Native Landscaping Comprehensive Report

Prepared for Friends Of The Dunes

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ABSTRACT

For our Capstone Project, we worked with The Friends of the Dunes (FOD) to collect information and data about the Humboldt Coastal Nature Center's (HCNC) natural landscaping program to compile into a living document. The purpose of the document is to provide FOD staff and board members information on previous, current, and possible future plans of the twelve natural landscaping sites at HCNC. We framed our project within FOD's natural landscaping goals for HCNC, as the focus for HCNC is based on demonstrational ecology and aesthetic values for the visitors. Multiple interviews were conducted with FOD staff, key volunteers, and board members to get important information about each of the sites and the development of HCNC. We recorded data on different species used, methodologies, key days of site development, history, challenges, success and failures, and future plans. We then accumulated qualitative and quantitative date into Excel spreadsheets. From this information we were able to derive an overarching vision that can be accessed, and added on to in our bundled deliverables for FOD. The end goal of our project is for the FOD to have a formalized system of documentation regarding site restoration and development to be available for continued and future use.

"Society must assign the same value to natural heritage as it does cultural heritage to successfully safeguard biodiversity for the long haul…"- E.O. Wilson

Introduction

The Friends of the Dunes is a 501(c)3 non-profit organization founded in 1982 that has been dedicated to community based coastal environmental restoration in Humboldt County. FOD's main focus has been interpretation, volunteer days, guided walks, restoration, and educational programs.

In 2000, FOD expanded to become a land trust in order to facilitate more intensive conservation efforts and became a part of the Land Trust Alliance. As a land trust, FOD has worked with a number of willing land owners to undertake conservation easements through land purchases or donations. These conservation easements allow the owner to continue owning the land; however certain deed restrictions are permanently placed on the property in order to ensure continued conservation. This is a significant environmental restoration strategy which helps solidifies long term conservation.

FOD so far as acquired 100 acres of connecting dune and wetland habitats which include the Eureka Dunes Protected Area (CNLM), Manila Dunes Recreation Area (MCSD), Humboldt Coastal Nature Center FOD, Ma-le'l Dunes Cooperative Management Area (HBNWR/BLM), and the Lanphere Dunes (HBNWR)(friendsofthedunes.org).

Image 1: Map of FOD Land Trust Sites (taken from friendsofthedunes.org)

The FOD goals include (friendsofthedunes.org):

- Provide community education that fosters understanding and appreciation and inspires conservation
- Build community based restoration programs that serve to maintain and enhance the natural diversity of coastal environments.
- Conserve strategically located coastal properties through conservation easements and land acquisition to ensure that land use is consistent with the ecological values of native coastal dune systems.
- Develop an effective and efficient organization capable of conserving coastal environments in perpetuity.

In 2007, FOD purchased a unique building known in Manila as “The Stamp House” on 113 acres of land that reaches out through a dune complex to the beach. The onsite house has been renovated and is now known as the Humboldt Coastal Nature Center (HCNC), which also is LEED-certified. However, much work still needs to be done onsite to continue restoration, recreational, and educational practices.

There are a 12 restoration and landscaping plots in varying degrees of completion. Perennial invasive grasses are the clearly the principal threat to finishing and maintaining native landscaping at HCNC in addition to key invasive species like sheep sorrel and Mexican tea shrub.

Image 2: Aerial Site Map of HCNC

As the goal for the HCNC area is largely focused on demonstration and aesthetics for visitors, ecological functionality is not a priority. Instead, the focus of the area (subdivided into 12 sites in Image 2) around HCNC is ecological demonstration, an extension of Native Landscaping. Native Landscaping "…promotes environmentally sound landscaping practices to preserve biodiversity through the preservation, restoration and establishment of native plant communities" (wildones.org). By using dune species like beach evening primrose, sand verbena, beach strawberry, sagewort, buckwheat, red fescue, and other native species, FOD have begun establishment of representational waveslope, foredune, interdunal wetlands, and the dune forest ecosystems. HCNC visitors will be able to experience the dune ecosystem complexes in a controlled educational setting without having to go through all of the restoration sites off of HCNC in order to understand the important relationships amongst the different sub-ecosystems. This is ideal for children, elderly people, and other who cannot easily hike out to visit and experience all the different ecosystems where they naturally occur. A thriving landscape at the HCNC will enhance visitor experience and will serve to provide comprehensive educational opportunities.

The goal of this project is to assist FOD by collecting data and information on everything that has been done at HCNC so far and develop all information into a comprehensive document. Additionally, we will create a framework for FOD staff to use in order to clarify what parts of the project have been completed, what parts are still in work and what goals haven't been completed for each site. We will use the 12 different Native Landscaping sites at HCNC that we have identified for this project. The purpose of this project is to aid in the completion of FOD's goals. To complete the goals FOD have stated the importance of having a clearly laid out plan and list of goals so that a project design can be followed, maintained, and adjusted when needed.

Benefits of Native Landscaping:

In a globalized age of expansionist culture based on materialism, many individuals experience a loss of connection with the landscape through development and exploitation of natural resources. This loss creates a barrier for the protection of biodiversity and natural amenities, which ultimately translates to a loss of; sense of place, ecological literacy, and perception of natural heritage (Kermath, 2007). Landscape is a reflection of society's values, and can serve as a teaching tool. To reflect natural heritage appreciation, a fundamental shift must be fostered to work towards true sustainability.

A first step towards sustainability can be found in Native Landscaping, which has many definitions but for this report will be defined as: a holistic, environmentally sensitive alternative to conventional landscaping, relying on local regionalism and native species.

