Azalea State Reserve Vegetation Management Plan

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Azalea State Reserve
Vegetation Management Plan

Prepared by: Rosebelle Ines and Ethan Reibsome
Applied Ecological Restoration (ESM 455)
Humboldt State University
Dec. 19, 2019
This comprehensive vegetation management plan for Azalea State Reserve (Reserve) was produced by Humboldt State University students Ethan Reibsome and Rosebelle Ines in partnership with the California Department of Parks and Recreation (CDPR). As a capstone senior project within the Environmental Science and Management Department, these students collaborated to map existing habitat types, non-native, invasive species and encroaching conifers, and create a list of existing species at the Reserve. In addition, this document contains their observations and recommendations, which will inform future management actions as well as the conservation of the Reserve.
# Table of Contents

1. Introduction .................................................................................................................. 3  
   1.1 Project location ....................................................................................................... 3  
   1.2 Need for Project .................................................................................................... 5  
   1.3 Goals and Objectives ............................................................................................. 6  

2. Existing Environment .................................................................................................... 6  
   2.1 Land Use History ................................................................................................. 6  
   2.2 Natural Resources ................................................................................................. 6  
     2.2.1 Topography .................................................................................................... 6  
     2.2.2 Hydrology ...................................................................................................... 7  
     2.2.3 Geology and Soils ........................................................................................... 8  
     2.2.4 Climate ........................................................................................................... 9  
     2.2.5 Habitat Types and associated vegetation ....................................................... 11  
   2.3 Cultural Resources ................................................................................................. 15  
   2.4 Recreational Resources and Regulation ............................................................... 16  

3. Restoration Plan ........................................................................................................... 16  
   3.1 Restoration Objectives and Success Criteria ......................................................... 16  
   3.2 Best Management Practices .................................................................................. 17  
     3.2.1 Non-native Species Life History and Treatment Methods .......................... 19  
   3.3 Conifer Encroachment ......................................................................................... 24  
     3.3.1 Conifer Removal Methods ............................................................................ 26  

4. Project Monitoring Reporting ......................................................................................... 26  
   4.1 Adaptive Management Approach ......................................................................... 26  
   4.2 Restoration Monitoring ......................................................................................... 26  
     4.2.1 Vegetation .................................................................................................... 26  
     4.2.2 Cultural ......................................................................................................... 27  
     4.2.3 Photo Documentation .................................................................................... 27  
   4.3 Project Reporting ................................................................................................... 27  

5. Project Time Table ....................................................................................................... 28  
   5.1 Implementation and Monitoring ........................................................................... 28  

6. Project Considerations and Compliance ..................................................................... 29  
   6.1 Project Constraints ............................................................................................... 29  
     6.1.1 Restoration Constraints ................................................................................ 29  
   6.2 Regulatory Compliance ......................................................................................... 30  
     6.2.1 Environmental Documentation and Permitting Requirements .................. 30  

7. Literature Cited ............................................................................................................. 31  

8. Appendices .................................................................................................................... 34
1 INTRODUCTION

The Azalea State Reserve (Reserve) was obtained by the Department of Parks and Recreation (CDPR) in 1943 (Anderson, 1998; Ball, 1981). This was purchased with funding raised by a citizen (Mrs. George (Ora) Parrish) concerned with preserving natural stands of western azaleas (*Rhododendron occidentale*) (Anderson, 1998; Ball, 1981). Other portions of the property were later acquired from additional funding raised by Save the Redwoods League or were gifted to the State by Mr. and Mrs. Beecher Dixon and the descendants of Albert Hunt (Anderson, 1998; Ball, 1981). The property was officially recognized as a Reserve by CDPR in 1963 (Anderson, 1998; Ball, 1981).

Today, the Reserve is open to the public as a day use area for hiking and picnicking. It is also visited by western azalea enthusiasts worldwide especially when they bloom in late spring and early summer. Since loop trails are established through major stands of western azaleas within both sides of Azalea Avenue, visitors are able to walk through shrubs of western azalea, Sitka spruce and grand fir communities, and grassland habitats.

1.1 PROJECT LOCATION

The Reserve is located in McKinleyville, California (40.9184604°N, -124.0783968°W) in Humboldt County (Figure 1). The Reserve sits along Highway 200 (North Bank Road), one mile east of U.S. Highway 101 and can be accessed via a county road, Azalea Avenue. It consists of 30 acres of mixed conifer and western azalea shrubland (Anderson, 1998; Ball, 1981).
Figure 1. Location of Azalea State Reserve in McKinleyville, CA.
1.2 NEED FOR PROJECT
The Pacific region of North America bear many species unknown to the Central and Eastern United States (Campbell and Wiggins, 1947). This is due to the effective barrier mountains provide in preventing the latitudinal migration of plants (Campbell and Wiggins, 1947). This region includes the coastal slopes of Alaska, British Columbia, Washington, Oregon, and California, which all encompasses distinct climatic conditions in comparison to the rest of the United States. Within the Pacific Coast, California is unique because vegetation is shut off from the Rocky Mountains, the eastern part of the continents of Sierra Nevada, and the deserts of the Great Basin (Campbell and Wiggins, 1947). California is geologically and topographically complex as it is made up of rocks and soils of different ages and origins. These formations create diverse habitats and conditions that allow for a heterogenous array of species to thrive.

While most azaleas are specifically cultivated, western azalea (*Rhododendron occidentale*) shrubs naturally occur in areas of high moisture both near the coast and at high elevations in California (Oliver, n.d.). They have numerous characteristics that allow them to flourish and support the expansion of their range, but this is ephemeral due to the presence of competing vegetation (Oliver, n.d.). When competing vegetation is not adequately suppressed, studies indicate that western azaleas lack sufficient ecological advantage to survive (Oliver, n.d.). However, they are able to seed down and grow quickly for numerous miles when hostile vegetation is removed from an area (Anderson, 1998; Ball, 1981; Oliver, n.d.).

For the Reserve, the CDPR is responsible for maintaining and protecting the western azalea habitat within the property for the viewing pleasure and the enjoyment of the visiting public. Since the Reserve has limited prior management due to funding constraints, present-day observations indicate that the western azalea shrubs are shaded and overcrowded by a canopy of larger trees and shrubs as well as in competition for resources with numerous non-native, invasive species. These observations are comparable to observations stated in the 1981 vegetation management program (Ball, 1981). If this natural ecological succession is not controlled, the remaining shrubs of western azaleas will perish (Anderson, 1998; Ball, 1981).

