quality would continue to improve throughout the planning area, including in the Drakes Estero watershed where approximately 2,000 acres of grazing would cease, and Tomales Bay watershed where approximately 3,000 acres of ranching would cease. Under alternative D, grazing activities would also cease in the Duxbury Reef ASBS watershed. As described in chapter 3, the planning area contributes a small proportion of overall pollutant loading to the Tomales Bay watershed. Therefore, it is expected that while water quality improvements in the Tomales Bay watershed related to a reduction of active ranching operations in the planning area would occur, they would not affect the overall TMDL listing for Tomales Bays.

Impacts from Management Activities and diversification would be the same as those described under alternative B; however, the total number of Management Activities may be reduced with the cessation of ranching in some areas under alternative D. Removing acreage from grazing and other ranching activities, limiting intensive ranching activities to certain zones, and implementing required Practice Standards and mitigation measures would reduce or eliminate adverse impacts (e.g., nonpoint source pollution) on most surface water resources in the planning area and prevent disturbance and direct deposition of fecal matter by livestock in areas where they are excluded or limited, as described under alternative B.

Alternative D would also result in long-term, beneficial impacts on water quantity dispersed across a number of watersheds because of a reduction in the number of authorized livestock compared to existing conditions. With the removal of 7,500 acres of ranching, approximately 1,700 AU of beef cattle and 3,130 dairy animals would be authorized. Compared to existing water usage in the planning area (with a maximum of 124 million gallons per year for both beef and dairy operations), maximum water usage under alternative D would be estimated at approximately 83 million gallons per year, a 33% decrease.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative D would continue to contribute adverse impacts on water resources in the planning area from beef and dairy cattle ranching, Manure and Nutrient Management, and water use consumption related to ranching activities. However, implementation of a zoning framework would restrict more intensive activities to the Pasture and Ranch Core subzones, and the Resource Protection subzone would reduce direct disturbance from livestock grazing to protect water resources. Application of Practice Standards and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13) would reduce the intensity of adverse impacts on water resources across the planning area compared to existing conditions. Alternative D would also contribute beneficial impacts compared to existing conditions on the 7,500 acres removed from ranching because ranching-related impacts would cease in those areas. New development related to public use and enjoyment would result in short-term, adverse impacts on water resources during construction.

When the incremental impacts from alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on water resources would be adverse, with alternative D contributing a slight to noticeable increment, depending on the watershed. The primary driver of cumulative impacts would continue to be actions related to ranching and development outside the planning area. The Tomales Bay watershed would continue to be impaired under the Clean Water Act; however, ranching in the planning area would be a small contributor to that impairment, as described under alternative A. Overall, water resources would improve compared to existing conditions from the implementation of a zoning framework and cessation of ranching on 7,500 acres.

Alternative E

Impacts related to public use and enjoyment under alternative E would be the same as those described under alternative B. Impacts from elk management would be the same as those described under alternative A.

Ranch Operations

Implementation of a zoning framework and associated guidance for authorized ranching activities would be similar to alternative B; however, all dairy animals (approximately 3,115) would be removed from the planning area. Assuming all dairy ranches convert to beef ranches, based on the area and forage productivity on these former dairy operations, it is estimated that the converted ranches could add a total of approximately 750 beef cattle AU. Overall, up to 3,150 AU of livestock would be authorized under alternative E. Ranchers would still be required to meet the minimum RDM of 1,200 pounds/acre, so impacts are expected to be of the same intensity as alternative B. The total acres available for ranching (26,100 acres) and acres of additional resource protection areas (1,200 acres) would be the same as for alternative B. The water resources contained within the 2,000 acres of resource protection areas under alternative E would also be the same as those described for alternative B with most water resources in the planning area contained included in the Range subzone. Changes to water quality conditions in the Tomales Bay watershed would be the same as those described in alternative B, because all dairy ranch complexes that would close are outside of the Tomales Bay watershed.

As described for alternative B, monitoring studies show that water quality in the planning area has improved over time as NPS, partners, and ranchers implement Management Activities, establish buffers, and treat problematic sites (Carson 2013; Parsons and Ryan 2015; Wallitner 2016; NPS 2017a; Voeller et al. 2018; Lewis et al. 2019; appendix L). Based on current water quality trends and the actions proposed under alternative E, water quality in the planning area is expected to continue to improve under alternative E. Additionally, reductions to lower AU from the higher number of dairy animals and associated concentration areas would contribute directly to improved water quality conditions.

Alternative E would also result in long-term, beneficial impacts on water quantity through the cessation of dairy operations and removal of dairy animals from the planning area. Compared to existing water usage (with a total maximum use of 124 million gallons per year for beef and dairy operations combined), the maximum water usage under alternative D, following cessation of dairy operations, is estimated to be 20 million gallons per year, an 84% reduction from existing conditions.

Ranch Infrastructure and Water Control Management. Impacts from Ranch Infrastructure and Water Control Management activities would be the same as those described under alternative B; however, the total number of projects may increase slightly during the first few years as ranches transition from dairy to beef ranching. The overall number of activities may be reduced in the long term as many of the more intensive activities associated with dairy operations would be discontinued.

Vegetation Management. Impacts from the implementation of Vegetation Management activities would be the same as described for alternative B.

Other Management Activities. Once dairies are converted to beef operations, adverse impacts (e.g., levels of nonpoint source pollution runoff) on surface water resources in the planning area associated with dairy ranching activities such as livestock congregation and concentrated manure in locations near milking barns would decrease. Manure and Nutrient Management and associated systems would be eliminated from approximately 2,500 acres of the planning area resulting in reduced potential for water quality impacts associated with these activities. Forage Production would no longer be authorized under alternative E, which would eliminate the potential for pollutant loading to surrounding water resources from this activity.

Diversification. Diversification activities would not be authorized under alternative E. Diversification activities that are currently authorized would cease and could not be restarted, resulting in long-term, beneficial impacts on water quality.

Ranch Complexes. Impacts on water resources from management of ranch complexes would be similar to those described under alternatives A and B. While no structural measures would be required to support diversification activities, alternative E would likely require additional structural changes on the six dairy ranches that could convert to beef ranching.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative E would contribute noticeable adverse impacts on water resources in the planning area from beef cattle ranching and water use consumption related to ranching activities. However, implementation of a zoning framework, specifically the Resource Protection subzone would protect water resources and reduce the direct disturbance from livestock grazing. Application of Practice Standards and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13) would reduce the intensity of adverse impacts on water resources across the planning area compared to existing conditions. The cessation of the existing dairy operations over a five-year period would eliminate all adverse impacts associated with dairies as described above, resulting in beneficial impacts compared to existing conditions. New development related to public use and enjoyment would result in short-term, adverse impacts on water resources during construction.

When the incremental impacts from alternative E are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact of alternative E on water resources would be adverse, with alternative E contributing a slight to noticeable increment depending on the watershed. The primary driver of cumulative impacts would continue to be actions related to ranching and development outside the planning area. The Tomales Bay watershed would continue to be impaired under the Clean Water Act; however, ranching in the planning area would be a small contributor to that impairment. Overall, water resources would improve under alternative E compared to existing conditions from the implementation of a zoning framework and cessation of dairy operations.

Alternative F

Public Use and Enjoyment

Under alternative F, NPS would consider new visitor opportunities in former ranch complexes and additional trail linkages. The overall quantity of additional amenities and opportunities would be similar to all other action alternatives because they would be driven by NPS's capacity to build and maintain these trails. Short-term, adverse impacts on water quality could occur from the potential for sediment and other pollutant loading during construction activities. These impacts would be similar in type and intensity to alternative B but could affect a larger percentage of the planning area because of the removal of ranching from the park landscape.

Ranch Operations

Under alternative F, ranching would be discontinued, and the park would undertake an assessment to prioritize treatment and restoration areas. Existing grazing practices and treatments, as described under alternative A, would continue on each ranch until ranching operations are phased out after one to five years, or when the two life estates terminate. Impacts on water use and most nonpoint pollution from livestock manure and other ranch activities would be fully eliminated after five years with the exception of operations on the two remaining life estates. Shrub and weed management, seeding, and Targeted Grazing, if necessary, after the closure of all ranches, could have minimal short-term, adverse impacts on water quality. Eliminating dairy operations and removing grazing would result in long-term, beneficial impacts on water quality compared to existing conditions. As described in chapter 3, the planning area contributes a small proportion of overall pollutant loading to the Tomales Bay watershed. Therefore, while water quality improvements in the Tomales Bay watershed related to a cessation of active ranching operations in the planning area would occur, they would result in only limited effects at the watershed scale and would not affect the overall TMDL listing for Tomales Bay.

Eliminating ranching in the planning area would have long-term, beneficial impacts on water quantity. Based on the number of authorized cattle in the planning area, the amount of water saved by eliminating all ranching activities would be similar to the water usage values presented in table 8 in chapter 3. Eliminating dairy operations would eliminate the use of around 127,000 to 300,000 gpd; eliminating beef operations would eliminate the use of around 9,192 to 39,985 gpd for an estimated total water use reduction of 50 million gallons to 124 million gallons per year.

Like alternative E, non-cattle livestock, Manure and Nutrient Management, and Forage Production would not be authorized anywhere in the planning area, which would have long-term, beneficial impacts from reduced potential nonpoint source pollution and water use. Vegetation Management activities, including targeted grazing and shrub and weed management and seeding would occur only for resource management purposes, thus the scale of these activities and any associated impacts would be reduced.

Adaptive use of infrastructure in the historic ranch complexes would occur. The reuse or demolition of existing structures would result in short-term, adverse impacts on water quality by increasing the potential for sediment and other pollutant loading. However, construction mitigation measures (e.g., sediment barriers at construction site edges) and managing runoff from existing buildings would limit adverse impacts on water quality.

Elk Management

Under alternative F, ongoing monitoring such as annual counts and Johne's disease monitoring would continue and would not affect water resources.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative F would contribute noticeable long-term, beneficial impacts because beef and dairy ranching would be phased out across the planning area, although implementation of new visitor opportunities would contribute some limited adverse impacts to water quality and quantity. When the incremental beneficial impacts from alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on water resources would be adverse. However, alternative F would contribute a meaningful beneficial increment to water resources, and the overall condition of water resources would improve compared to existing conditions within the planning area. The primary driver of cumulative impacts would continue to be actions related to ranching and development outside the planning area. While the Tomales Bay watershed would continue to be impaired under the Clean Water Act, with the removal of ranching in the planning area, ranching activities under alternative F would no longer be a contributor to that impairment.

VEGETATION, INCLUDING FEDERALLY LISTED SPECIES

Methodology and Assumptions

Potential impacts on vegetation in the planning area are evaluated based on resource expert knowledge and professional judgment; communication with park staff; and a review of available research, reports, and data. The area of analysis includes the vegetation (including communities of concern, non-native plant species, and other special-status plant species) within the boundaries of the planning area.

The forage production model developed by the park was used to produce grazing capacity and stocking rate estimates under the alternatives (see appendix K). The estimates help quantify the range of plant biomass change. California grassland ecosystems are complex, and their dynamics are driven to a large degree by abiotic factors such as annual weather patterns, soils, and topographic site characteristics (Jackson and Bartolome 2002; Spiegal et al. 2016). The abiotic factors that drive the dynamics of California grassland ecosystems were considered when quantifying the change in biomass. Long-term park vegetation monitoring and RDM data from ungrazed, beef-cattle grazed, and dairy-cattle grazed plots are also compared to evaluate potential differences in biomass and species composition, including invasive species, under the alternatives. For the purposes of this analysis, a moderate level of grazing is considered to be grazing that is consistent with the requirement to maintain an average RDM of 1,200 pounds/acre at the end of the grazing season.

The use of Targeted Grazing is considered under alternatives where grazing pressure from livestock is removed in order to mitigate some of the undesirable impacts of grazing reduction or removal. The analysis assumes mitigation measures would be implemented to minimize adverse impacts.

The impact analysis for federally listed species focuses on potential changes to the presence and distribution of threatened and endangered species and their habitat that could result from actions proposed in the GMP Amendment. Listed plant species that were carried forward for detailed analysis due to potential impacts include: (1) Sonoma alopecurus, (2) Sonoma spineflower, (3) Tiburon paintbrush, (4) Marin dwarf flax, (5) beach layia, (6) showy Indian clover, and (7) Tidestrom's lupine.

Alternative A

Public Use and Enjoyment

Impacts on vegetation from visitor activities in the planning area are associated with the use of existing trails for hiking, biking, running, and horseback riding, which can change species composition, as well as spread weeds and pathogens (Pickering et al. 2010). Trampling associated with these activities can adversely affect vegetation in the locations where visitors are not using formalized trails. Visitor use of ranchlands would not affect vegetation.

Ranch Operations

Grazing. Grazing by large herbivores, such as cattle, involves three primary processes—defoliation of vegetation, trampling, and nutrient redistribution (Jackson and Bartolome 2007). Each of these processes, individually and in combination, directly affects the plant communities where grazing occurs. Impacts on vegetation can be beneficial, neutral, or negative, depending on a complex set of factors and their interactions (Diaz et al. 2007), including timing, duration, and intensity of grazing, as well as management goals. Research that links these grazing processes directly to plant and plant community responses are limited for California vegetation types (Jackson and Bartolome 2007).

Under alternative A, approximately the same level of cattle grazing on 27,000 acres would perpetuate existing vegetation structure, species composition, and biomass production. Impacts on vegetation associated with dairy cattle would continue to be more concentrated relative to impacts associated with beef cattle, especially in areas closer to the developed complexes because dairy cows on the milking string are brought into the dairy barns twice a day for milking. Beef cattle typically are more widely distributed across the landscape; consequently, grazing impacts are also more dispersed.

Holding paddocks, corrals, and areas such as those surrounding water troughs; feeding areas; or sites with mineral supplements typically receive heavy use and are likely to have limited or no vegetation and contribute to the estimated 150 acres of high-intensity-use areas in the planning area. Management Activities, such as using sufficient fencing and/or water troughs to improve distribution, could be implemented to minimize adverse impacts on vegetation to the extent possible. Impacts related to non-cattle livestock operations, including a horse boarding operation and one authorized but currently inactive chicken operation, would continue, resulting in impacts similar to grazing.

Under alternative A, NPS would continue to employ range management guidelines and require a minimum RDM of 1,200 pounds/acre remaining in the fall to protect soil resources and optimize vegetative production (Bartolome et al. 2006, 2015). Grazing activities at current authorized levels that meet the established standard are consistent with maintenance of the grassland plant communities (Bartolome et al. 2006; Bartolome et al. 2007; Hallett et al. 2017). Ongoing monitoring and implementation of Management Activities in areas identified by park range managers and ranchers would be expected to continue on a case-by-case basis resulting in incremental improvement in overall conditions.

Ranch Infrastructure and Water Control Management. Similar to the impacts described under water resources, construction and maintenance of ranch infrastructure, including Road Upgrade and Decommissioning, Infrastructure Improvements, Waterway Vegetation and Planting, Fencing, Livestock Water Supply, Pond Restoration, Waterway Stabilization and Stream Crossings could disturb ground surfaces and result in removal, trampling, or crushing of vegetation from equipment and foot traffic during construction activities. Using heavy equipment and motorized vehicles could also increase the potential for accidental releases of fuel, oil, or other agricultural and mechanical pollutants, which could affect vegetation in localized areas. However, the use of mitigation measures, including vegetation planting to prevent erosion and restore site conditions to pre-construction levels, would continue to minimize and/or avoid these impacts. Similarly, preconstruction surveys would be required prior to implementation of Management Activities in applicable habitats to determine if special-status plant species are present at or near construction areas, and if present, avoidance or applicable mitigation measures would continue to be required to minimize any potential impacts. Long-term impacts associated with each Ranch Infrastructure and Water Control Management activity are detailed below.

Road Upgrade and Decommissioning treatments provide long-term stabilization for eroding roads or drainage infrastructure, reduce erosion, and allow vegetation to return to previously eroded areas. Any disturbance during construction would continue to be restored with native or site-appropriate vegetation approved by NPS.

Fencing allows for better management of livestock distribution across grazing lands. It can be used to control the timing, duration and intensity of grazing, which can have positive, negative, or neutral effects on vegetation that may vary for particular species. In some vegetation communities such as riparian forests where it is used to limit grazing it can result in benefits to vegetation (see below).

Stream Crossings and associated Fencing improve control of livestock by reducing access to riparian habitat to specific crossings. These activities benefit vegetation in the long term. Although Stream Crossings focus impact to specific locations which can result in long term changes to wetlands and vegetation at the crossing, the overall action reduces overall impact to riparian corridors by reducing cattle access and time spent in other portions of those sensitive habitat areas. Mitigation measures for Stream Crossings would continue to limit the potential short-term impacts associated with project implementation. Infrastructure Improvements would continue to be limited to developed areas and would not affect vegetation.

Pond Restoration directly affects a portion of any existing aquatic and pond margin vegetation in the short term by removal or damage associated with dredging of sediments or restoration of levees; however, vegetation is expected to recover to existing conditions in the long term, and NPS would continue to monitor vegetation condition to ensure recovery goals are met. In the planning area, Livestock Water Supply is focused on improving or redeveloping existing water sources. Following redevelopment, existing water sources are often fenced, which improves vegetation in those areas over the long term. Livestock Water Supply noticeably alters vegetation from existing conditions in localized areas when troughs are added, which can increase high-intensity-use areas and denude existing vegetation in the vicinity of the trough. However, off-stream water sources can also reduce livestock residence time in riparian areas. As new troughs are established, they would be sited in locations that avoid and buffer sensitive plant communities to minimize overall impacts of high-intensity-use areas. Installation of structures, like rocks, as part of Waterway Stabilization could decrease the potential for vegetation growth in these limited areas but would have overall benefits such as reduced erosion and sedimentation as discussed under the impact topics above. Waterway Vegetation and Planting would include native species where possible and improve conditions.

Vegetation Management. Vegetation Management practices, including Upland and Riparian Vegetation Management and Planting, Mowing, IPM, and Targeted Grazing would continue to be approved on a case-by-case basis and subject to mitigation measures to minimize or prevent adverse impacts associated with these practices. Using herbicides and biocides on cultivated or rangeland areas for purposes of weed management would continue as necessary consistent with NPS IPM regulations and procedures and could potentially affect non-target species. Compliance with these regulations and procedures, applicable handling and disposal laws, and the use of appropriate herbicide application methods (e.g., restrictions on spraying during windy or wet days) would continue to minimize or prevent adverse impacts on non-target vegetation. Upland and Riparian Vegetation Management and Planting increases perennial or self-sustaining vegetation (e.g., grasses, forbs, legumes, shrubs, and trees). Preconstruction surveys would continue to be required, as noted above.

Mowing and Targeted Grazing focus on reducing undesirable weed species, as well as maintaining native grassland communities and sensitive plant species, to sustain or increase desired conditions for vegetation communities, including native species composition in the planning area. Mowing largely occurs in locations with predominantly non-native, seeded agricultural, or invasive species, which would limit impacts on native species.

Other Management Activities. Manure and Nutrient Management on dairies, including the application of compost and fertilizer, would continue under alternative A. As described in the “Soils” section, manure spreading increases soil nutrients, which increases forage species production but may increase weedy species and have adverse impacts on native grassland plant species, some of which are less abundant in fertilized soils (Weiss 1999; McKenzie et al. 2003; Gea-Izquierdo, Gennet, and Bartolome 2007). Manure spreading largely occurs in areas where the vegetation is predominantly non-native, such as agricultural

pastureland and annual grassland, thereby limiting impacts on native species. Manure spreading occurs on approximately 715 acres of land authorized for Forage Production, where Manure and Nutrient Management is intended to increase silage crop productivity. Forage Production would continue, consistent with lease/permit terms, on approximately 1,000 acres. This practice also involves seedbed preparation, seeding, and harvest mowing, all of which would affect vegetation in the locations where Forage Production occurs. However, because vegetation in these areas is largely non-native, impacts on native plants would be limited.

Non-Native and Invasive Plants. Ranching would continue to both adversely and beneficially affect the control of invasive plants. When livestock are properly managed, grazing can be an effective method to control certain invasive species (Spiegal et al. 2016). Hayes and Holl (2003) reported that ungrazed sites averaged as much as four times more common velvetgrass cover, one of the most common perennial grass weeds in the coastal prairie and widespread at Point Reyes, than the grazed sites. Under alternative A, some invasive species, including velvetgrass, would continue to be controlled to some degree by cattle that eat the new growth. Cattle grazing pressure would also continue to control, to some degree, the ubiquitous, naturalized, non-native annual grasses that can outcompete native plants (Hayes and Holl 2003, 2011; Skaer, Graydon, and Cushman 2013). In addition, ranch operations would continue to contribute to the control of invasive species and provide early detection. In many cases, ranchers may be the first to observe and report any new infestation.

Ranching operations may also result in the introduction and spread of invasive species (Spiegal et al. 2016). Under alternative A, ranching operations, including ranch vehicle movement, supplementary feeding, and manure spreading, would continue as potential pathways for the introduction and/or spread of invasive plants. Livestock movement could also spread invasive species in the planning area. Cattle fecal pats concentrate nutrients and can serve as establishment sites or as sources of non-native and invasive plants as seeds can pass through a cow's digestive system and subsequently germinate (Chuong et al. 2016). In the 150 acres of high-intensity-use areas documented in the "Soils" section, the exposed soils and elevated nutrient levels provide more favorable conditions for germination by non-native and invasive plants. However, as noted above, minimum RDM standards limit bare ground caused by grazing and trampling (Bartolome et al. 2015). Under alternative A, areas of heavy livestock use would continue to provide conditions favorable to non-native and invasive plants. In the 2,500 acres where dairy manure is spread, higher soil fertility could continue to result in a greater abundance of non-native species.

Mowing and other forms of weed control using IPM would continue under alternative A. Unlike grazing by herbivores, mowing is indiscriminate and removes all vegetation above the mow-line. If invasive species are not mowed when they are phenologically vulnerable, their growth and reproduction can be encouraged (DiTomaso et al. 2013). Similarly, native plants may be adversely affected if mowed at the wrong phenological stage, for example during reproduction. Unless cut vegetation is removed, mowing also increases dead surface biomass that can result in thick thatch layers, inhibiting germination of some species. Mowers and other ranch vehicles, trucks, and equipment can also disperse weed seeds into uninfested areas if the machinery, undercarriages, and tires are not carefully cleaned. Assessing vegetation in areas proposed for mowing and using mitigation measures on a case-by-case basis would continue to minimize the impacts associated with mowing.

Habitat-Specific Impacts

Ranch management and cattle grazing affect vegetation habitats in different ways. The effects on vegetation from continued ranching are addressed by habitat type below.

Wetlands. Limited information on livestock grazing effects in California wetlands is available (Jackson and Bartolome 2007). Efforts in the park have focused on refining and updating existing wetland mapping, including within the planning area, where they comprise less than 7% of the total acres. In Sierra foothills wetlands, light livestock grazing did not appear to cause notable changes in vegetation cover and species richness (Allen-Diaz et al. 2004), nor did livestock grazing appear to affect wetlands

composition in East Bay grasslands, although grazing may affect vegetation structure in wetlands with willows (Allen-Diaz et al. 2001). In the Sierra foothills study, long-term, moderate to heavy grazing intensity reduced plant cover, although occasional moderate grazing did not affect plant cover (Allen-Diaz et al. 2004).

Grazing does occur in wetlands dispersed across the planning area. Site-specific impacts on wetlands from grazing depend on location, access, timing, and intensity of use by cattle in these areas. While grazing may disturb these features, it has not been observed to affect the location and extent of wetlands in the planning area. Under alternative A, livestock stocking rates are established to ensure ranchers meet the 1,200 pound per acre RDM level, consistent with light to moderate grazing intensity, which is compatible with maintaining herbaceous wetland vegetation (Allen-Diaz and Jackson 2000; Allen-Diaz et al. 2004; Pyke and Marty 2005; Marty 2005; Jackson and Allen-Diaz 2006). In collaboration with ranchers, NPS has implemented protective measures including exclusion or seasonal fencing around approximately 112 acres of wetlands to control the timing and duration of grazing. Additional acres are protected by topography or are in areas that cattle rarely access.

Riparian Forest/Shrubland. Cattle are attracted to the shade, green vegetation, and water provided in riparian zones and tend to concentrate in riparian areas, resulting in direct and indirect damage to riparian vegetation (Spiegal et al. 2016). Overuse by cattle can degrade riparian areas by reducing vegetative cover, affecting water quality, and damaging creek banks (Bush 2006). Under alternative A, fencing would continue to exclude cattle from grazing approximately 800 acres of land under lease/permit, including an estimated 9% of the riparian forest/shrubland in the planning area. As noted in chapter 3, only 1% of the planning area is riparian, and the most highly sensitive riparian areas would continue to be fenced and protected from livestock use. Unprotected riparian areas would continue to be susceptible to access and potential impacts by cattle. However, much of the remaining 200 acres of riparian forest/shrubland is located in parts of the planning area where topography and dense vegetation limit cattle access.

Grasslands. California coastal grassland ecosystems are complex, and their dynamics are driven to a large degree by abiotic factors such as annual weather patterns, soils, and topographic site characteristics (Jackson and Bartolome 2002; Spiegal et al. 2016). In general, at landscape scales, grazing effects in California grasslands are limited; abiotic factors are more important driving forces (Jackson and Bartolome 2002; D'Antonio et al. 2002). However, depending on intensity, livestock grazing can have localized impacts on vegetation and on specific plant species.

As identified in chapter 3, approximately 60% of the planning area is composed of grasslands, including annual grasslands (44%), agricultural pasturelands (12%), and coastal prairie (4%). Most grazing occurs in grasslands. Grazing and other disturbances such as fire, are a fundamental ecological process in this plant community (Hayes and Holl 2003; Jackson and Bartolome 2007). Under alternative A, cattle grazing in grasslands would continue to result in lower litter depth and vegetation height and greater potential area of bare ground compared to ungrazed sites (Hayes and Holl 2003; Skaer, Graydon, and Cushman 2013). Soil pH, organic matter content, total nitrogen, cation exchange capacity, phosphorus, potassium, calcium, and magnesium levels would likely not be affected in beef cattle-grazed areas (Hayes and Holl 2003). On agricultural pasturelands, including areas of manure spreading, Forage Production, and high-intensity-use areas adjacent to developed complexes, cattle waste products are likely to be more concentrated, resulting in increased soil nutrient levels, which may have adverse impacts on native plant species. In general, limited or no information exists regarding grazing effects on specific species in the coastal grasslands.

In an observational study of cattle grazing impacts in 25 coastal grassland sites, Hayes and Holl (2003) reported that native annual forb species richness and cover were greater in grazed sites, as were non-native annual forbs and some non-native annual grasses. This relationship between grazing and higher annual forb and grass richness and cover may result because grazing reduces vegetation height and litter biomass, which, in turn, opens up microsites favorable to short-statured plants (Hayes and Holl 2003). In

contrast to the annuals, the study found that native perennial forb cover and species richness were higher in ungrazed sites, perhaps because tall perennial forbs do not reproduce well when clipped, although in general, cattle prefer to eat grasses over forbs (Larson, Barry, and Bush 2015). Under alternative A, the potential for adverse impacts on native perennial forbs from cattle grazing would continue.

Hayes and Holl (2003) also found that species richness and cover of native perennial grasses taken as a functional group were not affected by cattle grazing. A Monterey County coastal grassland study also did not find any grazing effects on native perennial grasses (Skaer, Graydon, and Cushman 2013). These functional groups would likely remain unaffected under alternative A.

The limited information available suggests that individual native perennial grass species vary in their response to grazing. California oatgrass (*Danthonia californica*), a coastal prairie indicator species, had twice as much cover in grazed sites as in ungrazed sites (Hayes and Holl 2003). These findings for California oatgrass have been corroborated by Hayes and Holl (2011) in subsequent experimental work that showed that at a Santa Cruz County site with abundant California oatgrass, cover of California oatgrass declined in plots that were not grazed (or clipped, a proxy for the defoliation component of grazing) but remained the same or increased in plots that were grazed or clipped. In contrast, Point Reyes' recent NRCA (NPS 2019a), which analyzed 51 coastal grassland plots grazed by cattle from 1988 through 2013, found that California oatgrass declined in frequency on 24 of the 37 transects on which it occurred. However, the sampling design did not specifically include any paired ungrazed comparison plots and was not representative of all the park's coastal grasslands, so the role of cattle grazing in this observed decline was not clear. Under alternative A, California oatgrass would likely continue to benefit from cattle grazing, even though the current trend indicates a decline in the grass, because grazing is not likely the cause of the decline; rather, the studies by Hayes and Holl (2003, 2011) imply that in the absence of grazing, the decline might be even greater.

Coastal Dunes. The dominant vegetation in coastal dune systems—woody shrubs, forbs and the invasive European beachgrass and iceplant—are not the primary forage preferred by cattle. Cattle are currently excluded from most coastal dunes at Point Reyes, but when they inadvertently gain access to dunes, they may trample or eat dune plants. Under alternative A, cattle would continue to be excluded from most of the coastal dunes directly adjacent to the ocean, and approximately 45% of the 611 acres in the planning area. Therefore, ranching under alternative A would continue to have limited impacts on coastal dunes. Native dunes are mobile, and in some areas are documented to encroach on actively ranched lands and impact the effectiveness of boundary fencing. In those areas, NPS has worked with ranchers to adjust fencing to keep cattle in permitted areas.

Coastal Scrub. Coastal scrub frequently encroaches on coastal grasslands where grazing and fire are absent; complete conversion of grasslands to coyote brush-dominated coastal scrub can take place within 15 to 25 years (Ford and Hayes 2007). Livestock do not generally browse coastal scrub dominated by coyote brush, although they will graze the herbaceous understory in stands with sparser canopies. Livestock travel through coastal scrub and may damage vegetation with trailing and trampling. By defoliating and trampling coyote brush seedlings in the shrub-grassland ecotone and in open grassland, cattle slow the expansion of coastal scrub into open grassland (Ford and Hayes 2007). Under alternative A, continued cattle grazing would maintain existing grassland-shrubland boundaries in some areas, and the rate of shrub encroachment into grasslands would likely not accelerate. Analysis of cattle-grazed coastal grassland plots monitored in the park from 1988 to 2013 found that coyote brush occurred in 23 of the 51 plots, increasing in cover on 10 of those plots—6 of them to a major degree—and decreasing in cover on 8 during the period sampled, although in some plots, cattle grazing had ceased (NPS 2019a). Continued cattle grazing is anticipated to slow coyote brush encroachment into coastal prairie; however, once a coyote brush stand has established, grazing would be of limited use in eliminating the shrubs in favor of grassland vegetation. The NRCA suggests that shrub encroachment into park grasslands could continue to increase without additional management actions (NPS 2019a).

As noted in chapter 3, approximately 30% of the coastal scrub on park-managed lands falls within the planning area. Under alternative A, NPS would continue to evaluate and authorize mechanical treatment (e.g., mowing) of shrubs on a case-by-case basis to reduce encroachment into grassland to maintain disturbance in this community type, and provide improved forage for livestock as well as certain wildlife species. Mowing would have short-term impacts on non-target vegetation but would maintain coastal grassland habitat in treated areas.

Plant Biomass. As described in chapter 3, the benefits of biomass reduction to native annual plants would continue under alternative A. Using livestock grazing to reduce vegetative fuel loading would continue across approximately 27,000 acres.

Special-Status Plants. Grazing impacts, both beneficial and adverse, on rare plants are often difficult to determine, and some species in the planning area experience more adverse impacts from competition with invasive or non-native species than from grazing. For several of the state listed/state rare plants, like the Mount Vision ceanothus (*Ceanothus gloriosus* var. *porrectus*), cattle grazing likely would continue to reduce competition from non-native annual and perennial grass species or maintain preferred habitat characteristics. In addition, several of the state listed/state rare plants do not occur in habitat likely to be used by cattle or occur in areas where cattle are already excluded (e.g., coastal dunes, riparian areas); ranching activities are not likely to affect those species.

On the other hand, in some cases certain species that may continue to be adversely affected by cattle grazing or trampling, such as coastal marsh milkvetch (*Astragalus pycnostachyus*), swamp harebell (*Campanula californica*), Marin checker lily (*Fritillaria lanceolata* var. *tristulis*), North Coast phacelia (*Phacelia insularis* var. *continentis*), and Point Reyes checkerbloom (*Sidalcea calycosa ssp. Rhizomata*) (Aoyama et al. 2018), however, more research is needed to determine potential effects of grazing on special-status plants.

Federally Listed Plants. Approximately 20% of beach layia occurrences are on remnant dune features in grazed pastures on the B, C, F, and AT&T Ranches, where cattle could directly affect plants through trampling, as well as indirectly via grazing disturbance, which may increase the potential for establishment of weeds. Livestock trampling was indicated as a threat when beach layia was listed (57 FR 27848); however, in 2002, after reviewing the status of beach layia in the park and the potential effects of ranch activities and other cumulative effects, USFWS (2002a) determined that ranching in the park is "not likely to jeopardize" the continued existence of the species. Since 2004, the estimated beach layia population in the park has declined 84% from an estimated 35,893 plants in 2004 to 5,689 plants in 2018 (NPS 2019g). Although beach layia occurrences have increased in areas where coastal dune restoration has occurred (NPS 2019g), those subject to grazing have declined in abundance since 2004 (NPS, Parsons, pers. comm. 2019b). Alternative A would continue to prevent cattle from accessing dune habitats because the majority of known beach layia occurrences are found outside grazed pastures or in existing resource protection areas, but adverse impacts on approximately 20% of known beach layia occurrences could occur (NPS 2014f).

Six occurrences of Marin dwarf flax have been documented in the planning area on serpentine soils at Nicasio Ridge on the Cheda, McIsaac, and Zanardi Ranches (NPS 2001b). Trampling by livestock is a potential threat to individual Marin dwarf flax plants, although NPS did not list this activity as a threat to the species (NPS 2019h). Encroachment by larger plants and shrubs, including natives but especially non-native grasses and annual species, are likely the greatest threat. As such, grazing under alternative A could help Marin dwarf flax plants to grow by reducing taller competing plants and thatch buildup (NPS 2001b). The impact of livestock grazing on Marin dwarf flax was unknown at the time of its listing under the ESA (USFWS 1998), but the effect of livestock grazing on rare plant populations on serpentine soils is generally beneficial via decreased accumulation of nitrogen that promotes annual grass invasions (Weiss 1999; Beck et al. 2015). In 2002, after reviewing the status of Marin dwarf flax in the park and the potential effects of ranch activities and other cumulative effects, USFWS (2002a) determined that ranching in the park is "not likely to jeopardize" the continued existence of the species. Grazing under

alternative A would adhere to appropriate RDM standards recommended by Bartolome et al. (2015), which would limit the intensity of direct impacts on Marin dwarf flax from tramping or herbivory.

No published literature is available to determine whether grazing has a positive, negative, or neutral effect on Tiburon paintbrush at Nicasio Ridge. However, Tiburon paintbrush also grows on serpentine soils, so impacts are expected to be similar to those on Marin dwarf flax and generally beneficial. In 2002, after reviewing the status of Tiburon paintbrush in the park and the potential effects of ranch activities and other cumulative effects, USFWS (2002a) found that ranching in the park is "not likely to jeopardize" the continued existence of the species. Because alternative A would continue ranching in the planning area under similar conditions, its implementation would not likely have adverse impacts on Tiburon paintbrush.

Showy Indian clover was not addressed by NPS's previous consultation (2001b) with USFWS (2002a) for ranching in the planning area because it was extirpated from the park at that time. The listing rule for the species (62 FR 54791) suggests that grazing could have eliminated some historical locations. However, livestock grazing did not affect the one known natural population at Dillon Beach at the time of listing or at the time of the first five-year review (USFWS 2007). Gopher activity was a primary source of plant mortality, and other native herbivores (deer, rabbits, voles, snails, slugs, and insects) could have deleterious impacts on showy Indian clover plants (USFWS 2012). Between 2010 and 2015, showy Indian clover was reintroduced by seeding experimental plots on areas of D Ranch that are both grazed and ungrazed by cattle within the planning area. Future monitoring is needed to determine if this reintroduced will persist. Jeffery (2016) reports that a subset of reintroduction plots in the cattle-grazed area had the highest number of flowering heads, suggesting potential positive impacts of livestock grazing; however, more research is needed. Therefore, based on this limited information, it is not likely that continued ranching under alternative A would have adverse impacts on showy Indian clover in this location.