With the world population over 7 billion, demand has exponentially increased for resources and global biochemical systems face high stress. The environmental issues of the modern era have globally expanded, where once they were contained within regions. There have been three large-scale regional societal collapses, also known as Dark Ages (Chew, 2008). These Dark Ages are a reoccurring phenomenon and have been significant time periods which acted as catalysts for system transformation. The first occurred in 3000 BC in Egypt and Mesopotamia; the second occurred in 1200-700 BC with the crisis of the late Bronze Age; and the third in 300 to 400 BC with the Fall of Rome (Chew, 2008). Because of the scarcity of natural resources, limits were reached in both social and natural systems, and with each Dark Age, they expanded from micro regions to entire continents (Chew, 2008). In Sing Chew's *Ecological Futures*, he outlines the socioeconomic, political, and environmental preconditions to each of these impeding societal collapses on a regional scale and applies the model to today's globalized scale. Chew

makes empirically based claims that the modern era's current state mirrors that of an expanded pre-collapse Roman Empire due to population growth figures, the high degree of environmental degradation on a global scale, mass extinction rates, migration patterns, climate change, and the reduction of available natural resources, deforestation rates, and erosion from mal agricultural practices.

Alternative life practices have risen that focus on decentralization, rehabitation, and bioregionalism. However these represent a direct contrast to modern societal norms, therefore great effort must begin in response. Bioregionalism propped up in the 1960s and the 1970s as a counter to the dominant paradigm as a reaction to the prevailing socioeconomic, political, and ecological conditions (Chew, 2008). In bioregionalism, there is no separation between man and nature, where "…interrelationships between humans and their surroundings is considered harmonious, complex, and diverse…"(Chew, 2008), much like Arne Naess' Deep Ecology.

With previous collapses, populations either died or migrated to other regions, however in the modern era that is no longer a reality. The global population cannot migrate to allow nature to replenish and recover. Complexities of ecological functions and systems are still, and will continue to be, studied as conventional knowledge of the growing synergisms at work are limited. Chaos Theory states that environmental systems often maintain long term dynamic equilibria before unpredictably jumping to different states when stressed or pushed (Crutchfield et al., 1989). A new approach and societal transformation is needed to work with ecology and not against it. As stated before, Native Landscaping can become an important first step for that transformative shift. In Harvard biologist Ed Wilson's 1984 *Biofilia*, he states "…as biological knowledge grows the ethic will shift fundamentally so that everywhere…the fauna and flora of a country will be thought part of the national heritage as important as its art, and its

language…"(Wilson, 1984). An extension of this statement suggests that incorporating natural heritage into cultural landscape will aid in instilling value of earth's natural amenities and biodiversity.

One way to reincorporate natural heritage into the community is to alter the existing human landscape. North America's landscape has largely become industrialized, relying on synthetic fertilizers, pesticides, and herbicides. These large fossil fuel based inputs produce significant negative externalities and therefore prices for these inputs and practices are kept artificially low (Kermath, 2007). Key facts about the United States' industrial landscaping go as follow (Bormann et al., 1993):

- ¾ billion dollars are spent on chemical pesticides for backyards and are used ten times more per urban acre than per agricultural acre
- In Connecticut, over 60% of all pesticides are used on urban yards
- 1/3 of urban water consumption in the East and 60% in the West are used on resident irrigation
- 600 million gallons of gas per year is used to power lawn mowers
- In California, yard machinery emits emissions equal to 3.5 million cars (of a 1991 model year) driven 16,000 miles per year. Additionally, California spends more money to manage an acre of lawn than an acre of corn.

Conventional landscaping has a significant effect on regional native species of an area. Landscape architects Ahern and Boughton from the University of Massachusetts state that "The landscape industry thrives on an instant landscape mentality that accelerates ecological growth with heavy subsidies of labor and chemicals and with monocultures of genetically altered plants. Paradoxically, the landscape industry has become a major obstacle to the acceptance of a new landscape aesthetic founded on sustainable native species and natural processes." (Ahern, 1994). Globally, non-native taxa present a serious threat. In the United States, around 7000 naturalized exotic flora and fauna species have been identified as having the most threat to biodiversity (Kermath, 2007). Without limiting factors like natural predators, parasites, and competitors, most

invasive have been able to overwhelm desirable environments. This significantly decreases the genetic diversity of local native species and may cause extinction in extreme cases (Kermath, 2007). These invasive species alter the "genetic swamp" and can alter many ecological functions and processes by displacing complex relationships and mechanisms (Kermath, 2007). This phenomenon is increasing in scale and unpredictability due to the rapid rate of human induced climate change and the decrease of natural areas and increased fragmentation. Habitat fragmentation can also intensify invasive species effect on an area.

A study in Florida concluded that Florida has the worst problems with invasive species than any other state in the nation. With a population of 17 million, Florida is the fourth most populated state and projections estimate a population of 25 million by the year 2030 (Kermath, 2007). Florida's climate is warm and humid with long growing seasons, lots of pests, and porous soils which do not filter pollutants well (Kermath 2007). Florida landscaping plants have been naturalized in decades past, most of them being exotic plant species. For example, the Brazilian Pepper (*Schinus terebinthifolius*) is by far the worst naturalized landscaping plant. Currently it dominates over 300,000 hectares and had a spread rate of 12,000 hectares a year in the 1990s (Kermath, 2007). The Florida Exotic Pest Plant Council has identified around 1200 different naturalized exotic plants of special concern. Florida certainly faces a significant challenge to ecological restoration due to historic rejection of native species for landscaping use in favor for transformative non-native threatening exotics.

The way a community landscapes an area is a "…combination of learned aesthetic preferences that clearly reveal some of the environmental blind spots in our collective wisdom and how emotionally, intellectually, and spiritually disconnected from nature we are." (Kermath, 2007). Biodiversity is undeniably important to regional ecological, social, and economic health.

The essential causality of environmental degradation and the associated problems can be sourced to the prevailing world view. Native Landscaping can be an integral tool for shifting societal norms by reflecting values of biodiversity and demonstrational ecology that expresses the importance of a region's native and natural complex within the human landscape. Altering human and urban landscapes to express values of symbiotic relationships with nature can influence having an ecologically based sense of place.