Hence, it is important to remove the encroaching conifers and non-native, invasive species within the Reserve, because these species can outcompete the western azaleas and native species as well as replace their functional roles (Zavaleta et al., 2001). This can lead to undesirable secondary effects, which can further extend towards contiguous ecosystems as more unwanted species interact and establish themselves in greater amounts throughout the area (Zavaleta et al., 2001). Eradicating and controlling non-native, invasive species and encroaching conifers have prominent, positive outcomes for native biotas (Zavaleta et al., 2001). Integrating this into an inclusive process of assessment and restoration will help combat adverse effects on the remaining native species and ecosystems.
1.3 GOALS AND OBJECTIVES
This section identifies general management goals and objectives of the Azalea State Reserve Vegetation Management Plan. Specific actions to complete the following goals are provided in subsequent chapters.
- Goal 1: Restore the ecological function and native flora for all habitats in the Reserve.
- Goal 2: Restore, enhance and maintain existing western azalea patches throughout the Reserve.
- Goal 3: Restore, enhance and maintain culturally significant flora, such as California hazel throughout the Reserve.

2 EXISTING ENVIRONMENT
This section covers the current ecological, environmental, cultural and recreational settings of the Reserve. Land use history is discussed to influence future practices based on the actions taken by previous landowners or CDPR. A substantial classification of the vegetation types and non-native, invasive species observed in 2019 at the Reserve are included as well.

2.1 LAND USE HISTORY
Local newspaper articles from the past indicate that the Reserve was utilized to raise and grow cattle since the descendants of Albert Hunt (a cattleman who settled in the area in 1884) donated their portion of the Reserve to the state (Azalea Park Blooming, Under Continuous Development Program, n.d.).

2.2 NATURAL RESOURCES
The area is comprised of several habitat types including Sitka spruce (*Picea sitchensis*) forest, grand fir (*Abies grandis*) forest, and western azalea (*Rhododendron occidentale*) shrubland. The azaleas are known for their unique floral displays. This species typically grows along the ecotone of forested landscapes and grassland communities, serving as the transition from grassland to closed canopy forest (Anderson, 1998; Ball, 1981). It is natural for native species, through succession, to eventually over crowd *R. occidentale* species and be shaded out (Anderson, 1998; Ball, 1981).

2.2.1 Topography
The Reserve occupies a parcel that is five miles north of Humboldt Bay, north of the Mad River in southern McKinleyville, CA. The Reserve is characterized by south facing 10% slopes with an elevational range between 100 to 200 feet above sea level (USGS, 2015). A variety of wetland types are present, especially along several creeks found on the site.
2.2.2 Hydrology
The Reserve contains several seasonal creeks that flow from north to south towards the nearby Mad River, following the natural topography of the landscape (Figure 2). This allows a variety of riparian species and wetland plants such as sedges (*Carex* sp.) and rushes (*Juncus* sp.) to establish within the Reserve.

![Figure 2. Topographic map of Azalea State Reserve and surrounding area, including the nearby Mad River (TopoZone, n.d.).](image)

2.2.3 Geology and Soils
Three geologic types exist within the Reserve: 1) early and middle Pleistocene fluvial and marine sediments, 2) Franciscan melange, and 3) Franciscan sandstone (McLaughlin et al., 2000; Anderson, 1998; Ball, 1981). The early and middle Pleistocene fluvial and marine sediments encompass a moderately to strongly weathered, unconsolidated to poorly consolidated marine estuarine and fluvial siltstone, sandstone, and conglomerate as found in the Falor formation (Anderson, 1998; Ball, 1981). A reverse or thrust fault separates this type from the Franciscan melange, which consists of a highly sheared melange with a silty clay matrix and other exotic lithologies (Anderson, 1998; Ball, 1981). Additionally, Franciscan sandstone is separated from the early and middle Pleistocene sediments by an erosional or depositional contact (Anderson, 1998; Ball, 1981).
The Reserve sits on the edge of a peneplain, which may be mid-Miocene in age (Manning, 1950). Erosion of the softer Quaternary sediments by the Mad River in conjunction with periodic uplifting along fault lines has resulted in the exposure of the older Franciscan melange and sandstone in this area (Manning, 1950).

The original soils within the Reserve consist entirely of the Hookton soil series (Anderson, 1998; Ball, 1981). Hookton soil series is made up of a moderately deep, moderately drained brunizemic regosol soil, which is fine and silty in texture (Anderson, 1998; Ball, 1981). Soil samples have shown that soil texture within the Reserve range from loam in the A horizon and clay in the C horizon (Anderson, 1998; Ball, 1981). Presently, the Reserve lies on Arcata and Candymountain soils and Coppercreek-Slidecreek-Tectah complex (Figure 3) (UC Davis and NRCS, 2017). Arcata and Candymountain soils are composed of well-drained soils that formed from marine deposits derived from sedimentary rock (UC Davis and NRCS, 2017). Coppercreek-Slidecreek-Tectah complex encompasses well-drained ultisols, which originated from colluvium and residuum derived from sandstone and mudstone (UC Davis and NRCS, 2017).

Figure 3. Map depicting Azalea State Reserve is composed of Arcata and Candymountain soils (map unit 226) and Coppercreek-Slidecreek-Tectah complex (map unit 581) (UC Davis and NRCS, 2017).

2.2.4 Climate

The location of the Reserve is coastal with moderate temperatures year round. The mean annual temperature for Eureka, California is 52.6 °F (NOAA, 2019). The rainy season is October
through April, while the dry season (June through September) retains fog conditions and maintains the high humidity throughout the year (Humboldt County, n.d.). The average precipitation of Eureka, California is 36.75 inches, but varies from year to year between 16.60 and 67.21 inches (NOAA, 2019). Additionally, the average wind speed of Eureka, California is 4.5 mph (NOAA, 2019).

2.2.5 Habitat Types and Associated Vegetation
There are twelve habitat types and/or alliances within the Reserve (Figure 4). Each of these are described in the next section.
Figure 4. Vegetation types and associated alliances of Azalea State Reserve (mapped October 2019 by the authors).
Habitat Type Descriptions

**Abies grandis Forest Alliance - Grand fir forest (S2.1, G4)**
Grand fir trees are dominant or co-dominant in the tree canopy (>60% cover). These trees are <70 m tall (Sawyer and Keeler-Wolf, 1995), cover a continuous canopy, and are open to abundant in the herbaceous layer. Grand fir trees grow along marine terraces, coastline slopes, and bluffs (Sawyer and Keeler-Wolf, 1995). *Abies grandis* Alliance spans for 6.74 acres, dominating the eastern portion of the Reserve. Grand fir were dominant with *Alnus rubra* and *Picea sitchensis* alliances in the tree canopy throughout the Reserve. Grand fir are coniferous, evergreen trees that occupy upland settings, usually on mesic sites above creeks and river mouths (Sawyer and Keeler-Wolf, 1995).

