

McKinleyville Land Trust
Dow's Prairie Wetland



Environmental Science Senior Project
Spring 2009

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Outline of Goals, Objectives and Implementation:

Goal 1: Delineate Wetland

Objective A: Sample and identify 90% of plant species on property.

Objective B: Soil 363 group will dig soil pits to identify and map soil in GIS.

Implementation:

1. Utilizing the Army Corps of Engineers Wetland Delineation Manual (1987), wetland boundaries on the property will be identified and mapped.

Target Date: April 20, 2009

Goal 2: Remove Invasive Plant Species

Objective A: Remove 50% of the current Scotch Broom population.

Objective B: Remove 50% of the current Himalayan blackberry population.

Implementation:

1. Physical removal of Scotch Broom will take place on weekends in March and April.
 - a. Weed wrench, machetes, pruners and shovels will be used to remove existing Scotch Broom when possible and eliminate flowering parts when full removal is not possible.
2. Physical removal of Himalayan Blackberry will take place at a future date
 - a. Blackberry will be pulled out by the roots when possible, or clipped to the ground when full root removal is not possible.

Target Date: May 2, 2009

Goal 3: Reintroduce Native Plant Species

Objective A: Introduce 3-5 native plant species

Implementation:

1. Under assistance by a representative from the California Native Plant Society (CNPS), recommendations will be made for the introduction of native species.
2. Specific number of propagules, locations for planting, and costs will be determined and submitted with the final report to the McKinleyville Land Trust.

Target Date: May 2, 2009

Goal 4: Increase Community Awareness of the Sensitive Ecosystem

Objective A: 10 community members help with invasive plant species removal.

Objective B: 10 community members attend an educational outing on the site.

Implementation:

1. Lisa will attend the McKinleyville Land Trust Annual Dinner 2009
 - a. An announcement will be made regarding Scotch broom removal and an Open House tentatively scheduled for May 9, 2009.
 - b. A contact list will be collected at the dinner and all interested parties will be notified of the upcoming events.
 - c. The educational outing will be the Open House where attendees will be informed of the work at the pool property to date, the nature of the unique ecosystem and the recommendations for future management.
 - d. Brochures will be distributed at the Open House and a press release submitted to the North Coast Journal with Board approval.

Target Date: May 9, 2009

Goal 5: Create a Management Plan

Objective A: Outline short/long term goals regarding the educational use of the property.

Objective B:

1. Outline invasive/native plant species management
2. Produce guidelines and schedule for future management and restoration efforts

Implementation:

1. Make arrangements with McKinleyville Land Trust for an annual broom/blackberry pulling event.
2. Create informational and interpretive signs to be posted permanently on the property
3. Place "roping of the Vernal Pool" on the Land Trusts December Agenda

Target Date: May 9, 2009

General Actions Not Covered in Above Implementation:

1. Integrate property into HSU professor Allison Purcell's restoration curriculum
2. On-going utilization of the property as a model of wetland and restoration in cooperation with the Land Trust and professors at HSU

Problem Statement:

The invasive species, Himalayan Blackberry and Scotch Broom, currently occupy approximately 35% of the Dow's Prairie property. The unique and sensitive properties of the ecosystem are currently unknown to the local community. The McKinleyville Land Trust is currently lacking a management plan for invasive species and restoration for the Dows Prairie Property.

1.0 Introduction:

The Dow's Prairie wetland is located approximately 95 meters east of Central Avenue on Grange Road in McKinleyville. In the year 2000, the McKinleyville Land Trust began an eight year effort to acquire this unique property. The entire project includes 6 acres on the corner of Central Avenue and Grange Road. In December 2008, the McKinleyville Land Trust succeeded in the acquisition of 2.55 acres of the total 6 acres. The 2.55 acre parcel contains a seasonal pond and its acquisition is the first phase in the McKinleyville Land Trust's proposal to acquire the entire 6 acres. The site is intended to provide visibility of the land trust conservation process. The property is intended to be an educational site for the adjacent Dow's Prairie Elementary School and the general public. The second phase of the project includes the removal of exotic vegetation, the development of an interim and long-range plan, and the development of an amphibian school curriculum (McKinleyville Land Trust Project Description, 2000).