By pursuing Native Landscaping practices at the HCNC, FOD can showcase important native ecosystem complexes in an aesthetically pleasing way. By understanding the different ecosystem complexes, their needs, and their challenges, visitors will gain more appreciation for the coastal dune environments. The FOD works to actively engage visitors, members, and volunteers directly into land processes in order to instill valuation. Becoming ecologically literate within different ecosystems will aid in instilling moral responsibility and stewardship amongst volunteers and visitors. Those that value biodiversity are more likely to act to protect it, and Native Landscaping is a definite path to pursue to attain community ecological values.

History of HCNC:

The "Stamps Place", built in 1985 from an earth shelter kit and served as the home of Charles and Rachel Stamps. They wanted to ensure that the public could enjoy the property and surrounding environment and after they passed away the Stamps family contacted Friends of the Dunes to see if they were interested in the property.

The Stamps family trust finished the sale in 2007 and the Friends of the Dunes began renovation in 2010. This property was purchased with funds from state and federal grants, private donations, and other state and federal funding from the interpretive center (Vander Meer, 2010). Terms of the funding sources include public access, outdoor recreation, habitat

construction, protection of threatened and endangered species, construction of migratory bird habitat, open space, bird watching, nature photography, guided walks, and surf fishing (Vander Meer, 2010).The Stamps retains 17 acres adjacent to the HCNC and 2 barns on the property. Before renovation began, the entire roof was covered in ice plant (*Carpobrotus edulis*) which is naturally from South Africa (Malan and Notten, 2006). Ice plant is a known high priority exotic in the dune mat community habitat dune units. Ice plants form vast monospecific zones which have negative effects on biodiversity as ice plants compete directly with threatened and endangered plant species for nutrients, light, and space (NBII, 2008). Ice plant was imported from South Africa in the early 1900s to stabilize soil structure along railroad tracks and later was used in Caltrans' policy for stabilizing coastal road networks. Ice plant eventually escaped the confines of landscaping and actively invades foredunes, dune scrub, coastal bluff scrub, coastal prairie, and maritime chaparral (NWRC, 2011). Thousands of acres were planted along the California coast until the 1970s and today is still a favored landscaping and garden plant (NBII, 2008). Ice plant actually speeds up erosion because it holds a lot of water mass in its leaves and has shallow root systems (NBII, 2008). Consequently in the rainy seasons, the added weight from the rain on unstable sandstone slopes and dunes increase the risk for landslides and slope collapse (NBII, 2008).

The Humboldt Coastal Nature Center property from the Stamps family encompasses a total of 113 acres and bridges different coastal lands being managed for resource conservation and public access. This important linkage is consistent with the Friends of the Dunes' mission statement and interests. The property is able to support distinctive and rare plant communities like dune swale, seasonal wetlands, and maritime forest (Vander Meer, 2010). Additionally, there are over 40 different species of native bees in the Humbodlt Bay Dunes in which some are

unique to the coastal dune complex. The continual actions to restore the HCNC property is an important restoration effort for the entire coastal dune complex as it reduces fragmentation and though the landscaping at the HCNC is not purposed for ecological function, native plants are used to construct a representation of targeted ecosystems.

Methods

Creating documentation for FOD HCNC restoration sites was implemented mainly by exchange of human resources. Through interviews, vegetation surveys, site evaluation, and site walks with staff members, we collected and identify the undocumented goals and objectives of FOD to aid in the completion of a restoration plan. We aimed to collect information on each restoration site to rank priority, document past and presently used methodologies, list past and present plant species, find success and failure rates, and identify varying volunteer efforts. Part of our goal is to create formal documentation that will be available so that all staff and board members can access the project goals and objects of FOD HCNC restoration. By collecting information through interview and other data sources we have outlined the hierarchical list of goals, and the specific restoration work for each site. This is to be a living document that is easy to understand and can be used for continued documentation of future work within the currently identified sites and possible futures sites.

The project was carried out in a series of phases in order to produce a valuable structural document. The first phase was creating the framework for interviews of staff and board member in order to ensure a standardized approach to data collection. The general outline of the interview questions are as follows:

1. When was a specific site started? Is information on the exact day, month or year available? Is there another form of media that would have this information?
2. Is interviewee the head person for any of the sites? What sites are they working on?

3. Were specific goals and objective laid out? Were these goals and objectives followed or attempted?
4. What were the methodologies used? What tools were used? Were some methods or tools better suited for the goals?
5. Was there a list of plants involved with a site i.e. invasives, natives, and nonthreatening invasives? What species were removed? What species were planted? If plants were removed, how? Where some species more successful then other?
6. Was removal or planting repeated?
7. Have new goals or objectives been created or added to previous ones?
8. Are there individual projects with in the sites? What are the goals and objects of these projects?
9. Are there any recommendations for collecting or removal of specific species?
10. What is the best use of staff or volunteer time?
11. Where the goals and objectives met? Why or why not? Should the goals and objective be reworked to be more feasible if they were not met?
12. What would ideal action be for the next step or phase of specific site according to interviewee? Specific work being undertaken by interviewee?
13. Is there anything interviewee can identify as being an obstacle to continued or future work? Does the interviewee have any suggestions to finding a solution to these problems?
14. What does the interviewee view as the sites hierarchy? What site is most critical? What site is least critical? Are any new projected sites?

Interview question did not all apply to every person that was interviewed. After collecting the responses from each interview, the answers were sorted so that they could be put into the designed framework. Any additional information was then put into a word document and attached to the final framework so that it could be referenced if the extract information was needed.

Phase two included contacting people outside of FOD staff members that were identified as possibly having information in order to access all available data. Matching photos with data information to sites was used to gauge the dates and aided in piecing together a chronological understanding of restoration phases.