**Alnus rubra Forest Alliance - Red alder forest (S4, G5)**
Red alder is dominant or co-dominant in the tree canopy with >50% relative cover. These trees grow <40 m tall, cover a continuous canopy, and are open to continuous in the herbaceous layers with forbs and ferns (Sawyer and Keeler-Wolf, 1995). They grow along streams, river bottoms, backwaters, banks, floodplains, mouth, terraces, and slopes. In the Reserve, *Alnus rubra* Alliance spans for 3.14 acres. Red alder were dominant with *Picea sitchensis, Abies grandis, Pseudotsuga menziesii,* and *Pinus attenuata* alliances within the Reserve. The red alder stands throughout the Reserve encompassed a well-developed shrub understory that mainly consists of *Rubus* sp. (*R. parviflorus, R. spectabilis, R. ursinus*) alliance. In California, *Alnus rubra* Alliances occur in riparian areas and establish in upland areas where logging activities have just concluded (Sawyer, 2006).

**Baccharis pilularis Shrubland Alliance - Coyote brush scrub (S5, G5)**
Coyote brush shrubs are dominant or codominant in the shrub canopy (>15% shrub cover over grassy understory, >50% compared to other shrub species, and 50% absolute cover in the shrub layer) (Sawyer and Keeler-Wolf, 1995). These shrubs grow <3 m tall and covers the canopy as well as the herbaceous layer sporadically (Sawyer and Keeler-Wolf, 1995). They grow on open slopes, river mouths, ridges and in other areas where soils range from sandy to heavy clay (Sawyer and Keeler-Wolf, 1995). In the Reserve, *Baccharis pilularis* Alliance spans for 1.3 acres. Coyote brush shrubs were intermixed with *Rubus* sp. (*R. parviflorus, R. spectabilis, R. ursinus*) alliance with individuals scattered near *Rhododendron occidentale* Provisional alliance throughout the Reserve. Moreover, coyote brush were found on the edges of *Abies grandis, Picea sitchensis,* and *Umbellularia californica* alliances within the Reserve. Coyote brush shrublands typically occur along the North Coast with great amounts of native grass and forb species that are not disturbance-related (Sawyer and Keeler-Wolf, 1995).
Ceanothus sp. Shrubland Alliance - Tobacco brush (S4, G5)
Tobacco brush is dominant or co-dominant in the shrub canopy (>50% relative cover). These shrubs are <4 m tall, cover the canopy periodically and continuously, with a scattered herbaceous layer (Sawyer and Keeler-Wolf, 1995). They grow on upper slopes, and shallow draws (Sawyer and Keeler-Wolf, 1995). In the Reserve, Ceanothus sp. Alliance spans for 1.2 acres. These shrubs of tobacco brush were found growing on the edges of Picea sitchensis, Alnus rubra, and Pinus attenuata alliances on the Reserve. They were often intermixed with Rubus sp. (R. parviflorus, R. spectabilis, R. ursinus) alliance near several, small patches of Rhododendron occidentale within the Reserve. The site quality of tobacco brush are vital in determining the rate at which conifers replace these shrubs (Sawyer and Keeler-Wolf, 1995).

Grassland
Native grasses are dominant or co-dominant with other non-natives in the herbaceous layer (>50 to 80% relative cover). These herbaceous species grow <50 cm tall and covers the landscape sporadically or continuously as they can grow on any slopes or aspects (Sawyer and Keeler-Wolf, 1995). In the Reserve, grasslands spans for 0.73 acres. Grasslands were outside of the largest distribution of Rhododendron occidentale as well as outside of Salix sp. and Abies grandis alliances on the Reserve. Although most are non-native, grasses are frequently used as wildlife habitat and accommodate the seasonal presence of native plants that have restricted distributions (Sawyer and Keeler-Wolf, 1995). Restoration plans need to consider that non-native grasses acquire dominance during rainy years whereas the natives are overlooked (Bartolome et al., 2007; Harrison and Viers, 2007).

Picea sitchensis Forest Alliance - Sitka spruce forest (S2, G5)
Sitka spruce trees are dominant in the canopy with >50% relative cover. These trees grow <75 m tall, canopy cover is continuous or irregular, and are typically abundant with ferns in the herbaceous layer (Sawyer and Keeler-Wolf, 1995). They grow on upland steep slopes, bottomlands, and gorges close to the ocean. They prefer sandstone or schist-derived soils that are seasonally flooded to permanently saturated (Sawyer and Keeler-Wolf, 1995). Dominating the western portion of the Reserve, Picea sitchensis Alliance spans for 13.38 acres. On the eastern part, Sitka spruce trees were at the middle edge of the Reserve, outside of Rubus sp.(R. parviflorus, R. spectabilis, R. ursinus), Baccharis pilularis, and Abies grandis alliances. Sitka spruce is a conifer whose seed dispersal is dependent on moisture (Sawyer and Keeler-Wolf, 1995). These trees rapidly invade stands of Corylus cornuta subsp. californica (California hazel), Rhododendron occidentale (western azaleas), and other shrubs at the Reserve and Stagecoach Hill Azalea Reserve in Humboldt Lagoons State Park (California Native Plant Society, n.d.).
**Pinus attenuata Forest Alliance - Knobcone pine forest (S4, G4)**

Knobcone pine trees are dominant (>50%) or codominant (>30%) in the tree canopy. They are <25 m tall, cover an open to continuous and one or two tiered canopy, and are sporadic in the herbaceous layer (Sawyer and Keeler-Wolf, 1995). They grow along slopes and ridges where soils are ultramafic, granitic, sedimentary or contain volcanic substrates (Sawyer and Keeler-Wolf, 1995). In the Reserve, *Pinus attenuata* Alliances spans for 0.65 acres. Knobcone pines were found near *Abies grandis* alliance on the western portion of the Reserve between *Picea sitchensis* and *Alnus rubra* alliances. In addition, another *Pinus attenuata* Alliance was in between the dominant *Picea sitchensis* and *Pseudotsuga menziesii* alliances. Knobcone pines have seed cones that are persistent and serotinous (Sawyer and Keeler-Wolf, 1995). These trees require fire to release its seeds, which remain viable in the soil for more than 25 years (Sawyer and Keeler-Wolf, 1995).

