ECOLOGICAL RESTORATION PROJECT

For

Point Reyes National Seashore, California

Prepared for:

FES 445

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1.0 Abstract

This restoration project focuses on a 2,000-acre section of Point Reyes National Seashore located on the Point Reyes Peninsula in Marin County, California. The site is noted by its rugged cliffs, hills, diverse vegetation, and sandy beaches. Due to climate change, intensive ranching, overgrazing, ocean acidification, ocean acidification, and sea-level rise, Point Reyes has faced significant ecological degradation. These factors have led to habitat loss, reduced biodiversity, and the decline of critical species like the Western Snowy Plover. The western snowy plovers are critical to Point Reyes as they are an indicator species, reflecting the health of the ecosystem, and they contribute to the biodiversity, habitat quality, and food web of the seashore.
The restoration plan aims to mitigate these impacts by reintroducing native vegetation, stabilizing eroded banks, improving water quality, and controlling invasive species. Using the Monterey Bay Dunes as a reference ecosystem, the project aims to restore the ecological balance and enhance habitat quality. The project involves a combination of transformation and full recovery efforts alongside a timeline with short-term, medium-term, to long-term milestones. The involvement of multiple stakeholders, including federal and state agencies, nonprofit organizations, and local communities, is crucial for the project's success. This project aims to preserve its rich biodiversity, enhance ecological resilience, and maintain the cultural and recreational value of this iconic landscape for future generations.

2.0 Introduction and Context

2.1 Site Information

Point Reyes National Seashore is located on the Point Reyes Peninsula in Marin County, California. Officially recognized in 1962, Point Reyes spans approximately 71,000 acres, including 32,000 acres of designated wilderness (Point Reyes Record. National Park Service). The geographic coordinates to this location are *38º 4’N and 122º53’W*. For this restoration plan, we will be focusing on a 2,000-acre section of the coastline of Point Reyes (“Image 3” outlines the designated location).
The climate of Point Reyes is characterized by cool, wet winters and mild, dry summers, influenced by fog and winds. The terrain includes rugged seaside cliffs, rolling hills, grassy terrain, and beaches (Point Reyes. National Park Foundation). Vegetation consists of coastal Douglas-fir, coast live oak, tanoak, and California bay. Unique to this region are several endemic species, including the endangered Point Reyes blue butterfly and the Tidestrom's lupine. The park's diverse ecosystems and unique geological features support a wide range of flora and fauna, making restoration efforts crucial for maintaining biodiversity (Point Reyes, NPS).

2.2 History

Managed by the US National Park Service, the park was established in 1962 due to the efforts of US Congressman Clem Miller to protect the Seashore from development (Point Reyes,

Wikipedia). This park is a protected area dedicated to preserving its rich cultural and natural heritage. Point Reyes has a history dating back thousands of years, providing critical habitats for marine and land-based wildlife. First and foremost, this site was “inhabited originally by the Coast Miwok Indians. European explorers, led by Sir Francis Drake, arrived in the late 1500s.” (Point Reyes. National Park Foundation) Centuries later, following the Gold Rush period around 1855, “significant sections of the Point Reyes Peninsula were turned into dairy ranches. From 1890 to 1968, the U.S. Life-Saving Service monitored Point Reyes' eighty miles of undeveloped coastline.” (Point Reyes Record. National Park Service). Fast forward to today, the site is owned by the federal government and managed by the National Park Service.

2.3 Degradation

Point Reyes grapples with multiple sources of degradation, encompassing climate change impacts (Elizabeth A. P., et al., 2005), intensive ranching practices, overgrazing, ocean acidification, sea-level rise (Peter Byrne 2022), and shoreline erosion. These factors contribute to ecological dysfunction, jeopardizing the diverse flora and fauna dependent on this habitat (Thuy-Tien Bui., 2023). Restoration initiatives focus on restoring habitats critical for species such as the western snowy plover and Tidestrom's lupine, both federally classified as threatened or endangered.