Phase three was the collection of data by vegetation surveys. Surveys were completed to gather a list of plants that are currently at the 12 different sites. The goal of surveying vegetation was to allow for a comparison of the initial and current species. The information on the initial

plants was collected from interviews with staff members. Information on all sites initial species lists was not available.

Phase four was the actual integration of collected data into the series of documents which all fit into the standardized framework. Some information in this phase includes; history, methodologies, success/fail rates, plant species, site ranking, site scoring system, reference map, extra notes and applicable photos for each site's section. Additionally, an easy to follow layout was included for the FOD to upkeep and add with their information and progress. The goal of phase four was to remove barriers to communication amongst staff members and to perpetrate standardized site plans that any future staff or member can access and find applicable.

Phase five was the creation of recommendation for FOD. There were three forms of recommendations the first was a set of criteria to score sites allowing for a comparison of the 12 sites. The second part of recommendations was to provide FOD with information to include on future interpretative signage for the Living Nature Trail. The final portion was the recommendations for volunteer vegetation surveys. In addition, phase four is when we uploaded the entire document to the FOD's server. Ensuring the availability and accessibility of the document is important to guarantee the staff and member understanding of the document.

Recommendation

We have identified twelve restoration site plots at HCNC, which have been described and quantified on the Excel worksheets. These Excel worksheets are purposed to provide FOD with an accessible framework for updating information about each of the sites. The framework is made available to add new data or potential new sites. Keeping active records for sites will allow

for improved management and knowledge for any staff to access. It is recommended that FOD keep this report for all to access on Dropbox or a main server if available.

Information included in the Excel worksheet include: site number, start date, goals for particular site, name of persons involved, work dates, site scoring, methodologies, tools, planting, removal and notes. Site numbers are referenced to a map of HCNC, which identifies by corresponding numbers where each site is located. The person who is leading the work will be identified as the individual who has been responsible for the site and who will most likely have the most knowledge about the site. Start dates and work dates are important to record and reference to in order to establish a timeline. Understanding methodologies used on corresponding work dates is equally important to formulate comparisons and understanding success or failure rates. A list of species and estimated percent cover will be included. Goals for each site will be stated to get a broader understanding of each site and how they relate to HCNC's Master Plan and future plans, (i.e. aesthetics, dune mat ecosystem functionality, or certain species incubation). Lastly, notes will be included for any other relatively important information that could not be categorized.

It is the goal of this project is for FOD staff to be able to use this report for continued record and data collection for each of the sites. Additionally, monitoring and evaluation is strongly recommended. Once a year in the spring, staff should do a site survey around HCNC and visit each of the sites and record a new site score and observed changes using the Excel worksheets for comparison and evaluation. Understanding site changes will be important for further site development. New data should be recorded in the Excel worksheet along with a new site score.

Site scoring will be recorded on a numerical scale of 0-5. Scoring will be an important aspect of the continued effort to improve and enhance the restoration sites as it provides an objective baseline of reference. Using simple scoring criteria will work to minimize interpretation and maximize consistency throughout all the site scoring. Scores will be ranked by quantitative data to apply to observation and estimation. This will also aid in restoration decisions, and will help in native landscaping strategic planning. A score of 0 will represent a site with all invasive/threatening non-native species percent cover, or having none of the site goals met. A score of 1 will represent a site with majority invasive/threatening non-native species percent cover, or majority of goals unmet. A score of 5 will represent a site with little to no invasive/threatening non-native species percent cover, and presently on track to complete site goals. The goals for the sites at HCNC are to serve as demonstration areas with focuses on both aesthetic value and natural diversity of native plants for visitors. Therefore, ecosystem functionality and services will not be a part of the scoring system.

Score	1	3	5
Presence of Native Species	Few or no native species present	Most or around half native species	All or significant majority native species
Cover % of Native Species	0-20%	40-60%	80-100%
Invasive Species	All or significant majority invasives	Most or around half invasive species	Few or no invasive species present

Figure 1

Figure 1 is a visual representation of the site scouring system. Sites that fall within “2” and “4” categories are estimated between the “1” and “3”, and “3” and “5” categories.

Vegetation surveys are an important way to gauge project progress and have been suggested to be done at least ones a year by a staff member. Volunteer surveying is another way to complete vegetation surveys and aid FOD in gathering the information at a greater frequency.

The recommendations that have been outlined in this section of the document were selected to allow for FOD to use volunteer surveying. In a study done by Brandon (2003) it was found that volunteers were able to reliably survey vegetation. The findings showed that volunteers are capable of collecting acceptable data for evaluating baseline changes and tracking the spread of invasive plants. The level of training to successfully identify plant species entirely depended on the number of species and what kind of information was going to be collected e.g. species cover, species composition or species richness. The results of the study found that the area that volunteers had the most difficulty of identifying species was in genera that with low species diversity. However this was also the case for some of the professional botanists.

The use of volunteer surveying would allow for FOD to collect information on a more frequent basis. This would fill in gaps in information that can be used in management decision making. This new option of volunteer work could also be used as a way to attract more volunteers. Advertising the option to work on volunteer vegetation surveys would likely attract students of the natural resource sciences that are looking to improve a resume.

Another new suggested project for FOD to consider and implement is an "Adopt a Plot" program. This would be ideal for the dedicated and passionate volunteer to work in close stewardship with one of the twelve HCNC sites. This individual would be titled the official "point person" for that site which would include a temporal and fiscal responsibility (i.e. monthly donation). In theory, this would create incentives for continued responsibility for the defined plot by instilling pride, land stewardship, and thus a sense connectedness with the land. Land stewardship and connectivity are vital assets for an individual and a community to possess. Volunteers seeking to participate in the "Adopt a Plot" program must be approved and educated

by FOD staff in order to ensure that preventable mistakes will be avoided and that the volunteer knows exactly what needs to be done.