**Pseudotsuga menziesii Forest Alliance - Douglas fir forest (S4, G5)**

Douglas fir trees are dominant or co-dominant in the tree canopy with >50% relative cover. These trees are <75 m tall, and cover a sporadic to continuous canopy that may be two tiered (Sawyer and Keeler-Wolf, 1995). They grow along all topographic positions including along substrates that encompass serpentine (Sawyer and Keeler-Wolf, 1995). In the Reserve, *Pseudotsuga menziesii* Alliance spans for 0.21 acres. This Alliance was limited towards the edge of the western portion of the Reserve next to *Alnus rubra* and *Pinus attenuata* alliances. Within the North Coast Range, stands of Douglas fir are young because low-elevation stands were logged within the last 50 years (Sawyer and Keeler-Wolf, 1995).

**Rhododendron occidentale Provisional Shrubland Alliance - Western azalea patches (S2, G3)**

Western azaleas are dominant in the shrub canopy. These shrubs are <5 m in height and are sparse to abundant in the herbaceous layer. They are common along streams, gullies, drainages, and hill slopes with high water table (Sawyer and Keeler-Wolf, 1995). They grow in soils that are seasonally saturated sedimentary and serpentine substrates (Sawyer and Keeler-Wolf, 1995). The *Rhododendron occidentale* Alliance that once dominated the Reserve, now only dominates 1.72 acres. Inclusions of western azalea patches were also found on the edges of the Sitka spruce forests, red alder forests, *Rubus* sp. (*R. parviflorus*, *R. spectabilis*, *R. ursinus*) shrubland and/or *Ceanothus* sp. shrubland alliances throughout the Reserve. Western azalea is a native perennial shrub belonging to the heath family (Ericaceae) and typically occurs as scattered patches of plants within a variety of open, mesic sites (Baldwin et al. 2012). California hazel (*Corylus cornuta* subsp. *californica*) an important species to the Wiyot tribe is intermixed in the western azalea patches. Other typical species found within the western azalea patches include sword fern and bracken fern. Threats to the western azalea patches include encroachment of competing native vegetation and trees and invasive non-native plants such as English ivy (*Hedera helix*) and *Cotoneater* sp.
Rubus sp. (*R. parviflorus*, *R. spectabilis*, *R. ursinus*) Shrubland Alliance - Coastal brambles (S3, G4)

These species of coastal brambles are dominant by themselves and create an array of mixtures in the shrub canopy. All three species occur with approximately proportionate cover. They grow <2 m tall and covers the canopy continuously or every so often (Sawyer and Keeler-Wolf, 1995). They grow in exposed slopes and gaps in forest stands. In the Reserve, Rubus sp. Alliance spans for 3.41 acres. They were intermixed with *Baccharis pilularis* alliance, making up the understory near the *Abies grandis* and *Picea sitchensis* alliances on the eastern portion of the Reserve. Shrubs of coastal brambles are transitional between *Baccharis pilularis* and coastal coniferous forest alliances that are salt spray tolerant (Sawyer and Keeler-Wolf, 1995).

Salix sp. Shrubland Alliance - Willow thickets (S4, G4)

Willows are dominant or codominant in the tall shrub or low tree canopy (>50% relative cover in the shrub or tree canopy). These plants are <10 m tall, with open to continuous canopy cover, and a variable herbaceous layer (Sawyer and Keeler-Wolf, 1995). They grow on stream banks, slope seeps, and stringers along drainages. In the Reserve, Salix sp. Alliance spans for 0.20 acres. These shrubs were outside of the grasslands and *Abies grandis* alliance on the western portion of the Reserve. Willows generate abundant wind-dispersed seeds that are short-lived (Sawyer and Keeler-Wolf, 1995). Nonetheless, they are important for bank and slope stabilization (Sawyer and Keeler-Wolf, 1995).

Umbellularia californica Forest Alliance - California bay forest (S3, G4)

California bay is dominant or co-dominant in the tree canopy when its relative cover is >30%, and there are <30% relative conifer canopy cover (Sawyer and Keeler-Wolf, 1995). California bay is <25 to 30 m tall, covers a sporadic to continuous canopy, with an open to scattered shrub layer, and a sparse to abundant herbaceous layer (Sawyer and Keeler-Wolf, 1995). They grow on alluvial benches, streamsides, steep north-facing slopes and rocky outcrops (Sawyer and Keeler-Wolf, 1995). They prefer soils that are shallow to deep as well as sandy to clay loams (Sawyer and Keeler-Wolf, 1995). In the Reserve, Umbellularia californica Alliance spans for 0.28 acres. This Alliance was between the dominant *Abies grandis* and Rubus sp. (*R. parviflorus*, *R. spectabilis*, *R. ursinus*) and *Baccharis pilularis* mixed alliances within the eastern portion of the Reserve. California bay is an evergreen tree that produces large quantities of drupes annually (Sawyer and Keeler-Wolf, 1995). Most stands within the North Coast are small (<5 ha), occurring in mesic and riparian areas where other evergreen trees may be present (Sawyer and Keeler-Wolf, 1995).

2.2.6 Non-native Plant Species

There are multiple non-native plant species in the Reserve (Table 1). The majority of the species are invasive and have already negatively altered some of the habitats in the Reserve. In order to
restore the western azalea stands and other habitat types in the Reserve, these species will need to be removed.

Table 1. Non-native, invasive plant species found within the Azalea State Reserve and their invasiveness rankings.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Cal-IPC Rating</th>
<th>CalEPPC Rating</th>
<th>CDFA Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortaderia jubata</td>
<td>jubata grass</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotoneaster sp.</td>
<td>Cotoneaster</td>
<td>Moderate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cytisus scoparius</td>
<td>Scotch broom</td>
<td>High</td>
<td>A-1</td>
<td>C</td>
</tr>
<tr>
<td>Hedera helix</td>
<td>English ivy</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ilex aquifolium</td>
<td>English holly</td>
<td>Moderate</td>
<td>Alter</td>
<td></td>
</tr>
<tr>
<td>Rubus armeniacus</td>
<td>Himalaya blackberry</td>
<td>High</td>
<td>A-1</td>
<td></td>
</tr>
</tbody>
</table>

1 Cal-IPC - California Invasive Plant Council; 2 CalEPPC - California Exotic Pest Plant Council; 3 California Department of Food and Agriculture, 4 Although this listing has no standing in California, it show that these plants are considered invasive in an adjacent state that is part of larger bioregion.

2.3 CULTURAL RESOURCES

The Reserve lies within Wiyot ancestral territory (see Appendix B) (Humboldt State University, n.d.) along the coast of Humboldt Bay which extends roughly 56 kilometers from South to North and 38.6 kilometers from the coast inland along the Eel River (Heizier and Elsasser, 1980). Wiyot, a native term, refers to the southern portion of Wiyot territory along the lower Eel River (Heizier and Elsasser, 1980). The Wiyot population was once estimated at 3,300 and they occupied at least 172 village sites around Humboldt Bay (Heizier and Elsasser, 1980). Historically, greed for land and resources led to acts of violence against the Wiyot people. This left the Wiyot tribe population at 200 individuals (Heizier and Elsasser, 1980).
The Park was historically used by this Native American Tribe. The Wiyot people used the shoots of hazelnuts to create arrows and darts (Loud, 1918). To generate baskets, hazelnut shoots were interlaced with ferns and tree roots. The Wiyot people also gathered hazelnuts as food abundantly (Loud, 1918).