The Dows Prairie wetland is the site of a unique ecosystem, a seasonally-ponded wetland. Wetlands are among the most threatened ecosystems in California. The preservation and restoration of this McKinleyville Land Trust property provides an opportunity to preserve one of the few that remain.

There are many species of plants found at the Dows Prairie property; some are native and some are invasive. Our goal is to identify which species are native to the area and which are invasive. Our intention is to remove the invasive species Scotch Broom and Himalayan Blackberry and to prevent further encroachment by recommending an invasive species management plan.

1.1 Wetland Functions and Services:

(Reference: Professor Sharon Kahara lecture to HSU, SOIL 363 Class, March 2009)

Wetlands provide multiple functions within the geographical region where they are located. These functions include hydrologic services and providing wildlife habitat. Wetlands provide services such as storm water interception, water storage, ground water recharge, sediment trapping and carbon sequestration. Another important function of wetlands is the purification of water and the interception of pollutants within watersheds. The saturated conditions also promote anaerobic activity in the underlying substrate of wetland ecosystems. Anaerobic microbes break down toxins, mitigating damage to down-stream biota. Because wetlands sequester water in seasonal ponds, wetlands also provide valuable water storage and contribute to groundwater recharge. Flood prevention is another important service provided by wetlands. The maintenance of riparian areas helps to prevent sudden inundation of rainwater runoff into developed areas. In addition, the presence of coastal salt marsh and mangrove ecosystems has been shown to provide a buffer against hurricanes. Finally, wetlands trap sediment that may otherwise enter lakes, rivers or oceans and cause abnormally high levels of turbidity. Upon entering the wetland, water velocity is slowed and sediments are deposited.

In addition to these important services, wetlands provide critical habitat for many amphibians, fish and birds. Waterfowl migration corridors include critical wetland breeding habitat for waterfowl, and 95% of commercial fishery harvest depends on wetlands that act as spawning nurseries. Some species of fish require up to 5 years to reach maturity and the presence of wetland habitat is crucial to their survival into adulthood.

1.2 Why not a Vernal Pool?

The Dow's Prairie Wetland was previously referred to as a "vernal pool" wetland by the McKinleyville Land Trust, but upon further consideration, it was concluded that the site does not meet the criteria that define vernal pools. Vernal pools are episaturated, seasonal, freshwater wetlands (Richardson, 2001). Episaturation indicates that the soil surface is saturated from above either by precipitation and/or a perched water table. Saturation does not originate from groundwater or an underground spring. An underlying layer of weakly lithified sandstone has low permeability. Because of the sandstone, precipitation and runoff from the immediately surrounding areas accumulates in the depression. The pool fills with water from winter and spring rains and remains ponded for 4-5 months. When heavy rains cease, the water in the pool evaporates.

Currently, there is no clear definition of what constitutes a Vernal Pool. World-wide ecosystems referred to as Vernal Pools vary in size and species composition. Typical vernal pools in California are located in the Central Valley. These pools are underlain by claypans and duripans (a silica cemented soil horizon) (Richardson, 2001) that prevent deep percolation of the rainwater into the underlying ground water system. Typical vernal pools also form networks of proximate pools as precipitation fills one pool and then moves along interconnected surface channels and shallow ground water channels to successive pools in the area (Richardson, 2001). In addition, Vernal Pools are typically populated with rare, endemic, herbaceous perennials specific to each pool area.

Although the property contains a seasonally-ponded depression, vegetation surveys have not revealed rare, or endemic species and aerial photography has not revealed a network of pools in the area. Due to these factors, the lack of an underlying hardpan, and the geographical location of the pond, we have concluded that it is not a Vernal Pool.

2.0 General Site Description

2.1 Topography

The Dow's Prairie Wetland has a bowl-like topography. Contour lines are circular around the pool and elevation in feet above sea level decreases from 220 in upland areas, to 216 at the wetland boundary, to 214 near the center of the pool. Because of this bowl-like topography, water drains into the pool basin from Grange Road and land on all sides.

