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Patrick's Point State Park Habitat Restoration Plan

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Patrick's Point State Park
Habitat Restoration Plan

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Patrick's Point State Park looking west (photo by K. Moore, October 2020)

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1. Introduction

1.1 Project Summary

Ongoing efforts at Patrick's Point State Park (PPSP) seek to restore the ecosystems contained therein. Over time, non-native invasive plant species have become established within the Park. This habitat restoration plan (or Plan) aims to aid in restoring native and sensitive habitat through the removal of non-native invasive species. The Plan will take many different approaches to targeting the invasive non-native plant species depending on the target species and specific site conditions.

1.2 Project Location

PPSP is located on the north coast (41.1365° N, 124.1552° W) within Humboldt County, California (Figure 1). The Park lies along Highway 101 and is about 45.1 km (28 miles) north of Eureka, California. It can also be accessed from Patrick's Point Drive, north of Trinidad. The project site is approximately 420.01 acres (169.97 ha).

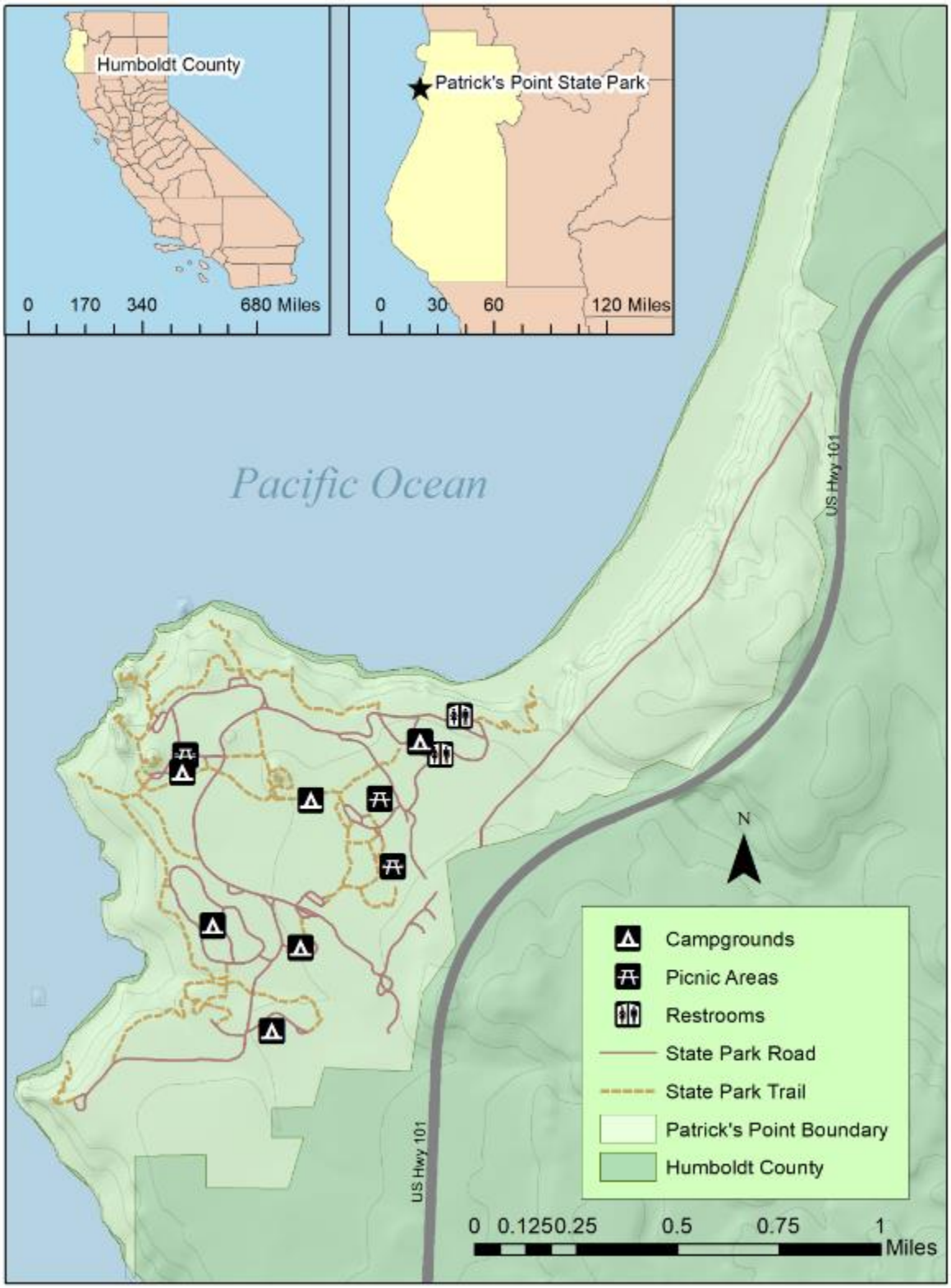

Figure 1. Location of Humboldt County within California (upper left inset), location of Patrick's Point State Park within Humboldt County (upper middle inset), and Patrick's Point State Park Boundary and amenities contained within (Map made by Marina De Paul using ArcMap version 10.6.1).

1.3 Need for Project

California State Parks has a mission of providing recreation while also preserving California's biological diversity and protecting natural resources (*About Us*, 2020). A threat to PPSP is the invasion of non-native invasive plant species. There is substantial evidence that invasive species are a significant environmental issue affecting native ecosystems (Barney et al., 2013). Some of the documented non-native invasive plant species within PPSP include English ivy (*Hedera helix*), jubata grass (*Cortaderia jubata*), cotoneaster (*Cotoneaster* spp.), Himalayan blackberry (*Rubus armeniacus*), Scotch broom (*Cytisus scoparius*). More non-native invasive species and their descriptions can be found in Appendix A and Appendix B. The degree of plant invasions in PPSP threaten sensitive habitats within the Park.

Within PPSP are several sensitive native shrub and herbaceous communities such as Western azalea (*Rhododendron occidentale*) and Pacific reed grass (*Calamagrostis nutkaensis*). To facilitate stewardship efforts in protecting sensitive communities, a Plan needs to be developed. The purpose of this Plan is to provide information about vegetation alliances and invasive species found within PPSP. This information will help management identify areas easier and provide knowledge on the extent of existing damage from invasive species throughout the Park. Without this Plan, California State Parks will not be able to facilitate their mission of protecting natural resources.

1.4 Goals and Objectives

The goal of this Plan is to restore the various habitats in PPSP by treating invasive non-native plant species while protecting sensitive species.

Goals

Restore and maintain coastal scrub communities within PPSP.
Restore and maintain native forest understory.
Restore and maintain western azalea stands.
Restore and maintain coastal grasslands.

Objectives

Map non-native species located in the Park to document effectiveness of treatment and areas in need of re-treatment.
Prioritize and treat invasive non-native plant species.

2. Vegetation Mapping Methods

In order to better understand the location and extent of invasive non-native species and vegetation alliances in the Park, we mapped these elements using handheld GIS software. Mapping of invasive non-native species and vegetation alliances at PPSP occurred in September and October 2020 over four separate days of field work. Previous mapping was done by North Coast Redwoods GIS and additional mapping was completed by Humboldt State University Environmental Science and Management students in the Ecological Restoration concentration as part of their senior capstone project. To make surveying PPSP as efficient as possible, the roads and trails were used as survey routes. The vegetation mapping was done using cellular phones with the applications Survey 1, 2, 3 (version 3.11.164, ESRI) and Collector (version 20.2.2, ESRI). These applications were able to record Global Positioning System (GPS) Points and/or

polygons for invasive plant species and vegetation alliances. The vegetation alliances were identified using "A Manual of California Vegetation" (Sawyer, et al. 2009). The invasive plant species were identified using the "Invasive Plants of California's Wildlands" (Bossard, 2000). The points and polygons that were recorded were then made into four separate maps, two for the vegetation alliances found in PPSP (Figure 2 and Figure 3) and two for the invasive plant species found in PPSP (Figure 5 and Figure 6). These maps were made using the ESRI GIS mapping software ArcMap version 10.6.1.

3. Existing Environment

This section contains the current physical, natural, cultural, and recreational settings within PPSP.

2.1 Natural Resources

PPSP includes a variety of different vegetation types such as Sitka spruce (*Picea sitchensis*) forest, red alder (*Alnus rubra*) forest, various coastal shrubland, and herbaceous grassland. The different natural resources found within the project area are discussed below.

2.1.1. Physical Environment

Topography

PPSP has 6,126 meters (20,100 linear feet) of ocean frontage. The coastline terrain contains marine terraces, large rock outcrops known as sea stacks, moderately sloping hills, steep ocean-facing cliffs, and a sandy beach (Department of Parks and Recreation, 1985). The marine terrace is approximately 61 meters (200 feet) in elevation and dissected by three streams. The sea stacks are remnants from a higher sea level and were formed from waves eroding rocky headlands, isolating more resistant rocks to create individual sea stacks (Flynn, 2003). Ceremonial rock, the largest outcrop, rises as high as 88 meters (287 feet). Lookout Rock rises to approximately 76 meters (250 feet). The moderately sloping hills occur above Agate Beach, ranging in elevation from 61 to 152 meters (200 to 500 feet). The 2514 meters (8,250 linear feet) of Agate Beach starts at the base of the terrace's northern edge and extends northward to the Park boundary (Department of Parks and Recreation, 1985).

Hydrology

Because substantial portions of the terraces found within the Park are so flat, many watershed boundaries are indistinguishable. There are three perennial streams that flow throughout the Park: Agate Creek, Penn Creek, and Beach Creek. Of the three, Agate Creek is the largest individual watershed, covering 581 acres. The second largest, Penn Creek, drains 471 acres and the third, Beech Creek, drains 310 acres (Department of Parks and Recreation, 1985).