2.4 RECREATIONAL RESOURCES AND REGULATIONS
The Reserve allows for a variety of recreational opportunities while also providing areas for natural resources to be protected and restored. Low impact recreational activities such as hiking and picnicking are allowed at the site. The Reserve is open for day use only; camping is not permitted. There is a small paved parking lot that permits approximately 10 vehicles to park. Unpaved trails are present at the Reserve, while no other facilities are provided.

3  RESTORATION PLAN

This chapter discusses the restoration objectives and specific techniques that will be applied in order to reach the plan’s goals.

3.1 RESTORATION OBJECTIVES AND SUCCESS CRITERIA
As presented in Chapter 1 of this plan, there are three goals for this project and the following objectives have been established to meet the vegetation plan goals. Objectives and the associated success criteria are listed below with a quantitative measure for restoration success that will guide adaptive management strategies. Success criteria will be established for both objectives that will either utilize a cover-abundance scale of native and non-native plant species occurrences and or through acres of habitat restored (Table 2).

- Objective 1: Remove non-native plant species throughout the Reserve.
- Objective 2: Remove encroaching shrubs and conifers throughout the existing western azalea and California hazel stands.
Table 2. Proposed restoration results for Objective 1.

<table>
<thead>
<tr>
<th>Non-native species to be removed</th>
<th>Common Name</th>
<th>Success Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cortaderia</em> sp.</td>
<td>Pampas grass</td>
<td>100% of existing cover removed</td>
</tr>
<tr>
<td><em>Cotoneaster</em> sp.</td>
<td>Cotoneaster</td>
<td>&gt; 80% of existing cover removed</td>
</tr>
<tr>
<td><em>Cytisus scoparius</em></td>
<td>Scotch broom</td>
<td>100% of existing cover removed</td>
</tr>
<tr>
<td><em>Hedera helix</em></td>
<td>English ivy</td>
<td>&gt; 80% of existing cover removed</td>
</tr>
<tr>
<td><em>Ilex aquifolium</em></td>
<td>Common holly</td>
<td>&gt; 85% of existing cover removed</td>
</tr>
<tr>
<td><em>Rubus armeniacus</em></td>
<td>Himalayan blackberry</td>
<td>&gt; 80% of existing cover removed</td>
</tr>
</tbody>
</table>

Table 3. Proposed restoration results for Objective 2.

<table>
<thead>
<tr>
<th>Habitats to be Restored</th>
<th>Success Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western azalea and California hazel</td>
<td>197 encroaching trees removed</td>
</tr>
<tr>
<td>Western azalea and California hazel</td>
<td>1.72 acres of habitat restored</td>
</tr>
</tbody>
</table>

### 3.2 BEST MANAGEMENT PRACTICES

Non-native, invasive species present at the Reserve were mapped (Figure 5). Removal techniques are described below and can be done in conformance with the Draft NCRD Invasive Species Best Management Practices (CDPR, 2018).
Figure 5. Invasive species present at Azalea State Reserve based on vegetation surveys conducted in October and November 2019.
Removal Techniques

**Manual Removal Technique:** Non-native, invasive plants will be removed using hand tools such as a weed wrenches, pulaskis, and shovels. Plants will be dug out of the ground to a depth of no more than 2 ft. For larger plants a brush cutter, handsaw or chainsaw will be used. The vegetation will be piled away from trails in order to prevent visual impacts. When feasible removed native vegetation may be placed in inconspicuous areas not visible to the public and allowed to decompose naturally.

**Mechanical Technique:** Heavy equipment may be used for the initial treatment of certain large invasive species such as jubata grass. Either a dozer and or excavator will be used to remove target species. A 17 ft. heavy equipment exclusion zone will be placed around all sensitive natural and cultural resources.

**Flaming/Torching Technique:** Flaming/Torching is a removal technique that can effectively control a variety of plant species, without disturbing the ground. A handheld and/or backpack propane torch will be used to burn the target species. Two types of flaming are commonly used: green and black. Green flaming sometime called wilting or blanching utilizes a small torch that is applied just long enough to wilt the plant. Although the plants do not brown and look dead until the next day, this is enough heat to actually kill many species of plants. Black flaming utilizes the same equipment, but the torch is left on the plant long enough to actually cause it to incinerate. Both techniques will be utilized to treat multiple invasive non-native plants such as Scotch and French broom seedlings. Flaming will be conducted during the wet season and any necessary permits will be obtained prior to employing this treatment method. Vegetation left after flaming treatments will be left in place.

**Solarization/Covering:** Infestations will first be mowed to the ground with weed whackers and shrubs and small trees (<8 in dbh) will be cut at the base. Either weed cloth and or black 6 mil plastic tarps or a combination of both will then be placed over the target species and secured with sand bags. If clean chips (free of invasive non-native plant material) can be obtained, they will be placed over the tarping to help keep it in place and reduce the aesthetic impact. Based on the target species the weed cloth and/or plastic tarps will be left in place for at least one year or longer if plants are not completely dead.

3.2.1 NON-NATIVE SPECIES LIFE HISTORY AND TREATMENT METHODS

Proposed non-native plant treatment methods and life histories are described in this section and will be utilized with best practice methods in mind and at hand (Table 4). There are six target species (Table 1).

English ivy is the most abundant and dominant invasive non-native plant species occurring within the reserve. This species originates from Europe and is highly invasive. Individuals can
develop a dense cover that outcompetes other vegetation in natural areas (DiTomaso et al., 2013). English ivy is able to grow over the natural vegetation of an area and eventually kills them due to the amount of foliage present with this species (DiTomaso et al., 2013). English ivy is able to climb up trees to increase dispersal rates (DiTomaso et al., 2013). Fruits are consumed and dispersed by birds and harbors the ability to reproduce from juvenile (DiTomaso et al., 2013). If stem fragments of this species are left intact and within the vicinity of moist soil, it is able to continue reproduction (DiTomaso et al., 2013). English ivy is ranked by the California Invasive Plant Council as High (Cal-IPC 2017).