Lastly, content for potential interpretative signage is included bellow for FOD to use when funding and labor are available. There are three different sign themes designed to go along the Living Nature Trail which include information on the importance of native species opposed to invasives/exotics, the snowy plover as a flagship species, and the different ecosystems of the dunes. To include more volunteer connectivity to FOD and HCNC, it is suggested that the FOD hold a poster/advertisement contest for education outreach for elementary school children. Students would draw and design a sign featuring the snowy plover that shows warnings about nesting grounds from information templates. The winning sign could be featured on the snowy plover interpretative signage and the winning class could get a tour at the HCNC. This could further expose students, teachers, and volunteer parents to the importance of coastal dune restoration and FOD mission.

Western snowy plover

The western snowy plover sign information has been collected to aid in the creation of an education sign about the snowy plover (westernsnowyplover.org). The information bellow is a collection of general information that can be selected from to fit into a variety of signs.

General Information

The snowy plover is a small shorebird that makes it nest on the sandy shores and in estuaries. It is about the size of sparrow, and is white and tan with black marks on the eyes, head and sides of the neck. They are federally listed as threatened under the Endangered Species Act (ESA).

Nesting Habits

The snowy plover usually lays three tiny eggs, which are tan and black speckled to look like sand for camouflage. This makes the eggs barely visible, even with a well-trained eye. Plovers will use almost anything they can find on the beach to make their nests including kelp, driftwood, shells, rocks, and even human footprints. The use of these items also helps keep the nest unseen from predators. Because the nests are so well disguised from predators humans will sometimes not see them and step on the eggs. Even if a person does not step on the nest but is instead to close it can frighten the plovers away leaving the nests unguarded. When the nests are unguarded predators can find the eggs, sand can blowing over and covering the nest, or the eggs can get cold.

Predators and other threats

The snowy plovers natural predators are falcons, raccoons, coyotes, and owls. Recently because of human activity new predators have come in likes crows and ravens, red fox, and domestic dogs. Other threats that the plover faces are; off road vehicles, bikes, foot traffic and dogs that humans bring to the beach. Kite flying is another scare for the snowy plover. When the kite is flying overhead it looks like a predator to a plover. This can scare the plover off the nest just as much as walking by the nest.

Solutions

People don’t have to stay off the beaches entirely, but instead they can share the beach. By fencing or roping off areas that the plover is nesting in and respecting the signs that say where these places are, we can share the beach. When flying kites keep in mind where the areas that are marked as nesting sites are and try to move as far away as possible. Because you may not be standing in the nesting grounds but the shadow and kite might be right on top of it.

Dunes Ecosystems

The Dune Ecosystem sign have been suggested to be used in two ways. The suggested placement of the sign would be alone the Living Green Trial facing northwest, looking over the north side of the HCNC roof. The sign would show the different sections of the dune system, e.g. waveslope, foredunes, etc. The first suggested option for the sign is to have a brief description of each dune section all on one sign. The second suggestion is the use of four sign. Using one sign for each dune ecosystem and placing these signs in the representative ecosystems. For this suggestion the first sign would be the dune forest places in the same suggested location

Waveslope

The waveslope is the area that sand is in constant movement, by the wind, waves, and tide. Because of this constant change and inundation of water few plants are found here. The plants that you might see are sea the rocket and native dune grass. Here you can see shore birds feeding on invertebrates that are in the sand and on seaweed (michigan.gov).

Foredunes

The foredune is the first ridge after the beach. Although foredunes are above waves and tides they are still subject to storm waves. Similar to the waveslope, the foredunes sands are shifted by winds. The hardy species that occupy the foredunes do offer some stability; they are usually referred to as the dune mat and are made up of a variety of wildflowers. At FOD there are two federally listed endangered plant species in the dune mat, the Humboldt Bay wallflower and the beach layia (friendsofthedunes.org).

Interdunal wetlands

The interdunal wetlands are the shallow ponds or pools located between dunes. They are created from summer winds carving out the interdune down to the water table. As the name would suggest they are found between the dune ridges. With the presence of standing water tadpoles of the pacific tree frog and red-legged frog can be found here. Unlike the dune ridges here the plants don't suffer from water stress and more water-loving plants occupy the site.

Dune forest

Dune forests are the farthest dunes ecosystem from the water. The dune forest is coniferous with species such as Sitka spruce and grand fir. The sites that the dune forests occur on are more stable than any of the other sites covered. This is because of the protection from wind and the large root systems of the different trees and shrubs

Native vs. Non-Native plants

This suggested sign would show the importance of native plants. And would talk about the negative affects the non-native/invasive plant European beach grass. The placement of this sign is suggested to be near the native beach grass nursery. We have synthesized research on *Ammophila arenaria* (Buell et. al. 1995). Some of the information included is a background on the establishment of these species, characteristics, and distribution maps in the Humboldt area.

The coastal dune system is a very unique system that has developed along with the unique plants that are found there. These plants have adapted to the condition that are found at the dune, like rapidly draining soil, high winds, contently shifting dunes and low nutrient levels. When plants that have not developed along with the dune system are introduced they bring in their own adaptations. This can cause problems for the plants and wildlife that were already there. An example of a problem causing non-natives is European beach grass. European beach grass was introduced to keep sand from blowing onto roads and railways. At the time this was thought

to help improve the dunes, but later was it was found that the shifting of the dunes was part of the ecosystem services of protecting the coast. The dense clumps of European beach grass prevent native plants from growing in areas it has invaded.