Geology

Underlying PPSP is the geologic unit known as the Franciscan Formation or Franciscan Complex. This Franciscan melange consists of a sheared matrix of fine-grained rocks including graywacke, sandstone, shale, and chert (Department of Parks and Recreation, 1985). The rocks themselves are ancient deposits and associated oceanic crust that have been carried down a subduction zone. It is hypothesized the Franciscan rocks were scraped off the ocean floor and

jammed into the continent (Department of Parks and Recreation, 1985). Overlaying the Franciscan Formation are marine terrace deposits. The terraces were formed by ocean wave action when sea level was at a higher elevation. The current elevation of the terraces are due to sea level fluctuations and regional tectonic uplift (Department of Parks and Recreation, 1985).

Behind Agate Beach is a bluff, partially capped by vegetated sand dunes, that is composed of terrace sands and other marine sands and clays. The dunes themselves were formed by wind transport of beach sands. Composed of poorly consolidated sands and marine deposits, the bluffs are unstable on steep slopes and susceptible to landslides and wind and water erosion (Department of Parks and Recreation, 1985).

Soils

PPSP has four primary soil series within its boundary. The first, and most prominent, is the Candymountain series (Soil Survey Staff, 2019). It occurs on 30 to 75 percent slopes and is mostly marine terraces and bluffs with elevations that range from 10 to 600 feet. The Candymountain series typical profile consists of fine sandy loam, is well drained, and has parent material of marine deposits (Soil Survey Staff, 2019). The second soil series is Halfbluff-Tepona-Urban Land. It usually occurs on 2 to 9 percent slopes, at elevations from 10 to 120 feet, and are usually on marine terraces. A typical profile ranges from Oi to C, from sandy loam, to fine sandy loam, to loamy fine sand. Typical vegetation on this soil type are Sitka spruce, coastal redwood (*Sequoia sempervirens*), salal (*Gaultheria shallon*), and western bracken fern (*Pteridium aquilinum*) (Soil Survey Staff, 2019). The third soil series is Timmons and Lepoil soils. These soils occur on 2 to 9 percent slopes, at 10 to 600 feet elevation, and on marine terraces. The soil profile ranges from A to Bt, from loam to sandy clay loam. Similar to the previous series, typical vegetation on this soil are Sitka spruce, coastal redwood, salal, California huckleberry (*Vaccinium ovatum*), and western sword fern (*Polystichum munitum*) (Soil Survey Staff, 2019). The final prominent soil series is the Lepoil-Espa-Candymountain complex. The Lepoil-Espa-Candymountain complex slopes range from 15 to 50 percent, have elevations of 10 to 600 feet, and are on marine terraces. The majority of the soil profile is loam to clay loam. The typical vegetation that occurs on it are Sitka spruce, coastal redwood, salal, California huckleberry, and western sword fern (Soil Survey Staff, 2019).

2.1.2. Biological Resources

Habitat Types and Associated Vegetation

PPSP consists of many habitat types that can broadly be classified as Sitka spruce forest, red alder forest, coastal scrub, and non-native grass lawn. Within these broad habitats are more detailed vegetative alliances (Table 1, Figure 2, & Figure 3). A vegetative alliance is a repeating pattern of plants in an area. It is defined by species composition and is determined by effects of local climate, soil, water, disturbance, and other environmental factors (California Native Plant Society, n.d.).

Sensitive Plant Species

There are several sensitive species found within PPSP. They range from conifer to herbaceous plant species and are considered imperiled, vulnerable, rare, or endangered (Table 1, Figure 4). One of the sensitive plant species found is the Oregon coast paintbrush (*Castilleja affinis* ssp. *litoralis*). It is considered vulnerable at the state and global level (S3G3) and is rare or

endangered in California (2B) (California Native Plant Society, n.d.). Another species, Tracy's Romanzoffia (*Romanzoffia tracyi*), is considered imperiled at the state level (S2), apparently secure at a global level (G4), and rare, threatened, or endangered in California (2B) (California Native Plant Society, n.d.). A conifer species, the Bishop pine (*Pinus muricata*), is considered vulnerable at both the state and global level (S3G3) (California Native Plant Society, n.d.). More sensitive species and their rankings can be found in Table 1.

Table 1. Vegetative alliances and sensitive species found within Patrick's Point State Park and their rarity ranking from CNPS (California Native Plant Society), state CNNDB (California Natural Diversity Database), and global CNDDB (California State Parks, n.d.; California Native Plant Society, n.d.; California Natural Diversity Database, 2020).

	Species Name	CNPS	CNDDB State	CNDDB Global
Vegetative Alliances	Sitka spruce (*Picea sitchensis*)		S2	G5
	Coast Redwood (*Sequoia sempervirens*)		S3.2	G3
	Red alder (*Alnus rubra*)		S4	G5
	Monterey pine (*Pinus radiata*)	1B.1	S1	G1
	Beach pine (*Pinus contorta* spp. *contorta*)		S3	G5
	Bishop pine (*Pinus muricata*)		S3.2	G3
	Western azalea patches (*Rhododendron occidentale*)		S2	G3
	Coastal brambles (*Rubus parviflorus, R. spectabilis, R. ursinus*)		S3	G4
	Coyote brush scrub (*Baccharis pilularis*)		S5	G5
	Coast silk tassel scrub (*Garrya elliptica*)		S3	G3
	Wax myrtle scrub (*Morella californica*)		S3	G3
	Pacific reed grass (*Calamagrostis nutkaensis*)		S2	G4
	Non-native grasslands			
Sensitive Species	Bishop pine (*Pinus muricata*)		S3.2	G3
	Slough sedge (*Carex obnupta*)		S3	G4
	Fawn lily (*Erythronium*)	2B.2	S3	G4
	Heart-leaved twayblade (*Listera cordata*)	4.2	S4	G5
	Oregon coast paintbrush (*Castilleja affinis* ssp. *litoralis*)	2B.2	S3	G3
	Sea watch (*Angelica lucida*)	4.2	S3	G5
	Tracy's romanzoffia (*Romanzoffia tracyi*)	2B.3	S2	G4
	Trailing black currant (*Ribes laxiflorum*)	4.3	S3	G5

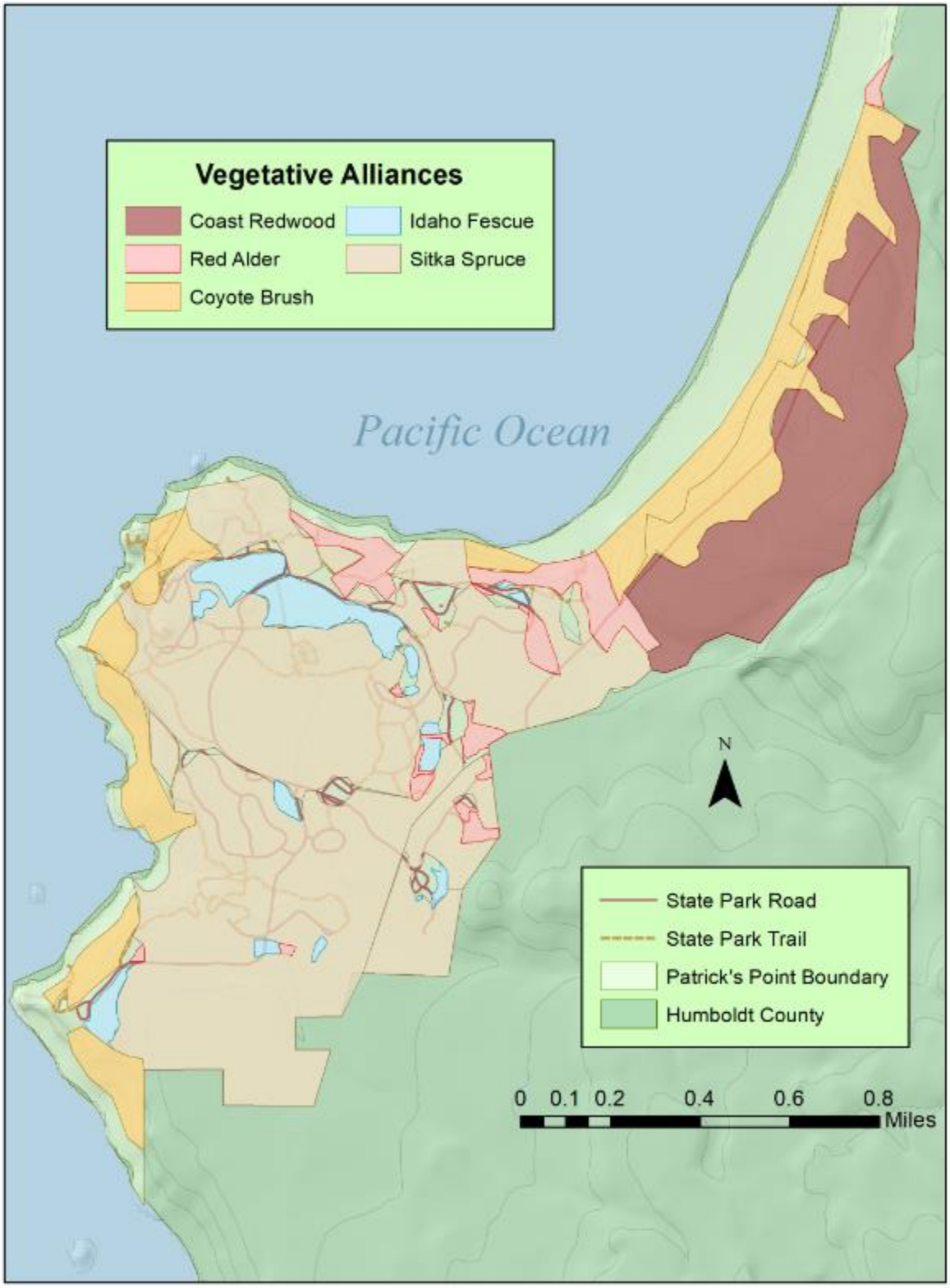

Figure 2. Vegetative alliances found throughout Patrick's Point State Park. Data were collected from Aerial photos by Patrick's Point State Park employees in 2020 (Map made by Marina De Paul using ArcMap version 10.6.1).