2.4 Vegetation, Fish, Wildlife, and Protected Species

Some areas support private farms and ranches with cattle grazing, while conservation authorities and the National Park Service manage others. Point Reyes hosts a wide variety of wildlife, “including 490 bird species, 80 mammal species, 85 fish species, 29 reptile and amphibian species, and numerous invertebrates” (Point Reyes, NPS). Restoration efforts focus on 2,000 acres, particularly coastal dunes crucial for endangered species, such as the notable Western Snowy Plover. This species, protected under the Endangered Species Act of 1973, relies heavily on the coastal habitat for nesting and feeding. There have been three immediate factors that are responsible for the decline of the population: “1) habitat loss and degradation due to beach development and invasive dune plants, 2) human disturbance, and 3) predation.” (Snowy Plovers. NPS). This species is essential to the delicate coastal ecosystem, and the health of the beaches depends on their survival.

The park also houses iconic species such as the Tule elk herd and elephant seals. The Tule elk, once on the brink of extinction, have thrived in Point Reyes (Viewing Tule Elk, NPS). Meanwhile, the elephant seals, known for their massive size and seasonal presence, attract visitors and researchers alike, contributing to the park's rich biodiversity and ecological importance (Viewing Elephant Seals, NPS).

2.5 Ecoregion and Watershed

Ecoregions are defined by their similarities in ecosystems, and as for Point Reyes, it “falls within the California Interior Chaparral and Woodlands Ecoregion” (Point Reyes, Wikipedia).

According to the EPA, this region is classified as “Level 1 Mediterranean California” (Ecoregions Research. EPA), and at Level 3, it's designated as Coast Range, with a boundary outlining the forested area (Ecoregions Research. EPA).

2.6 General Goal

At the moment, a general goal for a restoration project addressing these issues at Point Reyes would be to mitigate the impacts of degradation by restoring ecological balance, enhancing habitat quality, and promoting resilience in the face of climate change and environmental stressors. This is crucial for the ecosystem, and the wildlife that inhabit this location. By taking detailed initiatives that focus primarily on the causes of degradation, we will be able to bolster habitat resilience against climate change and safeguard these critical environments for future generations.

3.0 Project Goals

3.1 Objectives and Goals

The restoration project aims to enhance the ecological integrity, economic value, and cultural significance of the area. The environmental goals include improving habitat conditions for threatened and endangered species, preserving the seashore’s biodiversity, and improving resilience to disturbances (Babalis, T. (2011)). Given this site's cultural importance, the project's cultural goals are to preserve the park's historical and educational value.

Point Reyes National Seashore necessitates restoration due to the degraded coastal dune habitats, invasive plant species, anthropogenic impacts, and diminished populations of native species, not to mention to aid in the preservation of endangered species (Point Reyes National Seashore. U.S. Department of the Interior. 2007). The endpoint of the project is a self-sustaining, diverse ecosystem that supports the native and endangered species.

The restoration project involves a combination of transformation and full recovery efforts. Transformation efforts address the removal of invasive species and the reintroduction of ecological processes. Full recovery efforts focus on re-establishing native plant communities and improving habitat quality.

3.2 Alternative Option 1: No-Action

The No-Action approach means ceasing activities that contribute to habitat loss and minimizing human disturbances in sensitive areas. By removing ourselves, we are allowing natural processes to operate unhindered, expecting some degree of natural recovery. Over time there may be a recolonization of native vegetation, a higher and/or thriving population of wildlife, and restoring some aspects of the ecosystem’s health. This alternative may not address all degradation factors effectively, and the timeframe for this option is uncertain and may be prolonged.

3.3 Alternative Option 2: Active

The Active approach involves a set of interventions aimed at accelerating the restoration of the ecosystem. Actions in this plan include the removal of invasive species like European beachgrass, followed by the replanting of native vegetation such as native grasses (Pendleton, E. A. et al. 2005). Additionally, habitat structures like nesting sites for the western snowy plover can be installed to support their population growth. This approach involves a higher budget and more intensive management but will provide more predictable results that restore the ecosystem's functional and structural components.