Over- or under-grazing may be detrimental to Sonoma alopecurus (USFWS 2010a, 2011). All known occurrences of Sonoma alopecurus in the park occur in the pastoral zone where cattle grazing has occurred since the 1830s. Today, this species competes with non-native annual grass and forb species (Parsons and Ryan 2019a). USFWS reported in the listing rule for Sonoma alopecurus in 1997 (62 FR 54791) that some grazing may be necessary for the species to survive in the face of competition from other plants. Substantial evidence suggests that grazing is important in maintaining habitat for this species, with two historic populations in the park extirpated shortly after grazing was removed (Gennet 2004). The adverse effects of grazing are associated with heavy, poorly managed livestock grazing, which can adversely affect plant growth and reproduction (Parsons and Ryan 2019a). However, these types of adverse impacts would generally be avoided under alternative A from continued adherence to appropriate RDM standards recommended by Bartolome et al. (2015). In 2002, after reviewing the status of Sonoma alopecurus in the park, the potential effects of ranch activities, and other cumulative effects, USFWS (2002a) determined that ranching in the park is "not likely to jeopardize" the continued existence of the variety of the species in the planning area. Ryan and Parsons (2014) completed a study to evaluate how Sonoma alopecurus responds to different grazing regimes and to the elimination of grazing. They found that seasonal grazing may be the optimal grazing strategy to maintain and enhance Sonoma alopecurus populations, and subsequently NPS constructed a seasonal grazing exclusion at the Abbotts Lagoon population (Ryan and Parsons 2015). NPS is also working with ranchers to conduct seasonal grazing for another population in the planning area. Because alternative A would continue to reduce competition with other wetland plants and NPS would manage the timing and intensity of grazing, its implementation would result in beneficial impacts that would allow Sonoma alopecurus populations to persist or increase.

Sonoma spineflower appears to be unpalatable to cows, and herbivory has rarely been observed during monitoring. Livestock herbivory on other plants reduces competition, providing for increased Sonoma spineflower reproduction, survival, and population size (Davis and Sherman 1992; USFWS 1998, 2010a). Insufficient grazing or no grazing in the spring may allow non-native or native species to outcompete spineflower for resources or reduce spineflower numbers indirectly through shading (Parsons and Ryan 2019b). Sonoma spineflower appears to be adapted to a moderate grazing regime; therefore, damage caused by livestock trampling is outweighed by the benefits of grazing (Davis and Sherman 1992). The original extant population of Sonoma spineflower in the planning area (when listed) is on Sirdrak soil, in a pasture that has been grazed for more than a century (57 FR 27848). Almost all of the introductions attempted by the NPS have occurred in areas subject to grazing because grazing appears to be important to the continued persistence and long-term viability of this species. At the time of listing, NPS had excluded most of this population from grazing, and although plants in the exclosure grew taller than unprotected plants, the overall effect of cattle grazing on Sonoma spineflower was unknown (NPS 2001b). In 2002, after reviewing the status of Sonoma spineflower in the park and the potential effects of ranch activities, and other cumulative effects, USFWS (2002a) determined that ranching in the park is "not likely to jeopardize" the continued existence of the species. Because ranching would continue under alternative A, and NPS would manage the timing and intensity of grazing, its implementation would not have adverse impacts on Sonoma spineflower.

Although cattle grazing has been associated with the extirpation of Tidestrom's lupine elsewhere in Marin County, the recovery plan for the species did not cite grazing as a primary threat (USFWS 1998). Approximately 15% of Tidestrom's lupine occurrences are on coastal dunes within grazed pastures on the F Ranch where cattle could continue to directly affect plants through trampling and indirectly affect them via increasing suitable conditions for weeds associated with grazing disturbance. Because of the invasion of non-native European beachgrass and iceplant and associated indirect seed predation by deer mice (*Peromyscus maniculatus*), a recently completed population viability analysis showed most of the park's Tidestrom's lupine populations are headed toward extinction (Dangremond, Pardini, and Knight 2010). During this study, researchers noted impacts on some populations from trampling by cattle and suggested that it was the cause of some plants going from a reproductive to non-reproductive state. However, because most of the population of this species is either outside the planning area or inside exclusion areas, the lupine's population decline is mainly a result of non-native plant invasion and mice (Dangremond, Pardini, and Knight 2010). While adverse impacts from ranching would continue under alternative A, the largest population, located southwest of Abbotts Lagoon, is stable with more than 200,000 plants and is excluded from grazing areas (Parsons 2018). In 2002, after reviewing the status of Tidestrom's lupine in the park, the potential effects of ranch activities, and other cumulative effects, USFWS (2002a) determined that ranching in the park is "not likely to jeopardize" the continued existence of the species. Under alternative A, cattle trampling could affect a small number of known Tidestrom's lupine occurrences within grazed pastures on F Ranch. Also, although cattle would continue to be excluded from coastal dunes, they infrequently breach pasture fences and could trample beach layia (NPS, Parsons, pers. comm. 2019b).

Elk Management

Management of the elk populations would result in limited damage to vegetation in the vicinity of Drakes Beach and Limantour herds caused by trampling and vehicle use from hazing activities. These impacts would occur on a regular basis and would be highly localized.

Cumulative Impacts

NPS would continue coastal dune restoration in the park to eliminate non-native European beachgrass and iceplant, resulting in long-term, beneficial impacts on coastal dunes. Dune restoration projects would have long-term benefits on beach layia and Tidestrom's lupine by eliminating the primary threat to the recovery of both endangered plants and allowing their populations and other state- and CNPS-listed rare plant species to expand.

The ongoing Lagunitas Creek salmonid habitat restoration projects would have temporary, adverse impacts on riparian vegetation during construction activities. Access routes through the riparian ecosystem could degrade habitat. However, mitigation measures would be implemented to reduce adverse impacts. These projects would have long-term, beneficial impacts on riparian vegetation from the restoration of riparian habitat.

The fire management program for Point Reyes and for the north district of Golden Gate and the new NPS agreement with Marin County for wildland fire operations and response would include prescribed fire and mechanical treatments. Both techniques would remove vegetation. The short-term, adverse impacts from mechanical treatments and prescribed fire would be minimized through guidance and mitigation measures provided in the plan.

Cultural resource preservation maintenance projects would temporarily adversely affect vegetation during construction, but they would have no long-term impacts on vegetation.

The FHWA road improvement project could introduce weeds and pathogens such as *Phytophthora* along a road that crosses through much of the planning area. Weeds use disturbance to propagate and spread, and road corridors are a major source of disturbance. The project would disturb soils and native habitats along the road corridor and could introduce new weeds or increase the abundance of established weeds through unclean equipment, vehicles, tools, and boots of construction workers, and bringing in soils or gravels that could be contaminated. *Phytophthora* and other pathogens, once introduced, can spread underground and affect native habitats. NPS has worked with FHWA to develop mitigation measures to reduce the spread of invasive species, but complete avoidance may be impossible because of the large amount of ground disturbance, resulting in long-term, adverse impacts.

PG&E fire prevention projects would remove vegetation to reduce fire hazards. Coordination with park staff during PG&E fire prevention activities, including tree removal, would avoid or minimize adverse impacts on vegetation. However, in some cases, ground disturbance due to regular access along PG&E corridors could contribute to the spread of invasive plants. Overall, fire management would reduce fuel load and help prevent large, intense fires on the landscape, benefiting vegetation (Fites-Kaufman et al. 2006).

The NPS Inventory and Monitoring program surveys roads and trails in the planning area for invasive plants, eradicates small new infestations, and develops annual priority lists by park (NPS 2018a). The control of invasive plants by NPS includes mechanical and chemical methods within an IPM framework. Control methods could damage non-target vegetation, with short-term, adverse impacts, but compliance with NPS IPM regulations and procedures and the use of appropriate herbicide application methods would minimize adverse impacts. In the long term, early detection and elimination of new invasive species and the control of existing invasive plant populations would maintain or benefit native plants and vegetation communities, including federally listed plants.

The Marin RCD Grant Program provides a multi-agency team to coordinate expertise and funding to implement conservation projects on lands throughout Marin County. This grant program benefits vegetation by promoting projects that provide environmental benefits through increased plant vigor and community diversity. Many of the projects focus on enhancement of riparian areas. Marin RCD's services would continue to bring together private landowners with state, federal, and local agencies to benefit vegetation by assisting with livestock management around sensitive natural plant communities or in areas with special-status plants.

Overall, these past, present, and reasonably foreseeable future actions have and would continue to have both beneficial and adverse cumulative impacts, with the road improvement project having the potential to contribute the largest portion of adverse impacts. Alternative A would contribute beneficial and adverse impacts on vegetation from continued grazing and ranching activities. Alternative A would contribute beneficial impacts through Vegetation Management activities by controlling invasive vegetation and planting native species. Grazing would control non-native annual grasses and reduce

biomass that competes with the native perennial grass and annual plants for establishment and would help prevent brush from invading and taking over grasslands. Grazing could also help reduce competition from other invasive species and reduce the height of taller vegetation that crowd out rare plants such as Marin dwarf flax, Sonoma alopecurus, and Sonoma spineflower.

Alternative A could contribute negative impacts through Manure and Nutrient Management activities, changing the nutrient content of soils and favoring non-native invasive species. Prolonged grazing in riparian areas could change their structure and composition. Vegetation would continue to be disturbed or removed in high-intensity-use areas and managed for Forage Production with non-native species on up to 1,000 acres. When the incremental impacts from alternative A are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on vegetation would remain adverse to some species and beneficial to others, depending on a number of factors. The incremental impacts of alternative A would continue to contribute a majority of the overall cumulative impacts on vegetation in the planning area.

Alternative B

Under alternative B, ranching activities in the planning area would be managed by a new zoning framework that would only authorize higher intensity activities, including Manure and Nutrient Management and diversification in areas without sensitive resources in the Pasture subzone. Activities besides grazing in the Range subzone would be limited to site-specific treatments to improve resource condition. Tables 15 and 16 list the percentage of each vegetation type in the planning area based on park GIS data derived from the analysis described in Schirokauer et al. (2003), including how much of each type is located in the three subzones where ranching activities would be authorized and the two zones where ranching activities would be excluded (Resource Protection subzone and Scenic Landscape zone).

Public Use and Enjoyment

Expansion of the trail network would result in limited adverse impacts on vegetation. While existing administrative roads would be used as much as possible, limited vegetation clearing would occur. Visitor use of new trails could result in higher probability of inadvertent introduction of non-native and invasive plants and plant pathogens (Pickering et a. 2010). New trails would be added to the NPS Inventory and Monitoring program for early detection surveys that would help detect invasive plant introductions and impacts on vegetation. The impacts of visitor use on these new trails would likely be small in comparison to current impacts of ranching and overall visitor activities because visitor use levels are not expected to change under alternative B.

Ranch Operations

Under alternative B, impacts from grazing would be roughly the same as described under alternative A. However, the implementation of the zoning framework would ensure that more intense land uses would occur in areas without sensitive resources throughout the planning area. As part of the zoning framework, approximately 1,200 acres would be added to existing exclusions and protected as part of the 2,000-acre Resource Protection subzone, resulting in long-term, beneficial impacts on vegetation in those locations due to the exclusion of ranching activities. Further, more intensive management activities would be limited to the approximately 9,000-acre pasture subzone, with activities limited to grazing and site-specific treatment within the approximately 16,900-acre Range subzone. In addition to the zoning framework, NPS would require ranchers to adhere to Practice Standards and mitigation measures for standard Management Activities, as detailed in appendix F, tables F-11 through F-13, for all ranching activities discussed in the subsections below, which are expected to reduce overall impacts on vegetation.

Grazing. Impacts on vegetation from beef and dairy cattle ranching operations would be similar to those described for alternative A. However, the inclusion of 1,200 acres in the Resource Protection subzone would have beneficial impacts on riparian vegetation and other sensitive vegetation types (such as wetlands and coastal dunes) compared to existing conditions because these areas would no longer be

negatively affected by grazing. Impacts on vegetation in these areas would continue, consistent with existing conditions, until fencing is installed. Beneficial effects of grazing activities, such as slowing coastal scrub encroachment into grassland, reducing abundance of some perennial grass weeds, reducing the biomass of highly competitive non-native annual grasses and forbs, and removing vegetative fuel, would continue under alternative B. In the Range subzone, livestock grazing would continue to be the predominant authorized activity and effects on vegetation are not expected to change compared to existing conditions.

Ranch Infrastructure and Water Control Management. Impacts from Ranch Infrastructure and Water Control Management activities would be similar to those described under alternative A but would occur on a more frequent basis and would be required to incorporate Practice Standards and mitigation measures (see assumptions at the beginning of chapter 4). The specific size limitations for each Ranch Infrastructure and Water Control Management project are provided in tables F-2 through F-9 in appendix F.

Overall, Ranch Infrastructure and Water Control Management Activities would be designed to minimize impacts on vegetation. Implementation of projects consistent with the Practice Standards and mitigation measures included in appendix F, table F-11, would reduce impacts on vegetation compared to existing conditions and, although adverse, impacts would be short term and limited in area.

Vegetation Management. Vegetation Management activities would be permitted primarily in the Pasture and Ranch Core subzones and in the Range subzone only to improve resource conditions. The Ranch Core is highly developed and contains mostly Other habitat (66%); the Pasture subzone is predominantly annual grassland (54%), agricultural pastureland (29%), and coastal scrub (11%). As described in chapter 3, *agricultural pastureland* is an agricultural vegetation type (Schirokauer et al. 2003; Pawley and Lay 2013), comprising naturalized non-native species, including seeded grass and legume forage species. Vegetation Management would predominantly affect annual grasslands, agricultural pastureland, and coastal scrub, which make up approximately 94% of the Pasture subzone, except where implemented to improve resource conditions, such as native vegetation planting in riparian areas. In the Pasture subzone, open coastal scrub with a grassland component would decline with mowing, and seeding would change vegetation composition, but these areas would remain dominated by non-native species, similar to existing conditions.

Mowing activities would continue to focus on reducing undesirable weed species and maintaining grassland communities. Undesirable changes in site-specific plant species composition related to short- or long-term effects of mowing could also occur but would be adaptively managed with the intent of moving toward desired conditions, as described in chapter 1. Mowing would be considered in up to 50% of the Pasture subzone in a given year to manage weeds and remove shrubs. The NRCA and other studies suggest that shrub encroachment and weed infestation could continue to increase without additional management actions (NPS 2019a; Skaer, Graydon, and Cushman 2013). Although coyote brush is a native species and coastal scrub is a native habitat type, in the absence of disturbance such as fire, grazing, or mowing, it encroaches into open grassland and reduces grassland habitat values. Mowing is expected to occur at recurring intervals to maintain conditions or until desired outcomes (e.g., weed suppression) are achieved. If invasive species are not mowed when they are phenologically vulnerable, their growth and reproduction can be encouraged (DiTomaso et al. 2013). Because mowing would primarily be permitted in the Pasture and Ranch Core subzones, both of which are predominantly agricultural areas with limited presence of native vegetation, the potential adverse impacts on native plants would be limited. Manual removal of invasive vegetation would also be considered, where appropriate, in areas where listed species are present. Impacts from IPM and Targeted Grazing would be the same as those described for alternative A. Alternative B would incorporate required Practice Standards and mitigation measures (table F-12, appendix F) that would reduce impacts from these activities compared to existing conditions. For example, to limit the spread of weeds, livestock that have

been in weed-infested areas would be held in "transitional pastures" for three or more days before being released into weed-free locations, including when being transferred into the planning area.

Other Management Activities. Manure and Nutrient Management, along with Forage Production would result in the same type of impacts as described for alternative A; however, these activities would be limited to the Pasture subzone and the intensity of these impacts would be reduced by implementation of the Practice Standards and mitigation measures provided in table F-13. Additionally, all activities would be required to meet all size and location requirements included in table F-10 and would only be authorized in the Pasture subzone.

Diversification. Under alternative B, the introduction of up to 50 sheep or 66 goats per authorized ranch into the Pasture and Ranch Core subzones would result in the potential for different forage consumption and landscape use (on up to approximately 7,310 acres). The Pasture subzone could become a more intensively managed landscape compared to existing conditions with the introduction of Vegetation Management and new livestock species. Cattle prefer to eat grass rather than forbs or shrubs, while sheep eat both grass and forbs and can eat shrubs, and goats eat shrubs, forbs, and grass and have a wide tolerance for plants that are toxic or too thorny/spiny for other ungulates (Larson, Barry, and Bush 2015). The addition of limited numbers of sheep and goats into the Pasture subzone could slightly increase the consumption of forbs, which could result in limited adverse impacts on the small number of native forbs in these subzones, depending on timing and duration of grazing (Masin, Nelson, and Valliant. 2018), although the limited AU of sheep and goats would reduce the potential for adverse impacts. While increased consumption of shrub species could help maintain grasslands, at limited AU these impacts would be minimal. Potential adverse impacts would be limited as the Pasture and Ranch Core subzones contain little native vegetation.

Under alternative B, chickens would be permitted in the Pasture and Ranch Core subzones; the impacts of up to 500 chickens on as many as 18 ranches and their associated mobile huts would primarily affect the non-native agricultural vegetation that predominates in these subzones. As described in the "Soils" section, chicken manure is especially high in nutrients. Excessive quantities of nutrients can exceed the needs of plants, and, as noted above, high nutrient levels typically tilt the competitive advantage to non-native, weedy species (McKenzie 2003). A substantial increase in soil nutrients from chicken manure could increase biomass production but could have adverse impacts on any present native grassland plant species (e.g., Weiss 1999; Gea-Izquierdo et al. 2007). Limiting the number of chickens per ranch and requiring rotation of chickens on pasture are included as mitigation measures to disperse nutrient inputs on any single permitted operation.

Allowing up to 2.5 acres of crops in the Ranch Core subzone would have limited or no adverse impacts on native vegetation because crops would be located in previously disturbed areas and species that have the potential to escape or become invasive (e.g., fennel) would not be authorized. Impacts on vegetation from irrigated or non-irrigated crops are anticipated to be similar (irrigation would require additional review and compliance). Activities associated with farm stays and ranch tours (e.g., walking around facilities or in pastures or driving on ranch roads) would occur in developed areas and would not affect vegetation.

Requests for horse boarding operations and small-scale dairy and/or meat processing would require additional review and compliance. It is anticipated these activities, if authorized, would result in limited impacts on vegetation because of the highly disturbed nature and lack of native vegetation present in the Ranch Core subzone.

Non-Native and Invasive Plants. Ranching would continue to both adversely and beneficially affect the control of invasive plants, as described under alternative A. The implementation of additional mitigation measures, such as pressure washing vehicles prior to entering the park, would reduce the potential for the spread of invasive species. These required measures, which are detailed in appendix F, Tables F-11 through F-14, would reduce the potential for non-native and invasive plants to be introduced in the planning area and provide additional tools to reduce existing infestations.

Habitat-Specific Impacts

Wetlands. Under alternative B, livestock grazing levels would be similar to those described for alternative A. Establishment of the zoning framework and limitations to ranching activities within certain subzones would reduce potential impacts on wetland resources. The Scenic Landscape zone would include approximately 86 acres of wetland including 7 acres of ponds/lagoons. Within the Ranchland zone, the Resource Protection subzone would total 2,000 acres, adding 1,200 acres to the 800 acres of existing protection areas identified in alternative A. These additional 1,200 acres removed from grazing encompass more than 171 acres of wetlands, including nearly 1 acre of ponds from actively grazed areas. The remaining 81% of wetlands in the actively grazed lands are within the Range subzone where limited activities other than grazing by cattle would be authorized. By definition, the Pasture subzone does not include wetlands. Less than 1% of wetlands (5.2 acres) are known to occur in the Ranch Core subzone. Table 15 displays the percentage of wetlands in each subzone of the Ranchland zone as well as the Scenic Landscape zone. NPS would work with ranchers to limit potential impacts on wetlands in these specific areas by identifying and prioritizing Management Activities in the ROAs.

TABLE 15: PERCENTAGE OF WETLANDS IN EACH OF THE ZONES (ALTERNATIVE B)*

Resource Protection Subzone	Pasture Subzone	Ranch Core Subzone	Range Subzone	Scenic Landscape Zone
14%	0%	<1%	81%	4%

Sources: National Wetland Inventory data and field-verified mapping conducted by NPS

*Estimated percentages based on maps shown in figures 45 and 46 in appendix A.

Riparian Forest/Shrubland. Approximately 1% of the planning area (220 acres) is mapped as riparian forest/shrubland. Under alternative B, the zoning framework, including limitations to Management Activities in the Range subzone, would reduce potential impacts on riparian forest/shrubland areas by not authorizing intensive land uses in these locations. The Scenic Landscape zone would include 4 acres of riparian habitat where no grazing would be authorized. Within the Ranchland zone, an additional 22% of riparian forest/shrubland in the planning area (48 acres) would be added to existing exclusions resulting in more than 67 acres of riparian forest/shrubland habitat within the Resource Protection subzone. The Range subzone would include approximately 149 acres of riparian forest/shrubland, and the Ranch Core would include less than 1 acre. Riparian forest/shrubland in Range subzone would remain accessible to grazing unless limited by topography or dense vegetation. Ongoing implementation of Management Activities would also improve this vegetation community (e.g., exclusion Fencing, riparian vegetation planting). Table 16 displays the percentage of each habitat type in each zone and subzone.

Grasslands. Grasslands comprise approximately 60% of the planning area. Grazing would continue to occur at levels similar to those identified in alternative A, but the zoning framework would establish greater structure and protection to the overall grassland habitat. The Scenic Landscape zone would include approximately 2% of the grasslands in the planning area. In the Ranchland zone, grasslands would make up approximately half of the Range subzone and 86% of the Pasture subzone. Overall, the Resource Protection subzone would contain under 3% of total planning area grasslands. Of the 1,154 acres of coastal prairie mapped in the Ranchland zone, 695 acres would be located in the Range subzone, 315 acres would be in the Pasture subzone, and 144 acres would be in the Resource Protection subzone.

NPS would work with ranchers to limit Management Activities to those that would improve or maintain coastal prairie habitat. Under alternative B, ranching would result in ongoing use and maintenance of grasslands in Pasture and Range subzones. Diversification activities in the Pasture subzone would be conducted at a low density and within authorized AU allocations, which would not increase potential impacts over current levels.

Coastal Dunes. Coastal dunes make up only 2% of the planning area. Under alternative B, an additional 121 acres of dunes would be added to the Resource Protection subzone. Overall, more than 64% of the coastal dunes in the planning area would be in the Resource Protection subzone. Less than 3% (16 acres) of coastal dunes would be in the Pasture subzone with the rest located in the Range subzone (33%). NPS would continue to work with ranchers to ensure that boundary fencing along the native dune areas are maintained in a manner that keeps cattle in permitted areas. Diversification limited to the Pasture and Ranch Core subzones would have potential to impact only a very limited portion (16 acres) of the park and planning area dune system. Ranching under alternative B would continue to have limited impacts on coastal dunes.

Coastal Scrub. Coastal scrub makes up 18% of the planning area. Under alternative B, 3% of coastal scrub would be included in the Scenic Landscape zone. In the Ranchland zone approximately86% of the coastal scrub would fall within the Range (3,502 acres) or Pasture (1,028 acres) subzones. The Resource Protection subzone would contain approximately 11% (569 acres) of coastal scrub. Similar to alternative A, coastal scrub is not generally affected by livestock and management concerns would continue to be focused on the encroachment of coastal scrub into grasslands.

Under alternative B and following site review, NPS would authorize mechanical treatment (e.g., mowing) of shrubs in the Pasture subzone consistent with Practice Standards and mitigation measures (see appendix F), and would evaluate Mowing in the Range subzone on a case-by-case basis to reduce encroachment into grasslands and improve conditions for livestock and wildlife. These activities may result in short-term impacts on non-target vegetation but would maintain coastal grassland habitat in treated areas.

TABLE 16: PERCENTAGE OF EACH HABITAT TYPE UNDER THE ZONING FRAMEWORK (ALTERNATIVE B)*

Habitat Type	Resource Protection Subzone	Pasture Subzone	Ranch Core Subzone	Range Subzone	Scenic Landscape Zone
Riparian Forest/Shrubland	**30%**	**2%**	**<1%**	**65%**	**2%**
Grasslands	**3%**	**45%**	**<1%**	**50%**	**2%**
Coastal Prairie (Grassland)	12%	27%	0%	59%	2%
Annual Grassland	2%	38%	<1%	58%	2%
Agricultural Pasturelands	1%	79%	<1%	18%	1%
Coastal Dunes	**64%**	**3%**	**0%**	**33%**	**<1%**
Coastal Scrub	**11%**	**20%**	**<1%**	**66%**	**3%**

Sources: Based on park GIS data derived from analysis described in Schirokauer et al. (2003).

*Estimated percentages based on maps shown in figures 45 and 46 in appendix A.

Special-Status Plants. Impacts on special-status species under alternative B would be similar to those described under alternative A and could be both beneficial and adverse. The intensity of adverse impacts, however, would be reduced compared to existing conditions because the zoning framework would ensure that cattle grazing would be the only potential disturbance. The Pasture subzone, which authorizes more intensive activities, would not contain rare plants. Grazing would occur at the same level across the

planning area. For special-status species located in the additional 1,200 acres removed from grazing, impacts would be beneficial.

Federally Listed Plants. Under alternative B, the intensity of adverse impacts would be reduced compared to existing conditions because the zoning framework would ensure that cattle grazing would be the only potential disturbance, if any, to the seven federally listed plants. The types of beneficial impacts to Marin dwarf flax, showy Indian clover, Sonoma alopecurus, Sonoma spineflower, and Tiburon paintbrush would be the same as those described for alternative A, and management using ROAs would provide a more effective mechanism for adaptively manipulating the timing, intensity, and duration of grazing to further benefit these species. Overall, grazing levels would be managed, consistent with the requirement to maintain an average RDM of 1,200 pounds/acre at the end of the grazing season, creating favorable conditions for these species by reducing non-native annual grasses, preventing thatch accumulation, mechanically breaking down the litter, and reducing competition from other species. New Resource Protection subzone fencing on E and F Ranches would protect approximately 22% of known beach layia occurrences that are currently exposed to grazing under existing conditions. This would limit potential impacts of cattle trampling under alternative B to approximately 12% of all known beach layia occurrences, located on the B, C, E, and AT&T Ranches (NPS 2019h). The resource protection fencing on F ranch would protect all 15% of known Tidestrom's lupine occurrences in the planning area (15% of Tidestrom's lupine in the park) that are potentially impacted by grazing under existing conditions. Beach layia and Tidestrom's lupine occurrences in the Resource Protection subzone could still be adversely affected, if cattle breach fences and enter coastal dunes, although the potential impacts would be infrequent. The BA (appendix N) further details these potential impacts.

Elk Management

Management of the Drakes Beach herd would result in limited damage to vegetation in the vicinity of Drakes Beach caused by trampling and vehicle use in the fall during removal efforts as well as during hazing activities. These impacts would occur on an annual basis and would be highly localized.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would implement a zoning framework that would focus the most intense uses associated with ranching operations in areas that are already highly disturbed and/or altered; remove certain areas from ranching; and increase the ability to manage the timing, duration, and intensity of grazing to protect sensitive species and vegetation communities, resulting in beneficial impacts on vegetation compared to existing conditions, especially in riparian and wetland areas. Grazing would continue to reduce cover of non-native annual grasses and biomass that competes with or limits the establishment of native perennial grasses and annual forbs and help slow or prevent brush encroachment into grasslands. Alternative B could continue to contribute negative impacts through Manure and Nutrient Management activities, changing the nutrient content of soils to favor non-native invasive species. Vegetation would continue to be disturbed or removed in high-intensity-use areas and managed for Forage Production with non-native species on up to 1,000 acres. Impacts from these activities as well as opportunities for diversification would be reduced through required Practice Standards and mitigation measures. Expanding development for public use and elk management activities would cause localized adverse impacts in limited areas. When the incremental impacts from alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on vegetation would be adverse for some species and beneficial for others, as described above. The incremental impacts of alternative B would contribute a majority of the overall cumulative impacts.

Alternative C

Impacts from ranch operations and visitor use and enjoyment under alternative C would be the same as those described for alternative B.

Actions to remove the Drakes Beach herd would have a direct, short-term impact on vegetation in the general location of the herd from the several months of removal activities, including trampling and vehicle use, but the type impacts on vegetation would not be considerably different than those described for alternative B; however, these impacts would be more intense during the several months of removal efforts and would then cease.

Adverse impacts under alternative C resulting from removal of the elk herd's contribution to grazing impacts, primarily in the coastal grassland, could include small increases in plant biomass, a possible reduction in native annual forbs and California oatgrass cover, increases in invasive species, especially velvetgrass, and encroachment of coastal scrub species such coyote brush (Johnson and Cushman 2007; Ender et al. 2017). Potential beneficial impacts from removal of the elk herd include a possible small increase in native perennial forbs (Johnson and Cushman 2007).

Federally Listed Plants. Under alternative C, the removal of the Drakes Beach herd would not affect beach layia, Marin dwarf flax, Sonoma alopecurus, Sonoma spineflower, Tiburon paintbrush, or Tidestrom's lupine because these species are not known to occur on lands used by the Drakes Beach herd. Impacts on these plants would be the same as those described for alternative B. The single reintroduced population of showy Indian clover occurs on lands used by the Drakes Beach herd on D Ranch. The elimination of elk grazing could affect showy Indian clover to some extent because the plant may benefit from grazing via disturbance and reduced competition from non-native plants (Jeffery 2016). If future monitoring of reintroduced showy Indian clover in areas not grazed by cattle or elk indicates that a lack of grazing is negatively affecting the species, NPS could use Targeted Grazing to benefit the species.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. The incremental impacts of alternative C would be the same as those described for alternative B, but the additional ground disturbance from the removal of the Drakes Beach herd could contribute short-term impacts on vegetation from trampling in the vicinity of the herd during removal activities. When the incremental impacts from alternative C are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on vegetation would be adverse for some species and beneficial for others, as described above. The incremental impacts of alternative C would contribute a majority of the overall cumulative impacts.

Alternative D

Under alternative D, ranching activities would cease on 7,500 acres and approximately 27% of the planning area would be incorporated into the Scenic Landscape Zone. Beef and dairy cattle would continue to graze the remaining area as described in alternative B. Alternative D would add 900 acres of resource protection areas for a total of 1,400 acres in the Resource Protection subzone. Impacts from public use and enjoyment, elk management, and diversification activities would be the same as those described under alternative B. In the 19,000 acres where cattle would continue to graze, beneficial and adverse impacts would be the same as those described for alternative B.

Cessation of ranching activities would change vegetation composition in the 7,500 acres. Native annual forb abundance and species richness would likely decline as plant biomass and vegetation height increase and accumulate in the absence of livestock grazing (Hayes and Holl 2003; Skaer, Graydon, and Cushman 2013). Cover of the coastal prairie indicator species, California oatgrass, would also likely decline substantially (Hayes and Holl 2003, 2011). Some invasive species, especially velvetgrass, are likely to increase (Foin and Hektner 1986; Hayes and Holl 2003). Coastal scrub is likely to encroach into open grassland; complete conversion of coastal prairie to coyote brush-dominated coastal scrub could take place within 15 to 25 years (Ford and Hayes 2007), resulting in loss of grassland habitat and substantially increasing woody vegetative fuels and the probability of large, intense wildfires.

Targeted Grazing and an increase in mechanical and chemical control of shrubs and invasive plants could help to reduce the adverse impacts of removing cattle grazing on grassland species but NPS would only have the capacity to manage vegetation in high priority areas.

Habitat-Specific Impacts

The habitat within the 7,500 acres of ranches where grazing activities would cease would convert to the Scenic Landscape zone. The total percent of wetlands and habitat in the Scenic Landscape zone and Ranchland zone, including Resource Protection, Range, Pasture and Ranch Core subzones, is included in tables 17 and 18. Overall impacts on vegetation on the 19,000 acres of active ranches associated with ongoing ranch activities and diversification would continue as described in alternative B; however, the extent of the impacts would be reduced to a smaller portion of the planning area under alternative D. With the removal of grazing in the Scenic Landscape zone, increased plant biomass would accumulate, and increased shrub encroachment and other potential impacts to grasslands are anticipated over the long term. On the 7,500 acres where cattle grazing would no longer occur, NPS would prioritize and implement Targeted Grazing within some grassland areas and rare plant habitat to maintain disturbance regimes necessary to support the plant populations.

TABLE 17: PERCENTAGE OF WETLANDS IN EACH OF THE PROPOSED ZONES (ALTERNATIVE D)*

Resource Protection Subzone	Pasture Subzone	Ranch Core Subzone	Range Subzone	Scenic Landscape Zone
12%	0%	<1%	60%	28%

Source: NPS (2020c)

*Estimated percentages based on maps shown in figures 45 and 46 in appendix A.

TABLE 18: PERCENTAGE OF EACH HABITAT TYPE UNDER THE ZONING FRAMEWORK (ALTERNATIVE D)

Habitat Type	Resource Protection Subzone	Pasture Subzone	Ranch Core Subzone	Range Subzone	Scenic Landscape Zone
Riparian Forest/Shrubland	**26%**	**2%**	**<1%**	**48%**	**24%**
Grasslands	**2%**	**36%**	**<1%**	**33%**	**29%**
Coastal Prairie (Grassland)	11%	24%	0%	34%	31%
Annual Grassland	1%	27%	<1%	37%	35%
Agricultural Pasturelands	1%	76%	<1%	17%	5%
Coastal Dunes	**33%**	**3%**	**0%**	**18%**	**46%**
Coastal Scrub	**8%**	**14%**	**0%**	**45%**	**33%**

Sources: Based on park GIS data derived from analysis described in Schirokauer et al. (2003).

*Estimated percentages based on maps shown in figures 45 and 46 in appendix A.

Special-Status Plants. Impacts on special-status plants under alternative D would be similar to those described under alternative B. Those special-status plant species that benefit from cattle grazing (e.g., Mount Vision ceanothus) would suffer adverse impacts from the removal of livestock grazing across 7,500 acres as well as from the increase in fire hazard.

Federally Listed Plants. Under alternative D, the beneficial impacts of ranching on federally listed plants would be similar in type to those described for alternative A. Like alternative B, adverse impacts would be reduced by implementation of a zoning framework. The cessation of ranching on 7,500 acres of the planning area could negatively affect several species. Sonoma alopecurus and Sonoma spineflower could experience adverse impacts because both species benefit from moderate grazing, and populations on the AT&T ranch could decline due to a reduction in grazing. Removing grazing on the Cheda Ranch could negatively affect populations of Marin dwarf flax and potentially suitable habitat for Tiburon paintbrush. Both populations of rare plants in serpentine soils have been shown to benefit from moderate levels of grazing and soil disturbance by cattle. While these plants do not require grazing to persist, the lack of grazing on the Cheda Ranch portion of Nicasio Ridge could reduce plant vigor or reproduction because of competition with other plants. NPS could use Targeted Grazing to partially offset adverse impacts of eliminating grazing, but it would occur at a smaller scale than cattle grazing under existing conditions, with priority given to these listed species. On the other hand, the cessation of grazing on the AT&T and F Ranches under alternative D could have beneficial impacts on beach layia by eliminating the potential for cattle to trample plants within grazed pastures or breach pasture fences and trample plants within coastal dunes. The cessation of grazing on the F Ranch would eliminate the potential threat of cattle trampling on 15% of Tidestrom's lupine occurrences in areas under current lease/permit.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Depending on the species, alternative D would contribute both beneficial and adverse impacts from grazing and ranching activities, especially in grasslands on 19,000 acres where grazing would occur. Alternative D would implement a zoning framework that would focus the most intense ranching activities in areas that are already highly disturbed and/or altered; remove certain areas from ranching; and increase the ability to manage the timing, duration, and intensity of grazing to protect sensitive species and vegetation communities, resulting in beneficial impacts on vegetation compared to existing conditions, especially in riparian and wetland areas. Alternative D would also contribute meaningful beneficial and adverse impacts on vegetation, depending on the species, for the 7,500 acres removed from ranching because ranching-related activities would cease in those areas. Within these areas, vegetation would change, but removing cattle grazing may not result in overall beneficial impacts on vegetation compared to existing conditions because invasive annual and perennial species such as thistles and grasses may increase, native forb species abundance and richness would likely decrease, shrubs would encroach into areas currently characterized as coastal prairie, and invasive perennial grasses would likely increase. Expansion of the trail network for public use and elk management activities would cause localized adverse impacts in limited areas. When the incremental impacts from alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on vegetation would be adverse for some species and beneficial for others, as described above. The incremental impacts of alternative D would contribute most of the cumulative impacts.