2.2 Hydrology

The property is located in the Dow's Prairie Sub-Basin which is bounded by Little River to the North and Mad River to the South. The Sub Basin is an elevated terrace drained by Mill Creek, Strawberry Creek, and White Creek. Groundwater formation occurs primarily in the western portion of the sub-basin and recharge is dependent on precipitation (HRCG, 2004). Average rainfall is 102 cm to 153 cm with the majority of precipitation occurring from October to May. (Soil Survey Staff, 2009)

2.3 Geology and Soil

The soil is characterized by the Natural Resource Conservation Service (NRCS) as Arcata series soils. This soil series consists of very deep, well-drained soils characterized by loamy, mixed, isomesic, Typic Hapludoll (Soil Survey Staff, 2009). At the soil taxonomic hierarchy of sub-order, "Udolls" are humid Mollisols. Mollisols are formed by the accumulation of calcium-rich organic matter from the dense root systems of prairie grasses, or in depressions where forest vegetation was present during formation. Mollisols have a dark surface horizon that is often 60-80 cm thick (Brady, 2002). The history of the

Dow's Prairie Wetland suggests each of these may have contributed to the formation of the thick, dark surface horizon at the site. NRCS Soil Survey staff note that some Arcata series soils in the Dows Prairie area may have a thick dark layer (10YR 3/2) up to 4 feet deep. The soil has good drainage, slow surface runoff and moderately-rapid permeability. Recent soil sampling pits confirmed a thick dark surface horizon 50-100 cm thick. Underlying the upper horizon is a layer of weakly lithified sand-stone that contains gravelly material found at some locations. This weakly lithified sand-stone is poorly drained and may be contributing to the temporary perching of precipitation and local runoff that creates the seasonal pond and surrounding wetland area.

2.4 Biota On-Site

The Dow's Prairie Wetland has evidence of several animal populations. Frog vocalizations have been heard throughout the property and egg masses were found on the grassy area surrounding the pool in early February. Although no detailed wildlife analysis was performed, there is evidence of deer (as decimated carcass), voles, gophers and birds. Furthermore, the Northern Red Legged Frog and the Southern Torrent Salamander are recognized as sensitive species and have been identified in nearby areas.

2.5 Plant Community

(See Tables 2,3 and 4)

The plant community on-site consists of both native and invasive species, a few of which are listed by the California Native Plant Society as problematic invasives. Among the invasives are Scotch Broom, English Holly, Cotoneaster and Himalayan Blackberry.

3.0 Targeted Invasive Species

3.1 Scotch Broom (*Cytisus scoparius*)

Scotch Broom is an invasive plant species in the Pacific Northwest and Eastern Coast of the United States and Canada. It is native to Central and Western Europe and was introduced as an ornamental plant in the 1800's. Leaves are small, alternate and compound with 3 leaflets. The leaves are often not noticeable, due to the dark green stems. The flowers are bright yellow, resemble sweet pea flowers and occur singly in axils of the leaves. Seed pods (legumes) are fuzzy on the edges, 1-2 in. (2.5-5 cm) long and will explode when mature. (GISD, 2005).

Scotch Broom grows well in areas that have cool, wet, winters. It grows well in direct sunlight. The plants produces many seeds protected with hard coats. When pods mature the seeds are ejected from the pods with an audible pop (SNP, 2009). The hard seed coats allow seeds to lie dormant from 60 to 80 years until conditions are optimal for growth.

Scotch Broom is usually spread by sticking to the wheels of trucks or tractors, or by birds, mammals or insects. In some areas ants collect the seeds of Scotch Broom aiding in their dispersal (OSU, 2009).

It is recommended that in ecologically sensitive areas Scotch Broom is removed manually. Manual removal consists of removing the entire plant including the majority of its root system. Small plants can be removed by hand while larger plants can be removed with the aid of shovels, picks or a patented tool called a *Weed Wrench*. The *Weed Wrench* is essentially a lever which attaches to the base of the plant and assists in removing the plant in its entirety. This tool is recommended for removing larger Scotch

Broom. Removed plants can be left on site and composted or taken to a green waste disposal site. The removed material may also be mulched and used to cover trails or the removal area itself. This mulch prevents re-sprouting and aids native species in their re-colonization of areas once overrun by Scotch Broom. This pervasive species is tough to eradicate and requires years of follow-up removal to prevent reestablishment of Scotch Broom (USNPS,2009).



tncinvasives.ucdavis.edu/photos/wrench3.j



sanjuan.wsu.edu/noxious/images/WeedWrench72.1.jpg

3.2 Himalayan Blackberry (*Rubus discolor*)

Himalayan Blackberry is the most pervasive of the invasive plant species at the Dow's Prairie Wetland property. The majority of the population exists along the eastern side of the property along the periphery of the *Spirea douglasii*. Most of the *S. douglasii* stand, and the pool area in its entirety have not been invaded.