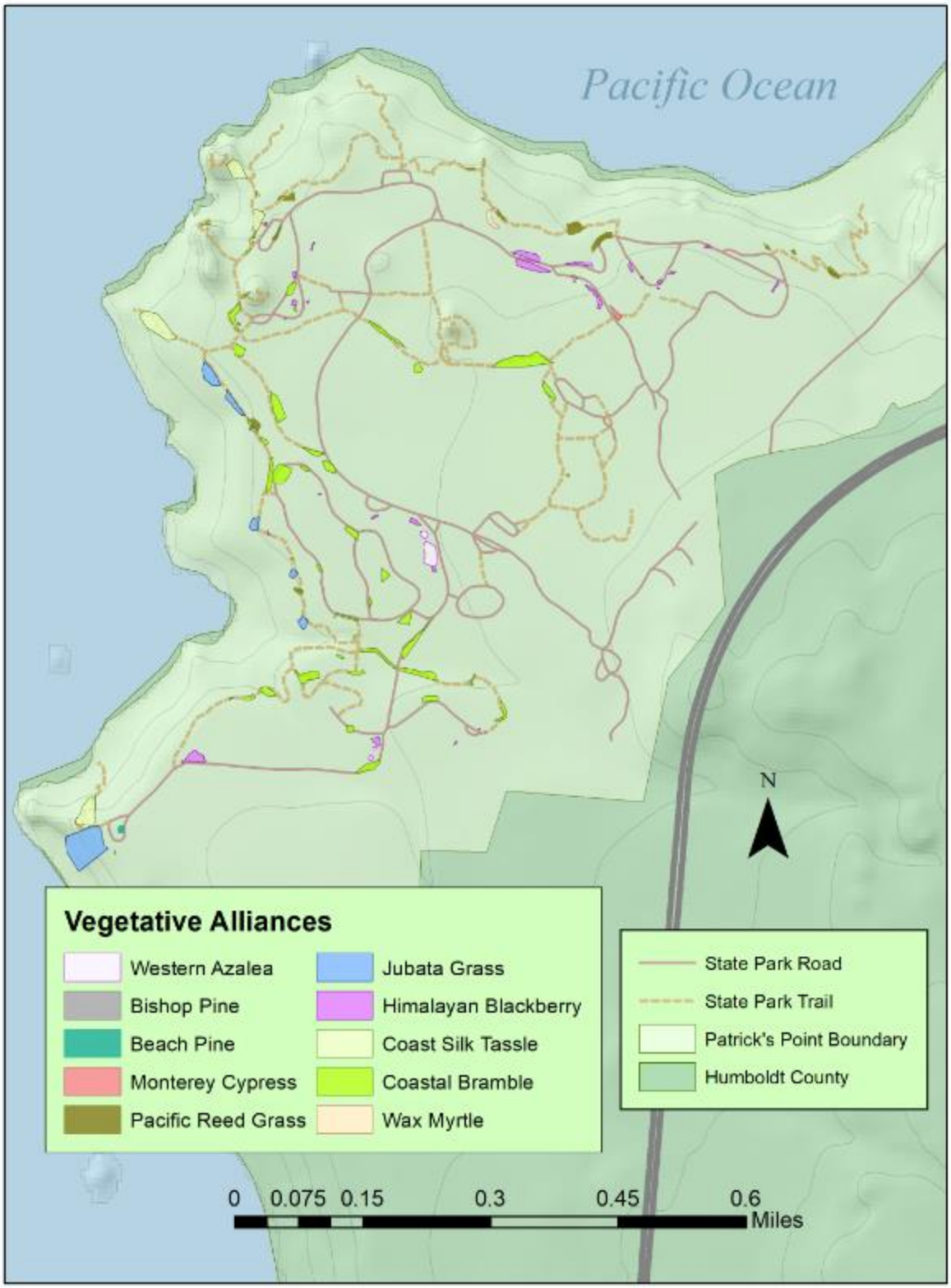

Figure 3. Vegetative alliances found throughout Patrick's Point State Park. Data were collected on the ground by HSU students in October 2020 (Map made by Marina De Paul using ArcMap version 10.6.1).

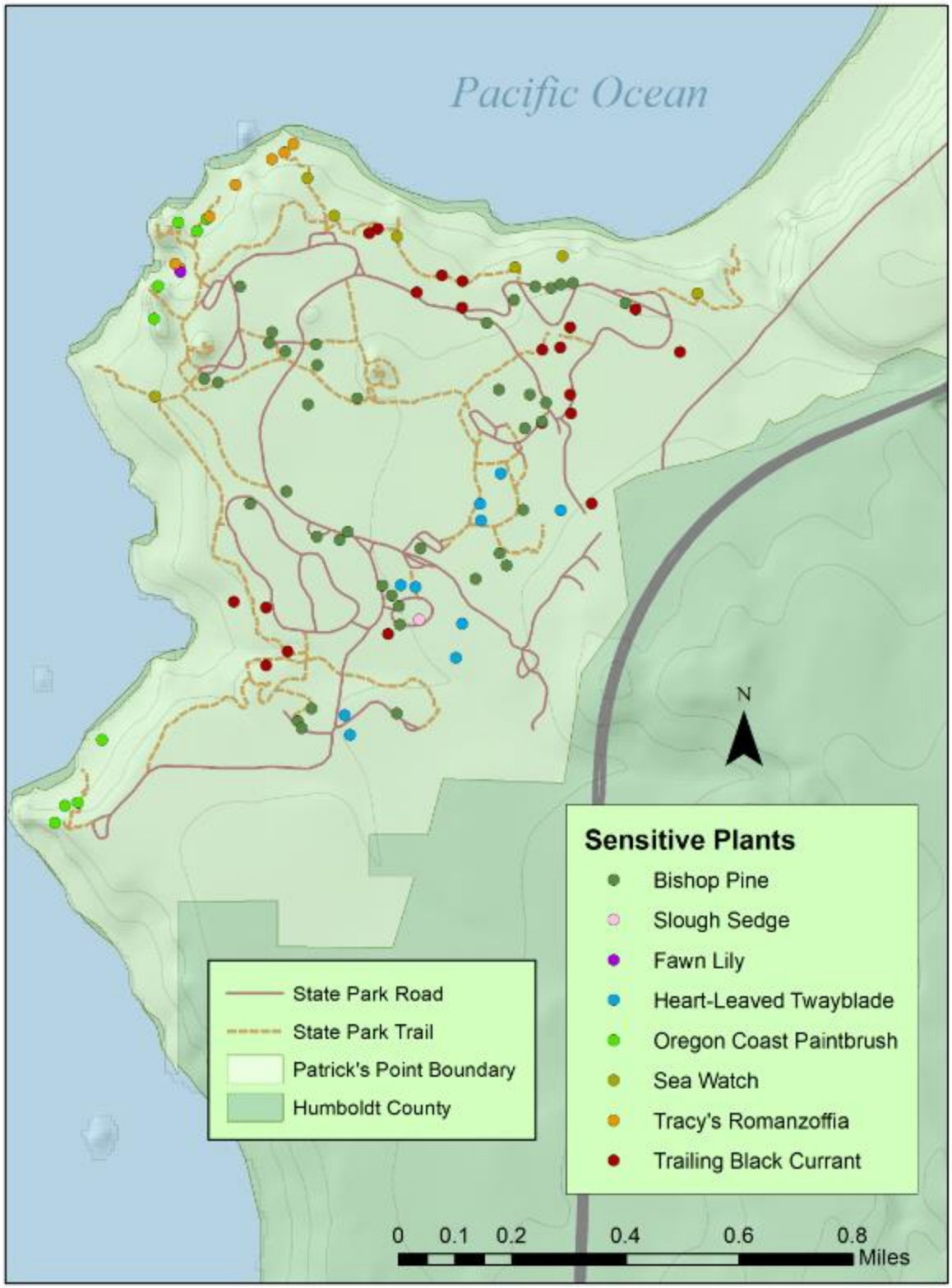

Figure 4. Locations of sensitive plants found within Patrick's Point State Park (Map made by Marina De Paul using ArcMap version 10.6.1).

Invasive Non-native Plant Species

Many invasive non-native plant species have established within PPSP the Park (Appendix A, Figure 5, and Figure 6). A few of the primary target species include jubata grass (*Cortaderia jubata*), Himalayan blackberry (*Rubus armeniacus*), cotoneaster (*Cotoneaster* sp.), Scotch broom *(Cytisus scoparius)* and English ivy (*Hedera helix)*. The full list can be found in Appendix A and their descriptions in Appendix B.

These invasive non-native species are a danger to the Park and a danger to areas that these plants can potentially spread to. Jubata grass is found mostly along the Rim Trail and the coastal bluffs where removing them can be treacherous for the workers trying to remove them. The windblown seeds that can get carried on the wind for 20 miles are spreading rapidly to other sections of bluff and into Abalone Campground where visitors can further spread the seeds on their clothes, shoes and vehicles (*Jubata Grass*, n.d.). Once the plant has established itself it will spread into a monoculture, shading out native plants (HCWMA, 2010).