3.4 Alternative Option 3: Integrated Approach

The Integrated Approach combines active ecological restoration with significant community involvement and education. Similar to the Active approach, it includes the removal of invasive species, replanting of native plants, and habitat enhancement. Additionally, this approach has a strong emphasis on engaging local communities, volunteers, and stakeholders through education programs, volunteer planting days, and citizen science projects. The budget for this approach may be costly as it involves funding for community outreach and education programs, however with volunteer labor, it may reduce the overall cost.

3.5 Preferred Alternative

The project seeks to create a self-sustaining, diverse ecosystem by removing invasive species, reintroducing ecological processes, and re-establishing native plant communities. The preferred alternative utilizes a series of targeted interventions designed to speed up ecosystem restoration. This plan involves removing invasive species, such as European beachgrass, and replanting native vegetation, including native grasses (Pendleton, E. A. et al. 2005). It also includes installing habitat features, such as nesting sites for the western snowy plover, to boost their population (Western Snowy Plover). Although this approach requires a larger budget and more intensive management, it is likely to yield more predictable results, restoring both the functional and structural aspects of the ecosystem. This alternative was selected due to its comprehensive approach, addressing the ecological, economic, and cultural value this location holds. The proposed restoration aims to align Point Reyes with a healthy condition that is observed at the Monterey Bay Dunes.

4.0 Reference System

4.1 Description, Historical State, and Environment

4.1.1 Monterey Bay Dunes

The reference site chosen for this restoration project is the Monterey Bay Dunes in California. This site was chosen because its fairly intact coastal dune ecosystem closely resembles the historical conditions of Point Reyes National Seashore, making it an excellent model for evaluating restoration needs and goals (SER Primer, 2004).

Well-preserved coastal dune habitats with minimal human disturbance and a rich diversity of native plant and animal species distinguish the Monterey Bay Dunes. The dunes are actively shaped by wind and tidal actions, retaining open sandy areas that allow native vegetation, such as dune grasses and flowering plants, to thrive (Marina Bay Dunes). These dunes support various mammals, invertebrates, and shorebirds, notably including the western snowy plover. The snowy plover, a keystone species, indicates a healthy, functioning ecosystem (Western Snowy Plover). Historically, the Monterey Bay Dunes experienced regular natural disturbances such as wind erosion, sand deposition, and tidal actions, creating a variety of habitats (The Mercury News, 2020). The open sands have been regularly disturbed by wind and water, creating dunes and allowing for the environment to play the perfect host to species that inhabit this location. Native grasses, forbs, and shrubs adapted to sandy, nutrient-poor soils, providing nesting and foraging grounds for wildlife (Marina Bay Dunes). The area receives mild precipitation with seasonal variations influencing soil moisture levels. The biotic community includes native dune plants, shorebirds, and many invertebrates. This reference site will help steer the restoration of Point Reyes, providing a model for the desired ecological outcomes, such as increased biodiversity, improved habitat conditions, and enhanced resilience to natural disturbances.

4.1.2 Point Reyes National Seashore

The historical conditions of Point Reyes will be referenced as a baseline for the previous ecological state and species composition at this site. Currently, Point Reyes is notably experiencing significant degradation due to climate change impacts, ranching practices, overgrazing, ocean acidification, and sea-level rise (Point Reyes National Seashore California, NPS). Historically, the area featured dynamic coastal dunes and beaches, frequently disturbed by natural occurrences such as storms and tidal actions (Pendleton, E. A. et al. 2005). These disturbances maintained open sand areas suitable for snowy plover nesting, supporting native plant communities and diverse wildlife. Historical records demonstrate that the region once had richer biodiversity and a more resilient ecosystem capable of resisting environmental stressors. By analyzing historical conditions, restoration efforts will be better guided by a concise image of what we are attempting to achieve through the ecological realities of the past. Additionally, utilizing historical data will help identify key factors that contributed to the ecosystem's health and resilience, enabling the restoration team to recreate those conditions and enhance the long-term success of the restoration project.