Himalayan Blackberry is native to Eurasia and was introduced to North America in 1885 as a cultivated crop. It is often found in sensitive wetland habitats and is successful at crowding out all other vegetation (GISD, 2005). This is apparent at the Dow's Prairie Wetland where large portions of the property consist of entirely Himalayan Blackberry.

Himalayan Blackberry can be identified by thick stems which are 2-3 cm in diameter, thorns up to 1 cm, and leaves clustered in fives with white undersides. Stems can grow up to 4.5 meters in length, and are capable of rooting at the nodes when they arch back towards the ground. In the first-year shoots (prima cane) no flowers are produced. In the second year of growth, side shoots will emerge with smaller leaves in groups of three. The shrub will also begin to produce flowers in the late spring or early summer of the second year with five petals, usually pink or white, that are approximately 2-2.5 cm in length (GISD, 2005). The shrub produces fruits that are 1-2 cm in diameter and are black when mature. Birds distribute the seeds after eating the fruit and there is evidence suggesting that seed passage through a bird's digestive system increases seed viability (USNPS, 2009).

To remove Himalayan Blackberry the canes should be cut and the roots dug up when possible. Several years of follow-up removal of re-sprouting will be required.

4.0 Discussion of Goals and Objectives:

Alternatives were generated, discussed and rated prior to the implementation of Objectives. A list of alternatives considered is located in Appendix C.

4.1 Goal 1: Delineate Wetland

Objective A: Sample and identify 90% of plant species on property.

4.1.1 Non-Invasive Species

4.1.1a California Native Plant Society (CNPS) Vegetation Series

“Introduced perennial grassland series”

The site is dominated by the introduced (non-native) species, Creeping Bent Grass (*Agrostis stolonifera*) and is classified as “Introduced perennial grassland series” by the CNPS. This series is characterized as wetland habitat that is seasonally or permanently saturated with a shallow water table. The series is often considered part of the northern California coastal prairie and has a dominance of introduced grass species (CNPS, 2009).

4.1.1b Secondary Dominant Plant Species

Douglas Spiraea (*Spiraea douglasii*) is intermixed with Creeping Bent Grass around the seasonal pond. These members of the Rosaceae family are herbaceous perennials that are 2-3 feet tall and form dense foliage that appears to dominate about 35% of the property. A volunteer from the CNPS reports that this is the largest *Spiraea* stand in the area.

4.1.1c Other Plant Species (See Appendix A for complete list of identified plant species)

The Army Corps of Engineers (ACOE) manual Chapter 2: Hydrophytic Vegetation Indicators are used to assess the “assemblage of plant species growing on a site, rather than the presence or absence of particular indicator species.” Wetland plant species are designated by the U.S. Fish and Wildlife Service, National Wetland Inventory as: OBL, FAC, FACW, FACU, and UPL. (USFWS, 1997) These designations are determined by state and some wetlands may lack any of these indicators. In order to evaluate the presence of hydrophytic vegetation on a site, ACOE recommends separating vegetation into the following four strata:

1. *Tree stratum* – Consists of woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.
2. *Sapling/Shrub stratum* – Consists of woody plants less than 3 in. DBH, regardless of height.
3. *Herb stratum* – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size.
4. *Woody vines* – Consists of all woody vines, regardless of height.

The Army Corps of Engineers (USACE) Wetland Delineation Manual designates plant species by wetland indicator status for the purpose of identifying jurisdictional wetlands. Results of nationwide surveys by state resulted in statistical occurrence of species. For delineation purposes, species are now given designations of Obligate (OBL), Facultative (FAC), Facultative-Wet (FACW), Facultative-Upland (FACU) and Upland (UPL). Species are considered “hydrophytic” if they have a FAC, FACW, or OBL designation.

The ACOE Regional Supplement utilizes three indicators: Dominance test, Prevalence index and Morphological Adaptations. If more than 50% of a site is dominated by OBL, FACW or FAC species, the site exhibits hydrophytic vegetation according to USACE Indicator 1 (See ACOE, 2008 for more detail).