General information

Ammophila arenaria was used to stabilize dunes on the North Spit in 1901 when seeds were imported from Golden Gate Park and planted over several acres. It was brought in after previous methods to control shifting sands had failed. *Ammophila* is a coarse, perennial, rhizomatous grass with stout culms in tufts up to 120 cm tall. It grows most vigorously on mobile and semi-stable dunes and thrives in the wind-blown foredune area just inland and above high-tide line. *Ammophila arenaria* has become a threat in Humboldt Bay to the native dune mat community a foredune community comprised of over 40 low-growing herbaceous species. The rapid and successful spread of *Ammophila* through the foredunes probably resulted from the interaction of a number of processes and conditions: optimal habitat, multiple introductions to the surrounding area, natural and human disturbance, and proximity to the strand where rhizome fragments are washed ashore by storm surf. An interesting fact about European beach grass it is highly adapted to sand accretion *Ammophila* can withstands being buried in sand up to 1m per year.

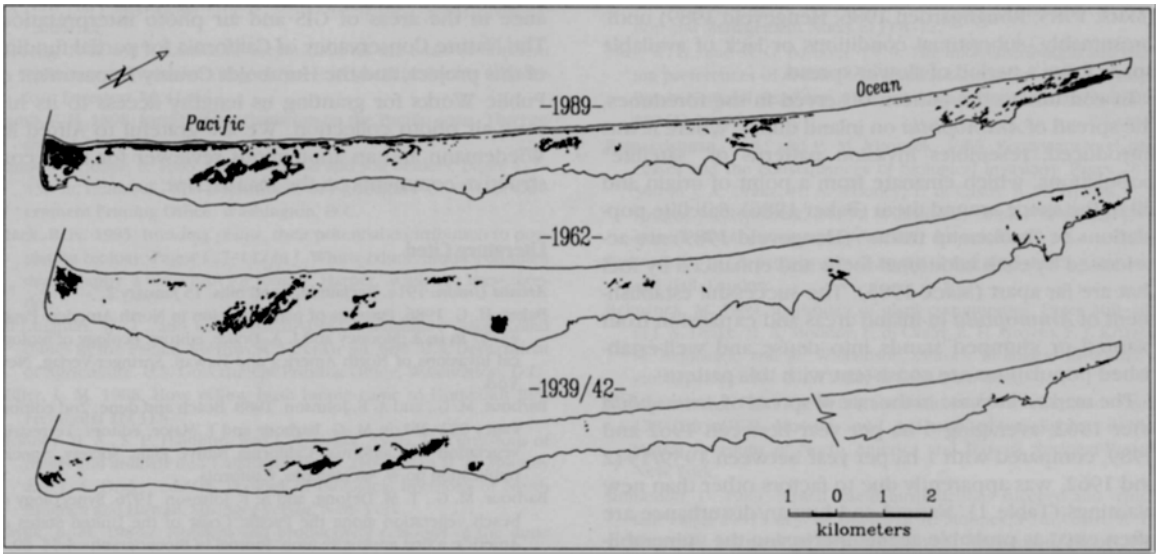

Image 3.

Image 3 shows the distribution of Ammophila arenaria on the North Spit of Humboldt Bay, California 1939/1942, 1962 and 1989. Image (?) is part of the suggested sign.

Conclusion

Both primary and secondary data was used to create this report in order to create the needed background data, which is required to establish a baseline and bring together an inclusive overview. Most of the information about the past, current, and future events for HCNC was either derived from pictures and interviews with Pete Haggard (a FOD board member), John St. Marie (a volunteer), and Carol Vander Meer (Executive Director for FOD). A formalized documentation framework has been established to enable FOD staff to access information regarding the twelve Native Landscaping sites.

With the use of interview information we have identified the three main goals of FOD currently has for the HCNC Native Landscaping project. Along with the three main goals a subset of main objectives and physical attributes has been identified, that will lead to the

completion of the goals. The three main goals are Native Landscaping, HCNC visitor education and increasing the number of volunteer Figure 2.

Project Goals	Objectives and Physical Attributes
1) Native Landscaping	Increase number of native dune mat species.
	Removal of invasives
	Conservation of rare native hybrids
	Increase cover on HCNC roof
	Keep invasives from reestablishing
2) Education of HCNC visitors	Add interpretive signs to the Living Green Trail
	Have representatives of the 4 dune ecosystems
3) Increase Number of Volunteers	Increase outreach about schedule volunteer days
	Introduce “Adopt a Plot”
	Introduce Volunteer Monitoring

Figure 2.
Figure 2 shows the project goals and objectives that FOD has outlined for the HCNC.

From information collected we have found that there is a site hierarchy, the hierarchy is as follows. Site 3 and the southeast corner of site 6 are the top priority sites. These two sections have received the most continuous work, and volunteer time. The reason for this has been that these sections are the areas with the least invasives and the goal is to continue this. With the low number of volunteers concentration on prevention at these sites has been all the FOD has had volunteer power for. Site 1 has been the ranked as the second site; the work that has been done here has been located on the south end of this site also concentrated on preventing invasives from coming back in. The goal for the future of this site is to expand the area that has been cleared of invasives and nutrient rich soil. Sites 5 and the rest of site 6 are ranked as the third site; the goal of these sites has been to establish the crest of the roof and find a method to keep sand anchored.

There have been two possible methods discussed. The first method would be to use gunnysack as a small-scale erosion control until plants have establish on the crest. The second method identified would be to grow low laying wood shrubs up and over the crest from a lower level were the plants would have an easier time getting established. The sites after this point have not received a rank and have been left up for discussion once the current sites goals have been meet.