If English ivy is carpeting the floor, it can be hand pulled right off the ground, but all vines must be removed (DiTomaso et al., 2013). Removal of English ivy must take place over continuous years to allow desired vegetation to return (DiTomaso et al., 2013). Young plants and smaller seedlings can be dug out (DiTomaso et al., 2013). Timing when removal of this species is essential to decrease seed production and dispersal (DiTomaso et al., 2013). If English ivy is growing on a tree, it must be cut at ground level and attempts to pry off the individuals may be made (DiTomaso et al., 2013). English ivy can resprout so all attempts to keep removed individuals off the ground must be made (DiTomaso et al., 2013). Controlled burning is not recommended or effective in controlling the spread of this plant. However, a blowtorch may be used and must be used repeatedly (DiTomaso et al., 2013).

Cotoneaster is the second most abundant non-native species in the Reserve and is the most threatening to the western azalea and California hazel stands. This genus originates from China and usually grow to be less than 10 feet tall (DiTomaso et al., 2013). This species can be a food source for many bird species. It typically grows in dense and crowded patches that severely impact the ability for native species to survive and thrive (DiTomaso et al., 2013). Smaller individuals and seedlings can be hand pulled (DiTomaso et al., 2013). Removed individuals will further assist in the efforts to prevent the spread of this genus (DiTomaso et al., 2013). Entire stumps or roots must be removed due to their ability to resprout (DiTomaso et al., 2013). This would require further control if roots are not removed entirely (DiTomaso et al., 2013).

Himalaya blackberry is an evergreen erect shrub that grows up to 10 ft. tall that originated from Armenia and grows in disturbed, open, moist sites (DiTomaso et al., 2013, DiTomaso and Healy 2007). The roots are typically found in the first 2 ft. of soil, but can grow up to 7 ft. in loose soil (DiTomaso et al., 2013, DiTomaso and Healy 2007). Due to its growth form, it is able to quickly shade out native vegetation as well as prevent access to water for wildlife in riparian areas (DiTomaso et al., 2013). New plants can emerge from root buds and occasionally from root fragments in good conditions (DiTomaso et al., 2013, DiTomaso and Healy 2007). The white to pinkish flowers are self-pollinating (DiTomaso et al., 2013, DiTomaso and Healy 2007). Seeds only survive on the soil for a few years (DiTomaso et al., 2013, DiTomaso and Healy 2007). The Cal-IPC ranks Himalaya blackberry as High Invasiveness (DiTomaso et al., 2013, DiTomaso and Healy 2007).
Healy 2007). There are multiple patches of Himalaya blackberry in the reserve primarily in the grassland areas.

**Table 4.** Treatment options for non-native, invasive plants found within the Azalea State Reserve.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Manual</th>
<th>Mechanical</th>
<th>Solarizing</th>
<th>Flaming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotoneaster sp.</td>
<td>Cotoneaster</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Cortaderia jubata</td>
<td>jubata grass</td>
<td>Yes</td>
<td>brushcutter/ chainsaw</td>
<td>None</td>
<td>Flaming seedlings</td>
</tr>
<tr>
<td>Cytisus scoparius</td>
<td>Scotch broom</td>
<td>Yes</td>
<td>No</td>
<td>None</td>
<td>Flaming seedlings</td>
</tr>
<tr>
<td>Hedera helix</td>
<td>English ivy</td>
<td>Yes</td>
<td>No</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Ilex aquifolium</td>
<td>English holly</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td>Yes</td>
</tr>
<tr>
<td>Rubus armeniacus</td>
<td>Himalaya blackberry</td>
<td>Yes</td>
<td>brushcutter/ chainsaw</td>
<td>None</td>
<td>No</td>
</tr>
</tbody>
</table>

Smaller populations can be removed using hand pulling (DiTomaso et al., 2013). For larger populations, complete control of this species can only be achieved through mechanical removal of the vegetation’s canes, roots, and root crowns (DiTomaso et al., 2013). If only aboveground biomass is removed, this can stimulate further growth of the root sprouts (DiTomaso et al., 2013). Burning is effective only as a pre-mechanical treatment tool (DiTomaso et al., 2013). Root sprout control or removal must be paired with burned in order to be effective (DiTomaso et al., 2013).
Jubata grass is a large perennial grass with basal leaves that are sharply serrated. Their tall inflorescences are plume-like and produce up to 100,000 light, highly dispersive seeds (DiTomaso et al., 2013). Designated as High Invasiveness by the California Invasive Plant Council (Cal-IPC), jubata grass can have “severe ecological impacts on physical processes, plant and animal communities, and vegetation structure” (Cal-IPC 2017). Jubata grass is known to create a fire hazard and to complicate fire management activities due to an excessive production and build-up of dry leaves and flowering stalks that can persist in the environment for extended periods of time. This plant can also block vehicle and human access and the sharply serrated leaves can cause injury to humans (Cal-IPC 2014). Within the reserve, there are less than 10 individuals. However these are large and well established and produce millions of seeds each year. These plants should be removed promptly so that the infestations do not spread further into the Reserve.

The spread of this species can be prevented by hand-pulling seedlings (DiTomaso et al., 2013). To remove established individuals, hand tools, pulaskis, and shovels should be used (DiTomaso et al., 2013). Chainsaws, brush cutters, and weed eaters can be used to reveal the base of the plant for further treatment (DiTomaso et al., 2013). It is recommended that removed clumps be placed upside down to force the roots to dry out due to their ability to take root after removal or if the root ball is too large for removal it can be covered with plastic for a year (DiTomaso et al., 2013). Use of heavy equipment such as excavators and backhoes, can be used as well (DiTomaso et al., 2013). Plumes can be removed to prevent seed dispersal but this may cause the individual to produce more plumes the following years (DiTomaso et al., 2013). Establishment of this genus is promoted by a number of disturbance events (DiTomaso et al., 2013). To prevent establishment, heavy mulching or planting of native vegetation is recommended (DiTomaso et al., 2013). Burning or grazing are not effective methods of controlling this species (DiTomaso et al., 2013).

Scotch broom is a deciduous shrub with yellow, pea shaped flowers growing as singles or pairs in leaf axils along erect branches. Up to 9 seeds are contained within a seedpod and once ejected, can remain viable in the soil for up to 30 years. Designated as High Invasiveness by the Cal-IPC, Scotch broom can have “severe ecological impacts on physical processes, plant and animal communities, and vegetation structure” (Cal-IPC 2017). Scotch broom is a fast grower, producing dense stands that are impenetrable and inedible to most wildlife. This plant can limit regeneration of most other plant species and can also create a dangerous fire hazard. With its ability to fix nitrogen, Scotch broom can give a competitive advantage to other invasive plant species by increasing soil fertility. Within the Reserve, there is one occurrence of Scotch broom.