4.2 Baseline Data

4.2.1 Monterey Bay Dunes

To effectively compare the reference site to Point Reyes, it is essential to gather extensive data, including vegetation surveys, wildlife information, soil and hydrology data, and the disturbance history of both areas. Aerial and ground-level photos of Monterey Bay Dunes will offer useful visual documentation of current habitat conditions, providing a basis for comparison. Historical

accounts will also be crucial for understanding long-term ecological trends and changes over time.

Additionally, collecting data on species composition and abundance, soil composition, water quality, and historical land use patterns will provide a detailed understanding of the similarities and differences between the two sites. This multifaceted approach ensures an inclusive comparison, pinpointing factors that influence ecosystem health and resilience. By incorporating these diverse sources, our expert researchers will have the ability to effectively develop detailed restoration strategies that are tailored to the specific conditions and needs of Point Reyes.

4.2.2 Point Reyes National Seashore

With vegetation surveys providing detailed mapping of native and invasive plant species, as well as population counts and behavioral studies of snowy plovers and other key species, we will establish a comprehensive baseline. Additionally, these surveys will include assessments of plant health, growth rates, and reproductive success, offering a deeper understanding of ecosystem dynamics. This baseline data is critical for monitoring progress and making informed management decisions throughout the restoration process. By incorporating advanced GIS technology and remote sensing, we can enhance the precision and accuracy of our surveys, leading to more effective conservation strategies and improved outcomes for the ecosystem.

5.0 Expenses

5.1 Expense Breakdown

Expenses

Subject	Category	Status	Costs	Notes
Paid labor	Invasive Speci...	In progress	1,000 hrs x $25/hour = $25,000	Volunteer Labor: Valued at $15/hr x 500 hours = saving $7,500
Paid labor	Native Plant R...	In progress	800 hrs x $25/hour = $20,000	Volunteer Labor: Valued at $15/hr x 300 hours = saving $4,500
Paid labor	Wildlife Mana...	In progress	400 hrs x $30/hour = $12,000	Volunteer Labor: Valued at $15/hr x 200 hours = saving $3,000
Paid labor	Human Activit...	In progress	600 hrs x $25/hour = $15,000	Volunteer Labor: Valued at $15/hr x 200 hours = saving $3,000
Herbicides and Equipment	Invasive Speci...	Not started	$5,000	Estimated 5,000 - 10,000
Native Plants and Supplies	Native Plant R...	In progress	$10,000	Estimated 10,000 - 15,000
Plant tools and supplies	Native Plant R...	In progress	$2,000	Estimated 2,000 - 5,000
Installing Habitat Features	Wildlife Mana...	Not started	$3,000	Estimated 3,000 - 6,000. Features such as nesting sites
Signage and Educational Materials	Human Activit...	Not started	$4,000	Estimated 4,000 - 8,000
Consulting Fees for Ecological Experts	Services	Not started	$10,000	No notes
Monitoring and Evaluation Services	Services	Not started	$8,000	No notes
Necessities for Volunteers/Paid Workers	Minor / Extras	Not started	$2,500	Includes waters, food, restrooms and such.
Total Estimated Costs	Total	In progress	~ $116,500	Funds primarly from: Government, Organizations, and Donors.

6.0 Stakeholders

6.1 Organizations Involved

Point Reyes National Seashore is a nonprofit organization aligned with the National Park Service and corresponding with many other stakeholders (Point Reyes National Seashore, "Our Partners".(NPS)). Funding for Point Reyes comes from a variety of sources, including but not limited to:

- Federal funding through the National Park Service (NPS) and Congress
- Grants from federal programs such as the Land and Water Conservation Fund (LWCF) and the National Fish and Wildlife Foundation (NFWF)
- State funding from the California Coastal Conservancy and the California Wildlife Conservation Board
- Nonprofit organizations funding such as Point Reyes National Seashore Association (PRNSA)

… as well as from other groups such as state Universities, Conservation Organizations, and private donations such as individual donors and foundations (Avery, C. (2009)).