The purpose of this project is to provide Friends of the Dunes staff, board members, and volunteers a comprehensive overview of the development and future goals of the Humboldt Coastal Nature Center (HCNC). The goal of the HCNC is to provide visitors and volunteers with access to the beach, participatory educational experiences, demonstrational ecology, and a valuable aesthetic view shed of the dune ecosystem complex. Participatory educational experiences, demonstrational ecology, and valuable aesthetic view sheds aid in instilling ecological literacy and stewardship into HCNC visitors and volunteers. Creating an aesthetically pleasing landscaping can help attract more volunteers and passing visitors to become more involved with activities at the HCNC. Ecological functionality is an underlying secondary goal for the HCNC. The main goal for HCNC is based on providing volunteers and visitors with both a pleasing view of the property and an ecological experience. This document has been created to aid FOD in achieving the goals they have for the HCNC.

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Appendixes

Notes from Interview with Carol Vander Meer

March 4, 2013

1. Would like to have an aerial map with identified sites (simple and contained)
    a. Done via Google Maps
    b. Native Landscape Area
2. Goals of Native Landscaping
    a. Demonstration/education
    b. Ecosystem services: recharging aquifers and to decrease runoff
3. Ideas to include in Final Report
    a. Benefits of native landscaping
    b. History of HCNC site: phases, timeline, duration
        i. Roof, back area, front area
        ii. Previous use, photos,
        iii. 100% volunteer work (no funding)
4. Volunteer info: methods
    a. 1st and 3rd Wednesdays are volunteer days
        i. Key: outreach
        ii. Who is coming? Who is interested? Drop-in restoration?
    b. Native transplants around the front entrance signs.
    c. Need: more drop in restoration and more guidelines to involve community (education)
5. Recommended to conduct Interview with John St. Marie
6. Methods of removal:
    a. Hand pulling
    b. Scrapping
    c. Weeding
    d. Transplanting
    e. Cuttings
7. List of plants
    a. Plantings: woody, shrub, herbaceous?
    b. Invasive species: European Beach Grass, burr clover, pampas annual grass
        i. Non-threatening: California Poppy
    c. Guidelines for collecting
        i. i.e. Goldenrod separation
8. Priority goals for HCNC
    a. Visual areas for visitors
    b. Planting site at trailhead or entry at parking lot
9. Discusses photos

   a. Compiled on a Dropbox shared folder
      i. Track transformation
      ii. Contact different people who may have more pictures
      iii. Important event: Dedication (Mike Thompson planting day on the roof)

Notes from Interview with Carol Vander Meer

April 2, 2013

1. North Roof: began January 2010
2. Front and side planters began at Dedication Day May 21st 2011
   a. Shrubs around bathrooms
   b. Planting around the out side of HCNC building
      i. Amphitheatre
3. South Roof: planting along top and down a bit later after January 2010
4. Important tool: Erosion control mat
   a. Made of coconut and straw
   b. Successful for roof establishment
5. HCNC Visitor use 2012
   a. Planting around HCNC (generic, focused native landscaping)
   b. Living Green Trail shrub planting 2012 Spring
   c. John St. Marie: planting in front area July 2012
6. Methodologies
   a. Sand compaction: hand tamping (compacting sand and soil important for dune plant species)
   b. Erosion control clothe
   c. Removal: hand, hoe, scrapping (continuous ongoing efforts)
   d. Beach Strawberries are among the best ground cover establishers
   e. Seed implant:
      i. Sea side daisy, beach buckwheat
   f. Seed only:
      i. Purple owl clover
   g. Beach burr seeded on its own (pioneered)
   h. Shrubs: red flowering currant, twin berry, silk tassel, wax myrtle, yarrow
   i. CA Poppy in the seed bank (non threatening non native) from when HCNC was owned by the Stamp Family
   j. Red Fescue Grass in front areas may be the wrong variety (from San Francisco)
7. List of Plants:
   a. Bear berry Manzanita hybrid
   b. Goldenrod and beach strawberries: good transplants
      i. Main carpet cover
   c. Beach buckwheat: transplant but seeds very well too (cheaper)
   d. Huckleberry
      i. Little success
      ii. Requires more irrigation and protection

    e. Tansy: successful transplant
    f. Coastal sagewort
    g. Bear berry on South Roof but dried out
    h. Yellow sand verbena: good seed collector
    i. Purple or silver leaf aster
    j. Shore Pine
    k. Wax Myrtles
    l. Spruce
    m. Native blackberry
    n. Knot weed: transplanted well
    o. Sea Thrift: transplanted well
8. Bee populations on the roof
    a. Long term study spearheaded by Pete Haggard
    b. Carol recommended interest in adding what Pete Haggard has so far to our end of report recommendations
9. Willows
    a. Need to be established
    b. Shallow watering may be detrimental
        i. Needs deeper irrigation to get roots to grow down
10. Invasive Species
    a. Carol recommended talking to Pete Haggard and John St. Marie
    b. Key invasive species: Poison hemlock, radishes, sheep sorrel, annual grasses, burr clover, dandelion
11. Methods for removing Invasive Species
    a. Pulling by hand
    b. Trimming
12. Goals for the sites
    a. Willows: create a wind break and delineate closure
    b. North side past roof: establish woody species for wind break
    c. West side: maintain viewshed of HCNC
    d. HCNC in general: views, education, identify opportunities for volunteers to connect with the land
13. Goals for future development of HCNC
    a. ADA Trail: trail and picnic area, planting, interp signage, expands reach beyond building…. 5+ years
    b. Identify better surface for the Living Green Trail
        i. Crushed gravel instead of woodchips
        ii. Establish stops and interpretation of native landscaping
            1. Connect visitors to the land
            2. Habitat conservation
            3. Planting native species