Alternative E

With conversion of the six dairy ranches to beef cattle operations, smaller herds typical of the planning area's beef cattle operations would be dispersed across the Range and Pasture subzones, and general livestock grazing effects would be similar to those described for alternative B. Vegetation in the approximately 86 acres of high-intensity-use areas on former dairies would see appreciable beneficial impacts near developed areas on the former dairy ranches compared to existing conditions, although the increase in vegetation is likely to be predominantly non-native and potentially invasive. Some acres of high-intensity-use areas would occur on the converted ranches, but with an estimated reduction of roughly 75% from current conditions based on the acres distributed across other beef ranches. An increase in livestock use of the Range subzone may occur, depending on the size of an operation's beef cattle herd compared to the previous dairy operation's grazing regime, particularly the replacement heifer herd. The authorized AU would be consistent with maintaining RDM of 1,200 pounds/acre, so while the intensity of

grazing may increase slightly, overall impacts in the Range subzone would be the same type as described under alternative B.

Under alternative E, manure spreading would cease, reducing or eliminating influences on plant species composition (often in favor of weedy species) and increased biomass production associated with this activity, although certain conditions could persist for a period of time depending on soil condition. Benefits to native vegetation would be limited because manure spreading currently occurs in areas comprising predominantly non-native, seeded agricultural, or invasive species.

Similarly, while Forage Production would no longer occur on 1,000 acres of the planning area, benefits to native vegetation would be limited because plant species in these areas are also predominantly non-native and potentially invasive. In addition, eliminating Forage Production would be unlikely to result in notable increases in native vegetation without active management because of the abundant non-native species seedbank and associated disturbance resulting from many years of this activity.

Under alternative E, other livestock, including sheep, goats, or chickens would not be permitted, resulting in limited beneficial impacts to native vegetation given that the vegetation in the areas where these animals are allowed is primarily non-native.

Habitat-Specific Impacts

The proposed zoning framework and habitat-specific impacts under alternative E would be similar to those described under alternative B. The specific wetland and habitat types by zone would be the same as provided in table 15 and 16. With the elimination of Forage Production and the need for Manure and Nutrient Management, the majority of impacts that would differ from alternative B would be in the Pasture subzone. As described under alternative B, the Pasture subzone is dominated by grasslands and coastal scrub. Because livestock do not generally affect coastal scrub, management concerns would continue to be focused on the encroachment of coastal scrub into grasslands. On the six ranches where dairy operations could convert to beef ranching, grasslands are expected to experience a similar level of grazing with the potential for fewer high-intensity-use areas. Ranching would result in ongoing use and maintenance of grasslands in Pasture and Range subzones; however, cessation of Forage Production and manure spreading would reduce the acres classified as agricultural pastureland over time. Agricultural pastureland is anticipated to convert to annual grassland with the support of Vegetation Management activities such as Mowing.

Special-Status Plants. Impacts under alternative E would be the same as described under alternative B.

Federally Listed Plants. Under alternative E, the beneficial impacts of ranching on federally listed plants would be similar in type to those described for alternative A. Like alternative B, adverse impacts would largely be avoided due to the zoning framework that would only allow livestock grazing, and not high intensity uses, in the Range subzone where federally listed plants occur. The cessation of dairy ranching and conversion to beef operations on approximately 6,200 acres under alternative E could impact known occurrences of beach layia and Tidestrom's lupine. For beach layia, approximately 13% of known occurrences are found on the dairies (B and C Ranches), half of which would continue to be protected from cattle trampling by existing resource protection exclusion areas; thus, only about 5% of all known beach layia occurrences could be affected under alternative E. Also, although 21% of known Tidestrom's lupine occurrences are found on dairies (A and B Ranches), all are within existing resource protection exclusion areas that would continue to be in place under alternative E, so the only potential impact could occur if cattle breach pasture fences and loaf in coastal dunes.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative E would contribute beneficial and adverse impacts from continued grazing and ranching activities, depending on the species, especially in grasslands where grazing would occur. Alternative E would implement a zoning framework that would focus the most intense uses associated

with ranching operations in areas that are already highly disturbed and/or altered; remove certain areas from ranching; and increase the ability to manage the timing, duration, and intensity of grazing to protect sensitive species and vegetation communities, which would result in beneficial impacts on vegetation compared to existing conditions, especially in riparian and wetland areas. Manure spreading and Forage Production would also be removed, reducing potential impacts from these high intensity activities. In addition, the conversion of the six dairy operations to beef cattle operations would reduce the adverse impacts of concentrated livestock use and continue the same types of adverse and beneficial impacts from beef cattle grazing as described above. Expansion of the trail network for public use and elk management activities would cause localized adverse impacts in limited areas. When the impacts from alternative E are combined with the incremental impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on vegetation would be adverse on some species and beneficial on others, as described above. The incremental impacts of alternative E would contribute most of the cumulative impacts.

Alternative F

Public Use and Enjoyment

Under alternative F, NPS envisions providing more diverse recreational opportunities than those described for alternative B, including development of additional trail linkages and the potential for adaptive use of ranch complexes, including development to support day use and overnight accommodations linked by trails. Most of the hiking, biking, and equestrian route expansion would use existing administrative roads, so new route construction would be limited, similar to alternative B, but could affect a larger percentage of the planning area because of the removal of ranching from the park landscape. Day use and overnight accommodations in the planning area would focus on previously disturbed areas, such as former ranch complexes. Consequently, disturbance to vegetation is likely to be minimal because the expansion of recreational opportunities would result in little new construction. Impacts from expanded visitor opportunities would be similar to those described under alternative B but would increase in intensity across the entire planning area. Increased potential for the introduction and spread of invasive species is the most likely impact from these activities.

Ranch Operations

Impacts under alternative F would be similar to those described for the 7,500 acres where ranching would cease under alternative D, but these impacts would extend across 27,100 acres where ranching currently occurs. The entire planning area and all associated habitat types would be part of the Scenic Landscape zone. Alternative F would eliminate adverse impacts on vegetation from ranching activities across the entire planning area, including the estimated 150 acres of high-intensity-use areas, and some native plant species are likely to benefit from grazing removal. Currently unprotected riparian areas and those wetlands that are heavily grazed may also benefit from the removal of livestock grazing. The limited adverse impacts on coastal dunes from ranching operations would cease. Over the long term, however, the cessation of ranching may not result in overall beneficial impacts, especially in coastal prairie and annual grasslands, which constitute 48% of the planning area and more than 77% of grasslands in the park. Rates of shrub encroachment into grasslands, invasive perennial grasses, vegetative fuels (both herbaceous and woody), and the consequent risk of large, intense wildfires are all likely to increase, resulting in adverse impacts on vegetation.

As noted for alternative D, beneficial impacts of terminating ranching include a possible initial increase in abundance of native perennial forbs (Hayes and Holl 2003) and a reduction in bare ground and livestock fecal pats that can serve as weed germination sites. In addition, ranching operations would no longer be a pathway for the potential introduction and spread of invasive species. Cessation of other ranching activities such as livestock diversification and Forage Production would increase vegetative cover and biomass. As noted under alternative E, discontinuing manure spreading would eliminate increases in biomass production and influences on species composition; however, benefits to native vegetation would be limited because manure spreading currently occurs in areas comprising predominantly non-native,

seeded agricultural, or potentially invasive species. The non-native plants species dominating the areas where these activities occur and the high-intensity-use areas would likely experience the greatest increases. Removing livestock grazing may not substantially increase native grass and forb populations. In a study of livestock grazing removal in Sonoma County coastal prairie, Foin and Hektner (1986) conclude that even after more than a decade with no livestock grazing, native herbaceous perennials had not appreciably increased; rather, invasive perennial species, including velvetgrass, had come to dominate much of the study site. Skaer, Graydon, and Cushman (2013) also found that removing cattle grazing from a Monterey County coastal grassland for three years did not increase native species abundance or richness.

Likely adverse impacts of livestock removal and cessation of other ranching activities such as harvest mowing for Forage Production under alternative F include substantial increases in plant biomass and vegetation height (Skaer, Graydon, and Cushman 2013), which could increase the wildfire hazard due to the accumulation of vegetative fuel. Where coastal scrub encroaches into grassland in the absence of grazing, vegetative biomass can increase substantially. Russell and McBride (2003) reported that coyote brush-dominated shrublands in the San Francisco Bay Area had more than 12 times more biomass than grasslands, substantially increasing vegetative fuels and the probability of large, intense wildfires. An increase in fire frequency and intensity on the landscape could result in changes in vegetation (Fites-Kaufman et al. 2006). Without grazing, native annual forb abundance and species richness would likely decline (Hayes and Holl 2003), and the coastal prairie indicator species, California oatgrass, would also probably decline substantially (Hayes and Holl 2003, 2011). Some invasive species, especially velvetgrass, are likely to increase (Foin and Hektner 1986; Hayes and Holl 2003).

Limited management, including Targeted Grazing and Mowing to control weeds and maintain portions of the grassland communities and cultural landscape values could mitigate some adverse impacts of removing ranching operations. Targeted Grazing treatments often necessitate grazing intensity, animal distribution, and grazing periods different from standard, light- to moderate-intensity grazing associated with ranching. Targeted Grazing would only be used in small portions of the planning area and would not offset the removal of livestock grazing, likely resulting in long-term degradation and conversion of this plant community to shrub and tree-dominated types without large scale disturbance. NPS would identify restoration actions needed to maintain high priority habitat. Increased elk grazing would also partially offset adverse impacts on vegetation resources from the discontinuation of livestock grazing, but to a small degree.

Overall, alternative F would have both beneficial and adverse impacts on vegetation in the planning area. While Targeted Grazing could mitigate some adverse impacts on species and vegetation communities prioritized by NPS, it would not replace the effects of cattle grazing over the entire planning area.

Special-Status Plants. Cattle grazing or trampling would no longer have the potential to adversely affect special-status plant species, although increased wildfire and shrub encroachment into certain habitats may attenuate the benefits of livestock removal. Special-status plant species, such as Mount Vision ceanothus, that benefit from cattle grazing would suffer adverse impacts from the removal of livestock grazing and the increase in fire hazard.

Federally Listed Plants. The cessation of ranching would have adverse impacts on several federally threatened and endangered plants because grazing is the most effective tool for promoting their persistence. Specifically, Sonoma alopecurus could decline because livestock grazing is an important factor for maintaining its habitat through the reduction of competition with other plants (Gennet 2004). Cessation of livestock grazing could also result in adverse impacts on the Tiburon paintbrush and Marin dwarf flax on Nicasio Ridge. Likewise, Sonoma spineflower benefits from a moderate grazing regime and the absence of livestock grazing could adversely impact this species (Parsons and Ryan 2019b). Only a portion of the reintroduced population of showy Indian clover in the planning area is grazed by livestock, but preliminary monitoring data (Jeffery 2016) suggests that the cessation of grazing could have adverse impacts on the species. For federally listed plants that would be adversely affected by the cessation of

grazing, the park would use future monitoring data to evaluate the status of populations and develop restoration plans, as necessary. Targeted Grazing could be used to reduce the adverse impacts that would follow the removal of cattle grazing but would be small scale and would not fully mitigate the adverse impacts to the populations of these species in the planning area. Increased elk grazing could also partially offset adverse impacts to a small degree, but the extent of those effects is difficult to predict, and elk consume less than cattle. In contrast, beach layia and Tidestrom's lupine would likely benefit under alternative F because existing occurrences on relict dune features within grazed pastures would no longer be subject to trampling by cattle. Elk weigh less than cattle, so even in areas where elk population numbers increase, trampling would still be reduced compared to existing conditions.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Impacts under alternative F would be similar to those described for the 7,500 acres where ranching would cease under alternative D, but these impacts would extend across the entire planning area. In the planning area, vegetation would change, and removal of cattle grazing may not result in overall beneficial impacts on vegetation compared to existing conditions because invasive annual and perennial species, such as thistles and grasses may increase, native forb species abundance and richness would likely decrease, and shrubs would encroach into areas currently characterized as grassland. By removing grazing, this alternative would substantially alter a fundamental ecological disturbance process in grasslands across more than 75% of their total area of occurrence in the park. When the incremental impacts from alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on vegetation would be adverse for some species and beneficial for others, as described above. The incremental impacts of Alternative F would contribute most of the cumulative impacts.

WILDLIFE, INCLUDING FEDERALLY LISTED SPECIES

Methodology and Assumptions

The impact analysis for wildlife focuses on changes to the presence and distribution of animal species and their habitat from expected changes in ranch operations (e.g., grazing, pasture management, and diversification), and public use and enjoyment. Elk management activities are not expected to result in noticeable population impacts on other wildlife and are therefore not analyzed further within this section. The area of analysis includes the planning area and other park lands, including wilderness, potentially affected by the proposed activities. Direct and indirect impacts are qualitatively described in terms of the duration and relative intensity of an impact based on scientific research, expert knowledge, professional judgement, and communication with park staff. For impacts from ranch operations, the analysis considers Practice Standards and mitigation measures that would be implemented to minimize adverse impacts under each alternative. Impacts are also evaluated based on changes in Management Activities in each subzone (Range, Pasture, and Ranch Core) compared to existing conditions without this zoning framework.

Impacts on species and groups of species are analyzed at the population level unless otherwise noted. Changes in habitat types and land uses considered under the alternatives would be the main drivers of population growth or decline. Population declines for species or groups of species would not necessarily be an adverse impact. In many cases, population decline for a given species or group may facilitate population growth for another. These tradeoffs were considered in the context of overall impacts on wildlife.

Potential impacts on individuals and populations of special-status species are specifically evaluated. Impacts would depend on the relative sensitivities of individual species because not all species respond the same way to grazing and other ranching activities, or to changes associated with public use. For the purposes of this analysis, a moderate level of grazing is considered to be grazing that is consistent with the requirement to maintain an average RDM of 1,200 pounds/acre at the end of the grazing season. A

species' response is usually also habitat-specific, meaning that not only does each species respond differently to the same activity, but also that a single species may respond differently to the same activity in different vegetation associations or site conditions (Krausman et al. 2011). The overall impacts on a species are evaluated in comparison to its population status in the planning area, focusing on: (1) the alternative's impact(s) on individual animal behavior and the implications for their survival and reproduction; and (2) the alternative's impact(s) on the species' population and the implications on its distribution and abundance.

The impact analysis for federally listed species focuses on potential changes to the presence and distribution of threatened and endangered species and their habitat that could result from actions proposed in the GMP Amendment. Federally listed wildlife species that were carried forward for detailed analysis due to potential impacts include: (1) California red-legged frog, (2) western snowy plover, (3) California coastal Chinook salmon, (4) Central California coastal steelhead, (5) Central California coast coho salmon (6) California freshwater shrimp, and (7) Myrtle's silverspot butterfly.

Potential effects on habitat required by federally listed species are evaluated using maps of existing vegetation communities (i.e., grasslands, coastal dune, coastal scrub, riparian areas and wetlands, and forests and woodlands), in combination with predicted changes in ecosystem processes resulting from agricultural practices, elk management, and other actions proposed under each alternative. In addition to the effects of habitat disturbance, impacts on individual animals and populations of federally listed species are evaluated based on predicted changes in competition for resources on ranches and dairies, such as potential changes to inter-and intra-species interactions (e.g., predation, herbivory, and symbiosis).

Alternative A

Under alternative A, wildlife habitat would be subject to grazing at levels similar to existing conditions across 27,000 acres. Impacts on wildlife would continue to result from habitat modification, food web alterations, changes in nutrient cycling, and human disturbance. The grazing system, number of cattle, ranch management practices employed, and affected habitats would determine the intensity of impacts. Management Activities such as Forage Production would also continue to affect wildlife.

Mammals

Cattle grazing would continue to be subject to RDM standards. This moderate level of grazing on park ranches would maintain the existing extent and distribution of habitat types for native mammals. Variable patterns of cattle grazing (i.e., forage utilization) would also continue to promote habitat heterogeneity and species diversity (Payne and Bryant 1994; Vavra 2005). Continued cattle grazing under alternative A would maintain habitat for mammals that prefer relatively short vegetation structure, such as the black-tailed jackrabbit and deer mice. Because grazing supports the maintenance of grassland habitats, it would continue to limit the ability of tall and dense grasslands favored by species such as American badger and shrubland habitats favored by species like Columbian black-tailed deer to expand in the planning area. Germano, Rathbun, and Saslaw (2001) reported a general trend of greater abundance of small vertebrates with decreasing levels of RDM in arid grasslands in the San Joaquin Valley of California, suggesting that introduced grasses and forbs create impenetrable thickets for small mammals and that livestock grazing is the best tool for decreasing dense cover (i.e., thatch) created by non-native annual grasses.

Trampling and soil compaction by cattle could reduce habitat quality for other small to mid-size mammals, including the special-status American badger and Point Reyes jumping mouse (*Zapus trinotatus orarius*) (Collins 1998; Bylo, Koper, and Molloy 2014). In, and adjacent to, the 150 acres of high-intensity-use areas, the lack of vegetative cover resulting from concentrated livestock use would continue to result in loss of habitat for mammals. These areas make up less than 1 percent of the planning area, so no population-level impacts would occur for any mammals.

Many ranching activities may increase the spread of invasive plants (see previous discussion under "Vegetation"), which could reduce the quality and availability of wildlife habitat by outcompeting plants that provide important wildlife forage and altering habitat structure, especially around high-intensity-use areas. Continued range monitoring and application of RDM standards that limit bare ground, and treatment of invasive plant populations through the park's IPM program, would minimize the potential impacts of invasive plants. Vegetation Management activities such as Mowing to control invasive plants and planting native species could result in temporary impacts on wildlife in localized areas, but overall impacts would be beneficial in areas where these targeted activities improve habitat over the longer term.

Temporary disturbance to mammals would continue to result from livestock management activities that include herding, vehicular travel, and use of machinery and heavy equipment on rangelands, pastures, and the ranch complexes. In addition, visitor use on trails and elsewhere in the planning area would continue to temporarily disturb and displace some mammals (Gutzwiller 1995). Impacts on individual mammals would be temporary but could affect animal fitness or reproduction during periods when they are most vulnerable (i.e., during spring and summer breeding seasons) or the development of young, especially if multiple disturbances occur. Impacts from human activities on wildlife in the developed ranch complexes would be minimal because these activities would occur in relatively small areas of residential and agricultural buildings where wildlife habitat is limited, and the species found there are generally habituated or tolerant of disturbance. However, domestic cats around ranch complexes could injure or kill small mammals, an impact discussed further below under "Birds."

Stock ponds would continue to be maintained and provide water sources for mammals, including several special-status bats (i.e., the pallid bat [*Antrozous pallidus*], Townsend's big eared bat [*Corynorhinus townsendii*], and western red bat [*Lasiurus blossevillii*]). Continued grazing could increase invertebrate prey for bats; studies have reported bats preferentially foraging over cattle because flying insects are attracted to them (Ancillotto et al. 2017).

Entanglement and collisions with barbed-wire pasture fences could injure or kill mammals as maintenance activities continue and construction of new fences is authorized. Problem fences include ones that are too high to jump over, too low to crawl under, are difficult to see, or have wires that are loose or too close together (Paige 2012). Under alternative A, wildlife-friendly fencing would be encouraged but not required, and impacts from fences would be mitigated on a case-by-case basis. As a condition of existing grazing permits, ranchers would be required to remove and dispose of abandoned fences, as directed by NPS. Impacts from fencing in the planning area affect individual mammals and do not cause population level effects.

Ranchers in the park occasionally use Mowing, authorized by NPS on a case-by-case basis, to improve livestock forage. Mowing would have short-term impacts on small mammals by injuring or killing individual animals or destroying shrubland habitat in the mowed area. Mowing would only be authorized outside spring and summer breeding seasons. However, Mowing minimizes the encroachment of shrubs into grasslands and enhances habitat for grassland species.

Forage Production would continue to limit the availability of native habitat on approximately 1,000 acres. However, grasses, forbs, and grains grown on these fields would continue to provide feeding opportunities for Columbian black-tailed deer and numerous small mammals (NPS 1990b). Small mammals that use these fields could be injured or killed by harvest mowing. Following annual harvest mowing, mammal species' diversity and abundance in these areas could be reduced. These adverse impacts would not occur at a level affecting mammal population levels in the planning area. This impact is also discussed below under "Birds."

Continued ranching under alternative A could affect water quality in coastal waters from runoff of bacteria, nutrients, and sediments, as described under "Water Resources." Wildlife exposure risk to poor water quality and bacterial pathogens associated with park ranching operations could result in adverse impacts on wildlife, including marine mammals. However, infectious diseases and bacterial infections are

not known to be significant mortality factors affecting mammal populations in the planning area (Stoddard et al. 2008; Greig et al. 2014). Additionally, mitigation measures would continue to be implemented on a case-by-case basis to meet SWRCB regulations for waste management, further reducing the likelihood of impacts on marine mammals from bacteria loading in coastal waters. Although livestock may infrequently escape pasture fences onto beaches, direct impacts on marine mammals are unlikely to occur and have not been previously documented in the planning area. As noted above under "Water Resources," monitoring of water quality would continue in the planning area, and water quality is expected to continue to improve.

Johne's disease has been detected in tule elk in the planning area and could continue to spread from the park's tule elk population or from infected livestock to other wildlife populations including black-tailed deer. However, the potential for further spread of Johne's disease among wildlife communities is not likely to noticeably affect wildlife populations or community structure in the planning area. This conclusion is supported by the fact that the park's tule elk population has continued to thrive despite being infected with the disease (Manning et al. 2003). Similarly, the park's black- tailed deer population is stable despite the long-term presence of Johne's disease in the park. NPS currently monitors Johne's disease in the park's tule elk population and would continue to do so under alternative A.

Birds, Including Western Snowy Plover (Federally Threatened)

Western Snowy Plovers. The NPS would continue to implement snowy plover nest protection measures. If cattle were to escape pasture fences and trespass into snowy plover nesting areas on beach and coastal dunes, infrequent adverse impacts on nesting birds could occur as a result of nest trampling or flushing of adults. This type of impact has not been documented in the park. NPS would continue to require pasture fences to be inspected regularly and maintained to minimize the likelihood of cattle on beaches. Continued ranching would also affect western snowy plovers by supporting higher numbers of predatory species, especially common ravens that prey on plover eggs and chicks (Roth et al. 1999). Mowing for Forage Production on approximately 1,000 acres supports increased numbers of ravens by inadvertently killing birds and small mammals that provide carrion for ravens to feed on (Roth et al. 1999). Under alternative A, ranch activities would continue to support increased raven numbers, especially around dairies where ravens may feed on grain provided to cattle (Kelly, Etienne, and Roth 2002). USFWS (2002a) found that because of the indirect impacts associated with increased raven numbers, renewal of permits for ranches in the planning area "may affect, is likely to adversely affect" the western snowy plover. In coordination with NPS, ranchers would continue to take actions to reduce feeding opportunities for ravens at ranches and dairies, such as covering feed troughs, cleaning up waste grain around troughs, removing and placing troughs in enclosed structures, and storing harvested crops in enclosed structures. Despite mitigation measures that would reduce raven numbers, alternative A could contribute indirectly to their predation on western snowy plovers, potentially causing population declines because of the small size of western snowy plover populations.

Other Birds. Livestock grazing in California grasslands maintains habitat values for numerous grassland birds by creating and maintaining a heterogeneous structure and increased native plant diversity in grasslands dominated by non-native annual grasses (Derner et al. 2009; Bartolome et al. 2014; Gennet et al. 2017). DiGaudio, Humple, and Gardali (2015) found that grazed areas in coastal grasslands support more grassland bird species than similar ungrazed areas. Habitat for grassland birds would be maintained as a result of continued livestock grazing via a reduction of shrubs, reduced accumulation of thatch from previous year's herbage, and existing bare ground (DiGaudio 2010). Grazed pastures are important to many species that prefer short vegetation, such as California horned lark (Bylo, Koper, and Molloy 2014), and serve as foraging and roosting sites for shorebirds and waterfowl when winter high tides inundate tidal flat foraging areas (Hickey et al. 2003). Some species found in taller grasslands in the planning area—savannah sparrow, western meadowlark, grasshopper sparrow, and red-winged blackbird (*Agelaius phoeniceus*)—would also respond positively to moderate levels of cattle grazing in these locations (Bock et al. 1993). Vegetation grazing in agricultural fields to less than 15 centimeters could improve foraging

habitat for tricolored blackbirds (Tricolored Blackbird Working Group 2007). Continued grazing under alternative A would also maintain habitat for several raptors, including burrowing owls and ferruginous hawks that generally respond positively to grazing as a result of increased habitat availability due to short, grazed vegetation, or increased prey such as deer mice (Dechant et al. 2002). White-tailed kites (*Elanus leucurus*), however, are usually found in ungrazed portions of grasslands (HSU Wildlife 2004), presumably because their preferred prey of California meadow voles is usually more abundant in dense, taller vegetation characteristic of ungrazed or lightly grazed areas (Fehmi and Bartolome 2002). As discussed for mammals, the introduction of invasive plant species through ranching activities could reduce available bird habitat.

Nests of grasshopper sparrow, northern harrier, and other ground-nesting birds would be susceptible to livestock trampling under alternative A (Jensen, Rollins, and Gillen 1990; Paine et al. 1996; Sharps et al. 2017). Cattle grazing in rangelands could affect species that prefer riparian areas, including the special-status yellow warbler (*Setophaga petechia*), olive-sided flycatcher (*Contopus cooperi*), and saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*) (Holmes et al. 1999). However, the potential for this type of impact is reduced due to the presence of fencing that prohibits grazing along most perennial streams in the planning area, as discussed below under "Fish." Also, cattle grazing in shrublands areas would continue to reduce habitat availability for many shrub-associated bird species (Holmes et al. 1999). As discussed above in the "Mammals" section, collisions with barbed wire fences could occasionally injure or kill birds, especially young-of-the-year migratory waterfowl and raptors (Allen and Ramirez 1990). Lastly, domestic cats would continue to be present around ranch complexes. Domestic cats injure or kill numerous birds, and this would be detrimental to species with small population sizes or limited ranges.

To protect nesting birds, ranch projects that affect nesting habitat during the bird nesting season are not permitted between March 15 and July 31. Some projects with minimal impact, such as vegetation removal, could be approved if nesting bird surveys are conducted in advance and no nests are found. Mowing thistle, however, is allowed during the nesting season but is targeted to avoid noticeable impacts on ground-nesting birds. This activity could result in localized reductions of nesting habitat for ground-nesting birds because birds may not nest on earlycut fields (Diemer and Nocera 2016).

Alternative A would maintain food resources for numerous birds that feed on exposed invertebrates and waste seeds from the continued harvest mowing of forage crops (Peach et al. 2011; DiGaudio, Humple, and Gardali 2015). Forage Production activities could inadvertently kill nesting birds and their young via harvest mowing and eliminate cover for birds that become seasonally dependent on the food and cover provided by forage fields. DiGaudio, Humple, and Gardali (2015, 2016) measured a decrease after mowing to both the number of breeding bird species detected and the relative abundance of the northern harrier, savannah sparrow, grasshopper sparrow, song sparrow, and red-winged blackbird. However, under existing conditions, Forage Production fields provide better nesting habitat than pastures for some species and many birds may be able to fledge a nest before silage is cut.

Ongoing dairy ranching activities would continue to promote an unnatural abundance of corvids (Roth et al. 1999), European starlings (Medhanie et al. 2015), and brown-headed cowbirds (Morrison et al. 1997) that compete with, prey upon, or parasitize nests of native birds, resulting in continued impacts to individual birds but not likely affecting overall populations over the long term.

Fish, Including Coho Salmon (Federally Endangered), Steelhead (Federally Threatened), and Chinook Salmon (Federally Threatened)

Salmon and Steelhead. Continued ranching under alternative A could affect aquatic habitat used by coho salmon, steelhead, and Chinook salmon from soil erosion and sediment and pollutants transported in stormwater runoff from grazed rangelands, pastures, and ranch complexes. Sediment inputs into streams could affect potential salmon and steelhead habitat by reducing pool depths, increasing gravel embeddedness, and creating wider, shallower stream channels. Sediment-laden runoff could indirectly

affect fish via reduced foraging and potential gill clogging (Berg and Northcote 1985; Newcombe 1994). However, cattle are excluded from direct access to Lagunitas and Olema Creeks, the two most significant streams occupied by coho salmon, steelhead, and Chinook salmon in the planning area. Cattle would only directly affect habitat for salmon and steelhead on occasion if they were to breach pasture fences into excluded riparian areas.

Dairy ranching and associated ranch Management Activities like Forage Production and Manure and Nutrient Management would not occur in any watersheds that support salmon. In the Drakes Estero watershed, where steelhead could occur downstream in Schooner and Creamery Bays, Forage Production would continue to be authorized on approximately 190 acres on the G Ranch, and manure spreading could occur on approximately 115 acres on the E Ranch.

Over the past two decades, NPS has implemented 170 activities to improve resource conditions. As described under "Water Resources," NPS has monitored turbidity and fecal coliform concentrations in the Olema Creek watershed for the past few decades and, where cattle exclusion and other conservation practices have been implemented, there have been significant reductions (Lewis et al. 2019; Appendix L). Under alternative A, aquatic habitat quality is expected to continue to improve from the continued implementation of Management Activities such as reducing cattle numbers, moving boundary fences, using exclusion fencing, relocating water sources away from riparian areas, repairing and removing culverts, and decommissioning or moving roads (see figure 4 in appendix A) on a case-by-case basis. Impacts from stormwater runoff would be avoided or minimized through continued application of the RDM standard and implementation of Management Activities that improve water quality (e.g., Infrastructure Improvements) on a case-by-case basis. Impacts on water quality are described in more detail above in the "Water Resources" section.

NPS consulted with NMFS prior to the previous renewal of lease/permits in the planning area, and NMFS (2004) concluded that ongoing ranching activities would "not likely jeopardize" the continued existence of coho salmon, steelhead, and Chinook salmon and would not likely "destroy or adversely modify" coho salmon critical habitat. Although the impacts on coho salmon, steelhead, and Chinook salmon described above would generally continue under alternative A, NPS, partners, and ranchers would continue to identify and implement mitigation measures on a case-by-case basis to reduce impacts on water quality and fish habitat.

Although most populations of coho salmon, steelhead, and Chinook salmon are declining throughout the region, populations found in the planning area are stable or increasing. Most streams potentially used by salmonids in the planning area are excluded from grazing, and a recent study indicates that several BMPs (e.g., Fencing and Manure and Nutrient Management) implemented on dairy and beef operations have improved water quality when compared to levels before 2007 (appendix L). Like existing conditions, adverse impacts from ranching would generally be minimized or avoided. Other factors influencing salmonid populations, such as ocean conditions, would have a greater population-level impacts than those in the planning area.

Other Fish. Continued ranching under alternative A could affect other fish indirectly via sediment and pollutants transported in stormwater runoff from grazed rangelands, pastures, and ranch complexes, as described above for salmon and steelhead (also see "Water Resources" section). However, impacts on fish would be mostly avoided or minimized via mitigation measures on a case-by-case basis where applicable to authorized activities. Cattle grazing in riparian areas, which would only occur along a small portion of perennial streams under alternative A, could reduce riparian vegetation that provides important cover and shade for fish and habitat for invertebrate prey. In localized areas, reduced plant cover could cause elevated water temperatures to a level unsuitable for native fishes because warmer water holds less dissolved oxygen (Belsky, Matzke, and Uselman 1999). Other ranch activities that could indirectly affect fish include Manure and Nutrient Management and other ground disturbance from ranch activities. Manure spreading, mostly associated with dairy operations, would occur on approximately 2,500 acres with spreading occurring on a portion of this acreage annually. Little if any manure spreading would

occur in the Tomales Bay watershed. In proximity to pastures where manure could be spread, potential runoff of nutrients could cause long-term, adverse impacts on aquatic wildlife; however, manure application would continue to only occur during dry conditions to minimize erosion and runoff potential. Ranch operations in the Tomales Bay watershed would remain subject to meeting San Francisco Bay RWQCB Waste Discharge Requirements and Conditional Waivers, limiting impacts from nutrient runoff, as described under "Water Resources."

Reptiles and Amphibians, Including California Red-legged Frog (Federally Threatened)

California Red-Legged Frogs. Cattle grazing under alternative A would continue in California red legged frog habitat, causing both adverse and beneficial impacts. Grazing would impact habitat via removal of emergent aquatic vegetation important for cover and anchoring egg masses or via trampling of individuals or eggs (USFWS 2002b). Cattle grazing could also reduce habitat for invertebrates that provide prey to juveniles and adults. Bank trampling by cattle could cause sedimentation and thereby decrease the pond depth of approximately 120 ponds that have the potential to support California red-legged frog breeding, but NPS would continue to authorize the removal of sediment via Pond Restoration on a case-by-case basis. Adult California red-legged frogs can move miles from breeding habitat into upland areas, and the most suitable breeding ponds dry out during late summer or fall. California red-legged frogs sheltering in upland locations would be at risk from livestock trampling or habitat alteration throughout most of the planning area. Lastly, nutrient inputs from cattle manure could affect the primary productivity of ponds and streams and affect California red-legged frogs (USFWS 2002b). However, continued grazing would help maintain open-water habitat and allow for increased sunlight necessary for frog basking and the growth of algae, the primary food for tadpoles. Grazing would also help maintain habitat suitability by preventing emergent vegetation such as cattails or bulrushes from becoming dominant or by limiting the growth of dense annual grasses around ponds, which reduce both the amount of open water habitat and the duration of pool inundation (USFWS 2002b; Huntsinger, Bartolome, and D'Antonio 2007). Despite potential adverse impacts, there are no known population declines due to ranching in the park, and USFWS (2002a) reported that grazing in the planning area is generally "compatible with sustaining California red-legged frog populations and habitat suitability." Thus, USFWS (2002a) concluded during previous consultation that the renewal of grazing lease/permits in the planning area "may affect, is likely to adversely affect" the California red-legged frog and was "not likely to jeopardize" the continued existence of the species. Although USFWS (2002a) also found that continued grazing could disturb critical breeding habitat in some stock ponds, USFWS determined that those effects would be temporary and short term and that renewal of lease/permits would "not likely destroy or adversely modify" designated California red-legged frog critical habitat in the planning area. Habitat conditions for California red-legged frog have not noticeably changed since 2002. Therefore, continued ranching under alternative A would result in similar adverse impacts on individual California red-legged frogs but would be unlikely to cause any population declines or adversely modify critical habitat.

Other Reptiles and Amphibians. Under alternative A, ranchers would continue to maintain approximately 120 stock ponds in the planning area that provide essential breeding habitat for several amphibians, including the special-status coast range newt (*Taricha torosa*). Impacts on other amphibians from cattle use of these waterbodies would be similar to those described above for California red-legged frog.

Direct impacts to known occurrences[8] of western pond turtle could occur near several ponds in the planning area from trampling of adults and nests (Hayes et al. 1999; Fidenci 2000), although other evidence suggests that moderate grazing practices would not substantially reduce habitat suitability for

[8] Occurrences document the areas surveyed for threatened and endangered animals in which a species is, or was, present. In many cases, an occurrence represents several observations of multiple individuals or multiple visits at a given location.

this aquatic turtle (East Contra Costa County Habitat Conservancy 2006). Continued grazing would maintain habitat for some reptile species via disturbance that increases invertebrate abundance, as observed by Reinsche (2008) where lizard density was significantly greater in grazed areas than ungrazed annual grasslands in Alameda and Contra Costa Counties. Lizard densities decreased with increased vegetation height and thatch density (RDM levels). Similarly, Jones (1981) found that western fence lizard (*Sceloporus occidentalis*) populations averaged three times greater density in grazed grasslands compared to ungrazed grasslands and concludes that seasonal, managed grazing by moderate cattle densities in California's annual grasslands tends to create favorable conditions for the western fence lizard and western skink (*Plestiodon skiltonianus*). However, based on previous studies in the planning area (Fellers and Pratt 2002), grazing could reduce the abundance of northern alligator lizard (*Elgaria coerulea*).

As described above in the "Fish" section, ranch activities could potentially affect reptiles and amphibians via pollutants in storm runoff. However, ranchers would avoid or minimize impacts on wetlands and riparian areas by continuing to exclude cattle from most riparian areas and implementing management practices and mitigation measures to comply with state and federal clean water regulations.