Himalayan blackberry (*Rubus armeniacus*) can be found along most trails, roads, and campgrounds in PPSP. The plant spreads through people and wildlife spreading the berry seeds. Humans tend to spread the seeds by eating the berry and spitting out the seeds. Himalayan blackberry create dense mounds and sprawling shrubs. These dense thickets shade out native plants and if spread to a pasture can reduce its forage value (HCWMA, 2010).

Cotoneaster (*Cotoneaster* sp.) is found in a few isolated patches throughout PPSP near the Park's offices. The spread of this plant's seeds are mostly due to the local birds eating the fruits and then spreading the seed (HCWMA, 2010). This species is spreading rapidly and is becoming a major problem as it has begun to displace native shrubs.

English ivy (*Hedera helix*) is found throughout the Park, though certain areas have greater infestations such as to the northmost part of PPSP. This plant will use its vines to climb up trees and suffocate them if not removed quickly. English ivy adds a significant weight to the tree and can topple a tree. This invasive non-native plant has been known to kill spruce and redwoods if given the chance (HCWMA, 2010).

Scotch broom *(Cytisus scoparius)* is an invasive species that produces a lot of seeds that can last in the soil for many years. Since it can reproduce with ease, it adapted easily to PPSP. This species was found in the center of the park in one big patch. It was not found in many other places than that. This plant can be unpredictable during fire season because it is known for creating a fire hazard (HCWMA, 2010).

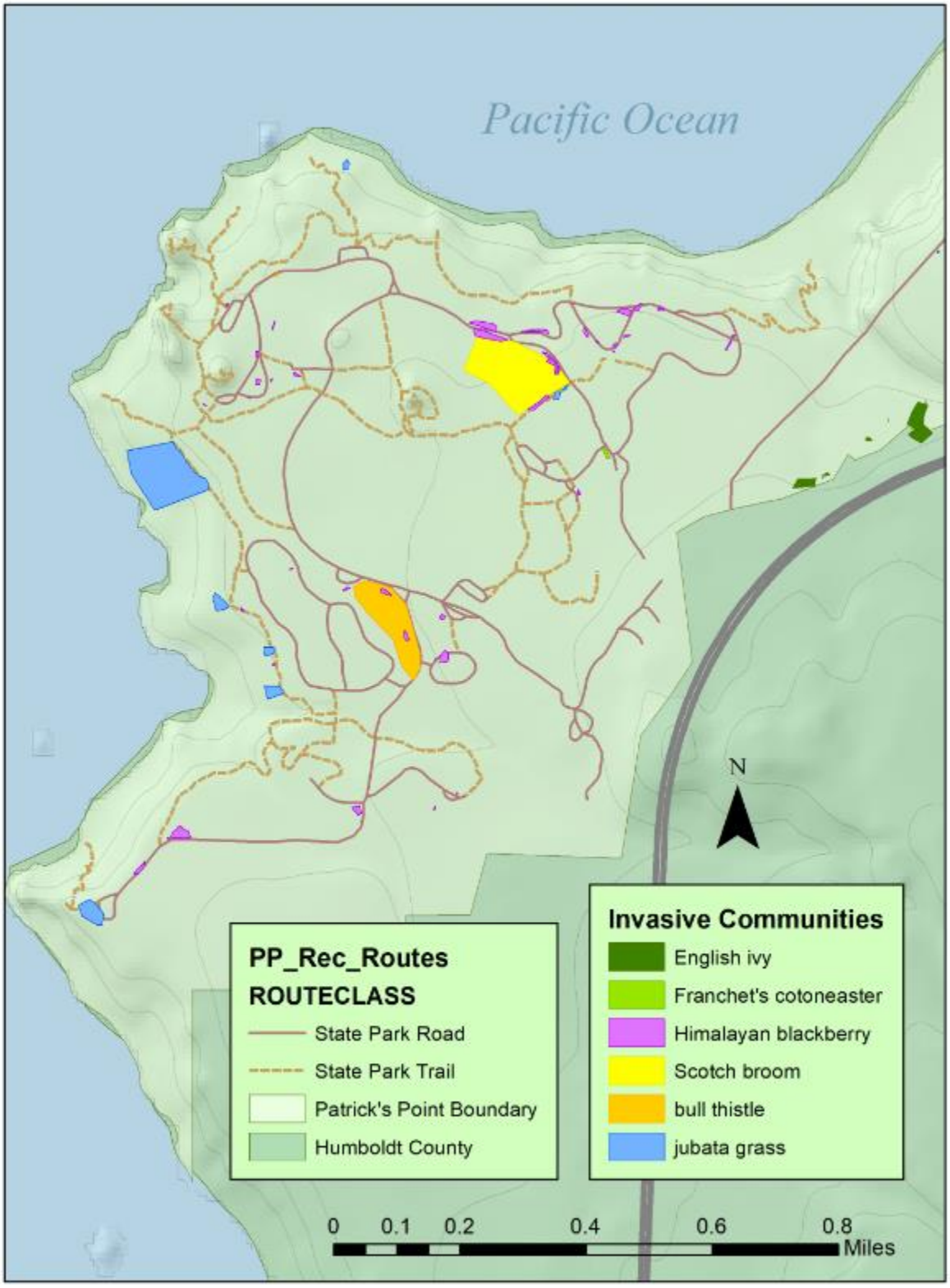

Figure 5. Patches of non-native invasives found within Patrick's Point State Park. Data were collected by State Park employees throughout 2020 and by HSU students in October 2020 (Map made by Marina De Paul using ArcMap version 10.6.1).

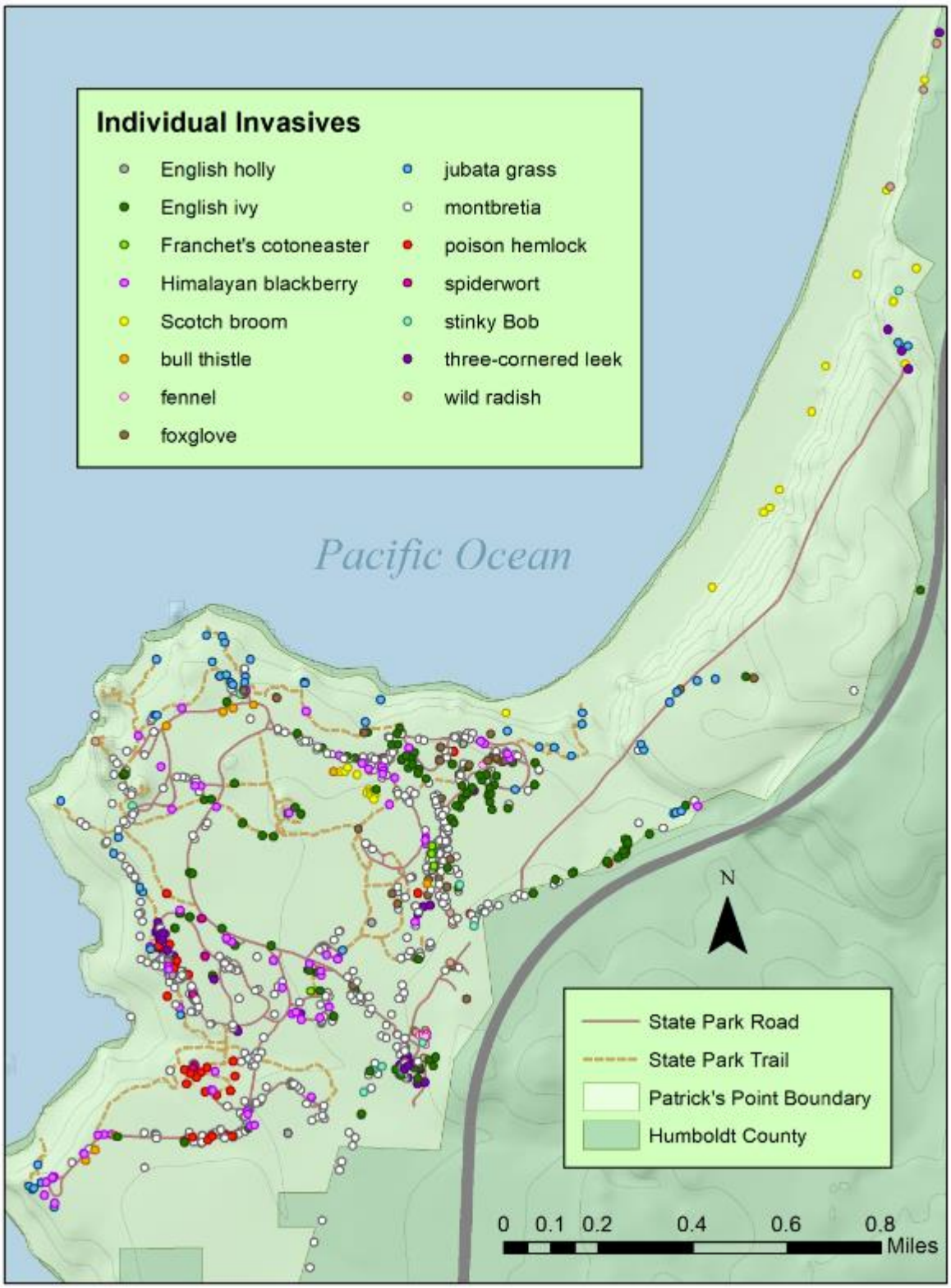

Figure 6. Non-native invasive plants found within Patrick's Point State Park. Each point represents an infested area. Data were collected by State Park employees throughout 2020 and by HSU students in October 2020 (Map made by Marina De Paul using ArcMap version 10.6.1).