Most seedlings and small shrubs can be hand pulled. For the larger shrubs, weed wrenches or other removal tools for woody weeds must be used (DiTomaso et al., 2013). If the entire root composition is not removed, resprouting will most likely occur (DiTomaso et al., 2013). Timing
when removing this species is essential: if it is removed during the flowering season, seed dispersal will be limited and most efforts will be produced by the plant, reducing its energy reserves (DiTomaso et al., 2013). If only burning practices are utilized, it will not be effective in completely removing the species from the Reserve (DiTomaso et al., 2013). Burning stimulates the germination of this species’ seed and releases additional nutrients into the soil. If burning practices are conducted, they must be combined with other form of control treatment (DiTomaso et al., 2013).

English holly is native to Europe, western Asia, and North Africa and is a moderately invasive plant in the Pacific Northwest (DiTomaso et al., 2013). Introduction of this plant began as an ornamental plant in 1869 (Olmsted, 2006). English holly is bird dispersed (Zika, 2010). English holly is able to reproduce from vegetative damage and seed until it from monoculture stands (Peterken and Lloyd, 1967).

Hand pulling, weed wrench, and cutting are effective but must be repeated due to the plant’s ability to resprout after removal. If heavy equipment such as bulldozers or excavators are used, the highest percentage of control can be reached (DiTomaso et al., 2013). Burning may be conducted but is only effective if repeated multiple times (DiTomaso et al., 2013).

Himalayan blackberry originates from Armenia and grows in disturbed, open, moist sites (DiTomaso, Kyser et al., 2013). Due to its growth form, it is able to quickly shade out native vegetation as well as prevent access to water for wildlife in riparian areas (DiTomaso, Kyser et al., 2013). Its growth form produces dense thickets that rarely allow sunlight to reach the understory that lies beneath (Cal-EPC, 2017).

Smaller populations of Himalayan blackberry can be removed using hand pulling (DiTomaso, Kyser et al., 2013). For larger populations, complete control of this species can only be achieved through mechanical removal of the vegetation’s canes, roots, and root crowns (DiTomaso, Kyser et al., 2013). If only aboveground biomass is removed, this can stimulate further growth of the root sprouts (DiTomaso, Kyser et al., 2013). Burning is effective only as a pre-mechanical treatment tool (DiTomaso, Kyser et al, 2013). Root sprout control or removal must be paired with burned in order to be effective (DiTomaso, Kyser et al., 2013).

### 3.3 Conifer Encroachment

Due to the presence of young successional shrubland habitat on the Reserve, encroachment of conifers has begun (Figure 6). Western azalea stands and California hazel thrive in transitional phases where the landscape is transitioning from grassland to forest cover. To achieve the goals of this plan, objectives have been made to preserve the sensitive habitat that the western azaleas and California hazel stands naturally occur within. The preservation of the Rhododendron occidentale Provisional Shrubland Alliance can be achieved by thinning and removing native
Conifer species as discussed in the next section. Conifer encroachment has been shown to have short term effects on the species coverage and richness and long-term effects on the soil and potential restoration of these unique habitats (Haugo and Halpern, 2007).

Figure 6. Number of individual conifers present within the vicinity of Western azalea stands. Larger circles indicate more individual conifers. Field data collected in October 2019.
3.4 CONIFER REMOVAL METHODS
Complete removal of the young coniferous trees will occur in areas that western azalea stands currently occupy. Many of these trees are 10-20 years old and are about 20 ft. in height. No substantial amount of thinning will occur. This process seeks to remove any overstory growth that may inhibit the survival of the western azalea stands and to replicate a static shrubland successional phase. Hand removal, weed wrenching and cutting may be utilized to remove smaller trees and saplings that are deemed feasible. For larger coniferous trees, chainsaws will be used to fell entire trees.

4 PROJECT MONITORING AND REPORTING
This section discusses the monitoring and reporting methods designed to meet the goals and objectives discussed in Chapter 1 and 3. This section will also discuss the adaptive management approach set forth by this plan and how monitoring will be essential to respond to unforeseen results. Monitoring will also assist in the evaluation of the project actions. A five-year report will be produced that will summarize the restoration work, monitoring data, and overall post-treatment response of the Reserve to the restoration actions. This section identifies specific actions to meet the following objectives listed in Chapter 3.

4.1 ADAPTIVE MANAGEMENT APPROACH
Adaptive management will be used during implementation and monitoring of this plan where deemed necessary. This management approach will prioritize resource protection and public access. Monitoring results will drive alterations to the plan and subsequent actions. The success of this plan will depend on the ability to adapt and respond to the new information on a consistent basis. As different phases of the plan are completed, monitoring results will be analyzed to inform further actions and adjust the plan to best meet the plan’s overall goals and objectives.

4.2 RESTORATION MONITORING
To respond to restoration results appropriately, monitoring of multiple environmental factors before, during, and after each phase must occur to avoid significant cumulative effects on the environment. Both cultural and biological monitoring actions will occur on site. Biological monitoring will prioritize the health of the western azalea stands as well as control of exotic species within the Reserve. Each method of monitoring within the project area is summarized below (Table 4).

4.2.1 VEGETATION
Stratified random sampling will be utilized within the Reserve to monitor the progress of non-native, invasive species removal. A base transect of 50 meters will be placed through the center of treatment areas determined at the time of treatment. Random base points will be recorded that
will allow for an accurate and substantial sample size. Species richness and diversity will be recorded as a measurement of % cover using m² quadrats. To minimize sampling error, the same persons recording this data shall remain constant over time if possible. This method should be utilized both pre-treatment and post-treatment to observe the changes post-restoration (Pickart and Sawyer, 1998). This method of monitoring shall begin after year one of implementation and should be conducted every year thereafter to decrease the possibility of an unexpected non-native species infestation.

4.2.2 CULTURAL
In the event that unknown cultural resources (including but not limited to dark soil containing shell, bone, flaked stone, groundstone, or deposits of historic waste) are discovered by anyone during project implementation, the project manager will suspend work at the specific area and workers will be given modified duties. A CDPR qualified archaeologist will document and examine what was found and work with the project manager to implement avoidance, preservation, or applicable recovery measures before any further work can resume at that specific location.

If any human remains are found, work will cease immediately in the area and the project manager will notify the CDPR cultural resource specialist assigned to this project. Any human remains and/or funerary objects will be left in place or returned to the point of discovery and covered with soil. The North Coast Redwoods District Superintendent or cultural resource specialist will notify the County Coroner, in accordance with section 7050.5 of the California Health and Safety Code.

4.2.3 PHOTO DOCUMENTATION
Photo documentation will occur before and directly after treatment and then annually thereafter. Photo documentation will be utilized in monitoring the effects of the restoration and retreatment methods on the site. Photographs will be taken from established Global Positioning Unit (GPS) points throughout the Reserve and at the selected vegetative transects. Photographs will be taken to monitor any further conifer encroachment after restoration occurs and to analyze the response of the western azalea and California hazel stands to conifer removal.