Invertebrates, Including Myrtle's Silverspot Butterfly (Federally Endangered) and California Freshwater Shrimp (Federally Endangered)

Myrtle's Silverspot Butterfly. Most documented occurrences of the Myrtle's silverspot butterfly in the planning area are in pastures grazed by cattle. At the time of the species' listing, USFWS believed that cattle grazing significantly decreased habitat quality for the Myrtle's silverspot butterfly. However, USFWS's five-year status review found that a moderate grazing regime, consistent with current RDM standard, does not adversely affect the distribution of Myrtle's silverspot butterfly (USFWS 2009a). Cattle grazing could benefit the Myrtle's silverspot butterfly by increasing the density of nectar sources via reduced competition from grazed plants, although heavy grazing could reduce nectar sources in localized areas (Murphy and Launer 1991). Inadvertent trampling by cattle of the host plant, western dog violet, could be a relatively minor threat, although the impacts of grazing on the persistence of host plants is unknown (Adams 2004). However, the presence of host plants alone does not reliably predict the presence of the Myrtle's silverspot butterfly (Launer et al. 1992), and USFWS (2009a) recommends further studies on the effects of grazing on western dog violet. Other ranching activities could have adverse impacts on the Myrtle's silverspot butterfly as well, such as collisions with vehicles, tractors, or other ranch equipment, or vehicles causing excessive dust from ranch roads on host and nectar sources or larvae development (USFWS 2002a). Lastly, ranching activities could cause ground disturbance and affect the distribution and abundance of nectar sources, including the potential spread of non-native nectar sources such as bull thistle (*Cirsium vulgare*) and Italian thistle (*Carduus pycnocephalus*) (USFWS 2002a).

After reviewing the status of the Myrtle's silverspot butterfly in the park and potential impacts on it from ranch activities, the USFWS (2002a) determined that ranching "may affect, is likely to adversely affect" the Myrtle's silverspot butterfly due to potential "harassment to all Myrtle's silverspot butterflies inhabiting 13,510 acres on the B, C, D, E, F, G, I, J, N, and the Home Ranch." Although there have not been formal Myrtle's silverspot butterfly surveys in the park in recent years, NPS (2019i) has recorded occurrences on B, D, E, F, G, J, N, and K Ranches. Overall habitat conditions for Myrtle's silverspot butterfly and the impacts of ranching are largely unchanged since 2002. Under alternative A, potential adverse impacts on the species would be offset by managed grazing at moderate levels that promotes the availability of nectar sources, thereby maintaining suitable habitat for Myrtle's silverspot butterfly.

California Freshwater Shrimp. Under alternative A, California freshwater shrimp would continue to experience localized, short-term impacts associated with the indirect effects of grazing and ranch activities on water quality, as described above under "Salmon and Steelhead." Erosion would be minimized from grazed lands through application of RDM standards and implementation of Management Activities and mitigation measures to reduce sediment- or pollutant-laden stormwater runoff from

ranches. No direct impacts on aquatic habitat occupied by California freshwater shrimp would occur because cattle are excluded from grazing along Lagunitas and Olema Creeks, except infrequently if cattle breach pasture fences. As a result of the limited potential for impacts, USFWS (2002a) determined that the renewal of ranching lease/permits "may affect, is not likely to adversely affect" California freshwater shrimp. Although numbers of California freshwater shrimp collected during salmonid monitoring in the Lagunitas Creek watershed do not show a detectable trend (MMWD 2017a), the species has increased in Olema Creek in recent years (Serpa 2016). Because continued ranching would not generally affect the riparian and instream habitat features required by California freshwater shrimp (see Martin, Saiki, and Fong 2009), alternative A is not expected to have no long-term, adverse impacts on the species.

Other Invertebrates. Under alternative A, the plant diversity of rangelands would generally remain in its current state or increase (Hayes and Holl 2003; Johnson and Cushman 2007), potentially resulting in improved habitat for invertebrates. Disturbance by cattle grazing creates a varied vegetation structure that provides a mosaic of habitat conditions suitable for a large array of grasshoppers and butterflies (Jerrentrup et al. 2014), ground-dwelling beetles, ants, and other native invertebrate species. Cattle manure would also continue to support a diversity of specialist dung fauna. Also, by consuming non-native annual grasses, cattle grazing would promote the growth of native forbs required by flying insects that feed on flowering plants, including sawflies, wasps, bees, and ants (Order: Hymenoptera) and butterflies and moths (Order: Lepidoptera) (USFWS 2009b, Holstein 2011; Barry et al. 2015). As described for other taxa, adverse impacts on many invertebrates could occur from grazing and other cattle-related impacts (e.g., cattle trailing, trampling of vegetation near water troughs) in the estimated 150 acres of high-intensity-use areas (Debano 2006; Louis 2016), but impacts from grazing elsewhere would be minimized by adherence to current RDM standards. Lastly, aquatic invertebrates would continue to experience localized, short-term impacts associated with the indirect effects of grazing and ranch activities on water quality, as described above under "Salmon and Steelhead." Aquatic invertebrates most sensitive to disturbance include Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (Whittier and Van Sickle 2010).

Cumulative Impacts

Coastal dune restoration projects could have temporary, adverse impacts on wildlife that inhabit coastal dunes, including small mammals and shorebirds, via temporary displacement or disturbance of individuals from noise or the presence of humans during restoration activities. Raptors that forage in dune habitat could also be temporarily affected. Removing non-native dune species and converting to native dune habitat, however, would have long-term benefits for most wildlife species. Dune restoration projects are scheduled after the shorebird nesting season but could potentially disturb western snowy plover fledglings or adults during fall or winter. NPS would minimize the potential for disturbance by conducting plover surveys during the breeding season to locate plover nests and broods and would establish a minimum 500-foot buffer between an active nest and restoration activities (NPS 2015b). The removal of invasive plants from coastal dunes would have long-term benefits for snowy plovers and other nesting shorebirds by creating suitable nesting habitat and reducing dense cover for some predators.

The Lagunitas Creek habitat enhancement projects would have temporary impacts on aquatic wildlife, including fish, reptiles and amphibians, and aquatic invertebrates via sediment inputs into streams during construction activities. Access routes through the riparian ecosystem would also disturb wildlife and degrade habitat, which would affect birds, small mammals, and amphibians. However, mitigation measures would be implemented to reduce adverse impacts. These projects would have overall long-term, beneficial impacts on aquatic wildlife by enhancing aquatic habitat, improving water quality, and restoring natural ecosystem processes. Instream and floodplain habitat restoration would have long-term benefits on federally listed coho salmon, Chinook salmon, steelhead, California red-legged frog, and California freshwater shrimp. Access routes would be cleared of non-native plants that may invade the disturbed areas and replanted with native riparian species, eventually allowing wildlife habitat in the riparian zone to recover to pre-construction conditions.

The park's fire management program and agreement with Marin County for wildland fire operations and response would include prescribed fire and mechanical treatments. Both types of fire operations would remove vegetation and organic matter on the surface and expose the soil to erosive processes, which could temporarily destroy habitat for wildlife, including federally listed species. For example, increased sedimentation in creeks and/or persistent turbidity following wildland or prescribed fires could affect habitat used by coho salmon, steelhead, Chinook salmon, California red-legged frog, and California freshwater shrimp. The short-term, adverse impacts from wildfire or fire suppression activities would depend on the fire's extent and severity and would be minimized by guidance and mitigation measures provided in the NPS (2004b) plan. However, native species are adapted to periodic fire and would thus recover over the long term, and wildfire could benefit wildlife by providing a greater diversity of habitats, stimulating seed germination, or improving habitat for prey species.

Road improvement projects at Point Reyes include repairs to roads, parking areas, and drainage features, all of which disturb vegetation and could temporarily increase sediment or pollutant runoff, resulting in short-term, adverse impacts on wildlife, including federally listed Myrtle's silverspot butterfly, California red-legged frog, and western snowy plover. This project would also disturb soils and increase potential soil erosion and sedimentation in nearby surface waters but would benefit aquatic wildlife through improved water flow that would enhance habitat in the long term. NPS would employ appropriate mitigation measures to minimize any potential short-term impacts on wildlife during construction.

PG&E fire prevention projects would disturb wildlife habitat during the removal of fire hazards. Coordination with park staff during PG&E fire prevention activities, including tree removal, would minimize adverse impacts on wildlife habitat. However, in some cases, ground disturbance due to regular access along PG&E corridors could contribute to the spread of invasive plants. Overall, fire management would reduce fuel load and help prevent large, intense fires on the landscape that could negatively affect wildlife habitat.

Corvid management in the park includes removing debris, covering feed bins, and installing riparian fencing. Corvid management would benefit the federally threatened western snowy plover and other birds that nest in the planning area by reducing the abundance of ravens, which predate on nests and chicks.

Invasive plant management in the park could involve vegetation clearing, which could affect pollinators and other invertebrates, including the federally listed Myrtle's silverspot butterfly. Compliance with the NPS's IPM regulations and procedures and applicable state pesticide regulations would dictate appropriate herbicide application methods to minimize any adverse impacts on fish, amphibians, and aquatic invertebrates. Herbicide treatments are not likely to enter surface waters by spray drift and runoff, and therefore not likely to adversely affect aquatic wildlife, including the federally listed coho salmon, steelhead, Chinook salmon, California red-legged frog, and California freshwater shrimp.

The Marin RCD Grant Program provides a multi-agency team to coordinate expertise and funding to implement conservation projects on private lands in Marin County. This grant program benefits wildlife through watershed stewardship, erosion control, stream restoration, road repair, and other projects that enhance aquatic and terrestrial wildlife habitat conservation. Marin RCD's services would continue to bring together private landowners with state, federal, and local agencies to conserve wildlife by assisting with managing livestock around sensitive habitats.

These past, present, and reasonably foreseeable future actions have and would continue to have adverse and beneficial impacts on wildlife, depending on the species. Under alternative A, adverse impacts would occur from disturbances associated with ranching activities and altered habitat conditions, while beneficial impacts related to maintaining key habitats such as grasslands and stock ponds would continue. Alternative A would continue to contribute most of the impacts to the overall cumulative impact scenario because ranching occurs at a larger scale than any of the other cumulative actions. When the incremental impacts of alternative A are combined with the impacts from past, present, and reasonably foreseeable

actions in the planning area, cumulative impacts on wildlife would continue to be adverse or beneficial, depending on the species, and would remain consistent with existing conditions.

Alternative B

NPS would establish a subzoning framework of Resource Protection, Range, Pasture, and Ranch Core subzones that would limit impacts on wildlife from authorized activities such as diversification. The additional 1,200 acres of exclusion areas in the Resource Protection subzone would remove grazing from sensitive resources such as riparian areas, surface waters, and federally listed wildlife habitat; however, impacts in these areas would continue until fencing is installed. Impacts on wildlife from ranching activities would be avoided, minimized, or mitigated through the implementation of required Practice Standards and mitigation measures (see appendix F, tables F-11 through F-13). Additional details regarding the potential impacts on federally listed species under alternative B are included in the BAs (appendices N and O) under "Section 8: Effects to Evaluated Species and Determinations."

Mammals

Cattle grazing under alternative B would continue at levels similar to existing conditions, which would help control the encroachment of shrubs and herbaceous fuel loads (i.e., annual grasses) and maintain habitat for mammals that utilize grasslands. Grazing would be the only authorized activity near riparian areas and other sensitive habitats in the Range subzone, which contains 65% of this habitat type in the planning area. The establishment of the Resource Protection subzone would protect 30% of the total riparian areas in the planning area and surface waters that are critical for mammals.

The potential impacts of fences on mammals would be reduced compared to existing conditions because the installation of any new permanent or temporary fencing would be required to be "wildlife friendly," unless otherwise approved by NPS, in accordance with proven methods (e.g., Karhu 2008; Paige 2012).

Brush mowing in the Pasture and Ranch Core subzones, which together compose around 35% of lands under lease/permit, could reduce habitat for mammals that prefer coastal scrub but would follow the Brush Management, Mechanical Practice Standard and would maintain habitat for mammals that prefer grassland habitats. Impacts on small mammals from Forage Production and Manure and Nutrient Management would still occur as described under alternative A. Impacts on mammals from these activities would be reduced compared to existing conditions because these activities would be restricted to the Pasture and Ranch Core subzones, which are unlikely to support large populations of special-status species such as the American badger. Restrictions on tilling under this alternative would increase crop residue and provide food, cover, and shelter for small mammals (USDA-NRCS 2013).

Because of the diversification activities under alternative B, the magnitude of impacts on wildlife could be greater as a result of disturbance from the newly authorized activities. The authorization of sheep and goats in the Pasture subzone could reduce habitat for small mammals relative to existing conditions because sheep and goats consume more shrubs and forbs than cattle. On the other hand, sheep and goat grazing could benefit mammals in the Pasture subzone by providing another method for controlling noxious weeds that would otherwise reduce wildlife habitat. The impacts of up to 500 chickens on as many as 18 ranches and their associated mobile huts within the Pasture and Ranch Core subzones could also impact wildlife habitat by altering plant communities due to nutrients in chicken manure, which could allow non-native, weedy species to outcompete native plants. Mitigation measures to limit the number of chickens per ranch and require rotation of chickens on pasture would minimize impacts. Within the Ranch Core subzone, impacts from diversification on habitat for native mammals would be minimal because authorized activities would occur within previously disturbed areas or areas where sensitive species are not present. The Ranch Core subzone contains poor quality habitat for most native mammals and is generally only occupied by species tolerant of human disturbance.

Livestock guardian animals would be allowed under alternative B, subject to the specific mitigation measures outlined in appendix F, table F-14. If used, guardian animals would adversely impact predatory mammals such as coyotes and bobcats through aggressive behaviors such as chasing (UC ANR 2018). They could also have adverse impacts to wildlife from harassment (potentially causing injury or death) of non-target species (UC ANR 2018) including non-predatory mammals (e.g., rabbits, squirrels, and skunks) and birds, particularly ground-nesting species (Redden et al. 2015). With proper training, livestock guardian dogs would be trained only to harass predators, which would reduce the risk to non-target wildlife (UC ANR 2018; Redden et al. 2015). While guardian animals would adversely impact individual animals as described above, population level impacts would not occur.

Impacts associated with the potential for transmission of Johne's disease between cattle and elk would be similar to those described under alternative A but slightly reduced because there would be fewer elk under alternative B. Diversification with sheep and goats in the planning area would increase the potential for transmission of Johne's disease, including transmission between livestock and wildlife because the number of potential carriers would increase. Ingestion of food tainted by manure from diseased animals is likely the most common way that Johne's disease is transmitted among animals (USDA-APHIS 2008). Proper manure management practices are important for limiting the spread of Johne's disease among wild and domestic ungulates (USDA-APHIS 2010). Mitigation measures regarding Manure and Nutrient Management may limit the risk of contamination in livestock feed supplies. If research becomes available regarding how the disease is spread, the lease/permits would be updated to include new mitigation measures for limiting disease spread, including new approaches to Manure and Nutrient Management. NPS currently monitors Johne's disease in the park's tule elk population and would continue to do so under alternative B. Mitigation measures under appendix F, table F-14, include requirements for regular veterinary care and disease screening, which would reduce the potential for disease transmission.

The authorization of other livestock and domestic animals in the Pasture and Ranch Core subzones could increase the risk of other disease transmission to wildlife as well. For example, Virulent Newcastle Disease is a highly contagious and deadly viral disease of birds that is spread from chickens to wild birds. However, it is currently only found in southern California. Also, unvaccinated domestic dogs can spread canine distemper to a variety of wildlife such as foxes, coyotes, raccoons, skunks, and weasels. However, potential adverse impacts to wildlife would be avoided or minimized by requiring mitigation measures from appendix F, table F-14, which include: vaccinating animals if regional disease issues have been identified, requiring that all livestock receive veterinary care, reporting any disease to NPS, conducting daily inspections and quickly disposing of any carcasses, moving portable livestock structures, and providing good hygiene within enclosures, buildings, and equipment.

Under alternative B, impacts on mammals from ongoing ranch activities in the Ranch Core subzone would occur as described for the ranch complexes under alternative A. Under alternative B, ranchers could also offer farm stays and farms tours, which would result in increased human activity in the Ranch Core subzone. Because the Ranch Core subzone is less than 1% of the planning area, contains poor quality habitat, and receives high levels of human activity, potential impacts on mammals would be limited in scale. Ranchers could also plant up to 2.5 acres of crops in previously disturbed areas in the Ranch Core subzone, which could increase or decrease food and cover for small mammals depending on the crops planted and the adjacent habitats. The lease/permits will allow ranchers to fence wildlife out of crop areas but will prohibit ranchers from killing or harming wildlife to protect crops. Because the Ranch Core subzone makes up less than 1% of the planning area and is highly developed, impacts from diversification activities in this subzone would not affect mammals at the population level. Other types of diversification in the Ranch Core (e.g., horse boarding, small scale processing, and farm sales) would require further environmental review and NPS approval before being implemented.

Development of new or expanded trails, roads, trailheads, and parking lots would be considered under alternative B. Temporary impacts from construction activities could occur, and visitor use on trails and elsewhere in the planning area would continue to temporarily disturb and displace some mammals.

However, new impacts would be limited because most trails would use existing administrative routes, and accommodations for day and overnight use would reuse existing ranch complex buildings where species are likely adjusted to human disturbances. Therefore, new development related to public use and enjoyment would result in short-term, adverse impacts on wildlife resources during construction. Long-term impacts are not anticipated.

Continued ranching under alternative B could affect water quality in coastal waters from runoff of bacteria, nutrients, and sediments, as described for alternative A under "Water Resources." However, the zoning framework and Practice Standards and mitigation measures for a defined set of Management Activities, as detailed in appendix F, tables F-11 through F-13, would reduce overall impacts on water resources. Therefore, the potential impacts to marine mammals as described in alternative A would be slightly reduced.

Birds, Including Western Snowy Plover (Federally Threatened)

Western Snowy Plovers. Under alternative B, impacts on nesting or overwintering western snowy plovers would occur as described under alternative A. The potential for unauthorized livestock on beaches would be reduced by two new resource protection areas on the E and F Ranches, approximately 20 and 70 acres in size, respectively. Required mitigation measures, described in appendix F, tables F-11 through F-14, would reduce potential impacts from increased numbers of ravens associated with ongoing ranching and agricultural diversification. Despite these measures, food sources would remain available to ravens in the planning area, so it is uncertain whether alternative B would reduce indirect impacts of ravens. Over the long term, ranch activities that support the continued unnatural abundance of ravens could still indirectly affect western snowy plovers. The BA (appendix N) further details these potential impacts.

Other Birds. Under alternative B, impacts on birds would occur as described under alternative A, but impacts would be reduced by implementation of required Practice Standards and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13). As described above under "Mammals," Forage Production would continue on approximately 1,000 acres, continuing potential impacts on birds from harvest mowing. Where necessary, NPS, in coordination with ranchers, would take actions to reduce impacts from Forage Production to avoid or minimize effects of mowing on ground-nesting birds (see Ochterski 2006). Shrub- and ground-nesting birds would be susceptible to trampling from non-cattle livestock (e.g., sheep and goats) within the Pasture and Ranch Core subzones under alternative B. The additional allowance of 2.5 acres of crops in previously disturbed areas in the Ranch Core subzone could increase or decrease bird habitat and provide food resources for some species, depending on the crops planted and the adjacent habitats. As described above, the presence of livestock guardian animals may result in the harassment of birds, specifically ground nesting birds, but may also reduce predation (Gehring et al. 2010, 2011; Taylor et al. 2005). Ongoing dairy ranching activities would continue to promote an unnatural abundance of corvids, European starlings, and brown-headed cowbirds that compete with, prey upon, or parasitize nests of native birds, resulting in continued impacts to birds over the long term.

Fish, Including Coho Salmon (Federally Endangered), Steelhead (Federally Threatened), and Chinook Salmon (Federally Threatened)

Salmon and Steelhead. Under alternative B, impacts on coho salmon, steelhead, and Chinook salmon from cattle grazing would occur as described under alternative A. However, the scale and intensity of these impacts would be reduced by implementing the zoning framework and Practice Standards and mitigation measures for standard Management Activities, as detailed in appendix F, tables F-11 through F-13. Nearly all stream reaches potentially occupied by salmonids in the planning area would remain excluded from grazing. Lands added to the Resource Protection subzone would further protect approximately 370 acres in the Drakes Estero watershed by preventing cattle grazing along portions of the Drakes Estero shoreline in Creamery Bay, Schooner Bay, and Home Bay; and along North Schooner Creek between the D and M Ranches, lower Home Ranch Creek and the adjacent tributary to Home Bay,

and the inlet of Creamery Bay. In the Lagunitas and Olema Creek watersheds, new resource protection exclusion areas would exclude cattle from approximately 2.4 miles of perennial streams.

Under alternative B, short- and long-term impacts on water quality in streams could also occur from the construction of new trails and roads, other classes of livestock grazing in the Pasture and Ranch Core subzones, diversification activities, and any new construction, development, or increased human activity in the Ranch Core subzone. Diversification activities authorizing new types of livestock in the Ranch Core and Pasture subzones could have indirect impacts on water quality in streams potentially occupied by coho salmon, steelhead, and Chinook salmon by changing the type and amounts of pathogens and nutrients in stormwater runoff. Ground disturbance from diversification activities could also indirectly affect fish habitat from erosion and sediment transported in stormwater runoff. However, such potential impacts from nonpoint source pollution would be mostly avoided because less than 1% of aquatic resources, including surface waters, occur in the Pasture and Ranch Core subzones, and Practice Standards and mitigation measures for a defined set of Management Activities (see appendix F, tables F-11 through F-13) would be implemented to meet the SWRCB regulations for waste management.

Manure and Nutrient Management on approximately 115 acres within the Pasture subzone on E Ranch could continue to contribute nutrients via stormwater runoff, which could cause long-term, adverse impacts on steelhead in the Drakes Estero watershed; however, manure application would continue to only occur during dry conditions to minimize erosion and runoff potential and would require an NPS-approved nutrient management plan. Also, as discussed in the "Water Resources" section, monitoring studies show that fecal coliform concentrations have decreased over time and other measurements of water quality in the planning area have been improving as NPS, partners, and ranchers implement Management Activities, establish buffers, and treat problematic sites (Carson 2013; Parsons and Ryan 2015; Wallitner 2016; NPS 2017a; Voeller et al. 2018; Lewis et al. 2019; appendix L).The implementation of Practice Standards and mitigation measures for a defined set of Management Activities (appendix F, tables F-11 through F-13) would avoid potential adverse impacts of diversification activities on salmonids.

Other Fish. Under alternative B, impacts on fish would occur as described under alternative A and as described above for salmonids but across all aquatic habitats in the planning area; however, the scale and intensity of these impacts would be reduced due to the zoning framework. For example, nearly 99% of the streams, ponds, and wetlands that would remain available for ranching under alternative B would be included in the Range subzone, where only cattle grazing would be authorized. This would minimize impacts on fish that could result from the more intensive agricultural activities authorized in the Pasture and Ranch Core subzones.

Diversification activities in the Pasture and Ranch Core subzones could have the same indirect impacts on other fish as described above for salmon and steelhead. However, zoning, including the Resource Protection subzone and the application of Practice Standards and mitigation measures for a defined set of Management Activities (described in appendix F, tables F-11 through F-13) would reduce impacts.

Reptiles and Amphibians, Including California Red-legged Frog (Federally Threatened)

California Red-Legged Frogs. Under alternative B, impacts on California red-legged frogs would occur as described under alternative A; however, the zoning framework would reduce the intensity of adverse impacts by authorizing the most intensive agricultural practices only in the Pasture and Ranch Core subzones, where habitat for California red-legged frogs is limited. All breeding habitat would fall in the Range subzone, where only cattle grazing and periodic Pond Restoration would occur, which would provide a beneficial impact compared to existing conditions. Frogs that disperse into uplands from breeding ponds could be vulnerable to disturbance or injury by other classes of livestock, such as chickens, or by vehicle collisions during the movement of chicken huts or other pasture management activities. Further detail about these potential impacts is found in the BA (appendix N). However, only 10% of known California red-legged frog occurrences are found in the Pasture or Ranch Core subzones.

Mitigation measures associated with Management Activities (see appendix F, tables F-11 through F-13) would be implemented to avoid or minimize impacts, such as performing pre-construction surveys of suitable wetland habitat and adjacent uplands surveys for projects in potential California red-legged frog habitat; monitoring ground-disturbing activities within 300 feet of suitable wetland habitat; halting work activities that may adversely affect California red-legged frogs until they no longer occupy the project area; and placing portable/moveable structures located in pastures for the production of fowl in the Pasture subzone a minimum of 300 feet from any drainages, riparian areas, wetlands, or ponds from mid-June through mid-September.

Other Reptiles and Amphibians. Under alternative B, impacts on reptiles and amphibians would occur as described under alternative A, but habitat for some species would be improved through the protection of several wetland and riparian areas as part of the additional 1,200 acres in the Resource Protection subzone. Beneficial impacts would continue for several species of lizards and snakes that prefer grazed annual grasslands due to the reduction of thatch. Also, as described above under "Fish" and in the "Water Resources" section, alternative B could adversely affect water quality and indirectly affect amphibian habitat, but mitigation measures would minimize impacts (see appendix F, tables F-11 through F-13).

Invertebrates, Including Myrtle's Silverspot Butterfly (Federally Endangered) and California Freshwater Shrimp (Federally Endangered)

Myrtle's Silverspot Butterfly. Under alternative B, impacts on Myrtle's silverspot butterfly would occur as described under alternative A. Alternative B establishes a zoning framework that includes known distribution of the Viola adunca, the host plant for Myrtle's silverspot butterfly, within the Range subzone. Overall, grazing would continue to benefit the species by removing vegetation that may compete with Myrtle's silverspot butterfly's host and nectar plants and minimizing vegetative cover, which could increase nectar sources and improve the ability of butterflies to detect host and nectar plants (Adams 2004). Applicable mitigation measures would be specified in ROAs and reviewed annually to minimize the potential impacts of ranching on Myrtle's silverspot butterfly habitat. For any authorized projects, NPS biologists would conduct surveys to determine if suitable habitat is present for the Myrtle's silverspot butterfly in the project area, including larval host plants or nectar sources. Host plants would be protected with a clearly demarcated 20-foot buffer zone. Potential changes in visitor use, especially along trails, could cause ground disturbances that would affect the distribution and abundance of nectar sources, including the potential spread of non-native nectar sources such as bull thistle. Additional impacts from human activities, including public use and enjoyment, are detailed further in the BA (appendix N).

California Freshwater Shrimp. Under alternative B, the indirect impact of ranching on water quality in streams potentially occupied by California freshwater shrimp would occur as described under alternative A, but the scale and intensity of these impacts would be reduced because new resource protection areas would exclude cattle from approximately 2.4 miles of perennial streams in the Lagunitas and Olema Creek watersheds. In general, California freshwater shrimp would benefit from the same improvements to aquatic habitat as described above for salmon and steelhead. Although ranch diversification practices could increase potential ground disturbance within the Pasture and Ranch Core subzones compared to existing conditions, mitigation measures would be implemented to minimize the intensity of any impacts related to erosion and sediment-laden stormwater runoff (see appendix F, tables F-11 through F-13). The BA (appendix N) provides further details about potential impacts.

Other Invertebrates. Under alternative B, impacts on invertebrates would occur as described under alternative A. However, the zoning framework and Practice Standards and mitigation measures for a defined set of Management Activities, as detailed in appendix F, tables F-11 through F-13, would avoid or minimize potential impacts on many native invertebrates. In particular, the protection and passive restoration of riparian areas included in the Resource Protection subzone would likely result in benefits to aquatic invertebrate communities (Stanford et al. 2020). Adverse impacts on invertebrates could occur in localized areas, and although there are not specific mitigation measures for invertebrates, impacts on

invertebrate habitat would be avoided or minimized by mitigation measures focused on other resources monitored by NPS (see appendix F, tables F-11 through F-13).

Cumulative Impacts

The impacts on wildlife from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would reduce some potential adverse impacts of grazing and other ranch activities compared to existing conditions because the establishment of the Resource Protection subzone as part of the zoning framework would improve habitat values for many species, especially those that use riparian areas and coastal dunes. Alternative B would contribute the majority of the incremental impacts to the cumulative impact scenario. When the incremental impacts of alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, overall beneficial cumulative impacts on wildlife would be the same as existing conditions. By contrast, overall adverse cumulative impacts on wildlife would decrease compared to existing conditions from the implementation of a zoning framework and other protective measures under alternative B.

Alternative C

Under alternative C, impacts on wildlife from ranch operations (e.g., grazing, pasture management, and diversification) and public use and enjoyment would be the same as described for alternative B. The removal of the Drakes Beach herd under alternative C would not have a noticeable impact on other wildlife because the removal would occur in one season, thereby limiting disruption to wildlife. Therefore, the direct, indirect, and cumulative impacts of alternative C would be the same as those described for alternative B.

Alternative D

Under alternative D, impacts on wildlife would occur as described under alternative A, but the intensity would be different because ranching would not occur on approximately 7,500 acres of the planning area where beef cattle ranching would cease. The implementation of a zoning framework, as described under alternative B, would limit the impacts of more intensive ranch activities, such as cattle concentration areas, ranch diversification activities, and Forage Production, to within approximately 25% of the planning area in the Pasture and Ranch Core subzones. Therefore, activities with the potential for the greatest impacts would be focused in areas that are already highly disturbed and/or altered and do not contain sensitive species or habitat. Diversification and the use of ranch complexes would result in the same impacts on wildlife as alternative B. Impacts from public use and enjoyment would be the same as those described under alternative B.

Mammals

The impacts on mammals from cattle grazing in the Range subzone would occur as described for alternative A, but on approximately 7,500 fewer acres, reducing the grazed acres to 19,000. On approximately 7,500 acres where ranching would no longer be authorized, mammals that prefer shrublands, such as brush rabbits, would benefit from the encroachment of shrubs and increased habitat; mammals that prefer grasslands and avoid dense shrublands, like American badger, could be adversely impacted. Habitat would be reduced relative to existing conditions for mammals that prefer relatively short vegetation structure, such as the black-tailed jackrabbit and deer mice. On areas where ranching is authorized, grazing would continue to benefit small mammals that prefer grassland habitat with less dense vegetation (i.e., reduced thatch). In addition, large-ranging mammals would benefit from the habitat heterogeneity provided by variable grazing intensities, and an increased mosaic of grazed and ungrazed habitats across the planning area (Fuhlendorf and Engle 2004). Potential impacts on marine mammals from bacteria loading in coastal waters would be the same as those described for alternative B because dairies would continue to operate in the same locations.

Birds, Including Western Snowy Plover (Federally Threatened)

Western Snowy Plovers. Under alternative D, impacts of ranching on western snowy plover would occur as described for alternative B. Although the cessation of ranching on approximately 7,500 acres would reduce ranch activities that promote an unnatural abundance of common ravens, it is uncertain whether it would reduce raven impacts on western snowy plovers compared to existing conditions because ravens tend to concentrate at the dairies, which would remain in operation, and raven predation can result from a small number of individuals. Forage Production on approximately 1,000 acres would continue to provide a potential food source of carrion for ravens from dead birds and small mammals. The potential impacts of trespass livestock inadvertently trampling western snowy plover nests would be reduced compared to existing conditions because cattle would be removed from 2 of 10 ranches (AT&T and F) that abut snowy plover habitat on the Pacific coast beaches.

Other Birds. As described for alternative A, many grassland songbirds depend on grazing to reduce thatch, increase habitat heterogeneity, or improve foraging conditions, so grassland birds would decline on approximately 7,500 acres of the planning area where livestock would be removed under alternative D. However, ungrazed grasslands in the planning area tend to have a higher avian richness and diversity (Holmes et al. 1999), so other bird species could potentially increase on approximately 7,500 acres. On these lands, there could be an increased availability of seed-producing plants, increased shrubs for perching, and increased cover to evade predators for species of birds that prefer habitats other than grasslands, such as wrentit, orange-crowned warbler, Bewick's wren, spotted towhee, and western scrub-jay. On 19,000 acres where ranching would continue to be authorized, the types of impacts on birds would be similar to those described under alternative A, including Forage Production on 1,000 acres. Ongoing dairy ranching activities would continue to promote an unnatural abundance of corvids, European starlings, and brown-headed cowbirds that compete with, prey upon, or parasitize nests of native birds, resulting in continued impacts to birds over the long term. Adverse impacts would be avoided or minimized through the implementation of a zoning framework and applicable mitigation practices (see appendix F, tables F-11 through F-13), as described for alternative B.

Fish, Including Coho Salmon (Federally Endangered), Steelhead (Federally Threatened), and Chinook Salmon (Federally Threatened)

Salmon and Steelhead. Under alternative D, habitat for coho salmon, steelhead, and Chinook salmon in the Lagunitas Creek watershed would be subject to lower levels of sediment and pollutants transported in stormwater runoff compared to existing conditions because ranching would cease on approximately 3,000 acres in the Olema Creek and Lagunitas Creek watersheds, including approximately 1,500 acres on the Cheda and Percy Ranches that contain salmonid bearing streams and have steep slopes (see figure 41 in appendix A) and high soil erosion hazard ratings (see figure 42 in appendix A). Beneficial impacts would also occur in the Drakes Estero and Tomales Bay watersheds, where 5,300 acres of ranching would be eliminated. In areas where ranching would continue, impacts would be minimized because livestock would be excluded from direct access to most streams potentially occupied by salmon and steelhead, including Lagunitas and Olema Creeks. The use of Practice Standards and mitigation measures would avoid or minimize adverse impacts on salmon and steelhead from livestock grazing and ranch management.

Other Fish. Under alternative D, the impacts on fish would occur as described under alternative A, but the intensity of impacts would be reduced compared to existing conditions from the cessation of ranching on approximately 7,500 acres and new resource protection areas. Indirect impacts on fish from grazing on the remaining 19,000 acres could occur in localized areas via decreased water quality from polluted ranch runoff during storm events (e.g., sediment and coliform bacteria). Indirect impacts on fish via reduced water quality could continue to occur downstream of pastures where Forage Production and Manure and Nutrient Management would be authorized. Additional Practice Standards and mitigation measures (see appendix F, tables F-11 through F-13) would avoid or minimize potential impacts of authorized activities within the Pasture and Ranch Core subzones.

Reptiles and Amphibians, Including California Red-legged Frog (Federally Threatened)

California Red-Legged Frogs. Under alternative D, the potential impacts from ranching on California red-legged frogs could occur as described under alternative A, but impacts would be on a reduced scale because of the cessation of ranching on approximately 7,500 acres, of which approximately 4,100 acres are within designated critical habitat. Of the approximately 136 known occurrences of California red-legged frog in the planning area, alternative D would eliminate livestock grazing on ranches that support approximately 23% of occurrences, which are mostly associated with stock ponds (NPS 2019i). In the Olema Creek watershed, these locations are associated with stock ponds and riparian areas on the E. Gallagher, C Rogers and McFadden Ranches. On the Point Reyes Peninsula, ranching would no longer have the potential to affect California red-legged frog occurrences associated with stock ponds on the N and K Ranches, Creamery Bay Creek on the F Ranch, and the coastal drainages on the F and AT&T Ranches. Removing grazing from areas around stock ponds and creeks on both locations would benefit individual frogs by reducing direct impacts of cattle trampling but could have overall adverse impacts on California red-legged frogs by eliminating the beneficial impacts of livestock grazing that prevents emergent and shoreline vegetation cover from becoming overly dense. To avoid or minimize these impacts, NPS would identify restoration actions needed to maintain priority California red-legged frog pond breeding habitat to protect the species.

Other Reptiles and Amphibians. Under alternative D, the impacts from ranching on reptiles and amphibians would occur as described under alternative A but at a reduced scale from the cessation of ranching on approximately 7,500 acres and the implementation of a zoning framework, as described under alternative B. The implementation of Practice Standards and mitigation measures for authorized Management Activities (see appendix F, tables F-11 through F-13) and 500 acres of additional resource protection areas would also avoid or minimize impacts to aquatic habitats used by breeding amphibians and protect other sensitive habitats occupied by reptiles and amphibians (e.g., riparian areas and coastal dunes). However, removing livestock grazing from 500 acres of resource protection areas could negatively affect reptiles and amphibians that benefit from reduced vegetation caused by cattle grazing around stock ponds and streams. To maintain priority wetlands within resource protection areas for reptiles and amphibians, such as breeding ponds, NPS would implement restoration actions as necessary.