Table 1: Frequency of Species Occurrence in Wetlands for Designation

| | |
|------|--------|
| OBL | > 99% |
| FACW | 67-99% |
| FAC | 33-67% |
| FACU | 1-33% |
| UPL | <1% |

Based on the nationwide surveys, plant species may have different designations in different states. The US Fish and Wildlife Service maintains a National Wetlands Inventory (1997) of plant species and wetland designation. The ACOE Regional Supplement utilizes three indicators: Dominance test, Prevalence index and Morphological Adaptations. If more than 50% of a site is dominated by OBL, FACW or FAC species, the site exhibits hydrophytic vegetation according to the Dominance Test. The Prevalence Index is used if the vegetation does not meet the Dominance Indicator. The Prevalence Index uses mathematical ranking to determine if a site has meets the hydrophytic vegetation parameter (See ACOE, 2008 for more detail).

Table 2: Pre-Existing Non-Invasive Species List

| Species | Common Name | Wetland Designation | Location on Property |
|---|-------------------------------------|---------------------|--------------------------------------|
| Tree Stratum | | | |
| <i>Malus sylvestris</i> | Apple | none | Non-Native (1 individual) |
| <i>Pinus contorta</i> | Lodgepole pine | none | South and West border |
| <i>Pseudotsuga menziesii</i> | Douglas-fir | none | South-east corner |
| <i>Salix spp.</i> | Willow | FACW-OBL | North border |
| Shrub Stratum | | | |
| <i>Lonicera involucrate</i> <i>var. ledebourii</i> | Twinberry | FAC | One individual found along new trail |
| <i>Rosa sp.</i> | | | |
| <i>Rubus ursinus</i> | California blackberry | FAC | South-west central |
| <i>Spiraea douglasii</i> | Spiraea | OBL | Central property |
| Herb Stratum | | | |
| <i>Agrostis stolonifera</i> | Creeping Bent Grass | FACW | Most dominant |
| <i>Anthoxanthum odoratum</i> | Sweet Vernal Grass | FACU | Not Native |
| <i>Carex obnupta</i> | Sedge | OBL | |
| <i>Cynodon dactylon</i> | Bermuda grass | FACU | |
| <i>Fragaria chiloensis</i> | Beach strawberry | none | East edge |
| <i>Juncus effusus</i> | Soft rush | FACW | Central property |
| <i>Lathyrus sp</i> | Wild Pea | | |
| <i>Lotus corniculatus</i> | Bird's Foot Trefoil | FAC | |
| <i>Plantago lanceolata</i> | English plantain | FAC | Not native |
| <i>Polystichum munitum</i> | Sword fern | none | South border |
| <i>Potentilla anserina</i> <i>ssp. pacifica</i> | Cinquefoil | OBL | Pool area |
| <i>Raphanus raphanistrum</i> | Wild Radish ("Jointed Charlock") | none | East border |
| <i>Rumex acetosella</i> | Sheep sorrel | FAC | Not native |
| <i>Vicia gigantea</i> | Vetch (native) | none | Property borders |
| <i>Taraxacum officinale</i> | Dandelion | FACU | |
| <i>Vicia spp.</i> | Vetch | | Property borders |

4.1.2 Invasive Species

Table 2 describes the invasive species found on the property. The California Native Plant Society (CNPS) lists invasive species as "A" or "B". An "A" designation indicates that a species is most harmful, and a "B" designation indicates that a species is of concern.

Table 3: Invasive Species List

| Species | Common Name | CNPS List | Location |
|-------------------------------|----------------------|-----------|---------------------------|
| <i>Cotoneaster franchetti</i> | Cotoneaster | B | South border |
| <i>Cytisus scoparius</i> | Scotch broom | A | East, South, North border |
| <i>Ilex aquifolium</i> | English holly | A | South border |
| <i>Rubus discolor</i> | Himalayan blackberry | A | All borders |

Objective B: Soil 363 group will dig soil pits to identify and map soil in GIS.