Wildlife

PPSP is located along the Pacific Flyway where many migrating and resident shorebirds, raptors, and songbirds utilize habitats in the Park and adjacent areas. Common land mammals found within the area are grey fox (*Urocyon cinereoargenteus)*, river otters (*Lontra canadensis*), mountain lions (*Puma concolor*), brown bats (*Myotis* spp.), black bear (*Ursus americanus*), deer (*Odocoileus hemionus* ssp. *columbianus*), mountain beaver (*Aplodontia rufa*), raccoons (*Procyon lotor*), striped skunk (*Mephitis mephitis*), brush rabbit (*Sylvilagus bachmani*), mice (*Zapus* spp., *Peromyscus* spp.), voles (*Microtus* spp.), and moles (*Scapanus* spp.). Common marine mammals include Steller sea lions (*Eumetopias jubatus*), California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and harbor seals (*Phoca vitulina*) (Trinidad Coastal Land Trust, 2019).

2.2 Cultural Resources

Yurok Tribe

PPSP resides on Yurok ancestral territory. Yurok is derived from a Karuk word for "downriver" (Del Norte County Historical Society, n.d.). Along the Pacific Coast and the Klamath River are 70 known villages within the Yurok ancestral land. This ancestral land is approximately 1,148 square miles with villages strewn throughout (Del Norte County Historical Society, n.d.). These villages tended to be near areas well suited for resource gathering such as places with good fishing access or coastal gathering sites (Del Norte County Historical Society, n.d.). After the discovery of gold in 1849, gold mining expeditions resulted in destruction of villages, loss of life, and a culture (Del Norte County Historical Society, n.d.). By the end of the gold rush era, 75% of Yurok people died due to massacres and disease (Del Norte County Historical Society, n.d.). Younger generations, who have survived from the harsh history of colonial actions, have become strong advocates for cultural revitalization (Del Norte County Historical Society, n.d.).

Located within PPSP is the reconstructed Yurok "Sumeg" Village. This village is currently utilized by local Yurok tribal members for educating their youth and sharing culture with the public. "Sumeg" itself is named after a former seasonal Yurok fishing camp that was located near the ocean (*Sumeg Village*, n.d.). It was built by Yurok people with the traditional material and style, but by using modern tools (Del Norte County Historical Society, n.d.). The primary building material, split redwood planks, has been used for centuries. Alongside Sumeg village is a garden of native plants that are used for medicinal, basketry, substance, and ceremonial purposes (Del Norte County Historical Society, n.d.).

Euro-American Colonization

Despite being inhabited by native tribes, the Humboldt area was colonized and changed by Europeans. In the early 1700s, Spanish explorers Don Bruno de Heceta and Juan Francisco de la Bodega y Cuadra intruded upon the people of the Chue-rey village and mounted a cross at Trinidad Head (Del Norte County Historical Society, n.d.). In the early 1800s, the first American ship visited the area of Trinidad and initially traded for sea otter fur (Del Norte County Historical Society, n.d.). Because of Jedediah Smith's expedition in the area in 1828, it influenced more trappers to come to, explore, and settle in the area (Del Norte County Historical Society, n.d.). By 1850, settlers and gold seekers came to what is now Humboldt County and eventually grew into a larger settlement. After realizing that gold and mining was not going to be successful, the

settlers turned to timber. Timber companies multiplied and grew, which led to greater ship building to export the timber. The increase in ship building led to an increase in fishing (Service, n.d.). Settlers also realized that the climate and land was great for agricultural purposes and farms were subsequently developed. Eventually movements to preserve the redwoods led to the creation of local, state, and national Parks (Service, n.d.).

2.3 Recreational Resources

Located within the Park are a variety of recreational opportunities available to the public. There is a total of six miles of trail that run throughout the entirety of the Park. The Rim Trail allows for coastal outlooks to overlook coastal wildlife, the beach, and seaside vegetation. A trail from the visitor center to Sumeg Village and Ceremonial Rock provide the community with a history of the Sumeg Village as well as accessibility to a stone stairway that leads to a former sea stack. The trail from Agate campground to Agate beach is a quarter-mile walk that leads to the beach through a trail of natural coastal vegetation (California State Parks, n.d.).

There are also 120 individual campsites and four cabins spread among three different campgrounds: Penn Creek, Abalone, and Agate Beach campgrounds. These campgrounds feature a table, fire pit, water faucets, restrooms, and coin-operated showers. There are also the Beach Creek and Red Alder group camps that can accommodate up to 100 people. These campgrounds feature a covered cook shelter, picnic tables, and fire pits with spigots, restrooms, and coin-operated showers (California State Parks, n.d.).

4. Implementation Plan

4.1 Restoration Plan Implementation

4.1.1. Proposed Invasive Management Plan

The proposed project will use a combination of herbicide application, flaming, solarizing, and manual removal to remove invasive non-native plant species and restore native habitat in PPSP using an Integrated Pest Management plan (IPM) (Holloran et. al, 2004). After doing an assessment of the potential treatment methods, their impacts to sensitive resources, past successes, and treatment costs, the best reasonable alternative was determined to protect the existing native habitat and reduce the detrimental effects of invasive species to the habitat. The IPM for this proposed project will be to select the control method(s) to match the management requirements of each specific species and site. Many of the target invasive non-native plant species can be removed with manual removal techniques using shovels and weed wrenches. However, certain species, such as pampas grass, may require mechanical removal or herbicide application.

4.1.2. Invasive Species Removal Methods

Any invasive non-native plants that are found in PPSP can be removed through a variety of methods. Different combinations of these methods can be used to treat specific areas in PPSP. The best approach for eradicating these invasive non-native species is to use more than one method depending on the situation (Bossard, 2000).

Manual Removal Technique

The manual removal of invasives will primarily be done by use of hand or power tools such as pulaskis, weed wrenches, etc. Manual removal will be done with as few as one laborer

depending on the infestation present at the site. The work will be labor intensive and done in areas where other removal techniques would be inappropriate. Using volunteer groups and paid work groups for manual removal technique has been successfully used in the past to control large populations of invasive plants (Bossard, 2000).

Mechanical Removal Technique

Mechanical removal of non-native plants will involve the specific use of motorized tools such as weed trimmers, mowers, and chainsaws. The mower and weed trimmers will help prevent seed formation on tall annual and perennial invasive non-native species. Though repeated use of mowing and weed trimmers may lead to the damaging of native plant species (Bossard, 2000).

Flaming Technique

Flaming is a method of non-native species control that quickly heats the plant and destroys cell integrity (DiTomaso, 2013). Flaming does not burn the plant or cause a disturbance to the ground. The torch will cause the plant's leaves to deepen in color, appear to be waterlogged and finally wilt (DiTomaso, 2013). Flaming works as a contact treatment, making it effective when using it on small annuals or seedlings of perennials and woody plants (DiTomaso, 2013). Flaming will be used repeatedly to control perennial plant species by exhausting the plant's reserves. The treatment should be repeated every two to three weeks if the conditions remain moist (DiTomaso, 2013).

Solarizing

This technique can be used to prevent photosynthesis of target species or used on soil to kill invasive non-native plant seeds. To solarize the soil, a clear polyethylene sheet is placed over moist soil and left to lay there for a month or more (Bossard, 2000). The solar radiation then hits the sheet, which causes a greenhouse effect on the soil, increasing soil temperature and killing or damaging the target plant seeds (Bossard, 2000). Since many non-native invasive seeds tend to germinate near the surface of the soil this technique greatly reduces the plant's seed bank (DiTomaso, 2013). Solarizing to prevent the plants from photosynthesizing requires a plastic tarp or weed cloth to cover the target plants, using sandbags to hold down the tarp. The tarp must then be left on for at least one year, usually longer depending on the species.

Chemical

Herbicides will be used at the most effective time depending on the pathway in which it is translocated and the target site where it acts (DiTomaso, 2013). The herbicide can be applied to the soil, directly on to the foliage or stems of plants (DiTomaso, 2013). Herbicide can be applied to a large treatment area, individual plants or small patches. Direct herbicide techniques will have individuals with a 4-gallon backpack sprayer with a single nozzle applicator. The backpack sprayer will be used for foliar spot spraying and when using a wick/sponge applicator (DiTomaso, 2013). When using the cut stump treatment, the woody stem must first be cut to the ground. The recently cut stump must then have herbicide applied to it. This technique is primarily used for woody shrubs and trees (DiTomaso, 2013). The advantage of the cut-stump technique is that relatively little herbicide is required and is very controlled.

Retreatment Methods

For small infestations of invasive non-native plants, retreating is essential to control and eradicate them (DiTomaso, 2013). Invasive non-native plants will revegetate an area if left untreated for even a few months after the initial removal (Bossard, 2000). The project will use a combination of removal methods on invasive non-native plants on a regular basis until these infestations are eradicated and/or controlled.

Disposal Methods

During manual removal efforts, removed vegetation will either be piled, left to dry, and burned at a later date, or transported to an appropriate dumping area to be composted or burned. Pile burning will occur outside of the wildfire season for coastal Humboldt County and all appropriate permits will be obtained. Vegetation will not be piled atop of or within 5 m of sensitive plants (CSP, 2020).

Revegetation

While a site may have a large infestation of invasive non-native plants, there could potentially be multiple native plants present in and surrounding the infestation. Once an area has been treated, it is anticipated that the native plants will recolonize. If a treatment area is left with large amounts of bare soil, it will then be mulched using native duff from within the project area and/or revegetated with native plants from the project area. The use of local native plants from the project area is important to keep genetic integrity of the native plants (DiTomaso, 2013).