Invertebrates, Including Myrtle's Silverspot Butterfly (Federally Endangered) and California Freshwater Shrimp (Federally Endangered)

Myrtle's Silverspot Butterfly. Under alternative D, impacts on Myrtle's silverspot butterfly would occur as described for alternative A. However, the cessation of grazing on approximately 7,500 acres could reduce the abundance of nectar source species used by Myrtle's silverspot butterfly (Adams 2004) across approximately 3,800 acres with known occurrences (NPS 2019i). Adverse impacts would be concentrated on the F and AT&T Ranches, which host 70% of known occurrences and would be removed from ranching under alternative D. Grazing would continue to benefit Myrtle's silverspot butterfly on approximately 6,000 acres of potentially occupied habitat, as defined by known occurrences (NPS 2019i; Launer et al. 1992). On these lands, continued grazing in compliance with appropriate RDM standards would continue to promote the density of nectar sources via reduced competition from grazed plants.

California Freshwater Shrimp. Under alternative D, the indirect impact of ranching on water quality in streams potentially occupied by California freshwater shrimp would be similar to that described for alternative A. Impacts could occur via reduced water quality in suitable freshwater shrimp habitat in Olema and Lagunitas Creeks but would be avoided or minimized through the application of the same mitigation measures described under alternative B. The discontinuation of ranching on approximately 3,000 acres in the Olema Creek and Lagunitas Creek watersheds would further reduce impacts on water quality, and by extension California freshwater shrimp. This would result in a beneficial impact compared to existing conditions.

Other Invertebrates. Under alternative D, the impacts of continued ranching on invertebrates would occur as described for alternative A but would differ on approximately 7,500 acres where cattle grazing would no longer occur. However, in general, cattle grazing on 19,000 acres where ranching would be authorized would enable the persistence of native forbs used by pollinating insects, while changes in soil structure, variation in ground cover, and vegetation height could affect other invertebrates. Additional protection and restoration of riparian areas would likely result in benefits to aquatic invertebrate communities (Stanford et al. 2020).

Cumulative Impacts

The impacts on wildlife from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. On lands where ranching continues, alternative D would contribute beneficial and adverse impacts, depending on the species. As described above, adverse impacts would occur from disturbance associated with ranching activities and altered habitat conditions, while beneficial impacts related to maintaining key habitats such as grasslands and stock ponds would continue. Establishment of the Resource Protection subzone as part of the zoning framework would also improve habitat values for many species, especially those that use riparian areas and coastal dunes. Cessation of grazing across approximately 7,500 acres of the planning area would remove the primary source of wildlife disturbance on that land and allow grassland habitats to transition into shrubland habitats, which would increase habitat for some wildlife but decrease it for others. Alternative D would contribute most of the impacts to the cumulative impact scenario. When the incremental impacts of alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on wildlife would be beneficial or adverse, depending on the species, as described above. On the land where ranching continues, cumulative impacts on wildlife would be reduced compared to existing conditions from the implementation of a zoning framework. On approximately 7,500 acres where ranching would cease, cumulative impacts on wildlife would increase or decrease depending on the species because of changed habitat conditions.

Alternative E

The cessation of dairy ranching and conversion to beef cattle on up to 6,200 acres under alternative E would eliminate impacts on wildlife from Forage Production and Manure and Nutrient Management. Alternative E would also result in reduced ground disturbance around milking and loafing barns and feeding areas in the Ranch Core subzone compared to existing conditions; however, these areas do not provide high quality habitat for wildlife. Impacts on wildlife from the establishment of the zoning framework, including the 1,200 acre Resource Protection subzone, ongoing use of RDM standards, and application of Practice Standards and mitigation measures (see appendix F) would result in reduced impacts on wildlife as described under alternative B. Continued grazing under alternative E would provide habitat conditions suitable for many species of wildlife that prefer grasslands, similar to existing conditions. Because no diversification activities would be authorized under alternative E, there would be no associated impacts to wildlife from diversification. Impacts from public use and enjoyment would be the same as described under alternative B.

Mammals

Ranching under alternative E would generally affect mammals as described for alternative B. However, the context and intensity of impacts on wildlife would change across approximately 6,200 acres where six dairy operations would be converted to beef cattle ranches. Mammals in the approximately 86 acres of high-intensity-use areas around former milking and loafing barns, feeding areas, and grazing areas closer to the developed complex would experience the greatest changes in habitat. Habitat suitability in these areas would increase for mammals that prefer taller, more, dense vegetation, such as the American badger, and decrease for mammals that prefer low-stature vegetation and bare ground. On areas of former dairy ranches that are farther from developed complexes, habitat suitability for mammals that prefer shorter, less dense grassland habitat could increase because these areas could experience increased

grazing associated with the conversion to beef cattle. On the existing beef cattle ranches, the impacts of ranching would be similar to alternative B, but impacts on small mammals from Forage Production would be eliminated on 1,000 acres, resulting in a beneficial impact compared to existing conditions. Potential impacts on marine mammals would be reduced because adverse impacts (e.g., bacteria loading) on water quality in coastal waters associated with dairy ranching activities (e.g., manure spreading) would be eliminated, as described under "Water Quality."

Birds, Including Western Snowy Plover (Federally Threatened)

Western Snowy Plovers. Under alternative D, impacts from ranch Management Activities would occur as described for alternative B. However, the elimination of six dairies where raven numbers are highest (Kelly 2001), encompassing approximately 6,200 acres, would reduce adverse impacts on western snowy plovers because livestock feeding that promotes an unnatural abundance of common ravens would cease on these lands. Although beef cattle ranching would be authorized on these lands, Forage Production would be discontinued on approximately 1,000 acres, further reducing potential raven food sources. However, impacts of raven predation on snowy plover nests can result from a small number of individual ravens, so conversion of the six dairies to beef operations would not eliminate this threat to snowy plovers. Snowy plover nest protection actions would continue.

Other Birds. Under alternative E, many native birds would benefit from the removal of dairy ranching activities that promote an unnatural abundance of corvids, European starlings, and brown-headed cowbirds that compete with, prey upon, or parasitize nests of native birds. Bird injury or mortality from harvest mowing for Forage Production would also be eliminated, which would benefit birds that nest in those fields. However, under existing conditions, Forage Production fields provide better nesting habitat than pastures for some species, and many birds may be able to fledge a nest before silage is cut, so the cessation of Forage Production may not necessarily benefit all birds. With continued grazing by beef cattle, beneficial impacts of grazing on grassland species would still occur. However, as reported by Holmes et al. (1999), cattle grazing would continue to reduce overall avian diversity in the planning area.

Fish, Including Coho Salmon (Federally Endangered), Steelhead (Federally Threatened), and Chinook Salmon (Federally Threatened)

Salmon and Steelhead. Because none of the dairies that would close are within watersheds occupied by salmon or steelhead (i.e., Lagunitas and Olema Creeks or the Drakes Estero watershed), impacts would be the same as described for alternative B, resulting in a beneficial impact compared to existing conditions.

Other Fish. The cessation of dairy ranching would reduce pollutant-laden runoff compared to existing conditions by eliminating dairy cattle concentration areas, Forage Production and intensive Manure and Nutrient Management in the Drakes Bay, Abbotts Lagoon, Kehoe, and the Coastal/Pacific Ocean Drainages (see figure 44 in appendix A). Water quality and habitat for fish in streams could also improve from the reduction in sediment transported from 86 acres of high-intensity-use areas, where dairy cattle cause erosion around milking and loafing barns and feeding areas. Also, the addition of 1,200 acres of resource protection areas would improve fish habitat as described under alternative B. Overall, impacts on fish from ranching under alternative E would be reduced compared to existing conditions, resulting in a beneficial impact because water quality would continue to improve in the planning area, and additional wetlands and riparian areas would be protected from livestock impacts.

Reptiles and Amphibians, Including California Red-legged Frog (Federally Threatened)

California Red-Legged Frogs. The types of potential impacts on California red-legged frogs described under alternative A could also occur under alternative E. However, the cessation of dairy ranching and conversion to beef cattle would change the intensity of livestock impacts on approximately 6,200 acres, of which approximately 2,900 acres are within designated critical habitat. Of the 136 known occurrences of California red-legged frog in the planning area, approximately 21% occur on lands subject to conversion from dairy to beef cattle operations under alternative E (NPS 2019i), but overall impacts from grazing would not change. The elimination of high-intensity-use areas and Manure and Nutrient Management

would have beneficial impacts on California red-legged frog by reducing the potential for nutrient inputs from cattle manure to enter the Drakes Bay, Abbotts Lagoon, Kehoe, and the Coastal/Pacific Ocean Drainages. Furthermore, water quality in ponds and streams used by California red-legged frog could be improved via reduced soil erosion and sediment runoff from areas around milking and loafing barns and feeding areas. On existing beef ranches, impacts on California red-legged frog would be the same as those described for alternative B.

Other Reptiles and Amphibians. The types of impacts on reptiles and amphibians from ranching under alternative E would be the same as those described for alternative A, but the intensity would be reduced on approximately 6,200 acres where dairies would be converted to beef cattle, particularly in proximity to areas where dairy cattle are most concentrated. Also, as described above in the "Fish" section, the closure of dairies would potentially benefit reptiles and amphibians via improved water quality in wetlands and streams in the planning area. The impacts of cattle grazing described under alternative A would also occur under alternative E, but impacts would be reduced compared to existing conditions by implementing the zoning framework, resource protection areas, and mitigations measures as described under alternative B.

Invertebrates, Including Myrtle's Silverspot Butterfly (Federally Endangered) and California Freshwater Shrimp (Federally Endangered)

Myrtle's Silverspot Butterfly. The types of impacts to Myrtle's silverspot butterfly under alternative E would be the same as described under alternative A. While only 11, or approximately 3%, of known Myrtle's silverspot butterfly occurrences are on dairies, the closure of dairies and their conversion to beef cattle on approximately 6,200 acres could beneficially affect Myrtle's silverspot butterfly habitat by reducing localized impacts on 86-acres of high-intensity-use areas and continuing grazing that supports native forbs that serve as essential nectar sources to Myrtle's silverspot butterfly. For example, NPS (2001b) noted that the impacts of heavy dairy cattle grazing on the K Ranch immediately south of the Tule Elk Reserve may limit movement of Myrtle's silverspot butterfly to suitable habitat on other ranches to the south. On the other hand, high-intensity-use areas could support non-native plants that also serve as nectar sources, such as bull thistle. Overall, cattle grazing would continue at a moderate intensity that meets RDM standards. This level of grazing would have mostly beneficial impacts because it would maintain sufficiently abundant nectar sources for the Myrtle's silverspot butterfly.

California Freshwater Shrimp. The conversion of dairies to beef cattle ranches would not affect California freshwater shrimp because they do not occur in the affected watersheds; therefore, impacts on this species would be the same as described under alternative B.

Other Invertebrates. The elimination of 6,200 acres of grazing and associated nutrient inputs from dairy operations could lead to an increased abundance and richness of invertebrate groups. Other impacts of continued ranching on invertebrates would be the same as those described for alternative B.

Cumulative Impacts

The impacts on wildlife from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative E would contribute beneficial and adverse impacts, depending on the species. As described above, adverse impacts would occur from disturbance associated with ranching activities and altered habitat conditions, while beneficial impacts related to maintaining key habitats such as grasslands and stock ponds through cattle grazing would continue. Establishment of the Resource Protection subzone as part of the zoning framework would also improve habitat values for many species, especially those that use riparian areas and coastal dunes. Alternative E would also eliminate the impacts associated with dairy operations including Forage Production and Manure and Nutrient Management and reduce the extent of high-intensity-use areas. Alternative E would contribute most of the impacts to the cumulative impact scenario. When the incremental impacts of alternative E are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on wildlife would remain beneficial or adverse, depending on the species, as discussed above. Overall, adverse

cumulative impacts on wildlife would be reduced compared to existing conditions from the implementation of a zoning framework and cessation of dairy operations.

Alternative F

Under alternative F, the elimination of livestock grazing would have widespread ecological impacts because the primary disturbance regime to which wildlife have adapted for more than 150 years would be removed. Without grazing, ecological succession would occur as grassland habitats transition into shrubland habitats in most areas, which would increase habitat for some wildlife but decrease it for those that live in grasslands. Vegetation that has been traditionally consumed by livestock would be left in place, providing increased ground cover and seeds for herbivorous small mammals and birds.

The cessation of ranching under alternative F would eliminate Management Activities that are currently performed by ranchers, many of which are beneficial to wildlife. For example, the lack of road and pond maintenance or the reduction of invasive plant management would have adverse effects on both terrestrial and aquatic species. NPS would seek to mitigate any adverse impacts on wildlife resulting from the lack of ranch operations but would not have the ability to do so across the entire planning area.

Under alternative F, additional public recreational and visitor opportunities are anticipated across the 28,000-acre planning area, including adaptive use of ranch complexes. Although overall visitation is not expected to change from existing conditions, changes in patterns of human activity could affect wildlife. Disturbance to wildlife would continue at most ranch complexes and could increase at locations with new public recreational and visitor opportunities. Potential effects to species or their habitat are not predictable without knowing the specific locations and intensity of future changes in visitor use. Potential impacts on wildlife would be evaluated in additional environmental review documents for specific projects that would include site-specific details and associated impacts for visitor use opportunities in the planning area after ranching operations cease.

Mammals

The cessation of ranching in the planning area would eliminate the potential disturbance of mammals from ranch Management Activities. Mammals that use Forage Production fields would no longer be subject to potential injury or mortality associated with Forage Harvest Management on approximately 1,000 acres. Reduced grazing and shrub management activities would increase habitat under alternative F for mammals that prefer shrublands. In addition, localized habitat changes associated with adaptive use of ranch complexes and buildings and different patterns of human activity could affect mammals over the long term. Affected species would be those that are generally tolerant of human activity, but impacts would be minimal because habitat around ranch complexes is predominantly low-quality and generally supports a lower abundance and diversity than the surrounding landscape. Visitor use on trails in the planning area would still temporarily disturb some mammals and displace individuals from their territories, but potential impacts could increase from additional types of recreational use in areas that have previously been used mainly for grazing or ranch activities. The impact of domestic cats, which can injure or kill small mammals in localized areas, would be eliminated under alternative F.

The elimination of livestock grazing under alternative F would provide small mammals with increased ground cover, allowing them to better avoid predation. Black-tailed jackrabbits, however, have been shown to avoid areas with dense vegetation because it limits their ability to see predators (Best 1996). Increased thatch would restrict the movement of small mammals within grasslands and make some annual grasslands less hospitable to species such as deer mice and black-tailed jackrabbits, which could affect populations of mesocarnivores that prey on them like foxes, coyotes, and bobcats. The increased abundance of elk under alternative F would provide prey for mountain lions, which could increase their range in the planning area as a result of the discontinuation of ranching. Lastly, the movement of Columbian black-tailed deer and other large-bodied wildlife across the landscape would improve as fences are removed, although the risk of injury or entanglement would persist until fences are completely removed.

Potential impacts on marine mammals would be reduced because adverse impacts on water quality in coastal waters associated with ranching activities would be eliminated.

Birds, Including Western Snowy Plover (Federally Threatened)

Western Snowy Plover. The potential for livestock to breach fences and trample western snowy plovers, nests and habitat would be eliminated. Western snowy plover would benefit from the cessation of ranch activities that promote the unnatural abundance of common ravens, which are predators of snowy plover nests. However, as food resources on ranches are reduced, individual ravens seeking alternative food sources could depredate greater numbers of snowy plover nests because even small numbers of ravens can have substantial adverse impacts. Snowy plover nest protection measures would continue.

Other Birds. Alternative F could benefit some birds via increased availability of seed-producing plants that are able to reproduce without being grazed. The large number of birds that avoid grazed habitats, as described for alternative A, would benefit from the increased availability of suitable ungrazed habitat (Holmes et al. 1999). For example, northern harriers and white-tailed kites would likely increase in number. Moreover, many native birds would benefit from the removal of ranch activities that promote an unnatural abundance of corvids, European starlings, and brown-headed cowbirds that compete with, prey upon, or parasitize nests of native birds. On the other hand, habitat could be reduced for several birds that require low vegetation that results from grazing, including the special-status burrowing owl, grasshopper sparrow, and tricolored blackbird. Ferruginous hawks, peregrine falcon, merlin, and several other special-status raptors that forage in grasslands would experience a decrease in forage because livestock grazing would no longer promote the abundance and visibility of their small mammalian prey (Best 1996; Pandolfino et al. 2011; Bartolome et al. 2014). Lastly, localized habitat modification from adaptive use of ranch complexes and altered levels of human activity at ranch complexes could affect birds, but the affected avian species are generally tolerant of existing disturbances around ranch complexes.

Fish, Including Coho Salmon (Federally Endangered), Steelhead (Federally Threatened), and Chinook Salmon (Federally Threatened)

Salmon and Steelhead. The cessation of ranching under alternative F would have overall benefits on coho salmon, steelhead, and Chinook salmon, and their designated critical habitat compared to existing conditions. All potential direct and indirect, adverse impacts of livestock grazing and ranch practices on salmon- or steelhead-bearing streams would be eliminated. This would reduce erosion, increase water infiltration and soil water holding capacity, and increase groundwater replenishment, which could improve habitat quality for salmon and steelhead. Improved and increased streamside vegetation and reduced nutrient inputs (i.e., cattle manure) would also benefit these species. In some locations where ranch roads cross over or run adjacent to salmon or steelhead streams, lack of maintenance could potentially increase sedimentation; however, this impact could be reduced by NPS addressing priority road maintenance issues as necessary. Overall, the elimination of adverse impacts from ranching could lead to improved spawning gravel from reduced eroded sediment, reduced water temperatures from increased shade from increased vegetation, and increased dissolved oxygen from reduced nutrient inputs. While elk would have more unrestricted access to streams and could increase grazing in areas currently fenced off from cattle, it is unlikely that elk grazing would increase in the foreseeable future to the degree that steelhead in Schooner or Home Creek would be adversely affected.

Other Fish. Under alternative F, the removal of livestock grazing from the park would eliminate adverse impacts on riparian areas and wetlands described under alternative A, thereby enhancing fish habitat compared to existing conditions. Reaches of streams that are currently accessible to livestock would experience increased growth of riparian vegetation, which could reduce summer water temperatures and enhance aquatic habitat. These beneficial impacts would mostly occur in pastures where livestock currently have access to perennial streams as a result of the lack of exclusion fencing. The amount and rate of habitat improvement in riparian and wetland habitats would be increased and accelerated in comparison to the other alternatives.

Reptiles and Amphibians, Including California Red-legged Frog (Federally Threatened)

California Red-Legged Frogs. Under alternative F, impacts on this species would be beneficial from the elimination of livestock grazing and trampling of vegetation around ponds, wetlands, streams, and adjacent habitats. However, California red-legged frogs could experience adverse effects at approximately 120 breeding ponds from degraded habitat conditions from overly dense non-native annual grasses and emergent vegetation such as cattails (USFWS 2010b), which could limit the species' mobility, reduce the inundation period of ponds, and reduce turbidity, making frogs more susceptible to predators (Ford et al. 2013). The lack of pond maintenance could also increase sedimentation. To avoid or minimize these impacts, NPS would identify restoration actions needed to maintain priority California red-legged frog pond breeding habitat to protect the species. There could also be beneficial impacts via improved water quality from a reduction of erosion and polluted runoff during storm events (e.g., coliform bacteria and suspended solids from cattle waste). Disturbance to critical habitat by cattle grazing would cease, but periodic maintenance to maintain California red-legged frog habitat would continue and result in short-term impacts, as described for alternative A.

Other Reptiles and Amphibians. Alternative F would affect reptiles and amphibians in much the same way as described for small mammals—increased vegetative cover could help animals avoid predators, but it would also create overly dense, unsuitable grassland habitat. Impacts would be greatest around stock ponds and other surface waters that support amphibian breeding, where habitat suitability could be reduced at some locations for certain amphibians and reptiles but increased for others. Livestock grazing of wetlands would no longer potentially trample individuals or eggs or indirectly impact water quality of aquatic habitats.

Invertebrates, Including Myrtle's Silverspot Butterfly (Federally Endangered) and California Freshwater Shrimp (Federally Endangered)

Myrtle's Silverspot Butterfly. The cessation of ranching under alternative F could reduce the density of nectar plants (Adams 2004). Launer et al. (1992) suggested that the subspecies' persistence is dependent upon grazing and that livestock grazing is the most effective tool to manage grasslands in a way that provides nectar resources and maintains larval host plants for them. Although an increasing elk population and limited Targeted Grazing would occur under alternative F, these types of grazing would not maintain nectar sources on grasslands as effectively as current levels of cattle grazing. Thus, the elimination of grazing would have adverse impacts on the Myrtle's silverspot butterfly compared to existing conditions.

California Freshwater Shrimp. Alternative F would eliminate all potential direct and indirect impacts of ranching on California freshwater shrimp in the planning area compared to existing conditions. Beneficial impacts would result from improved stream habitat and water quality. These beneficial impacts are described above in the "Fish" section and the "Water Resources" section.

Other Invertebrates. The cessation of grazing would likely cause some taxa to increase and others to decrease. Alternative F could increase the abundance of certain invertebrates, such as grasshoppers (Order: Orthoptera) from the elimination of grazing and increased herbaceous vegetation, and adversely affect pollinating insects, including sawflies, wasps, bees, and ants (Order: Hymenoptera) and butterflies (Order: Lepidoptera) from decreased native forb abundance (Holstein 2011). Overall, true bugs (Order: Hemiptera) and spiders could increase from the elimination of grazing (Debano 2005; Louis 2016). Aquatic invertebrates that are especially sensitive to water quality degradation and/or sedimentation (e.g., mayflies, stoneflies, and caddisflies) would benefit from the elimination of ranching from reduced impacts on water quality (Stanford et al. 2020).

Cumulative Impacts

The impacts on wildlife from past, present, and reasonably foreseeable actions would be the same as described for alternative A. Alternative F would eliminate all impacts on wildlife related to dairy and beef ranching from the planning area, including disturbance, trampling, erosion and nutrient inputs. Ecological succession would occur as grassland habitats transition into shrubland habitats in most areas, which would increase habitat for some wildlife but decrease it for others. When the incremental impacts of alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact to wildlife would be beneficial or adverse, depending on the species, as discussed above. The incremental impacts of alternative F would contribute a majority of the overall cumulative impacts. Overall, impacts on wildlife would increase or decrease compared to existing conditions, depending on the species, due to changed habitat conditions.

TULE ELK

Methodology and Assumptions

This EIS assumes that tule elk would be maintained in the Point Reyes portion of the planning area, and that NPS would take appropriate action to prevent elk from moving outside Point Reyes, whether onto adjacent private lands or into the Golden Gate portion of the planning area.

Impacts of the alternatives on elk are based on their overall effect on elk herd viability, a function of productivity and survival, compared to existing conditions. Free-ranging elk are not expected to exceed their carrying capacity in Point Reyes in the near future, so the effect of resource limitations on elk survival or productivity is not currently an issue if the population expands. Any action that would increase elk productivity and survival at the population level would have beneficial impacts on elk. Conversely, any action that would reduce the population below the minimum threshold for a viable herd of 100 elk (CDFW 2018c) would have adverse effects on the elk population over the long term. The focus on population level impacts is consistent with guidance in the NPS Management Policies (e.g., 4.4.2). For the purposes of this analysis elk reproductive rates are assumed to correlate directly with population size as long as the ratio of females to males remains approximately the same.

Actions under the alternatives that would result in changes to the geographic extent (range) of elk in the planning area were also considered. Actions that would facilitate expansion of elk in the planning area would have beneficial impacts. It is assumed that actions that would limit geographic extent would not result in noticeable adverse impacts on elk because sufficient habitat is available to avoid exceeding carrying capacity in the Point Reyes portion of the planning area, including the entire elk extent that is in designated wilderness adjacent to the planning area (appendix A, figure 2). Limitations on the range of elk herds could include use of exclusion fencing, management of herds within core areas, and restrictions on the establishment of new herds.

Other considerations for impacts include actions that may create hazards for elk, such as fences, which can result in injury due to entanglement. These impacts may be short or long term, depending on the specific action to be implemented. The analysis notes where such impacts would affect individual elk versus the overall population.

While continued exposure to the bacterium that causes Johne's disease has the potential to impact individual elk, the overall impact of Johne's disease on elk is not anticipated to be adverse at the population level. Johne's disease is already known to be present in elk at Point Reyes, and elk have continued to thrive despite being infected with the disease (Manning et al. 2003). Actions that would result in increased potential for the spread of Johne's disease, such as livestock diversification, were also considered.

The analysis of impacts on tule elk assumes mitigation measures would be implemented to minimize adverse impacts. The area of analysis includes all lands in the planning area.

Alternative A

Public Use and Enjoyment

Visitor use on ranchlands would continue to result in occasional disturbances to elk in the planning area, especially in the western portion of the planning area where they are most easily seen along Sir Francis Drake Boulevard and Drakes Beach Road near D ranch.

Ranch Operations

Competition with grazing livestock would not limit elk survival or productivity because grazing resources are not currently a limiting factor for elk. Maintenance of existing ranch fences would continue to result in the potential for injuries to individual elk from entanglement; however, installing additional elk crossings at appropriate locations and incorporating alternative fence designs, particularly around seasonal pastures, would minimize the intensity of this impact. Exposure to the bacterium that causes Johne's disease would continue to impact individual elk but would not result in population level impacts to elk.

Elk Management

Under alternative A, impacts on elk from hazing efforts, Johne's disease testing, and annual monitoring would continue to include temporary disruption of grazing or other behaviors and increased energy demand on individual animals. However, these actions would not affect elk at the population level.

Habitat enhancements would continue to directly benefit elk over the long term by providing water sources and improved forage habitat. Continued efforts to control invasive species under alternative A would also maintain suitable forage habitat for elk.

Future population management, which would occur through the initiation of a new planning process, would result in direct, adverse impacts on individual elk if lethal removal occurs. Management would be consistent with the goal of the 1998 EA of maintaining a viable, free-ranging elk population in Point Reyes. Similarly, possible lethal removal of elk that leave Point Reyes for Golden Gate or non-federal lands could adversely impact individual elk.

Cumulative Impacts

Past, present, and reasonably foreseeable actions that have affected or would affect elk include invasive plant management projects. Management of invasive plants has and would continue to have beneficial impacts by maintaining grassland habitat that is suitable for elk foraging. Alternative A would continue to contribute beneficial impacts from elk habitat enhancement projects and efforts to maintain a viable, free-ranging elk population in Point Reyes. Adverse impacts would result from fencing, hazing, and Johne's disease testing. When the incremental impacts of alternative A are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on elk would remain beneficial, with the incremental impacts of alternative A contributing a majority of the overall cumulative impacts. Overall, impacts on elk would remain consistent with existing conditions.

Alternative B

Public Use and Enjoyment

Expanded opportunities for hiking, biking, and equestrian access in the planning area would not limit elk movement or create entanglement hazards and would not otherwise noticeably impact elk. Potential impacts on elk associated with expanded visitor use include occasional displacement and/or disruption of grazing or other behaviors. However, the elk at Point Reyes are accustomed to some level of human activity, including noise and the presence of vehicles. Therefore, any impacts on elk as a result of expanded visitor use would not affect elk productivity or herd viability. Additionally, NPS would avoid constructing any trails or access projects in locations that would have high potential to disturb elk.

Adaptive use of unoccupied ranch complexes could potentially increase visitor use or NPS activities in these areas, including at D Ranch, where structures are adjacent to areas regularly used by the Drakes Beach herd. NPS would seek a compatible adaptive use for structures adjacent to core elk use areas to avoid adverse impacts on elk.

Ranch Operations

Continued ranching activities under alternative B would not result in a measurable change in grazing conditions for elk. Because grazing resources are not currently a limiting factor for elk, additional competition with other grazing livestock as a result of diversification activities would not affect elk productivity or survival.

Maintenance of existing ranch fences would continue to result in the potential for injuries to individual elk, as described under alternative A. Wildlife-friendly fencing would be required under alternative B, and additional lowered elk crossings could be installed in the areas frequented by the Drakes Beach and Limantour herds, which could reduce the risk of injury to elk compared to existing conditions.

Livestock diversification, primarily the introduction of sheep and goats, would increase the potential for transmission of Johne's disease, including transmission between livestock and wildlife, including elk, because the number of potential carriers would increase. However potential impacts on elk are not likely to be noticeable at the population level. As part of diversification, ranchers may elect to use livestock guardian animals, which could potentially harass or kill non-target wildlife or livestock, including elk. Any rancher that would like to use livestock guardian animals must demonstrate proper training of livestock guardian animals and other measures that would be taken to reduce the potential for adverse impacts (see appendix F, table F-14). Use of livestock guardian animals to haze elk would be prohibited.

Elk Management

Impacts from hazing, disease testing, control of invasive species, and habitat enhancement, as described for alternative A, would be the same under alternative B. Impacts of management actions specific to the Drakes Beach and Limantour herds are described below.

Drakes Beach Herd. Management actions under alternative B would limit the population of the Drakes Beach herd to 120 individuals through lethal removal. Approximately 12 to 18 adult elk would be lethally removed annually, resulting in a 9% to 13% annual reduction of free-ranging elk in the planning area, based on the current population size. With the Drakes Beach herd population in late 2019 at 138 total elk, the initial year of implementation would likely require the removal of more elk to bring the herd size down to 120. Removals would result in direct, adverse impacts on individual elk in the Drakes Beach herd that are lethally removed. However, NPS would strive to maintain the natural sex ratio and ensure a stable and viable Drakes Beach herd at a reduced number and consistent with natural conditions of the herd. Prior to conducting lethal removal operations, NPS would consult with CDFW biologists to develop a detailed implementation strategy and to determine, annually, the number of elk by age and sex to be removed from the Drakes Beach herd. Removal of the individual elk would result in temporary disturbances to remaining members of the herd from noise and the presence of humans. With a population threshold of 120 individuals, actions taken under alternative B would not jeopardize the viability of the Drakes Beach herd (CDFW 2018c).

Under alternative B, the geographic extent of the Drakes Beach herd would continue to be limited because NPS would actively manage the herd, using hazing techniques, to remain in its existing core use areas and off ranchlands and prevent new herds from establishing on areas under lease/permit, although male elk would be allowed to wander. Male elk that stray from core use areas would be monitored closely, and actions such as repairing fences and installing elk crossings may be taken to mitigate for impacts on ranching operations. Population reduction efforts may target male elk outside the core use areas if new conflicts with ranching operations arise. Population reduction efforts would also target elk that attempt to establish new herds on areas under lease/permit.

Limantour Herd. Management of the Limantour herd would focus on limiting the geographic extent of the herd to reduce their presence on leased ranchlands in Point Reyes. New herds would not be allowed to establish on areas under lease/permit, and no new female groups would be permitted to leave the wilderness area and become permanently established on lands under lease/permit. In both cases, NPS would use a graduated response, starting with attempts to haze animals back to their original location and then using more aggressive hazing techniques. The adverse impacts of hazing actions would be similar to those described above for the Drakes Beach herd. Lethal removal of individual elk could occur, if necessary, to prevent new herds or female groups from establishing on areas under lease/permit or to address localized impacts from the presence of elk on ranchlands. If needed, lethal removal would result in adverse impacts to individual elk. No population level management actions would be taken under alternative B, and NPS would maintain the viability of the Limantour herd consistent with the goals of the 1998 Tule Elk Management Plan/EA.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would continue to contribute beneficial impacts from habitat modifications and the preservation of a viable, free ranging elk population in Point Reyes. Adverse impacts from fencing and hazing would continue. Alternative B would also have adverse impacts on individual elk from the lethal removal of approximately 12 to 18 elk annually from the Drakes Beach herd to maintain this herd at a population threshold of 120 animals. Because this is a viable population level for the Drake Beach herd, this action would not be considered an adverse impact at the population level. Lethal removal of individual elk in the Limantour herd could potentially occur if needed to prevent new herds or female groups from becoming established on areas under lease permit. Although the impacts of lethal removal on individual elk would be adverse, lethal removal would not be used to control the population of the Limantour herd, which would be allowed to expand in size. When the incremental impacts of alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on elk would remain beneficial because a viable, free-ranging tule elk population would be maintained. The incremental impacts of alternative B contribute the majority of the cumulative impacts.

Alternative C

Under alternative C, NPS would lethally remove the Drakes Beach herd, totaling approximately 138 individual elk as of late 2019. Lethally removing the Drakes Beach herd would result in at least a 45% reduction of free-ranging elk in the planning area and a 2% reduction in the estimated California state-wide elk population (CDFW 2018c) compared to existing conditions and would eliminate one of two free-ranging tule elk herds in the national park system. Impacts on the Drakes Beach herd would be significant because it would no longer exist. Overall viability of the tule elk population in Point Reyes and in California would not be affected; however, removal rather than management of an entire elk herd would be unprecedented in the national park system and would be inconsistent with CDFW management of elk on ranchlands outside the park.

Under alternative C, impacts on elk in the Limantour herd from public use and enjoyment, hazing, diversification, Johne's disease exposure, disease testing, control of invasive species, habitat enhancement, and maintenance of existing ranch fences would be the same as those described for alternative B.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative C would contribute significant adverse impacts from the removal of the Drakes Beach herd but would maintain the Limantour herd as a viable population of free-ranging elk in Point Reyes. Alternative C would contribute beneficial impacts from habitat modifications and maintenance of the free-ranging Limantour herd, and adverse impacts from fencing and hazing of the

Limantour herd. When the incremental impacts of alternative C are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on elk would be adverse compared to existing conditions, primarily due to the removal of the Drakes Beach herd. The incremental impacts of alternative C would contribute a majority of the overall cumulative impacts.

Alternative D

Elk management actions under alternative D for the Limantour herd would be the same as alternative B. For the Drakes Beach herd, management actions would be similar to those under alternative B for lands in the Ranchland zone. For example, the Drakes Beach herd would be limited to 120 elk and maintained through annual lethal removal of 12 to 18 adult elk. While this would result in adverse impacts on individual elk, the Drake Beach herd would be maintained at a viable population level. Lands permitted for ranching under alternative D would be reduced by approximately 7,500 acres in the planning area compared to existing conditions. These lands would include portions of D Ranch (pastures B and C), which are frequently grazed by elk in the Drakes Beach herd. Existing fencing would be removed in these areas, which would reduce the risk of entanglement, and elk would no longer be hazed from these areas. Unimpeded access to these areas would benefit elk compared to existing conditions. If elk take up long-term use of these areas, NPS may revise the population threshold for the Drakes Beach herd.

Under alternative D, impacts on elk from visitor use and enjoyment, diversification, Johne's disease exposure, disease testing, habitat enhancement, control of invasive species, and fence repair would be the same as those described for alternative B.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative D would contribute beneficial impacts from habitat modifications and preservation of a viable, free-ranging elk population in Point Reyes. Cessation of ranching on approximately 7,500 acres would result in removal of existing fencing and additional grazing opportunities for elk on that land, which would provide a beneficial impact compared to existing conditions. Adverse impacts would result from fencing and hazing. Alternative D would also have adverse impacts on individual elk from the lethal removal of approximately 12 to 18 elk annually, but NPS would maintain a viable population of free-ranging elk. When the incremental impacts of alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on elk would remain beneficial because a viable, free-ranging tule elk population would be maintained. The incremental impacts of alternative D would contribute the majority of the cumulative impacts.

Alternative E

Under alternative E, elk would no longer be hazed from lands under lease/permit, resulting in long term beneficial impacts on elk compared to existing conditions. Discontinuation of hazing would avoid temporary disruption to grazing or other behaviors and increased energy demand on individual animals. Under alternative E, impacts on elk from public use and enjoyment, Johne's disease exposure, disease testing, control of invasive species, habitat enhancement, and maintenance of existing ranch fences would be the same as those described under alternative B.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative E would contribute beneficial impacts from habitat modifications and the cessation of hazing activities. Adverse impacts from fencing would continue similar to existing conditions. When the impacts of alternative E are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on elk would be beneficial compared to existing conditions.

Alternative F

Public Use and Enjoyment

Under alternative F, impacts on elk from visitor disturbance would be similar to those described for alternative B. Although visitor use patterns may change, overall visitation is not anticipated to increase compared to existing conditions. While the use of developed complexes may change from ranching to visitor uses, disturbance in these areas would continue, resulting in impacts similar to those described under alternative B. Elk habitat and land use patterns would be taken into consideration to avoid or minimize conflicts with elk from new visitor use facilities. However, the likelihood of visitors disturbing elk could increase over time as herd size increased.