6.2 Involvement Process

The plan for involving stakeholders includes distributing surveys, organizing meetings and forums, hosting educational workshops and seminars, creating online platforms, and opening open and public participation. Furthermore, it is essential to work closely with the Native American Tribe, the Coast Miwok Indians to ensure that their cultural heritage zone is protected and they are involved in the changes of the land (Seufert, C., et al.).

7.0 Regulatory Framework

7.1 Federal Level

At the Federal Level, the National Park Service (NPS) manages Point Reyes National Seashore. Given that UNESCO officially recognized this park as part of the Central California Coast Biosphere Reserve, there are several organizations with which this park needs to comply (National Archives, 2012). This includes but is not limited to:

- The National Environmental Policy Act (NEPA)
- The Endangered Species Act (ESA)
- The U.S Fish and Wildlife Service (USFWS)
- The Clean Water Act (CWA)

They may also work with the U.S. Army Corps of Engineers for any work affecting wetlands or water bodies.

7.2 State Level

The California Department of Parks and Recreation and the California Coastal Commission are important parties that coincide with Point Reyes (Avery, C. (2009)). Furthermore, this park works with several organizations ensuring that all activities are permitted and under the proper care, including but not limiting:

- The California Environmental Quality Act (CEQA)
- The California Department of Fish and Wildlife (CDFW)
- The California Coastal Act necessitates a Coastal Development Permit (CDP), overseen by the California Coastal Commission.

7.3 Regional and Local Level

Regionally, the San Francisco Bay Regional Water Quality Control Board (RWQCB) ensures adherence with the Porter-Cologne Water Quality Control Act, controlling clearances that may affect water quality. Locally, the Marin County Community Development Agency reviews projects consistently with land use plans.

8.0 Expected Outcome

8.1 Timeframe and Degrees of Change

Overall, this project is expected to take between 5 to 10 years to fully achieve its goals. In the short term (1-2 years), the focus will be on establishing native vegetation, reducing invasive species, and making initial improvements to snowy plover nesting sites. By the next checkpoint at 3-5 years, we aim to see a significant increase in native plant cover, a stabilized coastal dune system, and enhanced wildlife protection measures. Finally, the long-term goals, which span 5-10 years, include signs of a sustainable population of snowy plovers, a fully recovered dune ecosystem, active and continuous efforts to mitigate sea-level rise impacts, and minimal hands-on management requirements. Additionally, continuous monitoring and adaptive management practices will be implemented to ensure the resilience and sustainability of the restored ecosystem. This thorough approach will not only address immediate restoration needs but also promote long-term ecological health and stability.

The restoration efforts will target critical beach and dune areas within Point Reyes National Seashore, encompassing approximately 200 acres. The goal is to reduce invasive species by 90%, increase native plant cover by 70%, and boost the snowy plover population by 50%. Overall ecosystem health is expected to show significant improvement, closely resembling historical conditions. Additionally, these actions will enhance habitat quality, promote

biodiversity, and improve the resilience of the ecosystem against climate change impacts (Costanza R., et al. 1997). Continuous monitoring and adaptive management strategies will ensure the restoration progress is on track, providing a sustainable foundation for future conservation efforts (Restoration and Management of Coastal Dunes, 2013). By the project's conclusion, Point Reyes should exhibit a vibrant and balanced ecosystem, supporting diverse plant and animal species while maintaining its natural heritage.