4.1.3. Integrated Pest Management Plan

Table 2. Integrated pest management plan – treatment strategy for the project area

Scientific Name	Common Name	Manual Treatment	Mechanical Treatment	Chemical Treatment	Cultural Control	Biological Control	Fire
Allium triquetrum	Three-cornered leek	Yes	No	No	Solarizing	None	No
Cirsium vulgare	Bull thistle	Yes	No	Foliar spot spraying using a 4-gallon backpack with a 1% (1.5 oz.) solution of Milestone + 1.5 oz. MSO	None	None	No
Conium maculatum	Poison hemlock	Yes	Brushcutter/ Chainsaw	Foliar spot spraying using a 4-gallon backpack with a 1.5% (2 oz.) solution of Rodeo or Habitat + 1/2 oz. MSO	None	None	No
Cortaderia jubata	Jubata grass	Yes	Brushcutter/ Chainsaw	Foliar spot spraying using a 4-gallon backpack with a 2% (2.6 oz.) solution of Rodeo + 1% (1.3 oz.) solution of Habitat + 1/2 oz. MSO	None	None	Flaming seedlings
Crocosmia x crocosmiiflora	Montbretia	Yes	No	No	Solarizing	None	No
Cytisus scoparius	Scotch broom	Yes	No	Foliar spot spraying using a 4-gallon backpack with a 2% (2.6 oz.) solution of Rodeo + 1/2 oz. MSO	None	None	Flaming seedlings
Foeniculum vulgare	Fennel	Yes	Brushcutter/ Chainsaw	No	None	None	No

Scientific Name	Common Name	Manual Treatment	Mechanical Treatment	Chemical Treatment	Cultural Control	Biological Control	Fire
Geranium robertianum	Stinky Bob	Yes	No	Foliar spot spraying using a 4-gallon backpack with a 1.5% (2 oz.) solution of Rodeo or Habitat + 1/2 oz. MSO	None	None	No
Raphanus sativus	Wild radish	Yes	No	Foliar spot spraying using a 4-gallon backpack with a 1.5% (2 oz.) solution Garlon 3A + 1/2 oz. MSO	None	None	No
Rubus armeniacus	Himalayan blackberry	Yes	Brushcutter/ chainsaw	Foliar spot spraying using a 4-gallon backpack with a 1.5% (2 oz.) solution Garlon 3A + 1/2 oz. MSO or 1.5% (2 oz.) solution of Rodeo + 1/2 oz. MSO	None	None	No
Hedera helix	English ivy	Yes	No	Stump cut treatment with a 25% solution of Glyphosate or 20% solution of Imazapyr	None	None	No
Ilex aquaiflora	English holly	Yes	No	Stump cut treatment with a 25% solution of Glyphosate or 20% solution of Imazapyr	None	None	No
Cotoneaster sp.	Cotoneaster	Yes	No	Stump cut treatment with a 40% to 50% solution of Glyphosate or 100% Triclopyr	Solarizing	None	No
Tradescantia fluminensis	Spiderwort	Yes	No	Repeated solution of Glyphosate or Triclopyr	None	None	No
Digitalis purpurea	Foxglove	Yes	No	No	None	None	No

4.1.4. Discussion of Treatment Methods

The following treatment methods were considered during planning of the proposed project.

No action

Failure to address invasive non-native plant species infestations is not preferred as it will allow further decline of the sensitive plants, animals, and habitats in Trinidad State Beach. Non-native plant species will continue to invade infested sensitive plant populations and their habitats and if no actions are taken to reverse the current trend it will continue to degrade.

Biological Control

No insects or fungi have been approved by the California Department of Food and Agriculture for control of the target species. Grazing is not effective at removing most of the target species and in some cases could encourage further spread. Some target species are toxic to livestock and others are avoided by grazing animals (Appendix B). Neither biological method will completely remove an infestation, which is needed for full restoration of the habitats. Therefore, neither biological method is preferred.

Manual Control

Manual control can be effective on small infestations of certain non-native species, but it is not always feasible in some locations no matter the size of the occurrence. Manual control methods may not be suitable on steep slopes, such as coastal bluffs, and in areas with sensitive cultural resources if digging with shovels is required. Manual removal can also encourage further spread of some non-native plants. Due to limits on the use of shovels around sensitive cultural resources the potential to spread non-native plants and cause erosion as well as the intensive labor costs. This method will be primarily used to treat infestations in sensitive plant buffers and where infestations are still small.

Flaming/Prescribed Fire

Flaming and prescribed fire is effective on some species, such as Scotch broom seedlings and some grass species. Due to the variable terrain and the presence of a major highway, prescribed fire is not a preferred method at this time. Flaming will only be an alternative control method for species that do not readily germinate after fire.

Mechanical Control

Mechanical methods can be preferred over manual methods for treatment of some species due to the higher cost-efficiency. Mechanical control is not suitable in areas where there are sensitive resources, both natural and cultural. The majority of topography in the project area does not allow for mowing and in some areas cause erosion if heavy equipment were to be used. This method is not preferred in most areas due to the presence of sensitive resources and topography; however, it may be used on infestations that have become a monoculture or on woody shrubs.

Solarization

Solarization is effective on a few of the target species, but depending on the specific site characteristics, this method may not be feasible. Materials involved with this method are not cost efficient. This method is not preferred for most species due to site characteristics, such as steep slopes or sensitive habitats and its inability to successfully eradicate certain species. This method may be used on certain species in areas that are relatively flat.

Chemical Treatment

Chemical treatment is effective on most invasive non-native plant species and requires the least number of retreatments if applied properly during initial treatment. This is the preferred method of treatment for some target species. As to reduce unintended effects from herbicides, chemicals will only be applied directly to individual target species via a cut-stump method. Some herbicides are non-selective or cannot be used near or in water. Therefore, only aquatically registered herbicide will be used near water and none will be used on the water.

4.1.5. Avoidance Measures for Sensitive Resources

The project is designed to minimize impacts that will adversely affect sensitive resources and species that may be present within or adjacent to the project area. The following avoidance measures will be implemented along with CSP project requirements (Appendix J) to avoid or minimize potential adverse impacts to sensitive resources.

Avoidance Measures for Sensitive Plants

1. Floristically appropriate surveys in conformance with CDFW guidelines will be conducted prior to project implementation.
2. Prior to beginning restoration work in an area, sensitive plants will be flagged. Flags will be removed upon completion of work.
3. All people engaged in restoration activities with potential to negatively impact sensitive plants will be instructed by a NCRD botanist in the identification of sensitive species in the project area.
4. All personnel applying herbicides must be able to distinguish between target non-native plants and sensitive plants.
5. No herbicide use (storage, mixing, loading or application) within a 3 m (9.8 ft) buffer around sensitive plants.
6. During hand pulling care will be given to ensure that root systems of sensitive plants are not dislodged.

Sensitive Habitats and Wetlands

1. No wetlands will be actively filled.

2. Herbicide will not be stored, mixed, or applied within a 5 m (16.4 ft) buffer around wetlands or surface waters.

4.1.6. Safety Protocol and Site Logistics

Every workday will begin with the lead person discussing the work plan and safety concerns and ensure all workers have the required personal protective equipment (PPE). All workers will be advised of high-risk areas and situations and be provided safety guidelines.

Project Handbook

A project handbook will be kept on-site during work hours for the duration of the project. The handbook will contain all safety measures and plans for the project area, important contact information pertaining to possible emergencies and general project contacts, permits, and monitoring forms. The following documents will be included in the handbook:

- Copy of California Environmental Quality Act (CEQA) clearance
- Copy of required permit and conditions
- List of Emergency Contacts
- Location of nearest hospital or medical facility
- Hazardous Material Spill Contingency Plan
- List of sensitive species and their identification characteristics
- Copies of labels for any chemicals being applied

The lead person for the day will ensure a fully stocked first aid kit including eyewash materials is available on site at all times. At the end of the work day, the lead person will ensure all areas treated are mapped, any monitoring forms completed, and all equipment has been cleaned and stored safely.

Personal Protective Equipment (PPE)

Workers involved in mixing, loading, and or applying herbicide must have the minimum required Personal Protective Equipment (PPE) per the product label(s). The minimum required PPE for the herbicides proposed for use are eye protection (safety glasses or goggles), chemical resistant gloves, long sleeve shirt and long pants, shoes and socks. Different PPE is required when using weed eaters, brush cutters or chainsaws. All require the use of ear protection (ear plugs or muffs), eye protection, long pants, socks and shoes. Chaps are required when operating a brush cutter or chainsaw and a helmet and gloves are also required to operate a chainsaw.

Tool Safety

Hand tools and mechanized equipment will be used during project implementation. Workers tasked with operating any tools will be instructed in the safe operation of those tools. Safety precautions include wearing the appropriate PPE, maintaining a safe distance from others,

and using proper lifting and carrying techniques. Two people must be present to operate a chainsaw and a trauma kit should be on site.

Fire Safety

A fire safety plan will be in place prior to work involving flaming or pile burning. All required burn permits will be obtained and work will be conducted outside the coastal Humboldt County wildfire season.

Weather, Earthquakes and Tsunami

Workers should avoid being on beach sites during storm events that pose risk from high surf, wind, and flooding. In the event of high winds, workers should avoid working in forested areas A National Oceanic and Atmospheric Administration (NOAA) weather radio should be on site to alert workers of tsunami risks. If a notable earthquake is felt while working on site, all workers will leave the project site immediately to seek high ground if in a tsunami zone. Then wait for guidance from the NOAA weather radio.

Hazardous Materials

Risk of hazardous material spills will be minimized to the extent possible. No fueling or maintenance of mechanical equipment will be allowed within 30 m (100 ft) of a stream, the ocean, or a wetland. All equipment will be inspected each morning for leaks and repaired off site. All herbicide mixing, loading, and application equipment will be kept in good condition and routinely cleaned and calibrated to avoid over or under application.