Ranch Operations

Under alternative F, ranching activities would not disturb elk once ranching activities cease, which would result in a long-term, beneficial impacts on the elk population compared to existing conditions. Removal of existing ranch fencing after ranching is phased out would also result in beneficial impacts on individual elk. While removal of ranching will eliminate the potential of new transmissions of Johne's disease from cattle to elk, Johne's disease will remain with the tule elk herds at levels that impact individuals but not at a population level.

Elk Management

Under alternative F, NPS would take no action to limit the population growth of free-ranging elk in the Drakes Beach and Limantour herds, and management of the geographic extent of elk would occur only if needed to support other resource protection and park goals, including not allowing elk to establish outside Point Reyes. This would result in long-term, beneficial impacts on elk movement and behavior patterns compared to existing conditions. Impacts on fitness and energy demands or disruption of natural behaviors from hazing would no longer occur. Based on modeling efforts, without population management, the free-ranging elk population could grow to 2,800 individuals in 20 years. In addition to the expanded populations of the Drakes Beach and Limantour herds compared to alternative A, the fence at Tomales Point would be removed, further increasing the overall number of free-ranging elk in Point Reyes.

In order to limit shrub and weed encroachment in elk grazing habitat, NPS would identify priority areas for Vegetation Management using Targeted Grazing as necessary. These efforts would be unlikely to meaningfully affect elk grazing activities because of the limited size of the operations. Continued efforts to control invasive species would also maintain suitable forage habitat for elk.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative F would contribute long-term, beneficial impacts to the elk population in Point Reyes from the cessation of ranching, which would eliminate impacts related to hazing and fencing. There would be limited NPS management of the free-ranging elk population in Point Reyes, and elk from Tomales Point would be allowed to range into the planning area. When the impacts from alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on elk would be long-term and beneficial compared to existing conditions. The incremental impacts of alternative F would contribute a majority of the overall cumulative impacts.

VISITOR USE, EXPERIENCE, AND ACCESS

Methodology and Assumptions

Impacts on visitor use, experience, and access are analyzed by examining expected changes in visitor experience related to wildlife viewing opportunities; changes in visitor experience related to ranching operations, specifically viewing opportunities and ranching diversification; changes in visitor use, experience, and access related to improvements to trails, signage, and wayside exhibits; and changes in visitor experience resulting from the enhancement of interpretation at historic districts. Visitor use data, comments from the public, and personal observations of visitation patterns by park staff were used to estimate the effects of the alternative actions on visitor use, experience, and access.

Visitor experience could be altered because of changes to ranching operations in the planning area, including ranch closures (both positive and negative effects, depending on the type of visitor values), continued ranching, increased wildlife/bird/tule elk viewing opportunities related to the removal of ranch fencing and increased visitor access on ranchlands, and adaptive use of a limited number of ranch-related structures that could be used for public programs or venues such as classroom educational opportunities, tours, and overnight stays.

Visitor experience and access could change by expanding trail systems and connections; expanding multiuse (e.g., hiking and biking on the same trail) trails on existing administrative roads; promoting increased access to ranchlands; and improving signage, wayside exhibits, and roadside pullouts.

The area of analysis for visitor use, experience, and access is the planning area.

Alternative A

Public Use and Enjoyment

Under alternative A, park visitors would continue to have many diverse opportunities, ranging from passive recreation such as bird watching and wildlife viewing, to more active pursuits such as hiking. Annual visitation is not expected to change compared to existing conditions; approximately 2 to 2.5 million visitors are expected to continue to visit the park each year.

Ranch Operations

Park visitors would continue to have access to the ranchlands; however, access for visitors could continue to be unclear in certain areas because of fencing and ranch infrastructure. Under alternative A, visitors would continue to experience and have opportunities to understand the role of ranching in the history of coastal northern California. They would also continue to experience the conditions and characteristic features of the grazing lands, including grasslands that are associated with continued traditional ranching. These impacts would be beneficial for some visitors. Visitor opportunities related to experiencing natural sights and sounds would continue to be affected by the machinery, structures, odors, and noise associated with operating and maintaining ranches. For these visitors, ranching operations in the planning area would result in continued direct, adverse impacts on their use and experience.

Elk Management

Management of elk would not affect visitor experience because elk viewing opportunities of the Drakes Beach and Limantour herds would continue unchanged. Management activities such as hazing practices are not expected to disrupt visitor use, experience, and access, nor would they disrupt visitors' ability to view elk.

Cumulative Impacts

Past, present, and reasonably foreseeable actions that have affected or would continue to affect visitor use, experience, and/or access in the planning area include coastal dune restoration, the Lagunitas Creek Salmonid Habitat Restoration Project activities, the fire management program, cultural resource restoration projects, road improvement projects, PG&E fire prevention projects, corvid management, and invasive plant management activities. All of these projects and management actions have beneficial impacts on visitor use and experience because they restore habitat to support thriving populations of wildlife, reduce potential adverse impacts from unplanned wildfires, restore cultural resources, and improve roads and parking areas in the park. Although some of these actions may temporarily restrict visitor access in certain areas while restoration and other management actions are being completed, overall impacts on visitor experience from these cumulative projects would be long term and beneficial.

The cultural landscape and land uses associated with ranching are widespread in the planning area. Together, they strongly influence visitor opportunities and the sights and sounds that visitors experience. As a result of this influence, alternative A would contribute the majority of impacts to the Visitor Use and Experience cumulative impact scenario. As described above, these impacts would be either adverse or beneficial depending on the opportunities that visitors seek in the planning area. When the impacts of alternative A are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on visitor use and experience would be beneficial or adverse depending on the visitor. Overall, visitor use and experience would be the same compared to existing conditions.

Alternative B

Public Use and Enjoyment

Under alternative B, actions to enhance public use and enjoyment would be implemented. However, annual visitation is not expected to change, and approximately 2 to 2.5 million visitors are expected to continue to visit the park each year. Implementing additional strategies and projects would expand the range of visitor opportunities in the planning area compared to existing conditions. Expanded options for day use and overnight accommodations as well as enhanced interpretation would provide more diverse visitor use opportunities that would benefit the visitor experience. Currently there are no overnight accommodations in the planning area. With the potential incorporation of overnight camping or farm stays, overnight visits to the park would offer a new visitor experience under alternative B. New visitor experiences could also be provided through the adaptive use of vacant structures, including new concessions and educational opportunities. Providing a wider range of recreational opportunities in the planning area would benefit public use and enjoyment compared to existing conditions.

Implementing a broader range of strategies to address visitor access to and around the planning area would generally have an overall beneficial impact on the visitor experience by managing for a high-quality visitor experience. The provision of targeted and readily accessible information for visitors to be able to learn about and select experiences throughout the park would also be beneficial to the visitor experience compared to existing conditions. While visitors are currently allowed on ranchlands, without clear signage, many visitors do not use these areas. Improved wayfinding and trail connections, as well as gates or fence step overs, would help facilitate enhanced and compatible visitor use in the planning area.

In support of this strategy, NPS would develop additional hiking, biking, and equestrian access, focusing on the use of existing roads to facilitate connections across the planning area. Combined with improved signage and wayfinding, the expanded trail network would allow visitors to experience a larger portion of the planning area and would improve connectivity throughout the entire park. These trails could also provide connectivity to regional trails, allowing visitors to incorporate the park into a more extensive cycling network. Partnering with the county to improve multiuse roads to provide enhanced safety for bicycles would improve visitor circulation and safety and provide an additional modality for visitors seeking access to key areas of the park, which would have beneficial impacts on public use and enjoyment.

Adopting a comprehensive management framework for visitor capacity would help ensure the park's ability to achieve desired conditions for the visitor experience as opposed to responding to individual issues on a case-by-case basis.

Ranch Operations

Impacts on visitor experience from continued ranching operations would generally be the same as those described for alternative A. Alternative B would also authorize diversification activities such as farm stays and ranch tours that would result in additional beneficial impacts by creating new opportunities for visitors to observe and learn about ranch operations. Diversification activities under alternative B that add new types of livestock, crops, and associated fencing or other infrastructure could result in adverse impacts for visitor opportunities related to natural sights and sounds. The presence of livestock guardian animals could result in visitor conflicts. While livestock guardian animals are trained to protect livestock from predators, they can be aggressive towards humans. All livestock guardian animals would be required to be properly trained, as noted in appendix F, table F-14, to reduce the risk of conflict with visitors and wildlife; ranchers would be required to post signs alerting visitors that livestock guardian animals are working on the ranch.

Elk Management

Under alternative B, visitors would continue to have opportunities to view the Drakes Beach and Limantour herds in their existing core areas. While management actions would be taken to keep the population of the Drakes Beach herd at approximately 120 individuals, the herd would continue to be highly visible and accessible to visitors, especially along Drakes Beach Road. Adverse impacts on visitor use, experience, and access would be limited because only a small number of animals would be removed annually during low visitor use times. Localized areas may be temporarily closed to visitors during the removal of elk, although this activity is not expected to last more than a couple of hours and would not occur during times of high visitor use. These closures could occur several times a year, as needed.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would contribute noticeable beneficial impacts by providing a wider range of recreational and educational opportunities in the planning area. Adverse impacts on visitor use and experience could occur as a result of temporary closures during elk management activities. Opportunities to experience natural sights and sounds could be adversely impacted by diversification activities that add new types of livestock, crops, and associated fencing or other infrastructure. When the incremental impacts of alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on visitor use and experience would be beneficial, with the incremental impacts of alternative B contributing most of the impacts. Overall, visitor use and experience would improve compared to existing conditions.

Alternative C

Impacts related to public use and enjoyment and ranch operations under alternative C would be the same as those described under alternative B.

Elk Management

Under alternative C, the opportunity for visitors to view the Drakes Beach elk herd would be eliminated, which would result in a highly noticeable, long-term, adverse impact on visitor use and experience because this herd is the most visible elk herd in the planning area. However, other areas would still be available to view elk, including the free-ranging herd at Limantour, so the opportunity to view free-ranging elk in Point Reyes would not be completely eliminated for visitors. A portion of the planning area could be intermittently closed to visitor use during the removal of the Drakes Beach herd, resulting in

temporary, localized, adverse impacts on visitor experience, use, and access because this management action would occur over several months.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. The incremental impacts of alternative C would contribute noticeable beneficial impacts by providing a wider range of recreational and educational opportunities in the planning area. The loss of the opportunity to view the Drakes Beach herd, along with temporary closures during removal efforts, would have a noticeable adverse impact on visitor use and experience. Opportunities to experience natural sights and sounds could be adversely impacted by diversification activities that add new types of livestock, crops, and associated fencing or other infrastructure. When the impacts from alternative C are combined with the impacts of past, present, and reasonably foreseeable actions, the overall cumulative impact on visitor use and experience would remain beneficial, with the incremental impacts of alternative C contributing most of the impacts. Overall, visitor use and experience would improve compared to existing conditions.

Alternative D

Actions to enhance public use and enjoyment under alternative D would be the same as those described under alternative B, resulting in an expanded range of visitor opportunities in the planning area compared to existing conditions.

Ranch Operations

Visitor opportunities related to experiencing natural sights and sounds would continue to be affected by machinery, structures, odors, and noise associated with operating and maintaining ranches, although they would be slightly reduced compared to existing conditions from the removal of grazing operations on 7,500 acres. Impacts related to the presence of livestock guardian animals would be the same as those described under alternative B.

Elk Management

Impacts related to the management of the Drakes Beach herd would be the same as those described for alternative B. Under alternative D, elk viewing opportunities may be expanded if new herds become established on the 7,500 acres of land removed from ranching, resulting in beneficial impacts on visitor experience. The distribution of elk in the planning area would remain generally consistent with existing conditions, and the Drakes Beach herd would continue to be highly visible and accessible to visitors.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. The incremental impacts of alternative D would contribute noticeable beneficial impacts by providing a wider range of recreational and educational opportunities in the planning area. The reduced scale of ranching would improve visitor opportunities related to experiencing natural sights and sounds. Slightly adverse impacts on visitor use and experience would occur from temporary closures associated with managing the Drakes Beach herd. Opportunities to experience natural sights and sounds could be adversely impacted by diversification activities that add new types of livestock, crops, and associated fencing or other infrastructure. When the impacts from alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on visitor use and experience would be beneficial, with the incremental impacts of alternative D contributing most of the impacts. Overall, visitor use and experience would improve compared to existing conditions.

Alternative E

Actions to enhance public use and enjoyment under alternative E would mostly be the same as those described under alternative B, resulting in an expanded range of visitor opportunities in the planning area compared to existing conditions.

Ranch Operations

Under alternative E, NPS would continue to issue lease/permits for ranching in the planning area, which would have the same impact on visitor use and experience as described under alternative B. While dairy ranching would be discontinued, beef ranching would expand compared to existing conditions. Visitors would no longer be able to observe and experience dairy ranching operations in the planning area, but the conversion to beef ranching would likely reduce the noise and odors associated with concentrated dairy operations and benefit visitor opportunities related to experiencing natural sights and sounds in the planning area. The adverse and beneficial impacts related to diversification described under alternative B would not affect visitor use, experience and access because diversification would not be allowed under alternative E.

Elk Management

Under alternative E, NPS would not manage the elk population or its geographic extent. The elk population in the park would continue to increase, likely providing expanded opportunities for viewing elk, which would benefit visitor experience.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. The incremental impacts of alternative E would contribute noticeable beneficial impacts, particularly from the potential additional opportunities to view elk and the reduction in noise and odor associated with dairy operations. When the impacts from alternative E are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on visitor use and experience would remain beneficial, with the incremental impacts of alternative E contributing most of the impacts. Overall, visitor use and experience would improve compared to existing conditions.

Alternative F

Public Use and Enjoyment

Under alternative F, a comprehensive visitor use plan would be prepared to provide site-specific guidance for visitor use in the 28,000-acre planning area after ranching operations cease. Park resources would be managed to preserve and enhance their fundamental values, protecting and enhancing the outstanding natural and historic features that contribute to the scenic beauty of a large contiguous coastal landscape. Scenic trails, roads, and coastlines that provide sightseeing and related recreational opportunities would be permitted while allowing for the preservation and restoration of priority resources.

Without active ranching, NPS generally anticipates additional public recreational and visitor opportunities across the landscape, including adaptive use of ranch complexes; however, overall visitation is not expected to change from existing conditions. NPS anticipates many of the ranches and their associated facilities would be offered for public non-profit education, research, outdoor experiential activities, and other public recreational and visitor opportunities—all of which would expand visitor opportunities in the park. Under alternative F, NPS would also consider expanding trail linkages that connect new visitor opportunities located in former ranch complexes, which could improve connectivity across the entire park and region. The exact locations of additional linkages would depend on the future uses of the ranch complexes. NPS would interpret the history of ranching in the park using a range of techniques. Alternative F would provide opportunities for the most extensive adaptive use of ranchlands and ranch complexes/structures, resulting in long-term, beneficial impacts compared to existing conditions.

Ranch Operations

Under alternative F, visitors would no longer be able to experience working ranches in the planning area once ranching has ceased. Some historic buildings, structures, and landscapes could be preserved based on their relative historical significance, offering interpretive opportunities related to ranching history. Removing ranch operations would eliminate a unique experience that the park currently provides. However, impacts to visitor opportunities related to experiencing natural sights and sounds in the planning area would be beneficial because the impacts of ranch operations on natural resources (e.g., vegetation, wildlife, water resources and air) would cease as the park is restored to a more natural environment.

Structures and complexes that are not demolished or reused for housing or NPS operations could be renovated for adaptive use, including additional locations for overnight stays, nonprofit partnerships, and day use facilities, potentially providing expanded visitor opportunities in the planning area beyond those discussed under alternative B. Some ranches could receive less maintenance, especially if vacant, and would potentially be mothballed or stabilized to arrest deterioration while adaptive use opportunities are pursued. The deterioration of ranch buildings and associated landscape features over time and potential demolition would be an adverse impact on the scenic landscape and visitor experience. Mothballing of properties would have a short-term, adverse impact on the visual scenery because the setting would be altered with boarded-up buildings and potentially a long-term, adverse impact if a use could not be found and maintenance continued to be deferred.

Elk Management

Under alternative F, NPS would take no action to limit the population growth or geographic extent of free-ranging elk herd in Point Reyes, which would provide additional opportunities and new locations for visitors to view elk. In addition, the Tomales Point elk fence would be removed, and all elk would be free ranging throughout the park. The Tomales Point herd would likely expand into the planning area, which would further benefit visitor experience by increasing viewing opportunities.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. The incremental impacts of alternative F would have noticeable beneficial impacts on visitors by expanding the location and type of visitor experiences available in the planning area. Noticeable adverse impacts on visitor use and experience would occur from the elimination of the opportunity to experience working ranches in the planning area. When the impacts from alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on visitor use and experience would be beneficial for visitor opportunities to experience natural sights and sound and adverse for visitor opportunities to experience historical ranching compared to existing conditions, with alternative F contributing most of the impacts.

CULTURAL LANDSCAPES, HISTORIC DISTRICTS, AND HISTORIC STRUCTURES

Methodology and Assumptions

According to NPS *Management Policies* section5.3.5.2, the treatment of cultural landscapes should preserve significant physical attributes, biotic systems, and uses when those uses contribute to historical significance. Treatment decisions should therefore be based on a cultural landscape's historical significance over time, existing conditions, and use, and consider both natural and built features of the landscape as well as continued use (NPS 2006a). The actions and associated effects of the various alternatives were considered with regard to these attributes. Management Policies 5.3.5.2.6 further provide that when land use is a primary reason for the significance of a landscape, the objective of treatment will be to balance the perpetuation of use with the retention of tangible evidence that represents its history. Contemporary use of a cultural landscape is allowed under the *Management Policies* if it does

not adversely affect significant landscape characteristics and features and either follows the historic use or does not impede public appreciation of it (NPS 2006a).

Each of the proposed alternatives would have similar types of impacts on cultural resources in the planning area, including, but to varying degrees, physical modification of, or change in, use of some structures; development of new structures or facilities; use of temporary stabilization methods such as mothballing; and potential demolition of structures that have become extensively deteriorated and for which no compatible use can be found. Under an alternative where no ranching or a reduction of ranching would occur, impacts may also include a change from the historical use of a ranch complex and/or landscape to an alternative use that may have broadscale effects on the visual and intangible qualities of a cultural landscape.

The significance and integrity of the affected cultural landscapes have been well documented in the recently completed National Register nominations for the respective properties, and the 2018 Condition Assessment provides a baseline condition for all structures in the Olema Valley Dairy Ranches and Point Reyes Peninsula Dairy Ranches Historic Districts. Additionally, since land use is important to the significance of the Olema Valley Dairy Ranches and Point Reyes Peninsula Dairy Ranches Historic Districts, continuation of the existing historic use is the preferred preservation treatment according to NPS Management Policy 5.3.5.2.6.

Impacts on the four historic districts were analyzed by determining the relative number and type of contributing resources that would be affected by the actions of the various alternatives. Actions affecting the physical characteristics or use of the districts and their contributing resources in a manner inconsistent with NPS *Management Policies* for cultural resources and the Secretary of the Interior's *Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscapes* were considered adverse. Those actions consistent with these policies and standards that serve to maintain or enhance the important physical characteristics of the districts and the historic land use were considered beneficial. Analysis of cultural resources impacts considers measures that would be implemented to avoid, minimize, or mitigate adverse effects. The area of analysis includes the cultural resources within the boundaries of the planning area. However, impacts in the Olema Valley Dairy Ranches Historic District or Point Reyes Peninsula Dairy Ranches Historic District may affect the entire historic property, whose boundaries extend beyond the planning area.

Alternative A

Under alternative A, management of cultural resources would follow the 1980 GMP, NPS *Management Policies 2006*, and the *Cultural Resource Management Guideline*. The GMP specifies preservation or adaptive use for most buildings in the Olema Valley Dairy Ranches and Point Reyes Peninsula Dairy Ranches Historic Districts. The main management objectives in the 1980 GMP with regard to cultural resources at Point Reyes are:

- to identify, protect, and preserve the significant historic and cultural resources of Point Reyes
- to monitor and support productive land uses and activities that are consistent with historical patterns

Under alternative A, the continued operation of ranches would be used to manage and maintain the Point Reyes Peninsula and Olema Valley Dairy Ranches Historic Districts. Ongoing ranching would continue to be the preferred preservation strategy because the historic land use of these ranches is important to the significance of the historic districts. Ranch operations under alternative A, including the occupation and use of historic structures would continue to result in both adverse and beneficial impacts on cultural landscapes and historic districts. Continued occupation and use of ranch structures would benefit these buildings by preventing the accelerated deterioration due to neglect and vandalism that threaten buildings left vacant; however, condition assessment information suggests that the current level of maintenance invested by ranchers is not sufficient to meet maintenance needs in most cases. Over time, without substantial investment in these facilities, this deficiency in the level of maintenance is likely to continue

and result in adverse impacts as the condition of structures continue to deteriorate. Specific preservation activities would continue on a case-by-case basis, as needed and with availability of funds. Continued use of the historic pasture lands (which are a contributing resource of the cultural landscape) for cattle grazing would maintain the existing conditions and characteristic features of the grazing lands including annual and native grasslands. Continued grazing at the Marconi/RCA Bolinas Transmitting Station and RCA Point Reyes Receiving Station Historic Districts would maintain the character-defining low grasslands of the antenna fields in both districts. The continued historic use of the ranch structures and landscape would also continue to maintain the critical and, in some cases, less tangible aspects of the cultural landscape's integrity of design, setting, feeling, and association and be consistent with the Secretary of the Interior's *Standards for Preservation and Guidelines for the Treatment of Cultural Landscapes*. Overall, buildings in the Point Reyes Peninsula Dairy Ranches Historic District and Olema Valley Dairy Ranches Historic District cultural landscapes would continue in fair condition with a trend toward poor condition because of deferred maintenance in the absence of a substantial capital investment. Continued visitor use of ranchlands and elk management would not affect cultural landscapes and historic districts. The elk population would be managed to maintain ranching at the current authorizations and would not affect cultural landscapes, historic districts, or historic structures.

Cumulative Impacts

Past and present actions that have affected cultural resources in the park include cultural resource preservation projects that have occurred in both historic districts over the past five years. These activities have preserved or improved the condition of specific buildings and retained the integrity of contributing buildings and features of the districts. The benefits associated with completed maintenance projects will continue into the future, but new efforts are limited by the availability of funds, NPS staffing capacity, and the competing maintenance needs of other historic properties in the park. Overall, these actions have and will continue to result in beneficial cumulative impacts.

Alternative A would continue to contribute both adverse and beneficial impacts to cultural resources. The nature and extent of impacts on historic structures would depend on the level of funding available in the future to address deferred maintenance. Beef and dairy ranches would continue to be used for multi-generational ranching, which is recognized as an appropriate preservation strategy for cultural landscapes where land use is important to the significance of the historic districts. When the incremental impacts of alternative A are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative impact on cultural resources would be adverse compared to existing conditions because the maintenance backlog would eventually outweigh the limited preservation projects taking place, with alternative A contributing most of the impacts.

Alternative B

Under alternative B, existing historic ranching and dairy operations would continue in the planning area. The continuation of active ranching and occupied infrastructure is the primary preservation approach to support effective management and maintenance of the Point Reyes Peninsula and Olema Valley Dairy Ranches Historic Districts in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscapes*. Buildings currently under lease for ranch operations would continue to be occupied and used by ranchers. Historic pasturelands would continue to be used for grazing of cattle, which would result in the preservation of the cultural landscape by maintaining the historic land use according to the Secretary of the Interior's *Standards for Preservation and Guidelines for the Treatment of Cultural Landscapes*. NPS would revise and clarify building maintenance requirements so that the character-defining features and the long-term integrity of the historic districts would be better preserved, and maintenance needs and activities would be reviewed annually and incorporated into ROAs. Appendix G provides a list of preservation and maintenance guidelines for ranch buildings under lease/permit that are consistent with these standards.

ROAs would be explicit about the cyclic maintenance tasks that are the responsibility of each rancher. NPS would support projects to address the substantial deferred maintenance needs on many of the historic structures, which would make ongoing maintenance more manageable for individual ranchers. All maintenance and repair work would be consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* and the *Standards and Guidelines for Rehabilitation.* These mechanisms would help ensure ranchers are meeting cyclic maintenance requirements and would have long-term, beneficial impacts by reducing deferred maintenance over time. It is anticipated that the increased stability and certainty associated with longer lease terms would also contribute to enhanced investment by ranchers in the maintenance of ranch buildings and facilities. Like alternative A, continued cattle grazing of pastures would maintain the existing condition of the historic pasturelands, coastal prairies, and grasslands, including the low grasslands of the antenna fields at the Marconi/RCA Bolinas Transmitting Station and RCA Point Reyes Receiving Station Historic Districts; continue the historic use of the ranch structures; and maintain the overall cultural landscape. The increased opportunities for diversification in the Ranch Core subzone allowed as part of this alternative may result in alterations to historic buildings or the construction of new buildings. Any such proposals would be considered through additional review and compliance and would be required to meet the Secretary of the Interior's *Standards for the Treatment of Historic Properties,* including the *Guidelines for the Treatment of Cultural Landscapes.* New buildings would be designed and sited to be compatible with the historic setting. The adaptive use of existing buildings to support diversification activities could result in a long-term, beneficial impact if vacant or underused buildings are adapted and maintained to accommodate new uses. Diversification of operations could also result in increased investments in historic structures by ranchers, which would have a long-term, beneficial impact because the Secretary's Standards would be followed, and the overall condition of the historic structures would improve.

Elk management activities would reduce elk conflicts with ranch operations and supports continuation of multi-generational ranching, which would benefit the historic district. Development of new visitor use opportunities, including trails and trail-based recreation, would not noticeably alter the cultural landscape because most development would use existing roads.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable projects would be the same as those described for alternative A. The incremental impacts of alternative B would contribute most of the impacts and would be noticeably beneficial as a result of a reduction in deferred maintenance, development of a formal process for addressing vacant structures, and continued occupation and use of active ranches and the annual and native grassland landscape for multi-generational ranching. Alternative B could contribute adverse impacts on cultural resources if uses are not identified for vacant historic structures and the decision is made to demolish the structure. When the impacts from alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on cultural resources would be beneficial compared to existing conditions, with alternative B contributing most of the impacts.

Alternative C

Alternative C would have the same direct, indirect, and cumulative impacts as described for alternative B.

Alternative D

Under alternative D, cessation of ranching operations on 7,500 acres would focus on lease/permit areas where no residential use of historic complexes occurs, thereby minimizing adverse impacts on historic complexes in the districts. However, alternative D would have an adverse impact on the historic districts if the 7,500 acres removed from grazing converted to shrubs/forest. The conversion of the characteristic vegetation within the affected pasturelands would affect the cultural landscapes' integrity of design, association, setting, and feeling to the extent that these contributing resources would no longer convey their significance. Beyond the individual pasturelands, this loss of integrity would also fragment the

overall cultural landscape. In areas that were naturally brush/forest prior to the start of grazing, it is unlikely that these characteristics could be maintained on these pasture and grassland areas without continued ranching. However, continued ranching on the lands that remain in grazing would preserve the integrity of the cultural landscape in these areas. Impacts from adaptive use of vacant properties, deferred maintenance, elk management, and visitor use and enjoyment would be the same as those described for alternative B. Once the life estates expire, grazing would also be discontinued on the antenna fields in the Marconi/RCA Bolinas Transmitting Station Historic District causing long-term, adverse impacts on the setting and feeling of the historic district. The low grasslands associated with this district could be maintained through mowing or Targeted Grazing, which would reduce or eliminate potential adverse impacts.

Despite the adverse impacts, it is anticipated that all four historic districts would retain sufficient integrity to convey their significance, and these properties would remain eligible for listing in the National Register.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable projects would be the same as those described for alternative A. The incremental impacts of alternative D would contribute most of the impacts on cultural resources. Beneficial impacts would occur from a reduction in deferred maintenance, development of a formal process for addressing vacant structures, and continued occupation of active ranches and maintenance of the pastoral landscape in areas where ranching would continue. However, the removal of 7,500 acres from ranching under alternative D would contribute adverse impacts because the cultural landscape would experience diminished integrity of design, association, setting, and feeling in these areas. When the impacts from alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on cultural resources would be adverse compared to existing conditions, with alternative D contributing most of the impacts.

Alternative E

Phasing out dairy operations would have adverse and beneficial effects on cultural resources. For the six dairy operations that are phased out, long-term, adverse impacts are anticipated because of the number of ranch buildings and possibly entire ranches that would become vacant as a result of the change in use. The resulting vacant structures would be subjected to accelerated deterioration of the historic fabric and potential vandalism. Mothballing and other stabilization measures may be undertaken to protect vacant buildings while adaptive use opportunities are developed to minimize adverse impacts. If adaptive use opportunities are ultimately not identified, the decision may be made to demolish the structure, which would result in adverse impacts. In general, ranches with higher integrity would be prioritized for adaptive use. New uses that do not affect significant landscape characteristics would be preferred and would help reduce adverse impacts. If all dairy ranches converted to beef operations, grazing would continue (although at a lower density on the converted ranches) thereby maintaining the integrity of the historic pasturelands. If dairy ranches did not convert to beef ranches and cease operations, impacts on the cultural landscape would be similar to those described for the 7,500 acres closed to ranching under alternative D. Beneficial impacts on cultural resources from existing beef ranches that continue in operation would be the same as those described under alternative B.

Because the population of free-ranging elk would be allowed to expand within Point Reyes under this alternative, cattle AU would be adjusted for each ranch to ensure that RDM goals are met. This could result in a noticeable reduction in authorized AU at individual operations, and there is the potential for some ranches to eventually close under this alternative if authorized AU are dramatically reduced over time. If ranches close, the number of vacant structures would increase, grazing levels would decrease, and adverse impacts described above would increase in the planning area.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable projects would be the same as those described for alternative A. The incremental impacts of alternative E would contribute most of the impacts on cultural resources. It is anticipated that some dairy infrastructure would become vacant, resulting in adverse impacts on unused historic structures. While alternative E would allow for maintenance of the pastoral landscape on all 18 beef ranches and possibly on the 6 dairy operations if they convert to beef, it is possible that some ranches would close over time as the elk population expands. Ranch closures would have adverse impacts on historic structures and cultural landscapes like those described under alternative D for the 7,500 acres where ranching would cease. When the impacts from alternative E are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on cultural resources would be adverse compared to existing conditions, with alternative E contributing most of the impacts.

Alternative F

Under alternative F, no commercial agricultural activities would be permitted in the planning area, and ranch structures may become unoccupied. Alternative F proposes adaptive use for as many historic structures as feasible, prioritizing ranches that contain the characteristic buildings and structures typical of the historic ranches. High priority properties contain most, if not all, the requisite historic milking and dairy production structures; residential/domestic structures; ranch support structures such as barns, sheds, and garages; and historic landscape features such as pastures and windbreaks. Ranches with fewer examples of these characteristic structures would have lower preservation priority.

Consistent with NPS Management Policies (9.1.1.4), adaptive use of historic buildings on ranches that are high priorities for preservation would be pursued to the maximum extent feasible and would result in a long-term, beneficial impact on those ranch buildings that are effectively maintained and rehabilitated for the new use. Lower priority ranches would receive less maintenance and would potentially be mothballed or stabilized to arrest deterioration while adaptive use opportunities are pursued. If adaptive use opportunities are ultimately not identified, the decision may be made to demolish the structure. The deterioration of ranch buildings over time and potential demolition would result in long-term, adverse impacts on lower priority properties and the National Register districts to which they contribute. Mothballing of properties would have a short-term, adverse impact because the setting of the district would be altered with boarded up buildings and potentially a long-term, adverse impact if a use could not be found and maintenance continued to be deferred.

Changing the traditional historic use of ranches would have long-term, adverse impacts on the historic districts. In addition to the loss of the historical land use activity of ranching, while some historic buildings, and structures could be preserved based on their relative historical significance, landscape features such as fences, boundaries, and circulation features would be removed, and the integrity of the historic pasturelands would diminish over time as grassland environments maintained by ranching activities convert to shrublands/ forest. As described under alternative D, the conversion of the characteristic vegetation in the affected pasturelands would affect the cultural landscapes' integrity of design, association, setting, and feeling to the extent that these contributing resources would no longer convey their significance and would also fragment the overall cultural landscape. Over the long term, these adverse impacts would likely diminish the integrity of the Point Reyes Peninsula Dairy Ranches Historic District and the Olema Valley Dairy Ranches Historic District to the point that they would likely no longer retain sufficient integrity to convey their historic significance and therefore would no longer be eligible for listing in the National Register. This loss would likely result in significant, adverse impacts on the Point Reyes Peninsula Dairy Ranches and Olema Valley Dairy Ranches Historic Districts. However, individual ranches that have been effectively preserved through adaptive use or other preservation strategy may be individually eligible.

The pastoral appearance of the antenna fields in the Marconi/RCA Bolinas Transmitting Station Historic District and RCA Point Reyes Receiving Station Historic District would also not be maintained, causing long-term, adverse impacts on the historic districts' setting and feeling; however, these two districts would likely retain sufficient integrity to convey their historic significance.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable projects would be the same as those described for alternative A. The incremental impacts of alternative F would contribute most of the adverse impacts due to the great number of structures that would become vacant and subjected to accelerated deterioration and vandalism. Structures would be mothballed for extended periods and/or potentially demolished. The pastoral appearance of the pasturelands would not be maintained, and the integrity of the historic districts would diminish to the point of no longer being eligible for listing in the National Register. When the impacts from alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on historic resources would be adverse and significant compared to existing conditions, with alternative F contributing most of the impacts.

SOCIOECONOMICS

Methodology and Assumptions

The study area comprises both Marin and Sonoma Counties, California. However, the primary impacts from the alternatives would be felt in Marin County. Western Marin County, where the park is located, is primarily rural, with scattered, small, unincorporated towns that serve tourism, agriculture, and residents. Ranchers in the park also purchase goods and services from businesses in Sonoma County, and some workers at the ranches reside in Sonoma County. While these counties contain several larger cities, including San Rafael, San Francisco, Santa Rosa, Petaluma, and their surrounding areas, the park is located in a predominantly rural area away from the large urban areas. Additional information about San Francisco is included in this assessment because of its proximity to the study area and the economic relationship that the ranches in the study area may have with this county.

The analysis of socioeconomic impacts considers potential effects on employment, population, and revenue from park visitation and ranching activities that may result from changes in the leasing arrangements of ranching activities at the park. Beef cattle and dairy operations support the income and employment of farmers, ranchers, and operations staff. These operations also support income, sales, and employment at the businesses where they purchase goods and services. Beef and dairy ranch operations are analyzed quantitatively while impacts to ranch operations from elk are analyzed qualitatively. Additionally, visitation to the park supports gateway communities, hotels, tour operators, and visitor outfitters, such as kayak rental companies. Visitors support local communities and businesses through their spending, which supports jobs, income, sales, and fiscal revenues primarily in Marin County and beyond Marin County where the flow of goods and services from these businesses support additional employment and income.

Economic Impact Assessment of Changes in Sales at Ranches on Point Reyes (Backward-Linked Impacts). An Input-Output (I/O) analysis measures the interdependence among industries in the regional economy to provide an estimate of multiplier effects. This kind of analysis describes the demand and supply of products and services among industries, households, and governments to create a detailed mathematical description of an economy in a specified area. This approach is based on the notion that there is a fundamental relationship between the volume of output of an industry and the volume of the various inputs used to produce that output. Industries are often grouped into production, distribution, transportation, and consumption categories. The IMpact analysis for PLANing (IMPLAN®) is an industry-standard I/O model used to estimate economic impacts.

IMPLAN software and data are sophisticated economic tools that apply I/O analysis to estimate the impacts of changes in regional economies. IMPLAN customizes regional I/O models to provide estimates of output (sales), employment, income, and gross regional product effects in a specified location. Changes in the purchases of goods and services for final consumption (final demand change) are the driving forces in I/O models. Each industry that produces goods and services generates demands for other goods and services. For example, when construction firms pay their workers and purchase supplies or services, economic activity is generated in the local or regional economy through salaries, business, and household spending. Multipliers are used to describe this additional economic activity. As of 2020, IMPLAN has the capability to analyze 536 industry sectors, providing a detailed examination of the economic effects on specific industries.

Initial expenditure or revenue can have both a direct effect on the local economy (local labor) as well as effects that are considered leakages (e.g., imports, commuters). Some portion of the direct effect is likely captured locally, usually a portion of the direct jobs and income. Goods and services needed to produce the directly affected service or product include purchases from local (within the study area) and non-local (e.g., imports) businesses. Purchases made locally for services, products, and labor generate additional economic activity in the study area. Subsequent rounds of spending do not generate the same level of economic activity due to the import of goods, services, and labor and to account for transactions that do not stimulate further spending in the economy of an IMPLAN model (i.e., within the study area). It is often assumed that profits, savings, and taxes generate no further economic activity for the region because profits and savings represent monies set aside for later use, and collected taxes can leave the region before being spent.[9] The final result of all the purchase rounds generated in the study area by the initial expenditure is the total impact. Table 16 presents the types of impacts that can be estimated using the IMPLAN model.