9.0 Appendices

9.1 Species List

Vulnerable / Threatened / Endangered Species List at Point Reyes National Seashore
https://www.inaturalist.org/places/point-reyes-national-seashore#threatened=1

Sharp-tailed Sandpiper
Red Knot
Semipalmated Sandpiper
Horned Grebe
Brown Pelican
Heermann's Gull
Black-legged Kittiwake
Cassin's Auklet
Yellow-billed Loon
Peregrine Falcon
Spotted Owl
Olive Ridley Sea Turtle
Blue Whale
Humpback Whale
Guadalupe Fur Seal
Northern Fur Seal
Elegant Tern
Golden-gilled Waxy Cap
White Sturgeon
White Bog Orchid
Point Reyes Shoulderband Snail
Coastal Green Hairstreak
California Lancetooth Snail
Fog-belt Bumble Bee
Pink-footed Shearwater
Eurasian Wigeon
Pink Waxcap
Western Snowy Plover
Sea Otter
Coast Redwood
Sunflower Sea Star
California Giant Salamander
American Badger
Stream Orchid
Witch's-Teeth
Water Fern
Long-Rayed Brodiaea
Franciscan Thistle
Bald Eagle
Rufous Hummingbird
Long-Tailed Duck
Swainson's Hawk
Cooper's Hawk
Merlin
Blackpool Warbler
Sacramento Perch
Green Sturgeon
Salt Rush
Black Western slug
Button's Banana Slug
Ruff
Leconte's Sparrow
Toasted Waxcap
Northern Harrier
Marsh Harebell
Bank Swallow
Loggerhead Shrike
Olive-sided Flycatcher
Fragrant Fritillary
Common Mola
Monterey Pine
San Francisco Lacewing
Bishop Pine
Brown-headed Rush
Dark-eyed Gilia
Beach Tidytips
Osprey
Seaside Bone Lichen
Violet Coral Fungus
Black Scoter
Snowy Owl
Least Tern
Thresher Shark
Western Grasswort
Pacific Angelshark
Wavy Cap
Umbrose Seed Bug
Buff-breasted Sandpiper
Netted Specklebelly
Sooty Shearwater
Michael's Rein Orchid
Siberian Sand Plover

9.2 Site Photos

***Image 1**: State of California.*
Pinned location of Point Reyes (Point Reyes, Wikipedia)

***Image 2**: Highlighted in Purple* (Point Reyes, Wikipedia)

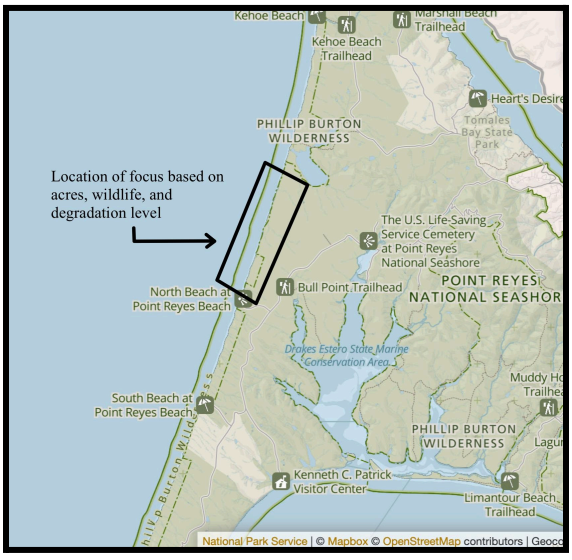

***Image 3**: Location of Focus* (Point Reyes, NPS)

***Image 4**: Point Reyes National Seashore* (Point Reyes, NPS)

***Image 5**: Headlands of the Point Reyes Peninsula from Chimney Rock* (Point Reyes, Wikipedia)

***Image 6**: Western Snowy Plover* (*Wikipedia, 2024*)

***Image 7 (Above)**: Tule Elk Herd* (Viewing Tule Elk, NPS)

***Image 8 (Above)**: Elephant Seal* (Viewing Elephant Seals, NPS)

***Image 9 (Above)**: Monterey Bay Dunes – Reference Site (The Mercury News)*

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