Notes from interview with John St. Marie

April 16, 2013

4:30

1. Roof
    a. Fabric erosion control: good for seedlings
    b. Seed collection parameters: done on sunny days for dryness and took seeds from different places to ensure genetic diversity and to not deplete any certain areas.
        i. Successful seed collection: sagewort, buckwheat
    c. Transplanted a lot of beach strawberries, successful mat establishers
    d. Added drip irrigation in for bear berry
    e. Gunny sack method
        i. Sacks filled with sand and seeds to be placed on roof to increase seedling survival. Sack ultimately disintegrates.
    f. Sand thinning on East and West sides of the roof.
        i. Loss of 2-3 inches
        ii. Loss of beach strawberries in thinned areas
2. Living Nature Trail
    a. Key invasives: annual grasses, mustard, Mexican tea shrub, sheep sorrel, hood clover, and burr clover
        i. Managed by hoeing
        ii. Other methods include: scrapping and hand pulling
    b. Goal: get sand back, return to dune like soils
        i. Needs to degrade soil (sand)
3. Priorities: Walkways and front planters
4. Methods:
    a. Should go lighter on watering the natural landscape
        i. Watering encourages invasives to grow and spread
        ii. Plantings done in the fall and winter, except for woody species
    b. When to plant
        i. Plant during the Fall or Winter when there is more moisture
        ii. Natives have evolved to the water regime in the area so use it to the your advantage
        iii. Weeds/invasives do better when there is excess water, try to keep watering to a minimum
5. Identified another site we had left out of our HCNC maps, named Site 12.
6. Volunteer work
    a. Keep hitting the areas that have already been worked on don't allow the invasives to get reestablished.
    b. Summer is the time to weed
7. Plants vs. seeds
    a. Seeds did better
        i. Probably because of moisture head on to by the mat

        ii. Some areas are more dense then others and not a nature density, this is because there were large numbers of seeds planted at the start
8. Things that didn't work
    a. Soaker hose did not work
        i. Didn't target the plants
9. Next step
    a. Expanding the front (Living Green Trail)
    b. Finish the back south plot that has been put on hold (the area near the dump)
    c. Wants/will be adding Pink sand verbena in the winter of 2013, hope it will establish well
10. Roof problems
    a. The roof has established well except for the very top portions
        i. Sand has blown away and there are only a few plants in the problem areas
    b. Things that will be tried
        i. Possibly use a drip system for the hybrid bearberry
        ii. Use of gunny sacks
            1. The goal is to fill the sacks with sand and seeds. As the seeds grow and get established the sand will be stabilized by the time the bag deteriorates.
11. Question that still need answers
    a. How much training is required for volunteers to successfully do work
        i. Would it be feasible to letting them do more or is supper vision still needed?
        ii. How to do better out reach, there is a need for more volunteers

Notes from interview with Pete Haggard:

April 25, 2013

4:00

1. Native bee project-started last year on the roof to see how long it takes for native bees to return.
    a. Goal is to get baseline data for a long term project
2. Carol, John, and Pete restoration techniques
    a. Decided to get plants from natural genetic area
        i. Seed collection
        ii. Bought some from local native nursery
    b. 1st goal for HCNC: get sand on the roof and STABALIZE (via planting and erosion control mat)
    c. Goal and methods of 1st two years of Roof establishment:
        i. Scattered seeds and put down erosion control mat
        ii. Implementing weeding by hand(eventually will end once natives established more)
        iii. Watered the 1st year
        iv. 2nd year, plants on their own
        v. Identified Challenge of Roof: Planting in the sand, stabilization, annual grasses
        vi. Roof seen as an overall success.
    d. Another 5 years everything will be established and "ok"
3. Site 1: Weed elimination
    a. Power source of 1st year=Volunteers, CCC,
        i. Planted lots of beach strawberry
    b. Established but no tall plants or trees, goal for site is a "sweeping" landscape
    c. Manzanita and Bear Berry hybrid
        i. Unique and native
        ii. Rescued from being destroyed from development
    d. Woody plants were lost initially because of the dry spring.
4. Idea for future program/project: Small native plant garden displaying Native American plants and what they were/are used for
    a. i.e. food, basket weaving
5. Challenge at FOD:
    a. Volunteer power: an extremely limiting factor, not enough volunteers.
    b. Burr clover: key bad invasive, an annual, difficult mat to break, will be a problem for 3-4 more years.
    c. Sheep sorrel: another key bad invasive species
    d. People and dogs

        i. Dog feces
        ii. 4WD running over pines and young woody plants
        iii. Littering
6. Beneficial and successful native plants:
    a. Beach strawberry- good stabilizer for ushering in more native plants.
    b. Buckwheat- good to collect and grow from seed, native bees and butterflies lay their eggs on them.
        i. Mentioned David Gordon's Master's Thesis on native bees
7. Site 10: willows need to get rooted which has been difficult because of the drought. May take 2-3 years to get established
8. Site 11: Lots of problems (identified 5c)
    a. People, dog, and car traffic run over plants
    b. Dog feces
    c. Littering
    d. Gumplant (*Grindelia stricta* var. *stricta*) more tolerant to traffic
    e. Could put in steaks to deter traffic in area but could be seen as a challenge
9. Dump Site: Site 8
    a. Poison hemlock-key invasive
10. Priority areas:
    a. Front area
    b. Roof
11. Hybrid
    a. Collected from Samoa bridge
        i. The area is going to be developed soon
        ii. Wanted to keep this native hybrid that only grows in the Samoa bridge area
        iii. Not a cultivar
        iv. Goal rescue/preserve
12. Happy with the Roof, but recognizes it will just take time to get established
13. Identified Need: MORE VOLUNTEERS
14. Identified successful techniques:
    a. Comb over planting technique (establish uphill)
    b. Seed scattering more successful
        i. Beach goldenrod rooted the best and can take some traffic

Image 3: Aerial Map of Native Landscaping Plots at HCNC

Created by Emily Clark and Chelsea Tougas with Google Maps

Site Number	Site Name
1	Living Green Trail
2	Native Beach Grass Nursery
3	Front Planters
4	South Front Area
5	North Roof
6	South Roof
7	Amphitheatre
8	Dump Area
9	Permeable Surfaces
10	Willow Area
11	Parking Lot
12	ADA Parking Lot