TABLE 16: ECONOMIC IMPACT DEFINITIONS

Impact Term	Definition
Direct impact	The direct effects are the initial expenditures (or production revenues) made by the industry experiencing the economic change.
Indirect impact	The indirect effects include the backward-linked industry suppliers for any goods and services used by the directly affected industries.
Induced impact	The results of local spending of employees' wages and salaries for both employees of the directly affected industry and the employees of the indirectly affected industries.

Source: Day n.d.

The IMPLAN model is started by creating an "event" that becomes the input into the model. This event is then "run" in the model to produce outputs from the model in the form of direct, indirect, and induced impacts to the study area in the form of changes to sales, employment, income, and gross regional product (referred to as "total output" in IMPLAN) that would occur as a result of the "event." In this analysis "events" represent changes in sales of beef and cattle dairy operations. These "events" are changed depending on the alternative to represent the likely change in sales at each ranch operation. The model calculates direct, indirect, and induced impacts to employment, sales, income, and output in the study area. Sales values have been adjusted for the following IMPLAN industries to measure these impacts:

- Sector 11 Cattle ranching and farming

[9] Taxes can be an important source of funding for local government entities. For instance, some taxes, such as property taxes and sales taxes remain within the local area and are used to fund government projects and services. Other taxes, such as severance taxes on mineral and energy extraction may be collected by a state agency that redistributes the revenues throughout the state. Thus, the local study area may only realize a portion of the tax revenues generated in the region.

- Sector 12 Dairy cattle and milk production
- Sector 13 Poultry and egg production

The IMPLAN study area for this model includes Marin and Sonoma Counties because goods and services provided to ranch operations at Point Reyes are assumed to come from both counties. Because the park is in Marin County, most impacts are assumed to occur there. However, agricultural suppliers and farm hands that provide goods and services to ranches in the planning area reside in Sonoma County. Therefore, a multi-regional input output analysis was completed to assess the separate impacts that would occur to Sonoma County as a result of this project. By performing multi-regional I/O modeling, these two counties are linked together to determine how dollars spent on purchases in one county, such as Marin, move to Sonoma County. This also allows the tracking of additional indirect and induced jobs supported by indirectly affected businesses in Sonoma County because these businesses in turn purchases additional goods and services in both Marin and Sonoma Counties (Day n.d.). It should be noted that IMPLAN estimates that impacts would occur in another county as a result of spending in an industry in the directly affected county based on the average purchasing methods of businesses in the directly affected industries. Real impacts would likely be different as individual businesses make decisions outside their industry averages that could lead to greater or fewer impacts in neighboring counties. The results of the IMPLAN model, especially impacts identified in neighboring counties, should therefore be viewed cautiously as an estimate of how an industry in general in Sonoma County may be affected by the modeled changes.

Assumptions for IMPLAN modeling:

- IMPLAN default values for the percentage of local goods that each ranch operation procures to produce its products were used as inputs into beef and dairy cattle operations. All initially direct impacts to sales at ranch operations were set at 100% for Marin County because all affected sales in the two directly affected industries occur in Marin County.
- All milk produced at the ranches is organic milk and is sold to third parties to be sold again directly to consumers or through intermediaries that turn the initial milk product into a higher value good such as yogurt or cheese.
- The total amount of milk produced per day per cow at each dairy ranch in the planning area is 71 pounds. This value was applied to all milking cows at Point Reyes based on the number of reported cows (see table 1 in chapter 2) at each ranch (Black 2019).
- A dollar value of $30.02 per hundred pounds was used to calculate the sales value of the milk produced at dairy ranches on Point Reyes (Marin County Department of Agriculture, Weights and Measures 2017). This value was adjusted from 2017 to 2018 dollars using the US Consumer Price Index (US BLS 2018).
- Three beef operations in the planning area are organic.
- The number of permitted animals (provided in table 1 in chapter 2) was used to calculate the production of beef at the park.
- Because the total number of permitted animals at each beef cattle operation are not ready for harvest at one time, only a portion of the herd was assumed to be available for harvest each year. Therefore, the number of permitted animals was multiplied by 86% to determine the actual number of animals sold each year relative to the number of permitted animals at each ranch. This value was determined by reviewing the "COW-CALF/GRASS-FED Beef Operation" Report published by the University of California Cooperative Extension in 2004 (UC Cooperative Extension 2004). This report states that a 200 cow-calf breeding cycle operation includes 375 animals in total each year. Of these, 200 are breeding cows, 142 are culled animals (20 culled cows, 1 culled bull, and 121 sale calves), and 30 are second year grass-fed heifers. That means there are 172 animals sold each year from an average cattle farm from a total of 200 permitted animals that reside on that farm during the year. Dividing 172 by 200 equals 0.86 or 86%.

- A dollar value of $749 per head of cattle was used to calculate the value of an animal produced for beef sales (Marin County Department of Agriculture, Weights and Measures 2017). This value was adjusted from 2017 to 2018 dollars using the US Consumer Price Index (US BLS 2018).
- Only one ranch is authorized to run a poultry operation in the planning area. It was assumed that this operation uses Rhode Island Red chickens that can produce up to 300 eggs per year and that the operation has 2,000 laying hens. It was also assumed that the price paid for one dozen organic eggs was $2.43 (2017$) (USDA-NASS 2017). Based on these statistics, this operation can raise $121,300 per year from egg production. Additionally, it was assumed that this operation sells 900 broiler hens per year based on park permit data and that these broilers are sold for $3.39 (2017$) per head (USDA-NASS 2018). Based on total sales of poultry in Marin County in 2017 of $17.816 million (2017$), it was determined that poultry sales at the park made up 0.26% of all sales in the county (Marin County Department of Agriculture, Weights and Measures 2017).

Discrepancy between IMPLAN Output (Sales) and County Reported Sales for Dairy Production. Marin County's 2017 Livestock and Crop Report states total milk production, also understood as "at the farm gate" sales, was $34,153,000 in 2017 (Marin County Department of Agriculture, Weights and Measures 2017). IMPLAN stated the same sector's output, interpreted as "at the farm gate" sales in this analysis, at $54,645,000 in 2017 dollars ($53,544,678 in 2016 dollars), after adjusting for inflation. IMPLAN obtained this value by using two inputs: (1) state-level output estimates for the farm sectors from the USDA, National Agricultural Statistics Service's Value of Production (NASS) and Economic Research Service cash receipts data series, and (2) by using the ratio of county physical production to state physical production in an industry from the latest Census of Agriculture (IMPLAN 2019). In this case, IMPLAN used 2016 Economic Research Service cash receipts totaling $6,065,550,000 for the "Dairy products, Milk" commodity (USDA-NASS 2019). IMPLAN multiplied this product by the ratio of Marin County sales to the state of California sales of "Milk from cows" in the 2012 US Agricultural Census. Marin County's sales were $61,264,000 (2012$) and California's sales were $6,945,102,000 (2012$) in the 2012 US Agricultural Census (US Census of Agriculture 2019c), for a ratio of 0.0088211. The resulting product of this ratio and ERS' cash receipts for "Dairy products, Milk" commodity in 2016 is $53,505,312, which is statistically close to $53,544,678 (note: there is a small discrepancy due to rounding in the calculations). The value of $53,505,312 adjusted for inflation results in a value of $54,645,164, which is 60% greater than the county's valuation of $34,153,000 in "at the farm gate" sales of dairy milk in the same year. Therefore, IMPLAN may be overestimating the impact that sales in this industry have in the local economy in its baseline data. However, because IMPLAN derives its industry sales multipliers from RIMS II, among other sources, there is no reason to believe that an incorrect assessment of baseline sales in an industry would have further impact in the model. Therefore, this should not affect results from the changes in sales that are run through the model for the various alternatives. However, because IMPLAN applies the latest employment statistics in an industry to an industry's output to measure changes in employment, income, and household spending associated with changes to an industry's output, the number of employees supported per dollar of output may be underestimated. NPS interviewed ranchers and identified employment for ranch operations in the park, and it is apparent that IMPLAN is undercounting the number of employees supported by this industry. To adjust employment impacts for this potential discrepancy, the results from a survey of employment at ranches in the planning area were incorporated into the inputs of the IMPLAN analysis. This allowed for a more accurate representation of impacts on employment. However, the model may still underestimate impacts on local output and gross regional product.

Forward-Linked Impacts from Changes in Operations

The IMPLAN model is not designed to calculate impacts to forward-linked industries that purchase outputs, such as beef and dairy products, from ranch operations at Point Reyes because goods sold by the ranches are commodities that would be replaced in the supply chain of forward-linked industries. Possible forward-linked impacts on businesses that purchase outputs from ranches at Point Reyes are discussed below in qualitative terms of the possible disruption of their supply chain from locally constrained inputs, such as milk, to increased transportation costs.

Data Sources

Data sources used in this analysis included IMPLAN for its trade flow models, the US Census Bureau for population and demographic information, the US Bureau of Labor Statistics for information on employment and unemployment in the study area, the US Bureau of Economic Analysis for information on employment by industry, David Lewis with the University of California's Marin County Cooperative Extension, Point Reyes, for information on ranch operations, and the 2012 and 2017 US Census of Agriculture for county and state level agriculture information.

Alternative A

Population, Employment, Income, and Sales

Ranching, as authorized under existing lease/permits, would not change. New lease/permits would be renewed every 5 to 10 years, subject to NPS discretion and based on updated FMV appraisal determinations. The current population residing on ranches in the planning area and total employment associated with the ranches is expected to remain the same. Ranchers would continue to purchase and sell goods and services in the local economy at existing levels.

As described in the "Visitor Use, Experience, and Access" section, visitation and tourism in the planning area would not change under alternative A. Therefore, visitor spending, $107 million in 2018, in the planning area and in gateway communities is not expected to change. This spending supported 1,150 jobs in the local area and had an aggregate benefit to the local economy of $134 million (NPS 2019d). Park visitation would continue to contribute economic benefits to Marin and Sonoma Counties on a similar scale.

Grazing, Ranching and Agricultural Activities

Beef and dairy ranching operations and one commercial chicken operation would continue. Ranching operations would directly support 64 local jobs, $5.8 million in income, $15.7 million in agricultural product sales, and population in the study area while also indirectly supporting additional employment, income, and sales through purchases of inputs into their operations from local suppliers as described in chapter 3. Mowing and Forage Production would continue to occur at existing rates, which reduces the need for ranchers to purchase supplemental feed for their livestock. NPS would continue non-lethal elk management activities; however, elk from the Drakes Beach and Limantour herds would still have adverse operational impacts on individual ranches from hay consumption and fence and infrastructure damage.

Beef ranching under alternative A would continue to account for 15% of total cattle ranching, by dollar value of sales, in Marin County, while dairy production in the planning area would account for 41% of dairy production, by dollar value of sales, in the county. Poultry farming in the planning area would account for less than 1%, by sales, of poultry production in the study area. Overall, ranching in the planning area would continue to contribute less than 0.06% of total regional employment and 0.01% gross regional product.

Cumulative Impacts

The following projects generate cumulative socioeconomic impacts in the planning area. Invasive plant management projects have the potential to contribute long-term support for employment, income, and sales in the study area as a result of goods or services that are purchased in the study area for development of these projects. PG&E fire management prevention projects have the potential to seasonally support local employment, income, and sales through purchases of goods and services over the long term as fire management projects are undertaken. The primary economic benefits to the study area would accrue through contracts to mechanically remove trees and brush. Cultural restoration projects and roadway improvements would result in beneficial impacts in the study area as a result of spending on local labor and supplies for roadway projects. This spending would directly and indirectly support local employment, income, and sales in the study area. The primary economic benefits of these projects would accrue to local laborers hired to work on these projects. These laborers would induce additional rounds of economic benefits in the study area as a result of their household spending on goods and services. These past, present, and reasonably foreseeable actions would have negligible beneficial impacts on employment, income, and sales in the study area and would continue to result in beneficial impacts on employment, income, and sales in the study area.

Alternative A would continue to contribute to regional employment and gross regional product from continued support of employment, incomes, sales, and taxes by ranchers, park spending and projects, and visitation to the park. When the incremental impacts of alternative A are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative socioeconomic impacts would remain beneficial. The incremental impacts of ranching under alternative A would contribute 0.06% of total regional employment and 0.01% gross regional product in the study area.

Alternative B

Population, Employment, Income, and Sales

Lease/permits would be issued for up to 20-year terms, based on updated FMV appraisal determinations. Under alternative B, projects to enhance public use and enjoyment may be implemented, and the construction of these projects may result in the temporary support of jobs, sales, and income for construction companies hired to implement them. Construction workers for these projects are expected to come from the study area; therefore, the local population would not increase in the short or long term. This alternative would further provide indirect support for local jobs and income as construction companies and their laborers purchase additional goods and services in the local economy. These impacts would occur only during the period of construction and would cease once construction is completed.

Alternative B could create limited new recreational opportunities over the long term. However, as described in the “Visitor Use, Experience, and Access” section, there would be no change in visitation under this alternative compared to existing conditions, and as such, there would be no change to jobs, income, sales, and taxes in the study area in the short or long term from visitor use. Nor would there be changes in local population or the need for permanent living areas as a result of these opportunities. Ranching operations would continue as under alternative A. Continued ranching would not cause an increase in the local residential population.

Grazing, Ranching, and Agricultural Activities

Under alternative B, all ranches would be offered lease/permits with 20-year terms allowing both beef and dairy ranches to continue operating generally at current levels. Consistent with existing conditions, ranching operations would continue to directly support 64 local jobs, $5.8 million in income, and $15.7 million in agricultural product sales in the study area. These operations would also indirectly support additional employment, income, and sales through purchases of inputs into their operations from local suppliers. Revenues are expected to change based on Consumer Price Index and other long-term indices. Longer lease terms could allow ranchers to more easily obtain loans for property upgrades and

provide for their businesses' financial security compared to existing conditions. Any restoration of vacant buildings or ranching improvements would directly support study area employment, income, and sales for any goods and services procured in the study area. The economic impact to each lessee may be influenced by the lease appraisal process.

Expanded ranch diversification activities, including sheep, goats, chickens, and crops, could provide a possible economic buffer for ranchers during poor forage production years, reductions in the price of products, or increases in the price of inputs. If ranchers undertake diversification activities, additional economic benefits in the study area could accrue. This diversification option could also result in additional spending in the study area for feed, equipment, and other supplies to support diversification activities. However, impacts would likely be minimal. For example, if all 18 ranches that are eligible to raise chickens elected to raise the maximum 500 chickens allowed under diversification activities, this activity would only account for 2.1% of all chicken revenue in the study area. Any economic benefits created by the sale of products from these activities and from purchases made by ranchers to develop these activities in the planning area would support local jobs, income, sales, and taxes in the study area. NPS elk management activities, including annual lethal removal of 12 to 18 individual elk at Drakes Beach, would reduce operational impacts on ranches.

Economic benefits from continued beef and cattle ranching would be similar to those described for alternative A, accounting for 15% of total cattle ranching, by sales, in Marin County. Dairy production in the planning area would account for 41% of dairy production, by sales, in the county. Overall, ranching in the planning area, including additional beneficial impacts from diversification activities, would continue to contribute less than 0.06% of total regional employment and 0.01% of gross regional product.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would continue to contribute to regional employment and gross regional product from ongoing support of employment, incomes, sales, and taxes by ranchers, park spending and projects, and visitation to the park. The socioeconomic impacts of alternative B would be beneficial compared to existing conditions from the potential for additional diversification activities and longer lease terms that would allow ranchers to invest more heavily in their operations. When the incremental impacts of alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative socioeconomic impacts would remain beneficial. The incremental impacts of ranching under alternative B would contribute 0.06% of total regional employment and 0.01% gross regional product in the study area.

Alternative C

Economic benefits from continued beef and cattle ranching as well as overall cumulative impacts would be the same as those described for alternative B except that adverse operational impacts on individual ranches from elk associated with the Drakes Beach herd would be eliminated.

Alternative D

Population, Employment, Income, and Sales

Alternative D would be similar to alternative B, except under this alternative, approximately 7,500 acres of ranching would be removed from the planning area. Because the ranches identified for conversion have no residential complexes, the population in the planning area would not be affected. As described for alternative B, construction of projects to support visitor use may result in additional local jobs, income, sales, and taxes in the study area. These impacts would occur only during the period of construction and would cease once construction is completed. However, as described in the "Visitor Use, Experience, and Access" section, no change in visitation would occur under this alternative compared to existing conditions. As a result, visitation would not generate any changes to jobs, income, sales, and taxes in the study area in the long term.

Grazing, Ranching, and Agricultural Activities

Under alternative D, ending grazing on 7,500 acres would reduce the authorized beef cattle AU in the planning area by approximately 700 to 1,700 AU. There would continue to be 3,115 dairy cattle in the planning area. The decrease in beef cattle AU would result in an approximate $500,000 reduction in annual beef sales in the study area, or about 5% of beef sales in Marin County. According to IMPLAN, these sales directly support 17 full-time equivalent jobs, indirectly support another 1.5 full-time equivalent jobs in Marin County, and 1 additional job in Sonoma County. As a result of the closure of these ranches, household spending by former ranch employees and by employees from businesses where ranches purchase goods and services would be reduced. This would result in the loss of support for 1 additional induced job in Marin County. In total, the jobs that would no longer be supported account for $560,000 in labor income, or less than 0.005% of labor income, in the study area. Gross regional product would be reduced by $630,000 in the study area under this alternative, less than 0.005% of the total gross regional product. Elk would continue to have operational impacts on individual ranches; these impacts may increase under alternative D.

If ranchers were to undertake diversification activities, additional economic benefits in the study area could accrue compared to existing conditions, as described under alternative B. This diversification option could also result in additional spending in the study area for feed, equipment, and other supplies to support diversification activities. Although likely minimal, economic benefits in support of local jobs, income, sales, and taxes in the study area would occur from the sale of products from these activities and from purchases made by ranchers to develop these activities in the planning area.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative D would contribute to regional employment and gross regional product, from ongoing support of employment, income, sales, and taxes by ranchers; park spending and projects; and visitation to the park. Alternative D would also contribute beneficial impacts compared to existing conditions from additional diversification opportunities. However, ending ranching on approximately 7,500 acres would result in adverse impacts compared to existing conditions from the loss of $500,000 in beef cattle sales and the corresponding elimination of 19 jobs in the study area. When the incremental impacts of alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative socioeconomic impacts would remain beneficial because the adverse impacts under alternative D would be such a small contribution to the overall beneficial cumulative impacts in the study area. The incremental impacts of ranching under alternative D would contribute 0.005% of total regional employment and 0.01% of gross regional product in the study area.

Alternative E

Population, Employment, Income, and Sales

Under alternative E, all dairy ranches would be phased out during a five-year period and would convert to beef ranches. This alternative would continue to authorize residential use on ranches, even if they are no longer operating dairy ranches, so no change in population in the study area is anticipated. However, alternative E would result in adverse impacts on local jobs, income, sales, and taxes in the study area because dairies would close, and jobs would be reduced as the operations converted to beef ranching, which, based on IMPLAN outputs and an interview with University of California's Sonoma County Cooperative Extension (Black, pers. comm. 2019) require fewer full-time equivalent workers. Like alternative B, actions to enhance public use and enjoyment would be implemented and would temporarily support construction worker jobs and income. As described in the "Visitor Use, Experience, and Access" section, no change in visitation is expected under this alternative compared to existing conditions. No changes to jobs, income, sales, and taxes in the study area would occur in the short or long term as a result of changes in visitation.

Grazing, Ranching, and Agricultural Activities

Dairy operations would cease under this alternative, and the one commercial chicken operation would no longer be authorized, resulting in a loss of up to $14.1 million in dairy, egg, and meat poultry sales annually compared to existing conditions. However, the conversion of dairy ranches to beef operations would offset approximately 5% ($565,000) of these sales losses if all closed dairy operations converted to beef. Total dairy sale losses would represent 41% of total dairy sales in Marin County, while the conversion of operations to beef cattle and subsequent sale of beef products would result in a 5% increase in county beef sales. In total, changes in dairy, cattle, and poultry product sales under this alternative would reduce support for 27 direct jobs at the ranches in the study area and another 21 indirect jobs for other businesses in Marin County as a result of the purchase of goods and services by ranchers. The conversion of dairy ranches to beef ranches would also reduce household spending by former ranch employees and by employees from businesses where ranches purchase goods and services. This would result in a reduction in support for 11 induced jobs in Marin County. In total, the loss of these 58 jobs would represent 0.03% of all jobs in the county and support $5.3 million in labor income. An additional 3 indirect jobs and 1 induced job, accounting for $210,000 in labor income, would no longer be supported by goods and services purchased by the dairy ranchers in Sonoma County. This alternative would reduce the gross regional product in the study area by $9.1 million (0.01% of the gross regional product). It is anticipated that the study area would experience an overall loss of jobs, income, sales, and tax revenues because dairy operations support more employment and sales than beef cattle operations.

Additionally, Forage Production and crops would not be authorized under this alternative. Ranchers would need to procure additional feed for their livestock from suppliers outside the planning area, which would increase operating costs. However, Forage Production is typically linked to dairies, so the conversion of dairy operations to beef should minimize the need to bring in feed from outside the planning area. The economic impacts of this action would be mixed and would primarily result in the increased transfer of dollars to a forage provider in the study area and reduced spending on goods, service, and labor in support of growing forage on the ranches, resulting in a minimal economic impact in the study area. Elk would continue to have an adverse operational impact on individual ranches. As the elk population increases in the planning area, these impacts could increase under alternative E. Authorized AU for each ranch would be reduced as needed to meet RDM goals, which may result in closure of some ranches. Should ranches close, there would be a direct, adverse impact on those specific ranches and a slight reduction in the overall economic benefits from continued beef and cattle ranching. This reduction may be at a similar level as described under alternative D.

There would also be “forward-linked” impacts on industries that purchase products produced by ranches in the planning area under this alternative. For example, creameries and dairy processors in Marin and Sonoma Counties, such as Clover Sonoma, Straus Creamery, and Sierra Organics, would no longer be able to purchase dairy products from ranchers in the planning area. They may choose to curtail their own production or purchase dairy products from other businesses. This choice would have an adverse impact on their business operations because they have presumably already optimized where they purchase their inputs, choosing planning area dairies for their price, quality, or another desirable trait. A reduction in the quality of the dairy product that these processors procure may affect demand for their own products or require further costly refinement of their product. Procurement of dairy products from a new dairy may also be more expensive than purchasing dairy products from ranches in the planning area either as a result of the additional distance that the dairy product would need to be shipped or because of a more limited market supply of dairy products in the region, and the subsequent increase in price received for these products. For example, one creamer works with nine dairy farms and operates off a quota-based system where dairy farms must meet a certain quota within 2% of a certain amount of milk annually (Black, pers. comm. 2018). However, given the historical decline in milk prices (Marin County Department of Agriculture, Weights and Measure 2017) and the current excess supply of organic milk available in the market (Black, pers. comm. 2018), it is possible that any remaining dairy farms that a creamery works with may be able to make up for the loss of one or more dairy farms in the planning area. In the short

term, creameries may have to cut production while adapting to the conversion of ranches in the planning area. However, depending on market conditions and availability of milk at the time of cessation of dairy ranching in the planning area, this impact is likely to be limited and short term in scale. Therefore, in the short term, forward-linked impacts are likely to be minimal but adverse in this industry as the result of converting ranching operations and closing one commercial chicken operation in the planning area.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative E would contribute to regional employment and gross regional product from continued support of employment, incomes, sales, and taxes by ranchers; park spending and projects; and visitation to the park. However, conversion of dairy ranching to beef ranching would result in adverse impacts compared to existing conditions from the loss of $14.4 million in annual revenue and 27 jobs in the study area. When the incremental impacts of alternative E are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative socioeconomic impacts would remain beneficial because the adverse impacts under alternative E would make such a small contribution to the overall beneficial cumulative impacts in the study area. The incremental impacts of ranching under alternative E would contribute 0.01% of gross regional product and 0.03% employment in the study area.

Alternative F

Population, Employment, Income, and Sales

Under alternative F, phasing out all beef and dairy operations would result in the eventual conversion of all ranch residences and ranch employment in the planning area. Alternative F would result in a reduced population in the planning area. It is not known whether families or employees residing in the planning area would relocate elsewhere in the study area. As shown in chapter 3, sales from ranching operations in the planning area currently support 63 full-time jobs. According to an analysis by park staff, 188 residents live on ranches in the planning area (NPS, Voeller, pers. comm. 2019e). These individuals represent 0.07% of the population of Marin County. Additionally, because these ranches represent 18 of the 144 beef cattle operations and 6 of the 31 dairy operations in Marin County, it is possible that workers could relocate to another ranch in the county (US Census of Agriculture 2019c). If all these individuals and families relocate outside the study area, the population in the study area would experience a small, direct, long-term reduction of 0.07%.

Demand for supporting goods and services associated with ranch operations in gateway communities, such as food and supplies, would decrease, reducing support for local sales, jobs, and income in these communities. Additionally, any ranch employees who reside in gateway communities would lose their jobs. It is possible that some of these individuals would relocate from gateway communities to find work elsewhere. Impacts from these relocations would vary depending on the proportion of the population that leaves any specific gateway community. For example, a reduction in population of 188 persons represents 33% of the population of Point Reyes Station and would be equivalent to over half the reduction in population that has occurred in this town over the past 15 years. This level of population reduction would result in a noticeable reduction in household spending and subsequent support for local jobs, income, and sales in this community. However, because most of the ranch workers and operators live on ranches in the planning area, their household spending is spread among a number of gateway communities in the area, diluting the impacts any one specific gateway community would feel from a reduction in the local population. Overall, the reduction in ranch spending in local communities and the reduction in household spending by ranch workers would result in adverse impacts on local employment, income, and sales.

As described in the “Visitor Use, Experience, and Access” section, visitation levels under this alternative are not expected to change compared to existing conditions. Therefore, no change to jobs, income, sales, and taxes in the study area are anticipated in the short or long term due to changes in visitation levels. However, expanded adaptive use opportunities including non-profit education, research, outdoor experiential activities, and other public recreational and visitor opportunities could provide additional

economic benefits in the study area. The conversion of ranch structures to public uses could involve construction and renovation, which would likely generate sales, income, and jobs in the study area, although impacts would likely be minimal. Any economic benefits created from these activities and from purchases made to complete these activities in the planning area would support local jobs, income, sales, and taxes in the study area.

Grazing, Ranching, and Agricultural Activities

All ranching operations at Point Reyes would cease under this alternative, resulting in the removal of $1.6 million in sales of beef products, $14.0 million in sales of dairy products, and approximately $124,000 in egg and meat poultry sales in Marin County. These losses would represent 15% of total beef sales, 41% of total dairy sales, and less than 1% in egg and poultry sales in the county annually when in operation. As described in chapter 3, these sales directly support 63 full-time jobs at ranches in the planning area and indirectly support another 27 jobs in Marin County from the purchase of goods and services by ranchers in the planning area. These jobs would no longer be supported by purchases from park ranches. As a result of the conversion of these ranches, household spending by former ranch employees and by employees of businesses where ranches purchase goods and services would be reduced. This would result in the loss of support for an additional 16 induced jobs in Marin County. These jobs would represent 0.06% of all jobs in the county and support $6.6 million in labor income.

Additionally, seven indirect jobs—primarily in the beef cattle ranching and other animal food manufacturing industries in Sonoma County—would no longer be supported as a result of reduced purchases from ranching operations in the planning area. These jobs support one additional induced job through household spending. In total, $350,000 in labor income in Sonoma County would be lost by eliminating ranching in the planning area, less than 0.01% of labor income in Sonoma County. In total, $10.7 million in gross regional product would be lost in the study area by removing sales of beef and dairy products from ranching operations in the planning area (0.01% of study area gross regional product).

Forward-linked impacts from eliminating beef cattle operations, dairy ranching, and the chicken operation would be similar to those described for dairy operations under alternative E, with the addition of forward-linked impacts from beef cattle operations. It is likely that businesses that process dairy and poultry products from the planning area would see a slight increase in the cost of their operational inputs and a decrease in the amount they are able to process, or both, as a result of the elimination of ranching. Marin County has no fixed slaughterhouse, and Sonoma County's sole slaughterhouse announced it will not perform work for most local operations. As a result, positive clustering effects of co-located slaughter/ranch operations would no longer apply. While it is likely that producers would identify other process plant operations, the cost of operation would likely increase slightly in the long run. While new supply chains are established labor operation costs would increase. This would result in a small, long-term, adverse economic impacts on the study area because income and sales could be reduced at processing facilities, which could further reduce employment at these facilities.

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Ending ranching under alternative F would contribute meaningful adverse impacts compared to existing conditions from the loss of approximately $16 million in annual revenue in the study area, which constitutes 0.01% of the study area's gross regional product. In addition, 63 jobs in the study area would be lost, as would the additional jobs and revenues described above. These jobs would represent less than 0.03% of regional employment. When the incremental impacts of alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the overall cumulative socioeconomic impacts would remain beneficial because the adverse impacts under alternative F would make such a small contribution to the overall beneficial cumulative impacts in the study area. Ranching in

the planning area would no longer contribute to the total regional employment and gross regional product in the study area.

AIR QUALITY

Methodology and Assumptions

The planning area is located in Marin County, California, which is a nonattainment area for the 8-hour ozone standard (marginal) and $PM_{2.5}$ (moderate) (USEPA 2019). Therefore, the relevant pollutants and thresholds for the general conformity applicability analysis are as follows:

- VOC: 100 tons/year
- NO_x: 100 tons/year
- $PM_{2.5}$ direct: 100 tons/year
- SO_2: 100 tons/year
- NH_3: 100 tons/year

The general conformity applicability is determined based on the incremental change in emissions associated with the action alternatives. VOC and NO_x are ozone precursors and VOC, NO_x, SO_2, and ammonia are $PM_{2.5}$ precursors.

Ammonia is considered a significant contributor to $PM_{2.5}$ formation in the Bay Area, as evidenced by the inclusion of ammonia in the California Air Resources Board $PM_{2.5}$ State Implementation Plan submissions to the USEPA (the primary source of NH_3 emissions is the agricultural sector) (CARB 2011).

Mobile Source Emissions

For contextual purposes, existing mobile source emissions in the park were quantified. Detailed information (vehicle classification, age, speed, road grade) is not readily available, and the effort to obtain this information would exceed the scope of the concern. An order-of-magnitude estimate of mobile source emissions was developed based on 2018 traffic count data on the park roadways and USEPA's MOVES model emission factors.

The mobile source emissions estimate covers emissions occurring in the park. Additional emissions would occur outside the park boundary because all visitor and most NPS employee commuting trips originate outside the study area. However, insufficient data are available on the routes used, stops, starting locations, and ending locations to accurately estimate Vehicle Miles Traveled external to the park. Furthermore, such external Vehicle Miles Traveled are not expected to substantially change as a result of the alternatives and therefore would not contribute to the relative comparison between alternatives.

Table 17 summarizes the estimate of vehicle miles travelled necessary to quantify mobile source emissions. NPS collects traffic counts on the major park roadways. Vehicles entering one of the listed areas were assumed to have driven the full length of the roadway (e.g., a vehicle counted on Sir Francis Drake Boulevard was assumed to have traveled to the lighthouse and back). Roadway lengths were estimated in Google Earth. For 2018, Vehicle Miles Travelled = 2018 entering vehicles × one-way roadway length × 2.

TABLE 17: 2018 VEHICLE MILES TRAVELED ESTIMATE

Count Location	Total Vehicles Entering in 2018	Roadway Represented	One-Way Length (miles)	2018 Vehicle Miles Travelled
Bear Valley Visitor Center	164,547	Bear Valley Road	2.27	747,043
Palomarin	70,872	Mesa Road	3.75	531,540
Limantour	101,638	Limantour Road	7.4	1,504,242
Pierce Point	132,760	Pierce Point Road	8.95	2,376,404
Sir Francis Drake	200,622	Sir Francis Drake Boulevard (from Pierce Point Road to Lighthouse)	13.3	5,336,545
			Total	**10,495,775**

MOVES emission rates were developed with the following assumptions:

- National scale (the MOVES national scale mode uses USEPA default data, which is not suitable for regulatory purposes, but appropriate given that the objective of this analysis is to provide a general order-of-magnitude emission)
- 2018 analysis year, January, 8:00 am–9:00 am hour
- Marin County, California, geographic bound
- Gasoline passenger car vehicle type (no other vehicle/fuel types)
- Rural unrestricted access roadway type (accounts for stop-and-go traffic pattern as opposed to freeway-type driving)
- Running exhaust and crankcase running exhaust for NH_3, VOCs, and CO_2e (and all required prerequisites) and tire and brake wear for $PM_{2.5}$
- Speed of 25 miles per hour (per Superintendent's Compendium, majority of park roadways have posted speed limit of 35 miles per hour or less)

Table 18 summarizes the generalized MOVES passenger auto emission rates.

TABLE 18. GASOLINE PASSENGER AUTO GENERALIZED EMISSION FACTORS (GRAMS/VEHICLE-MILE)

NH_3	VOC	$PM_{2.5}$	CO_2e
0.0233	0.0486	0.0139	355.7810

Note: $PM_{2.5}$ includes exhaust + tire wear + break wear

Existing condition $PM_{2.5}$ emissions from dust generated by vehicle travel on paved roads was estimated based on the following methods:

- Equation and inputs from CARB's Miscellaneous Process Methodology 7.9 Entrained road dust, paved road dust (updated November 2016)
- Silt loading factor of 0.32 grams/m^2 (statewide default for local roads used by CARB)
- Average vehicle weight of 2.4 tons (statewide average)

- Number of wet days with greater than 0.01 inch of precipitation of 66 (CARB calculation)
- $PM_{2.5}$ fraction of PM_{10} = 15%

Alternative-specific mobile source emission estimates were not prepared because vehicle use is anticipated to either remain at current levels or slightly decrease relative to existing conditions and the no action alternative. As explained in the "Visitor Use, Experience, and Access" section, visitation levels have been constant for many years and are expected to relatively stable over the life of this plan. Emissions from visitor- and park operations-related mobile source emissions therefore are not anticipated to change under any alternative. Mobile source emissions from ranching would continue similar to existing conditions under alternatives A, B, and C. Ranching is a small portion of overall vehicle travel because there are only 24 ranches and 188 residents. Decreases in mobile source emissions would occur under alternatives that reduce levels of ranching because there would be fewer ranch-related vehicle trips. The reduced mobile source emissions may include general ranch equipment/operations (e.g., tractors, deliveries, employees), as well as trips specific to certain types of ranching (such as dairy trucks). Under alternatives D and E, the small portion of mobile source emissions attributable to ranching activities are expected to decrease slightly relative to existing conditions. Under alternative F, emissions related to ranching activities would cease (except for two life estates) within five years.

Livestock Quantities by Alternative

Table 19 summarizes the number of dairy and beef cattle assumed for existing conditions and each alternative for purposes of estimating cattle-related emissions. For existing conditions, livestock numbers are based on the NPS estimate of the actual number of animals present on the ranches, which is less than the maximum number of animals authorized under current lease/permits. For the alternatives, the analysis is based on the maximum authorized number of animals to disclose the highest potential air pollutant emissions impact. The actual emissions under each alternative would be less than predicted if fewer than the authorized number of animals are present.

For existing conditions, the presence of an estimated 60 AU of non-cattle livestock (horses, sheep, goats, and pigs) was accounted for by increasing the analyzed number of beef cattle by 60. Similarly, the total authorized number of non-cattle livestock under alternative A (horses, sheep, goats, and pigs up to 121 AU) was accounted for by increasing the number of analyzed beef cattle by 121.

Diversification involving sheep or goats under alternatives B, C, and D would not exceed 180 AU; however, those AU would be part of the overall authorization for each ranch, and therefore are not added to the total number of authorized cattle. It is not known the extent to which ranchers would use the option of diversification or what combination of sheep or goats they would select. For purposes of this analysis, a maximum of 9,000 chickens was assumed for the planning area (500 chickens × 18 occupied ranch complexes). Except for chicken operations, the increase in emissions from non-cattle livestock diversification would be offset by the equivalent AU reduction in cattle emissions and would likely remain small relative to the overall livestock-related emissions occurring in the park. Therefore, emissions related to potential increased diversification from sheep and goats were not quantified separately.