In the unlikely event of a hazardous substance (herbicide, oil, gasoline) being released, a hazardous material plan will be available to ensure adequate and safe cleanup. In the event of any spill in or adjacent to the project area, work will be halted or moved to a nearby location, and the site supervisor will notify the appropriate CSP staff (e.g., project manager or supervisor). Appropriate agencies will be notified if the spillage is greater than 1⁄2 gallon. However, in the event of any herbicide spill, the County Agricultural Commissioner will be notified. Hazardous materials, if present, will be contained and removed from the site prior to resumption of work.

Mixing and loading of herbicides will be conducted at the project site or as close to the project site as possible. Used liquid herbicide containers will be triple rinsed and the rinse water will be applied at the work site. Backpack sprayers will not be overfilled and workers will be instructed on how to avoid spilling and proper application. A Qualified Pesticide Applicator will oversee herbicide use during implementation to ensure safety precautions are followed. Emergency information and first aid procedures for decontaminating a worker can be found under the statement of practical treatment on the herbicide label.

The public will be notified prior to the use of herbicides during the implementation of this project. Notification will be in accordance with County and State laws and include posted notices at trailheads and treatment areas. Posted notices will include the name of the herbicide being applied, the dates of application and phone number for more information.

4.2. Project Monitoring, Reporting, and Adaptive Management

This section will discuss the monitoring and reporting methods that are designed to meet the goals and objectives discussed earlier in the document. Additionally, this section will discuss the adaptive management approach set in place by the plan and how monitoring will be necessary for responding to unforeseen restoration outcomes. Reports will be produced addressing the restoration work completed, monitoring results, and the overall status of the implementation of the plan.

4.2.1. Adaptive Management Approach

The Adaptive management approach will be used during the implementation of this plan where appropriate and necessary. This management approach will be used to attain the highest level of habitat restoration possible. The key concept in an adaptive management approach is the willingness to let new information drive adaptations in the plan based on changing conditions and information. The plan must have the ability to adapt and respond to new information on a regular basis to be successful. Pre and post monitoring results will be analyzed as components of the plan are completed. Based on these results, actions can be adjusted to best meet the plan's overall goal.

4.2.2. Project Monitoring and Reporting

Effectiveness monitoring will provide information describing the success of restoration activities. This monitoring will be conducted at most areas where restoration activities are implemented. Monitoring objectives are:

- Protect natural and cultural resources present in the project area
- Track locations and numbers of sensitive plant species
- Detect changes in habitat quality (plant community composition and species cover) over time
- Document success of restoration activities
- Provide feedback for adaptive management to help with determining what management actions are necessary

Vegetation

Vegetation monitoring will consist of rare plant monitoring. A rare plant survey will be conducted prior to restoration activities to document any special status species that may occur within the current years' restoration area. The surveys will be conducted in compliance with approved state protocol (CDFG 2000). Should a special status plant be located within 2 m (6.6 ft.) of a target plant, then hand removal techniques will be used, unless the target plant is located on a slope greater than 10 percent. Spray shields will be used if this situation is encountered.

Cultural

If in the process unknown cultural artifacts are discovered at any of the management sites, the project manager will suspend and modify any needed work in the specific site and surrounding areas. Historically, Native American tribes such as the Yurok and Wiyot tribes resided along the coast prior to European settlement (NCIDC, 2020). A qualified archeologist will document and examine any artifacts found within the vicinity. The project manager will take appropriate steps and will implement any preservation, recovery and/or avoidance measures if applicable.

Meander Surveys

Meander surveys will be conducted in treated areas at least once each year (until five years following the last restoration treatment) to assess treatment success and the overall site conditions. The meander surveys will involve walking random routes throughout the restoration areas to identify successes and or problems such as significant invasive non-native plant mortality, new occurrence of invasive non-native species or sensitive species, native plant recolonization, etc.

Photo Documentation

Photo documentation will take place every year in the treated areas (until five years following the last restoration treatment). Photographs will be taken from established Global Positioning Unit (GPS) points throughout the project area to document changes in the landscape. Photo documentation will evaluate the success of the project by documenting evidence of plant death, vegetation growth, and re-establishment of native plant species as well as exotic invasive plant regrowth in treated areas.

Project Reporting

Project reporting will be important to observe the overall success of the project and to help assess adaptive management goals. Summary reports will be produced to document project tasks completed, methods used, and the outcome of the associated monitoring activities. The reports will be produced and authored by the project manager(s).

5. Project Considerations and Compliance

5.1. Conformance with Existing Management Plans

The restoration activities proposed in this plan are consistent with the Department's mission "To provide for the health, inspiration and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued

natural and cultural resources, and creating opportunities for high quality outdoor recreation." This project is in conformance with the California State Park's Natural Resource directives.

5.2. Regulatory Conformance and Permitting

A mitigated negative declaration (MND) will be prepared to meet environmental compliance requirements under the California Environmental Quality Act (CEQA). The City of Trinidad has a local coastal plan and permitting jurisdiction for activities in the project area. A Coastal Development Permit will be obtained from the City of Trinidad to meet California Coastal Act requirements.

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7.0 APPENDICES

APPENDIX A. INVASIVE NON-NATIVE PLANT SPECIES FOUND WITHIN PATRICK'S POINT STATE PARK PROJECT AREA

Scientific Name	Common Name	Cal-IPC Rating[1]	CalEPPC Rating[2]	CDFA Rating[3]	Oregon Rating[4]
Allium triquetrum	three-cornered leek				
Cirsium vulgare	bull thistle	Moderate	B	C	B
Conium maculatum	poison hemlock	Moderate	B		B
Cortaderia jubata	jubata grass	High	A-1	B	B
Crocosmia X *crocosmiiflora*	montbretia	Limited	Considered		
Cytisus scoparius	Scotch broom	High	A-1	C	B
Foeniculum vulgare	fennel	High	A-1		
Geranium robertianum	stinky Bob				B
Raphanus sativus	wild radish	Limited			
Rubus armeniacus	Himalayan blackberry	High	A-1		B
Hirschfeldia incana	summer mustard	Moderate			
Hedera helix	English ivy	High	B		B
Ilex aquifolium	English holly	Moderate	B		
Cotoneaster sp.	cotoneaster	Moderate	*		
Tradescantia fluminensis	spiderwort				
Digitalis purpurea	foxglove	Limited	Considered		

Blank - Not classified/rated

* - Some species considered A-2, some still need more information to be classified

1. Cal-IPC - California Invasive Plant Council rating

High - Plant communities and vegetation structure have severe ecological consequences from invasive species. The non-native invasives are widely distributed ecologically and have moderate to high rates of dispersal and establishment (California Invasive Plant Council, 2006).

Moderate - Plant communities and vegetation structure face substantial, but not severe, ecological impacts from invasives. Non-native invasive species establishment is generally dependent on disturbance and they have moderate to high rates of dispersal (California Invasive Plant Council, 2006).

Limited - Considered invasive species but ecological impacts are minor or there is not enough information to justify a higher score. Reproductive attributes result in low to moderate rates of invasiveness and distribution is generally limited (California Invasive Plant Council, 2006).

2. CalEPPC - California Exotic Pest Plant Council rating

A - Most invasive wildland pest plants that are documented as aggressive invaders that displace natives (CalEPPC, 1999).

A-1 - Widespread plants that are invasive in more than three Jepson regions

(CalEPPC, 1999).

A-2 - Regional plants that are invasive in three or fewer Jepson regions (CalEPPC, 1999).

B - Pest plants of lesser invasiveness that spread less rapidly and cause lesser degree of disruption (CalEPPC, 1999).

Considered - After review, plants do not appear to pose a significant threat.

3. CDFA - California Department of Food and Agriculture rating

B - Weed of economic or environmental detriment and limited distribution. They are subject to state-endorsed holding action and eradication. Subject to eradication, containment, suppression, control, or other holding action at the discretion of the individual county agricultural commissioner. (California Department of Food and Agriculture, n.d.).

C - Weed of economic or environmental detriment that is usually widespread. If found within the state, they are subject to regulations designed to slow spread or suppress at the discretion of the individual county agricultural commissioner (California Department of Food and Agriculture, n.d.).

4. Oregon - Oregon Department of Agriculture Noxious Weed Control Classification

B- A weed of economic importance that is regionally abundant, but may have limited distribution in some counties. Recommended to have limited to intensive control at the state, county, or regional level as determined on a site specific, case-by-case basis. If fully integrated statewide management is not feasible, biological control is the primary control method (Oregon Department of Agriculture, 2019).

APPENDIX B: DESCRIPTION OF TARGET INVASIVE NON-NATIVE PLANT SPECIES FOR MAPPING AND FUTURE REMOVAL

For each invasive non-native species below is a description of their features. The invasives below can all be found at PPSP.

Allium triquetrum **(three-cornered leek)** is a bulbous flowering plant. The leaves are mid-green and hairless with the underside being a little rigid. These plants sprout in the spring and die always after flowering. The root is a bulb that acts like a storage unit when the leaves start to die off. The white bulbs can reproduce into more than one plant. The flowers are carried on a stalk with white and green stripes in the center of the petals, in a one-sided umbel with 4 to 10 flower heads. The male and female parts can be found in each flower, which are then pollinated by bees and other insects. *Allium triquetrum* is edible (*Three-Cornered Leek*, n.d.).