4.3 PROJECT REPORTING
Project reporting will be used to evaluate the ongoing restoration success and health of the Reserve. A summary report shall be created five years after project completion to evaluate the methods taken, necessary changes to the plan, and future steps. The report will be produced by CDPR Natural Resource Management staff.
5 PROJECT TIME TABLE

This chapter describes the proposed timeline in which the project will be implemented and monitored. The recommended tasks and timeline of phases are described below (Table 5). Even though this is a ten-year plan, continued retreatment of non-native, invasive plants and monitoring of western azalea and California hazel stands will need to occur indefinitely. The recommendations made by this table may change over time due to the amount of funding or how the project progresses.

5.1 IMPLEMENTATION AND MONITORING

Table 5. Proposed restoration and monitoring timeline with tasks and phases of implementation by year.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Phase (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Restoration</strong></td>
<td></td>
</tr>
<tr>
<td>Conifer Removal and Thinning</td>
<td>X X X X X</td>
</tr>
<tr>
<td><em>Hedera helix</em> removal</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td><em>Cotoneaster</em> sp. removal</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td><em>Ilex aquifolium</em> removal</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td><em>Cortaderia</em> sp. removal</td>
<td>X X</td>
</tr>
<tr>
<td><em>Rubus armeniacus</em> removal</td>
<td>X X X X</td>
</tr>
<tr>
<td><em>Cytisus scoparius</em> removal</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td></td>
</tr>
<tr>
<td>Photo Documentation</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>Vegetation Monitoring</td>
<td>X X X X X X X X X X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase (year)</th>
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<tbody>
<tr>
<td>1 2 3 4 5 6 7 8 9 10</td>
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<tr>
<td>X X X X X X X X X X</td>
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<td>X X X X X X X X</td>
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<td>X X X X X X X X X X</td>
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</tbody>
</table>

Table 5. Proposed restoration and monitoring timeline with tasks and phases of implementation by year.
6 PROJECT CONSIDERATIONS AND COMPLIANCE

This section identifies the project constraints along with the regulatory compliances necessary for the implementation of the vegetation plan. It is crucial to recognize and interpret these constraints because they influence the implementation and outcome of the plan. Doing so allows the development of adaptive management practices to increase the probability of reaching the goals and objectives of the vegetation plan.

6.1 PROJECT CONSTRAINTS

These constraints range from logistics to financial restrictions, which may originate from within the CDPR, from the regulatory agencies entrusted to safeguard specific species and habitats, from the vegetation plan itself, the Reserve or the surrounding environment and infrastructure (Forys et al., 2009).

6.1.1 RESTORATION CONSTRAINTS

Although CDPR recognizes the need to restore or properly manage the Reserve, actions cannot commence without funding. Volunteer events cannot be held due to the abundance of poison oak (*Toxicodendron diversilobum*) throughout the Reserve. Thus, having a vegetation plan in place helps to leverage funding. With funding, the Reserve can be restored and the western azalea habitat which the Reserve is intended to protect will remain.

The discovery of cultural resources within the Reserve may present constraints in moving the project forward as all work immediately ceases if any resources deemed to be culturally symbolic or significant are encountered. This delays the timeline of the project which further hinders the enhancement of the project area. It is possible that no restoration work can resume after cultural resources are identified in a restoration site as the preservation of the unearthed resource will be a priority.

Complete invasive species removal is oftentimes impossible, costly, and time consuming (Zavatela et al., 2001). Non-native, invasive species regenerate easily and resprouting is inevitable when such species have established themselves for prolonged periods of time. Hence, restoring an area back to a state where it can become self-sufficient will require regular management, maintenance, and long-term funding. Usually, organizations or persons that fund restoration projects prefer or desire immediate results. However, this is almost never the case for restoration projects as it takes time for ecological process to recover and for species to reestablish themselves in the natural community. As the Reserve is substantially covered with non-native, invasive species, it will take many years to see desired or expected results.
6.2 REGULATORY COMPLIANCE
California requires restoration projects to undergo specific review processes prior to any project implementation (Forys et al., 2009). During this process, regulatory agencies and the public are granted the opportunity to review and critique the plan. The review period may prompt alterations to the original plan in order to place additional or more extensive measures to protect the environment. Permits may also be required by regulatory agencies before the project can commence (Forys et al., 2009). Furthermore, it is imperative to review regional and local general plans to ascertain that the project is in accordance with the missions and purposes of these plans (Forys et al., 2009).

6.2.1 ENVIRONMENTAL DOCUMENTATION AND PERMITTING REQUIREMENTS
Minimal permits and documentation will be acquired and prepared for this specific project. A Mitigated Negative Declaration (MND) will be prepared to meet requirements under the California Environmental Quality Act (CEQA).

Arcata South Quadrangle, USGS. (2015). 7.5-Minute Series.

*Azalea Park Blooming, Under Continuous Development Program*. (n.d.).


Humboldt County, California's Redwood Coast. (n.d.). Retrieved from https://humboldtgov.org/1217/Climate


APPENDICES

APPENDIX A

Native Species List
Abies grandis
Acer circinatum
Achillea millefolium
Alnus rubra
Anaphalis margaritacea
Aquilegia formosa
Arbutus menziesii
Asarum caudatum
Athyrium filix-femina
Baccharis pilularis
Blechnum spicant
Carex sp.
Ceanothus thyrsiflorus
Cirsium occidentale
Corylus cornuta californica
Equisetum sp.
Galium sp.
Juncus sp.
Lonicera involucrata
Lonicera hispidula
Marah oreganus
Myrica californica
Picea sitchensis
Pinus attenuata
Plantago sp.
Poa sp.

Polystichum munitum
Prunella vulgaris
Pseudotsuga menziesii
Pteridium aquilinum
Rhododendron occidentale
Ribes sp.
Rubus parviflorus
Rubus spectabilis
Rubus ursinus
Rumex sp.
Salix sp.
Stachys emersonii
Sequoia sempervirens
Toxicodendron diversilobum
Trillium ovatum
Umbellularia californica
Vaccinium ovatum
Vicia sp.
Viola sempervirens

Non-native Species List
Cortaderia jubata
Cotoneaster sp.
Cytisus scoparius
Hedera helix
Ilex aquifolium
Rubus armeniacus
APPENDIX B

Map showing the ancestral territory of the Wiyot Tribe along the coast of Humboldt Bay, extending roughly 56 km from South to North, and 38.6 km from the coast inland along the Eel River.