See Appendix A: Wetland Delineation Report

4.2 Goal 2: Remove Invasive Plant Species

It is recommended that in ecologically sensitive areas Scotch Broom is removed manually. Manual removal consists of removing the entire plant including the majority of its root system. Small plants can be removed by hand while larger plants can be removed with the aid of shovels, picks or a patented tool called a *Weed Wrench*. The *Weed Wrench* is essentially a lever which attaches to the base of the plant and assists in removing the plant in its entirety. This tool is recommended for removing larger Scotch Broom. Removed plants can be left on site (USNPS, 2009).

Objective A: Remove 50% of the current Scotch Broom population.

4.2.1 Scotch Broom Removal Techniques:

The most fundamental tool for Scotch Broom removal is the Weed Wrench. This apparatus comes in various sizes that can individually be matched up to the size of Scotch Broom plants present in an area. The most common size used in our removal project was the medium size. The local BLM did not have any of the large sized Weed Wrenches, but the medium size was effective in most cases. By chopping out surrounding foliage, the base of the Scotch Broom plant is uncovered. The Weed Wrench can be fit onto the base of a plant and the use of leverage jacks the plant, along with most of the roots, out of the ground. During times of high precipitation, the Scotch Broom plants could be push and loosened by two people. This was also an effective mode of removal for plants that were too large to fit the medium sized Weed Wrench around. It's also helpful to use a machete to narrow the base of the Scotch Broom plant in order to fit the wrench around the base. In several instances, the stalks would be split into several branches just above ground level. Typically, if the plant was too large in diameter for the wrench, the effective method of removal involved segmenting the base into individual smaller stalks that the wrench could fit onto.

With extremely large plants topping 10 feet, a combination of techniques must be utilized. In many cases, the plants were so large that they couldn't be moved. Therefore, by digging in the ground around the stock, the main roots would be exposed and then chopped with a machete. This would allow the entire plant to be moved and pushed in order to loosen the plant from the ground. In many instances,

plants would be attached by only a couple of large roots. It is in this situation where two or more people must yank and pull on the entire plant, in unison, to achieve removal. This method also removes a large portion of the roots. The ideal time frame to implement this technique is directly following precipitation. The technique will remain a viable removal option for up to a week; depending on how fast the soil dries. If large roots remain in the soil after a plant has been removed, they can typically be pulled out with a moderate amount of effort. If the root is too large to be pulled out by hand, the Weed Wrench can again be utilized. By attaching the wrench to the root, the same principle discussed above can be applied to remove the root and prevent future re-sprouting.

Results

We estimated that at the start of the project approximately 35% of the Dow's Prairie Wetland was predominantly made up of Scotch Broom. We removed an estimated 40% of the Scotch Broom present on the 2.55 acres.

Objective B: Remove 50% of the current Himalayan blackberry population.

4.2.2 Himalyan Blackberry

We estimated that 40% of the site was covered by Himalayan Blackberry. We were able to remove roughly 30% of the Himalayan Blackberry present on our site.

4.3 Goal 3: Reintroduce Native Plant Species

Objective A: Introduce 3-5 native plant species

4.3.1 Introduction of Native Plant Species

Our plan includes the (re) introduction of native plant species in areas where Scotch broom (*Cytisus scoparius*) and Himalayan Blackberry (*Rubus discolor*) were removed. There is very little vegetation left in this area, and in some areas the soil is bare because it was almost completely dominated by the invasive species. The patch of land cleared of invasive species can now be labeled as "disturbed habitat." Without proper management of native plant introduction, it will be re-colonized by the invasive species. Scotch broom thrives in full sun, so planting trees that will establish quickly and create shade will help reduce the re-establishment of Scotch broom in the removal areas.

Research and additional consultation with the California Native Plant Society (CNPS), has resulted in a list of plants ideal for the cleared area. Willows (*Salix spp.*) are a fast growing deciduous tree species. They are a good option for several reasons. First of all, there are already Willow trees growing on site. Willows provide habitat for birds and attract pollinators. Cuttings from the existing trees can simply be stuck in the ground and they have high likelihood of survival. This makes them a very economical choice. The CNPS also recommended Red Alder (*Alnus rubra*), Big Leaf Maple, (*Acer macrophyllum*) as trees that establish quickly and provide significant shading. Twinberry (*Lonicera involucrata*), a deciduous shrub is already growing at the edge of the forest on site and may be a good option. Some evergreen shrubs such as the hardy Silk Tassel (*Garria elliptica*) or Pacific Wax Myrtle (*Myrica californica*) would be a wise addition to help with shading all year. There are several surviving Sword Ferns (*Polystichum munitum*) that were growing under the removed Scotchbroom, and many others in the shaded south border of the property. Introducing more of these ferns is recommended in future years when more shade is

established. Seashore Lupine (*Lupinus littoralis*) is suggested for its hardiness. Wild Strawberry (*Fragaria chilensis*) makes an excellent ground cover and spreads quickly. Native grass seeds could be planted but will have low survivorship this late in the season.