Cirsium vulgare **(bull thistle)** is a noxious and invasive plant in California. They are covered in short, sharp prickles on the top part of the plant and have dark green leaf blades. This plant grows a rosette in the first year of its life and then blooms in the second year. The main stem of the plant is firm and thorny, with leaves that end in long, sharp thorns that are beige in color. There are many seeds produced by this plant that have small feathers and are fixed at the base by a ring until they mature. Bull thistle have taproots that are thin and run deep into the soil with several small lateral roots. The flowers are purple heads that measure 3.5 to 5 cm in diameter, 2.5 to 5 cm long and are usually solitary. Clusters of flowers grow at the ends of shoots and branches. The flowers are attached to narrow, spine-tipped bracts. The leaves are alternate, pinnately cut, and they have rough, bristly hairs. Bull thistle get to 7.5 to 30cm long and the leaves grow down the stem past the base causing the stalk to be prickly. Bull thistle gets up to 1.5 m tall (*Bull Thistle*, n.d.).

Conium maculatum **(poison hemlock)** is a biennial plant that grows throughout the year and the first year of the plant's life it is low-grown and may die in mild climates. Young poison-hemlock can sometimes resemble a wild carrot *(Daucus carota)*. There are distinguished features between these two species. The difference between wild carrot and poison- hemlock is that the two plants are that the poison hemlock has a lack of hair on the stems and also has purple-reddish blotches on the stems. The leaves are bright green that are fern-like and have a strong musty odor when cut. The flowers are tiny and arranged in small, umbrella-shaped clusters on the ends of each branched stem. Poison hemlocks are white with five petals per flower and have seeds that are hairless and egg shaped. These seeds are around 2 mm long and have ridges up them (*Poison Hemlock*, n.d.).

Cortaderia jubata **(jubata grass)** is a large perennial grass that grows in basal clumps. Jubata grass has narrow leaves with flowering stems that grow upward. The leaves are long and narrow and are typically 6.6 feet long and 0.8 to 1.2 inches wide. The flower ranges from 1 to 3 feet and the color ranges from deep violet to pinkish to creamy white which are all female and can form seeds without pollination. The stems are called culms and can be 6 to 13 feet tall. These stiff stems are 4 to 7 times larger than the paniclesa, which are loose branching clusters of flowers. The fruit is a dry, one-seeded fruit that is 2.5mm. The range of fruits found on a single plant is 34,000 to 122,000. Jubata grass are assexual (*Jubata Grass*, n.d.).

***Crocosmia* x *crocosmiiflora* (Montbretia)** is a perennial found mostly along the coast of California. Montbretia grows to be one meter in height with flowers that are slender and have branched flower spikes. The flowers get to 1 ½ to 2 inches across and the flowers are orange and there are usually six of them on each plant. Each flower has seed capsules containing brown, wrinkled, usually non-viable seeds. The leaves on this plant are grasslike and the rhizomes are bulb-like. The root is only one inch in diameter and the plants are clumping (*Crocosmia x crocosmiiflora - Montbretia,* n.d.).

***Cytisus scoparius* (Scotch broom)** is a perennial shrub with bright yellow flowers that are about ¾ of an inch long and have five petals. The shrub does not hold many leaves and the upper leaves are simple while the lower leaves are in three parts. The leaves are deciduous with pointed ends and the stems are woody/ dark green. When mature, the steams have no hair and the ridges on the leaves disappear once the shrub gets older. The seeds are brown-black legume-like pods and they have hairy margins with various seeds in each pod (*Scotch Broom,* n.d.).

***Foeniculum vulgare* (fennel)** is an upright, branching perennial that is typically used in cooking. It can grow up to six feet tall but it is most often shorter than that. The leaves are smooth and dark green in color with finely dissected and narrow lobes. This plant does not bloom until its second year of life and can only survive in an area that has a warm enough winter. It has small yellow flowers that are shaped in a terminal compound umbel section and have 20 to 50 flowers on pedicles. The pollen attracts insects and bees which fertilize other plants. The seeds mature in the fall and are dark green to brown ridged with ridges along the length of the seed. As the seeds age, the color turns grey (Mahr, 2015).

***Geranium robertianum* (stinky Bob)** is both a winter and a spring annual or biennial. This plant is typically a low growing plant that is hairy and has shallow roots. It tends to have a pungent odor and the flowers are pink with five petals. The leaves can be seen in the spring as light green but once it becomes fall the leaves turn red. The steams are hairy and turn red when there is a lot of light on it. The fruits are capsules that are brown and about 2 mm in length (*Herb-Robert,* n.d.).

***Raphanus sativus* (wild radish)** is an annual or biennial plant that is quick growing and can easily outcompete native species. It is usually about 1.2 m tall with large pinnately divided leaves. They also have unlobed leaves with toothed margins and prickly hairs. The flowers have open spikes at each stem end. This plant has both female and male parts that are symmetrical reaching 1.2 to 2.5 cm in diameter. It has four green sepals that are in two pairs that form a narrow tube. There are four petals that flare outward and are white, yellow, pink, purple, or bronze. The fruit are slim cylinders that are 3.8 to 8 cm. Mature pods are brown and woody with 2 to 8 seeds held in a spongy matrix (*Wild Radish (Not Native),* n.d.).

***Rubus armeniacus* (Himalayan blackberry)** is a strong evergreen shrub that grows up to 9.8 feet in height. The leaves are pinnately to palmately compound with five broad leaves. Sometimes the younger plants will hold three leaves which look like a California blackberry *(Rubus ursinus).* The color of the leaves are green to dull gray-green and underneath it has densely matter wooly hair. The flowers are presented in clusters of 3 to 20 and are commonly white, but can also be found as a rose or reddish color. The berries are soft, shiny, and black and

are composed of an aggregate of large succulent drupelets. This plant is capable of extensive and vigorous vegetative growth. It has an effortless time when reproducing each year because of birds and mammals eating the berry and then spreading the seed after (*Rubus Armeniacus,* n.d.).

***Hirschfeldia incana (*summer mustard)** is a biennial/short-lived perennial that erects 3 to 4 ft tall. Its leaves form a basal rosette that are moderately to densely covered with stiff grayish hairs. The pale yellow flowers form on an elongated raceme with fruits 8 to 15 mm long. While it only primarily reproduces by seed, plants can resprout from the base when damaged. Research is still ongoing to see the effectiveness of chemical control. However, mechanical removal has been successful so long as removal is before seeds develop. When implemented over a longer period of time, the seedbank eventually becomes exhausted (*Shortpod mustard,* n.d.).

***Hedera helix* (English Ivy)** is a dominant and aggressive plant that spreads quickly. This species likes medium moisture, well-drained soils, and partial to full shade. Although it can do well in most soil types, it does the best in rich loamy soil. It also does well when it is in moist conditions, but can also do fine in full sun. The plant produces a seed that birds take a disperse, which then spreads into stems that act like roots latching on to wherever the nodes touch. This can either cover the ground or climb up other plant species like trees and shrubs. When English ivy does spread up trees and other plants it can suffocate them to death. This plant is considered an evergreen perennial that is primarily a climbing vine trailing ground cover. Its height is typically 6-9" tall and can spread 50-100'. The leaves are dark green (about 4" long) and the flowers are greenish-white in early fall which turn into blue-black berries (*Hedera helix - Plant Finder*, n.d.).

***Ilex aquifolium* (English holly)** is an evergreen shrub native to Europe that is commonly sold as an ornamental plant used for landscaping and Christmas decorations in the United States. It has escaped cultivation and invaded many forested areas along the west coast (*Ilex aquifolium,* n.d.-a; *Ilex aquifolium,* n.d.-b). It has evergreen, glossy, and spiny leaves with red berries.The fruits are consumed by birds and mammals alike. It is also dioecious where the male plant can often be found on its own without any fruits. When both a male and female plant are present together, the female will produce fruits. The female plants produce fruits around 5-12 years of age, so they can be controlled by removing plants before seeds start producing (*Ilex aquifolium,* n.d.-b).

***Cotoneaster sp.* (cotoneaster)** is an evergreen shrub with arching branches that can get up to 10 feet. The leaves are simple and alternating with leaf blades that are elliptic to ovate.The leaves are densely covered with hairs on the lower surface and are ¾ to 1 ¼ inch long. They are dark green and glossy on the upper side and the flowers are solitary at the ends of the branches. There are 5 petals, 5 sepals, many stamens, and 2 to 5 pistols. The flowers are pink and the milk flowers are white and are often in clumps. The fruits are about ¼ inch wide and are orange to orange red with 3 seeds. The milk flower fruits are red with two seeds and are egg shaped (*Cotoneaster horizontalis,* n.d.).

***Tradescantia fluminensis* (spiderwort)** is a multi-branching perennial that forms dense ground cover. It has lanceolate shaped leaves with parallel veins that are either green or purple. The flowers are white and the fruit type is a 3-parted capsule. Spiderwort often invades disturbed areas, forests, riparian zones, wetlands, and more. Because it forms such a dense groundcover, it

will smother native vegetation and seedlings. It is very difficult to control once it is established. Mechanically weeding by hand is suitable if the entirety of the plant and root are removed. Chemical treatments are also used for controlling large infestations (*Tradescantia fluminensis*, n.d.).

***Digitalis purpurea* (foxglove)** is an herbaceous perennial that has a basal rosette of leaves. A leafy stock with long, bell-shaped, flowers appear in the second growing season. The flowers can vary from pinkish, purple, and white, sometimes with spots on the inside of the lower portion. It is commonly planted as an ornamental but escapes to areas with full sun to part shade, and well drained, fertile, and acidic soil. The seeds escape cultivation from both wind and water. The plant itself is lethal to animals and displaces natural vegetation by forming dense patches. Mechanical removal is effective in removing it in spring when soils are moist. The material must be removed from the site and destroyed or the flower stalks left will continue to mature and release thousands of seeds. Prescribed burning is not recommended because the smoke from burning leaves is toxic. Herbicides have been found to work, however mechanical removal is more efficient and effective (*Digitalis purpurea*, n.d.).