TABLE 19. NUMBER OF LIVESTOCK BY ALTERNATIVE FOR EMISSION ESTIMATES

Alternative	Beef Cows	Dairy Cows	Dairy Heifers	Dairy Bulls	Total Cattle	Chickens
Existing Conditions	2,454[a]	2,060	1,035	20	5,569	0
Alternative A	2,515[b]	2,650	655	20	5,840	2,900
Alternatives B and C	2,400	2,060	1,035	20	5,515	9,000
Alternative D	1,700	2,060	1,035	20	4,815	9,000
Alternative E	3,150	0	0	0	3,150	0
Alternative F	0	0	0	0	0	0

[a] 2,394 beef cows plus 60 AU of other non-cattle livestock

[b] 2,394 beef cows plus 121 AU of other non-cattle livestock

Livestock Waste Emissions

CARB sponsored a study that developed California-specific cattle NH_3 emission factors (CARB 2008). Table 20 summarizes the NH_3 waste emission factors from this study for range beef cows, dairy cows, and dairy manure spreading. For NH_3 emissions from dairies, the emission factors shown were applied to milking cows. For heifers and dairy bulls, substantially lower NH_3 emissions are expected compared to dairy cows, and a 50% reduction in the emission factor for heifers and dairy bulls is supported by the Agrammon N-flux model (see supplemental data tables included in Kupper, Bonjour, and Menzi 2015).

TABLE 20. LIVESTOCK WASTE NH_3 AND VOC ANNUAL EMISSION FACTORS

	NH_3 (lbs/head/year)	VOC (lbs/head/year)
Beef Cattle (Range Cows)	1.54	12.8
Dairy Cattle	74.0	20.0
Dairy Heifers and Bulls	39.8	20.0
Dairy Operations–Manure Spreading	5.6	NA
Poultry	0.096	0.02565

For VOC emissions from dairy cattle, an emission factor was obtained from a 2012 study conducted by the San Joaquin Valley Air Pollution Control District (2012). The VOC emission rates includes enteric emissions from cows, milking parlors, freestalls/barns, corrals/pens, liquid manure handling/land application, separated solids piles, and solid manure storage. For beef cattle, a Reactive Organic Gasses emission factor was obtained from a 2004 CARB methodology document (CARB 2004). For purposes of this relative comparison of alternatives, VOC emissions were assumed to be equal to Reactive Organic Gas emissions.

Poultry manure emission factors for NH_3 and VOCs were obtained from a South Coast Air Quality Management District guidance document (2016). For poultry manure, an uncontrolled PM emission factor of 0.0616 pounds/head/year was also obtained from the South Coast Air Quality Management District.

As noted previously in the section "Livestock Quantities by Alternative," emissions from other non-cattle livestock (horses, sheep, goats.) were estimated by increasing the number of beef cattle under existing conditions and alternative A.

Fugitive Dust Emissions

A particulate matter of 10 micrometers or less (PM_{10}) emission factor of 4.4 pounds per thousand head per day was selected to estimate emissions for dairies (Goodrich et al. 2002). The beef cattle-specific dust emission factors located in the literature review were specific to concentrated operations (feedlots) and not representative of the lower intensity of ranching occurring in the study area, where the animals spend most of the time on pasture. Therefore, beef cattle PM_{10} emissions were assumed to be the same as the dairy cattle dust emission factor (4.4 pounds per thousand head per day). Converting this daily emission rate to units of pounds/head/year results in an emission factor of 1.61 for beef and dairy cattle. A particulate size fraction of 0.15 is used to estimate $PM_{2.5}$ from PM_{10} based on AP-42 Chapter 13, Miscellaneous Sources, Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors.

As noted previously in the section "Livestock Quantities by Alternative," emissions from other non-cattle livestock (horses, sheep, goats) were estimated by increasing the number of beef cattle under existing conditions and alternative A.

Methods and Assumptions for Greenhouse Gas Emissions

A GHG emissions analysis was prepared for purposes of NEPA. As explained below, mobile source emissions were not analyzed, but cattle-related emissions from enteric fermentation and manure management were estimated based on the projected head of cattle under each alternative. The final emissions are presented in terms of metric tons of CO_2e per year.

Nonpoint Source Emissions

Enteric fermentation is fermentation that takes place in the digestive systems of animals and results in CH_4 being exhaled or belched by ruminants (USEPA 1995). USEPA has developed the following California-specific enteric fermentation emission rates as part of its 2019 Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2017 (Table A-176):

- Mature dairy cows—146 kg/head/year
- Mature beef cows—100 kg/head/year

The USEPA greenhouse gas inventory emission factors include different rates for different cattle ages, but detailed information on cattle age distribution is not readily available. Assuming all cattle are mature is a conservative approach that likely overestimates emissions.

Manure and Nutrient Management activities associated with ranching emit the greenhouse gases nitrous oxide (N_2O) and CH_4. USEPA's Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2016 provides a detailed manure management emissions quantification methodology that accounts for beef versus dairy cattle and various types of manure management (USEPA 2018b). The primary form of Manure and Nutrient Management in the planning area is storage of liquid slurry in ponds. The manure is spread on fields during dry periods. However, given the purpose of the GHG quantification for this EIS is to provide an order-of-magnitude and relativistic comparison of the alternatives, a simplified approach based on implied emission factors is used. The USEPA inventory provides the total dairy cattle and beef cattle population for the United States, as well as the total CH_4 and N_2O associated with these populations. Approximate emission factors were estimated based on this information as summarized in table 21.

The emission factors do not quantitatively assess the emissions from specific ranching operations at the specific activity level in the study area, but they do provide a reasonable approximation to compare alternatives. Calculating the emissions from specific ranch activities does not measurably alter overall emissions by alternative.

Poultry waste-related emissions were quantified based on CARB's statewide emission inventory factor of 20 grams CH_4 per head per year for pasture-raised broilers (CARB 2015). An N_2O emission rate specific to pasture-raised poultry was not available; therefore, an emission rate of 1.78 grams of N_2O per head per year for "poultry with bedding" was used (CARB 2015).

As noted previously in the section "Livestock Quantities by Alternative," emissions from other non-cattle livestock (horses, sheep, goats etc.), were estimated by increasing the number of beef cattle under existing conditions and alternative A.

TABLE 21: CH_4 AND N_2O EMISSION FACTORS FOR MANURE MANAGEMENT

	Total US Population (2015)[a]	Total US CH_4 (metric tons) (2015)[b]	US Ave. CH_4 Emission Factor (kg /head/year)	Total US N_2O (metric tons (2015)	US Ave. N_2O Emission Factor (kg /head/year)
Dairy Cattle	18,798,000	1,391,000	74.00	20,000	1.06
Beef Cattle	76,225,000	126,000	1.65	26,000	0.34

Source: USEPA 2018b

[a] https://www.epa.gov/sites/production/files/2018-01/documents/2018_all_annexes.pdf

[b] https://www.epa.gov/sites/production/files/2018-01/documents/2018_chapter_5_agriculture.pdf

The quantitative GHG analysis does not attempt to take any credit or benefit from soil carbon sequestration; however, practices that may serve to increase carbon sequestration are qualitatively discussed below under the heading of "Carbon Farming."

Greenhouse Gas Reduction and Carbon Sequestration Opportunities

While not required as part of any of the alternatives, this section provides information on optional approaches that could serve to reduce GHG emissions associated with ranching in the planning area. Certain practices that would occur under ranching alternatives may also have carbon sequestration benefits, as noted in chapter 2.

Alternative Manure Management. California funds non-digester emission reduction strategies for manure emissions reduction through the alternative manure management program (CARB 2018). Because CH_4 is formed when manure is stored under anaerobic conditions, alternative manure management strategies focus on creating aerobic conditions or decreasing manure storage under anaerobic conditions. Examples of alternative manure management approaches include mechanical solids-liquid separation with drying, conversion of flush systems to scrape with dry manure storage or composting, and conversion to pasture-based management and compost pack barns (CDFA 2018). Reductions at specific ranches would depend on the strategies selected for implementation compared to the baseline strategies on each ranch.

Carbon Farming. Carbon farming refers to practices that increase carbon sequestration (e.g., CO_2 removal from the atmosphere and conversion into plant material and soil organic matter) (Marin Carbon Project 2018). Practice Standards that have been identified as having GHG mitigation and/or carbon sequestration benefits on farms and ranches are noted in appendix F. Grazing practices that may improve carbon sequestration include limiting the number of animals per acre under continuous grazing, rotational grazing that allows pastures to recover, and adaptive multi-paddock grazing that shifts animals through multiple smaller paddocks (Project Drawdown 2020). Management practices to increase soil carbon sequestration in rangelands have been identified as cost-effective strategies for California (Silver, Ryals, and Eviner 2010). Marin County's Carbon Project includes assistance to ranches to encourage carbon farming by sponsoring the completion of carbon farm plans. Examples of carbon farming practices may include compost application, riparian restoration, and critical area planting, among others (Niebrugge and Creque n.d.). The carbon farming planning process involves inventory of the natural resources and soil conditions and use of various online emissions reduction calculator tools, such as NRCS's COMET

(USDA-NRCS n.d.). Like other GHG-reduction strategies, the actual reduction achieved would depend on the extent to which the carbon farming plan is implemented and the baseline emissions of a particular ranch. Not all carbon farming practices may be appropriate for implementation in the park, but to the extent that compatible practices are implemented voluntarily by ranches and with NPS approval, carbon farming could reduce GHG emissions from ranching activities.

Alternative A

Table 22 summarizes the criteria pollutants and GHG emissions that could be emitted under alternative A if ranchers used the maximum number of livestock authorized under current lease/permits compared to emissions levels that are occurring under existing operating conditions, which in some cases are below permit authorizations. Ranching-related emissions include emissions from the cattle directly, Manure and Nutrient Management on dairies, and fugitive dust. If the maximum authorization of cattle, chickens, and non-cattle livestock occurred under alternative A, emissions of VOC, $PM_{2.5}$ and CO_2e could increase in the range of 5% to 7% compared to existing conditions. Due to the high NH_3 emission rate of dairy cows, the potential increase in NH_3 emissions under alternative A is up to 15% greater compared to existing conditions.

TABLE 22: ANNUAL LIVESTOCK-RELATED EMISSIONS FROM RANCHING UNDER ALTERNATIVE A (TONS/YEAR)

	NH_3	VOC	$PM_{2.5}$	CO_2-Equivalent (metric tons/year)
Existing Conditions	104.9	46.9	0.671	24,601
Alternative A (Full Utilization of Authorized AU and Dairy Animals)	121.0	49.4	0.717	25,987
Net Change	16.1	2.5	0.046	1,386
% Change	+15.36%	+5.39%	+6.86%	+5.6%

Mobile source emissions related to visitor use, park operations, and ranching would also continue to emit criteria pollutants and GHG emissions similar to the levels shown in table 12. Emissions from mobile sources are not expected to change from existing conditions. Ranch-related activities on pastures and regular ranch operations would continue to include off-road vehicle and equipment operations, which can generate fugitive dust.

Livestock and mobile source emissions would continue to contribute to ambient concentrations of criteria pollutants and impacts on AQRVs (such as nitrogen deposition and visibility) in combination with other emission sources and transport of emissions from outside the planning area. Ambient concentrations of O_3 and $PM_{2.5}$ are expected to continue to be below the NAAQS thresholds. Visibility improvement trends noted in chapter 3 are also expected to continue (likely driven by changes in emissions outside the planning area); however, the incremental contribution of alternative A on visibility would be adverse. Nitrogen wet deposition impacts on ecosystems exceed NPS's critical load levels under existing conditions, and alternative A could worsen these impacts if the maximum authorized livestock levels are assumed. As shown in table 13, NH_3 (the pollutant most strongly associated with agriculture) emissions in the park represent approximately 11% of county-level total NH_3 emissions under existing conditions; this percentage could increase to 13% of county-level NH_3 emissions under alternative A. For other pollutants, the relative contribution of sources in the park would be substantially less. Overall, the air quality impacts from activities under alternative A would adverse to a limited degree, however, regional emissions sources would continue to be the driver of air quality conditions in the planning area.

The GHG emissions from livestock under alternative A would represent approximately 22% of agricultural sector emissions in Marin County and 6.1% of total county emissions. In comparison to statewide agricultural section emissions of 32.4 million metric tons CO_2e (CARB 2017 inventory), the emissions of alternative A would constitute less than a tenth of a percent (0.08%).

Cumulative Impacts

Coastal dune restoration projects, cultural resource restoration projects, and PG&E fire management projects would continue to generate criteria pollutant emissions and GHG emissions from the engines of off-road construction equipment and truck trips. Fugitive dust would also be generated during construction activities. Similarly, heavy off-road equipment and haul trucks used for repairing 22 miles of roads and parking lots in the park would release temporary and localized emissions of air pollutants, which would not exceed air quality standards. The Lagunitas Creek habitat enhancement projects would involve using heavy equipment (such as excavators, dozers and dump trucks) to adjust the floodplain to support the creek's salmonid population. This construction equipment would generate criteria pollutants and GHG emissions on a temporary and localized basis (approximately 1.2 tons reactive organic gases, 11.9 tons NO_x, and 0.6-ton exhaust $PM_{2.5}$ [MMWD 2017b]). Implementation of the *Fire Management Plan* would result in emissions—PM_{10}, $PM_{2.5}$, VOC, CO, and NO_x—from prescribed fires and mechanical treatments (e.g., chainsaws). Emissions modeling for the Fire Management Plan EIS demonstrated that the overall effect of the *Fire Management Plan* on air quality would be beneficial because although prescribed fires would have localized impacts, the potential for large-scale catastrophic fires would be reduced. Prescribed burns would be conducted in accordance with the Bay Area Air Quality Management District Smoke Management Program, which includes consideration of the appropriateness of meteorological conditions before approval for a burn program.

These impacts would be limited in geographic extent depending on the specific action. The magnitude of impacts from larger actions (such as prescribed fires) would be mitigated through existing regulatory processes (such as approval for prescribed fires being controlled by meteorological conditions to avoid fires when conditions could create adverse impacts on ground level ambient air quality from smoke).

Regional sources of emissions in the San Francisco Bay area[10] outside park boundaries (including transportation, agriculture/land use, power generation, and industrial facilities) would continue to be the largest contributor to air pollution effects in the park, and nitrogen deposition would continue to be a resource concern for park resource management in the future.

Regulatory actions could reduce criteria pollutant and/or GHG emissions. For example, SB No. 1383, requires CARB to investigate the feasibility of regulating methane emissions from livestock manure management as part of comprehensive short-lived climate pollutant strategy. The law sets a goal of reducing methane emissions from livestock/dairy manure management by 40% below 2013 levels by 2030 if certain economic and feasibility criteria are satisfied. If manure management regulations are put in place, this could reduce manure-related GHG emissions statewide.

Overall, cumulative actions would continue to have adverse impacts on air quality in the park, and park ecosystems would continue to be at increased risk for harmful effects from nitrogen deposition. Alternative A would continue to have adverse impacts from cattle, Manure and Nutrient Management on dairies, fugitive dust, and mobile source emissions. While emissions from ranching and dairy operations are the most substantial source of in-park emissions that incrementally contribute to air quality, the primary driver for nitrogen emissions and deposition are regional sources outside park boundaries and the planning area, as noted in chapter 3. When the incremental impacts of alternative A are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on air

[10] The Bay Area Air Quality Management District regulates air pollution in a regional airshed consisting of nine counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, southwestern Solano, and southern Sonoma.

quality would be adverse; however, visibility trends are expected to continue improving compared to existing conditions. Overall, the primary driver of air quality in the planning area would continue to be regional sources and the regulatory attainment status of the region would not change.

Alternative B

Under alternative B, emissions from ranching would generally be the same type and intensity as described under the existing conditions (table 12). The number of cattle in the planning area is assumed to remain similar to existing conditions. Diversification activities, like additional chickens (up to 9,000 authorized), could increase emissions of NH_3 and $PM_{2.5}$ slightly (table 23). Authorization of non-cattle livestock for diversification could occur, but their addition would be accounted for within the authorized AU, which would be a slight reduction from existing conditions. Mobile source emissions would continue to be consistent with existing conditions because no change in visitor use levels is anticipated. Overall air quality conditions and trends in the park would remain similar to existing conditions.

The GHG emissions from livestock under alternative B would represent approximately 21% of agricultural sector emissions in Marin County and 5.7% of total county emissions. In comparison to statewide agricultural section emissions of 32.4 million metric tons CO_2e (CARB 2017 inventory), the emissions of alternative B would constitute less than a tenth of a percent (0.08%).

TABLE 23: ANNUAL LIVESTOCK-RELATED EMISSIONS FROM RANCHING UNDER ALTERNATIVE B (TONS/YEAR)

	NH_3	VOC	$PM_{2.5}$	CO_2-Equivalent (metric tons/year)
Existing Conditions	104.9	46.9	0.671	24,601
Alternative B	105.3	46.6	0.706	24,468
Net Change	0.4	-0.2	0.035	-133
% Change	+0.37%	-0.49%	+5.23%	-0.5%

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative B would contribute adverse impacts from cattle, Manure and Nutrient Management, fugitive dust, and mobile source emissions. When the incremental impacts of alternative B are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on air quality would be adverse; however, visibility trends are expected to continue improving compared to existing conditions. Overall, the primary driver of air quality in the planning area would continue to be regional sources (see table 13), and the regulatory attainment status of the region would not change.

Alternative C

Direct, indirect, and cumulative impacts would be the same as those described for alternative B.

Alternative D

As shown below in table 24, the authorized beef cattle AU under alternative D (1,700) would reduce livestock-related NH_3, VOC, and $PM_{2.5}$ emissions by 0.14%, 10%, and 7%, respectively, relative to existing conditions. Livestock-related GHG emissions would also be reduced by 8.1%. Mobile source emissions would continue, similar to existing conditions (no change in visitor use levels is anticipated); however, the number of daily vehicle trips related to ranching activities may decrease slightly. The reduction in emissions under alternative D would have a beneficial effect on criteria pollutant concentrations and AQRVs (including visibility, and nitrogen deposition) compared to existing conditions.

The GHG emissions from livestock under alternative D would represent approximately 19% of agricultural sector emissions in Marin County and 5.3% of total county emissions. In comparison to statewide agricultural section emissions of 32.4 million metric tons CO2e (CARB 2017 inventory), the emissions of alternative D would constitute less than a tenth of a percent (0.07%).

TABLE 24: ANNUAL LIVESTOCK-RELATED EMISSIONS FROM RANCHING UNDER ALTERNATIVE D (TONS/YEAR)

	NH_3	VOC	$PM_{2.5}$	CO_2-Equivalent (metric tons/year)
Existing Conditions	104.9	46.9	0.671	24,601
Alternative D	104.7	42.1	0.622	22,618
Net Change	-0.1	-4.7	-0.049	-1,981
% Change	-0.14%	-10.05%	-7.34%	-8.1%

Cumulative Impacts

Impacts on air quality from past, present, and reasonably foreseeable projects would be the same as those described for alternative A. The incremental impacts of alternative D would be beneficial from the reduction in the number of authorized beef cattle AU. When the impacts from alternative D are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on air quality would be adverse or beneficial depending on the air quality indicator. Existing trends would likely continue. While alternative D would slightly reduce NH_3 emissions leading to nitrogen deposition, the magnitude of the reduction would not reverse the overall cumulative adverse impact for nitrogen deposition given the minimal reduction and that nitrogen deposition is primarily affected by regional pollutant transport from outside the park (see table 13), and the regulatory attainment status of the region would not change.

Alternative E

Under alternative E, all dairy animals (approximately 3,115), which generate more emissions of NH_3, VOC, and CO_2 per head than beef cattle, would be eliminated, but the number of authorized AU of beef cattle would increase by up to 750 AU if all dairy ranchers convert to beef ranching. Overall, the total number of cattle would be reduced compared to existing conditions, leading to a measurable reduction in ranching-related emissions of NH_3 (98%), VOC (57%), $PM_{2.5}$ (43%) and CO_2e (66%). Effects on air quality would be beneficial, compared to existing conditions, for criteria pollutants and GHG emissions as shown in table 25. Mobile source emissions would continue to be similar to existing conditions (no change in visitor use levels is anticipated); however, the number of daily vehicle trips related to ranching activities would decrease noticeably as milk transportation is no longer needed in the planning area. Ranching/livestock emissions would remain the main source of NH_3 and VOC emissions in the planning area (mobile source emissions of these pollutants are on the order of 1% of the livestock-related emissions). The reduction in emissions under alternative E would have a beneficial impact on criteria pollutant concentrations and AQRVs (including visibility, and nitrogen deposition). Regional transport from sources outside the park would continue to affect the planning area (see table 13 for county-level emissions information).

The GHG emissions from livestock under alternative E would represent approximately 7% of agricultural sector emissions in Marin County and 1.9% of total county emissions. In comparison to statewide agricultural section emissions of 32.4 million metric tons CO2e (CARB 2017 inventory), the emissions of alternative E would constitute less than a tenth of a percent (0.03%).

TABLE 25: ANNUAL LIVESTOCK-RELATED EMISSIONS FROM RANCHING UNDER ALTERNATIVE E (TONS/YEAR)

	NH_3	VOC	$PM_{2.5}$	CO_2-Equivalent (metric tons/year)
Existing Conditions	104.9	46.9	0.671	24,601
Alternative E	2.4	20.2	0.379	8,324
Net Change	-102.4	-26.7	-0.291	-16,277
% Change	-97.69%	-56.97%	-43.44%	-66.2%

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative E would have adverse impacts from beef cattle, fugitive dust, and mobile source emissions. The elimination of dairy cattle would result in beneficial impacts compared to existing conditions; however, alternative E would also add a small amount of $PM_{2.5}$ from an increase in beef cattle AU. When the incremental impacts of alternative E are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact on air quality would be adverse; however, visibility trends are expected to continue improving compared to existing conditions. Overall, the primary driver of air quality in the planning area would continue to be regional sources (table 13), and the regulatory attainment status of the region would not change.

Alternative F

Alternative F would phase out ranching in the park over a period of five years, except for the two life estates which would continue until their reserved rights expire. As a result, virtually all ranching-related emissions of criteria pollutants and GHG emissions would end within five years, and the remaining emissions would eventually also cease (see table 26). Vehicle trips associated with the ranches would be eliminated, further reducing overall emissions.

In the long term, public use of former ranchlands, including new visitor opportunities on former ranch complexes, could result in additional vehicle travel and emissions, but such emissions would be minimal in the context of overall visitor use. Overall impacts on air quality under alternative F would be beneficial compared to existing conditions because emission sources from ranching operations would be eliminated.

TABLE 26: ANNUAL LIVESTOCK-RELATED EMISSIONS FROM RANCHING UNDER ALTERNATIVE F (TONS/YEAR)

	NH_3	VOC	$PM_{2.5}$	CO_2-Equivalent (metric tons/year)
Existing Conditions	104.9	46.9	0.671	24,601
Alternative F	0	0	0	0
Net Change	-104.9	-46.9	-0.671	-24,601
% Change	-100%	-100%	-100%	-100%

Cumulative Impacts

The impacts from past, present, and reasonably foreseeable actions would be the same as those described for alternative A. Alternative F would contribute meaningful beneficial impacts compared to existing conditions because all emissions related to ranching operations in the planning area would cease. When the incremental impacts of alternative F are combined with the impacts from past, present, and reasonably foreseeable actions, the total cumulative impact would be adverse. Overall, the primary driver of air

quality in the planning area would continue to be regional sources (see table 13), and the regulatory attainment status of the region would not change.

UNAVOIDABLE ADVERSE IMPACTS

In accordance with NEPA section 101(c)(ii), NPS is required to consider if the alternative actions would result in impacts that could not be fully mitigated or avoided. The following discussion describes the potential unavoidable adverse impacts by alternative.

Alternative A

Under alternative A, there would be unavoidable adverse impacts on soils, water quality, vegetation, wildlife, and air quality associated with ongoing beef and dairy ranching activities. These impacts would include erosion and compaction, nutrient inputs to surface waters associated with manure management, alteration of vegetation and wildlife habitat associated with livestock grazing and other ranching practices, and emissions of criteria pollutants and greenhouse gases. Alteration of vegetation and wildlife habitat would adversely affect some species while benefitting others.

Alternative B

Under alternative B, unavoidable adverse impacts on soils, water quality, vegetation, wildlife, and air quality would be similar to those described under alternative A, but the intensity of these impacts would be reduced by requiring Practice Standards and mitigation measures for defined Management Activities and by implementing a zoning framework that would ensure more intense land uses occur in areas without sensitive resources. Alternative B would also have unavoidable adverse impacts on some individual elk because lethal removal would be used to limit the Drakes Beach herd to a population size of 120 elk.

Alternative C

Under alternative C, unavoidable adverse impacts on soils, water quality, vegetation, wildlife, and air quality would be the same as those described for alternative B. Unavoidable adverse impacts on elk at the individual and population scale would also occur because NPS would lethally remove the Drakes Beach herd, currently totaling approximately 138 elk. Alternative C could also result in unavoidable adverse impacts on visitor use and experience as a result of the removal of the Drakes Beach herd.

Alternative D

Under alternative D, unavoidable adverse impacts on soils, water quality, vegetation, wildlife, and air quality would be similar to those described for alternative B, but the intensity of these impacts would be reduced because ranching operations would be removed from approximately 7,500 acres in the planning area. Unavoidable adverse impacts on vegetation in areas where grazing is discontinued would include an increase in invasive annual and perennial species such as thistles and grasses; a likely decrease in native forb species abundance and richness; shrub encroachment into grasslands; and an increase in vegetative fuels. Unavoidable adverse impacts to wildlife species that depend on grasslands for habitat would occur. There would be unavoidable adverse impacts on socioeconomics because cessation of ranching on approximately 7,500 acres would result in the loss of $500,000 in beef cattle sales and the corresponding loss of 19.5 jobs in the planning area.

Alternative E

Under alternative E, unavoidable adverse impacts on soils, water quality, vegetation, wildlife, and air quality associated with continued beef ranching activities would occur. Alternative E would also have unavoidable adverse impacts on historic structures because it is anticipated that some dairy infrastructure may become vacant on the six dairies that would convert to beef ranching. There would also be unavoidable adverse impacts on socioeconomics because conversion from dairy to beef operations would

result in the loss of approximately $14.1 million in annual revenue and 27 jobs at ranches in the planning area.

Alternative F

Alternative F would have unavoidable adverse impacts on vegetation; wildlife; cultural landscapes, historic districts, and historic structures; and socioeconomics because ranching would be discontinued in the planning area. Unavoidable adverse impacts on vegetation and wildlife would be the same as those described for alternative D and would occur in all areas where grazing would be discontinued. Unavoidable adverse impacts on cultural landscapes, historic districts, and historic structures associated with the cessation of ranching in the planning area could include deterioration or demolition of historic structures and loss of pastures that are considered contributing sites for listing in the National Register. There would be unavoidable adverse impacts on socioeconomics because cessation of ranching would contribute to the loss of approximately $16 million in annual revenue and 63 jobs at ranches in the planning area.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

NEPA requires consideration of "the relationship between short-term uses of [the human] environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). For each alternative considered in a NEPA document, considerations of sustainability must demonstrate the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. NPS must consider if the effects of the alternatives involve tradeoffs of the long-term productivity and sustainability of resources for the immediate short-term use of those resources. It must also consider the effects of the alternatives over the long term without causing adverse environmental effects for future generations (NEPA section 102(c)(iv)).

Alternative A

Under alternative A, human use of the environment associated with ranching, management activities, and park operations including visitor use would be ongoing. Ranching operations would continue to affect soils, water quality, vegetation, and wildlife over the long term as described in chapter 4. Consumptive uses of park resources including water and vegetation for forage would continue at their current levels. Ongoing actions to reduce the impacts of elk presence on ranches, including hazing, would not alter or limit the population level or geographic extent of elk in Point Reyes. Therefore, continuation of current management based on the zoning framework outlined in the 1980 GMP and implementation of existing policies would maintain long-term productivity in the planning area in or near its current state and would not affect sustainability of park resources.

Alternative B

Under alternative B, use of the human environment associated with ranching, management activities, and park operations would continue to affect soils, water quality, vegetation, and wildlife over the long term, similar to alternative A. However, long-term management of park resources under alternative B would enhance sustainability by requiring Practice Standards and mitigation measures for defined Management Activities and by implementing a zoning framework that would ensure more intense land uses occur in areas without sensitive resources. Population management of tule elk in the Drakes Beach herd using lethal removal would limit elk productivity over the long term because the herd size would be limited to 120 individuals. However, lethal removal of elk would not affect sustainability of the resource because NPS would continue to maintain a viable population of free-ranging elk in Point Reyes.

Alternative C

Under alternative C, short-term uses of the environment would be the same as those described for alternative B, but NPS would lethally remove the Drakes Beach herd of approximately 138 elk. Removal of the Drakes Beach herd would limit elk productivity in the planning area over the long term but would not affect sustainability of the resource because NPS would continue to maintain a viable population of free-ranging elk in Point Reyes.

Alternative D

Under alternative D, short-term uses of the environment would be similar to those described for alternative B, but the intensity of human uses would be reduced because ranching would be reduced in the planning area. Long-term management of park resources under alternative D would maintain productivity and enhance sustainability.

Alternative E

Under alternative E, short-term uses of the environment would be similar to those described for alternative B, but dairy ranches would be converted to beef ranches. NPS would only manage the tule elk population to support other resource protection needs and management goals and would not limit elk productivity. Long-term management of park resources under alternative E would maintain productivity and enhance sustainability.

Alternative F

Under alternative F, short-term uses of the environment would change drastically because ranching operations would be discontinued, and visitor opportunities would be expanded. Consumptive uses of park resources would be reduced, and NPS would not limit the population growth or geographic extent of free-ranging elk in Point Reyes. Following the cessation of ranching operations, the elk fence at Tomales Point and non-historic infrastructure on many of the ranches would be removed. Consistent with desired conditions, long-term management of park resources under alternative F would require prioritization and implementation of activities to maintain habitat for rare and special status species, and manage expansion of shrubs and invasive plants into grassland habitat to enhance ecosystem productivity and sustainability, although it would not be possible to replace grazing benefits across the landscape in a manner that would fully support the persistence of a grassland community.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

In accordance with NEPA section 102(c)(V), NPS must consider if the effects of the alternatives cannot be changed or are permanent (that is, the impacts are irreversible). NPS must also consider if the impacts on park resources would mean that once gone, the resource could not be replaced; in other words, the resource could not be restored, replaced, or otherwise retrieved.

Alternative A

Alternative A could result in irreversible impacts on individual tule elk that leave Point Reyes for Golden Gate or non-federal lands if lethal removal occurs. Similarly, future population management, which would occur through the initiation of a new planning process, could also result in irreversible impacts on individual tule elk if lethal removal occurs. These impacts would not be irretrievable because NPS could decide later to allow the tule elk population at Point Reyes to expand. Irretrievable impacts on wildlife could occur as a result of ranch management activities (e.g. harvest mowing) or trampling by livestock. There would not be an irreversible or irretrievable commitment of resources related to other park resources because adverse impacts on other park resources could be reversed, and resources could be restored or replaced. If NPS decided in the future to discontinue ranching or eliminate other sources of adverse impacts on park resources and take restoration actions, impacts on soils, water quality, vegetation, wildlife, and other park resources could be reversed, and these resources could be restored.

Alternative B

Alternative B would result in irreversible impacts on individual tule elk because lethal removal would be used to limit the size of the Drakes Beach herd to 120 individuals. Like alternative A, these impacts would not be irretrievable because NPS could decide later to allow the tule elk population at Point Reyes to expand. There could also be irreversible impacts to wildlife as described for alternative A. There would not be an irreversible or irretrievable commitment of resources related to other park resources, as described under alternative A.

Alternative C

Alternative C would result in irreversible impacts on tule elk because NPS would lethally remove the Drakes Beach herd of approximately 138 elk. There could also be irreversible impacts to wildlife as described for alternative A. There would not be an irreversible or irretrievable commitment of resources related to other park resources, as described under alternative A.

Alternative D

The potential for irreversible or irretrievable commitment of resources under alternative D would be the same as described for alternative B.

Alternative E

Alternative E would have the potential to result in irreversible impacts on individual tule elk that leave Point Reyes for Golden Gate or non-federal lands if lethal removal occurs—the same as alternative A. Irreversible impacts to wildlife could also occur. Impacts on historic structures would be irreversible and irretrievable if vacant buildings are allowed to severely deteriorate or are demolished. There would not be an irreversible or irretrievable commitment of resources related to other park resources, as described under alternative A.

Alternative F

The potential for irreversible or irretrievable commitment of resources under alternative F would be the same as described for alternative E.

CHAPTER 5: CONSULTATION AND COORDINATION

PUBLIC PARTICIPATION AND SCOPING

The Scoping Process

Scoping in an essential component of the NEPA planning process. The formal scoping process for this EIS consisted of public scoping and consultation with federal and state agencies and tribal governments. The formal NEPA process and 30-day public scoping period was initiated on October 31, 2018, with the publication of a Notice of Intent in the *Federal Register* (83 FR 54775). In addition to the Notice of Intent, preliminary information regarding the EIS was provided to the public and other interested parties through a press release and a public scoping newsletter. During the public scoping period, NPS hosted two open house meetings and received more than 1,350 pieces of correspondence. A public comment summary report is available on the park website at www.nps.gov/poregmpa.

Public Review of the Draft EIS

NPS published the Notice of Availability for the draft EIS in the *Federal Register* on August 9, 2019 (82 FR 39296). Upon publication of the Notice of Availability, a news release was issued announcing the availability of the draft EIS and the dates, times, and locations of the public meetings. Notice and instructions on how to access and comment on the draft EIS were provided to the media, local government officials, congressional offices, interested individuals, tribes, organizations, and other potential stakeholders via the NPS standard mailing/distribution list. Two open house meetings were held during the comment period. The draft EIS was also posted online at the NPS Planning, Environment, and Public Comment (PEPC) website. More than 7,600 pieces of correspondence were received during the 45-day public comment period. NPS's responses to all substantive public concerns raised during the public review period for the draft EIS are provided in appendix P.

AGENCY CONSULTATION

Agency consultation is the early involvement of federal and state agencies and tribal governments that may be affected by the federal action. Similar to the public scoping process, this allows affected agencies or tribal governments to comment and contribute early in the decision-making process and helps NPS to identify key issues or requirements to be considered in the NEPA process. During development of the EIS, NPS had discussions with the regulatory and consulting agencies listed below regarding their recommendations for streamlining regulatory requirements related to the actions being considered in this EIS. The following permits/consultations must be completed prior to implementation of the selected action:

- Clean Water Act Section 404 permit—US Army Corps of Engineers
- Clean Water Act Section 401 permit—San Francisco Bay RWQCB
- Endangered Species Act Section 7, Biological Opinion—USFWS
- Endangered Species Act Section 7, Biological Opinion—NMFS
- Coastal Zone Management Act Federal Consistency Review—California Coastal Commission
- National Historic Preservation Act Section 106 Consultation—California SHPO
- National Historic Preservation Act Section 106 Consultation—Tribal Heritage Preservation Officer, Federated Indians of Graton Rancheria

RECIPIENTS OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT

Upon publication of the Notice of Availability of the final EIS in the *Federal Register*, notice will be provided to the media, federal departments/agencies, state and county governments, elected officials, tribal governments, organizations, businesses, and interested individuals on the NPS mailing list via email or postcard and news release announcing the availability of the document for public viewing. The final EIS will be available on the NPS PEPC website (http://parkplanning.nps.gov/poregmpa). Hard copies of the final EIS will be distributed to USEPA Region 9 and the California State Clearinghouse.

This final EIS will be made available for public inspection for a 30-day waiting period, which begins with the publication of USEPA's Notice of Availability in the *Federal Register*. After the waiting period, the National Park Service Regional Director for Interior Regions 8, 9, 10, and 12 will sign the Record of Decision that will document the alternative selected for implementation.

LIST OF PREPARERS

Name	Title	Qualifications
National Park Service		
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Dylan Voeller	Point Reyes National Seashore, Range Program Manager/Ecologist	MS, Conservation Biology & Sustainable Development; BS, Ecology, Behavior & Evolution
Dave Press	Point Reyes National Seashore, Wildlife Ecologist	MS, Ecology; BA, Biology
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Name	Title	Qualifications
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