4.3.2 Planting Methods

Most plants should be spaced at approximate 5 foot intervals, and willows can be more closely spaced. A mixture of tree species with approximately 40% Willow, 40% Red Alder and 20% big leaf maple will create diversity and have high survivorship. Wild Strawberry should be planted in between trees. 1-3 Silk Tassels and/or Pacific Wax Myrtle may also be a wise addition to create year round shade, thereby increasing moisture retention. Willow propagules can be made by taking cuttings from individuals on site. One gallon or 3-5 gallon seedlings are recommended for other tree species. To ensure high survivorship regular watering will be necessary through the May to October dry season for this year and intermittent watering will likely be necessary for the next year to ensure high survivorship. The property has evidence of a deer population and the animals are likely to feed on Alder and Myrtle saplings. Appropriate fencing will be required, and will be placed around each individual or cluster of trees.

Mulching all of these plants is important in ensuring their survival. Mulch retains moisture and prevents re-sprouting of invasive species. Mulch can easily be obtained on site by using dead grass.

In the long-term, after the invasive species eradication plan is complete, aquatic plants can be introduced around the pool. This will provide additional habitat for amphibians as well as help the pool retain moisture. Possible future aquatic plants include: Yellow eyed grass, Douglas Iris, Red flowering Currant, and Salal.

The CNPS recommended Freshwater Farms (Owner Rick) and Humboldt Fish Action Council, a non-profit (Contact Susan Isaacs) as sources for free seedlings. Freshwater Farms will donate roughly 20 Red Alders, 5-6 Big leaf Maples and 20-30 Wild Strawberries.

Native plants need to be established as soon as possible to give them a good advantage going into the dry season. A small sample of native plants will be established right away to provide a model for future planting. Eli planted several Willow (*Salix sp.*) cuttings from the existing trees on the property. Gina Rimson, our communication liason with the McKinleyville Land Trust, has agreed to water the trees once a week during the summer. Eli will plant 3 Red Alders (*Alnus rubra*) and 2 Big leaf maples (*Acer macrophyllum*) during the Open House on Saturday, May 9th.

Table 4: Recommended Native Species for (Re) Introduction

| Species | Common Name | Wetland Designation |
|-----------------------------|--------------------|---------------------|
| Tree Stratum | | |
| <i>Acer macrophyllum</i> | Big Leaf Maple | FAC |
| <i>Alnus rubra</i> | Red Alder | FACW |
| <i>Salix sp.</i> | Willow species | OBL-FACW |
| Shrub Stratum | | |
| <i>Garria elliptica</i> | Silk Tassel | none |
| <i>Myrica californica</i> | Pacific Wax Myrtle | FAC |
| <i>Lonicera involucrata</i> | Twinberry | FAC |
| Herb Stratum | | |
| <i>Fragaria chilensis</i> | Wild Strawberry | none |
| <i>Lupinus littoralis</i> | Seashore Lupine | none |
| <i>Polystichum munitum</i> | Sword Fern | none |

4.4 Goal 4: Increase Community Awareness of the Sensitive Ecosystem

Objective A: 10 community members help with invasive plant species removal.

4.4.1 Community Awareness

On March 28, 2009, Lisa Rodgers attended the McKinleyville Land Trust Annual Dinner. The Land Trust displayed photos and information about the project and student involvement. Lisa placed sign up sheets near the display, and the Land Trust President announced the need for volunteers to the dinner attendees. This generated only one volunteer.

On April 25, 2009, HSU Professor Alison Purcell brought her restoration class to the Dow's Prairie Wetland. Lisa Rodgers gave the class an introduction to the project and the property and the group answered questions about the invasive removal and native introduction plans. The class of 20 students worked for 45 minutes and cleared additional land area of Scotch Broom and Himalayan Blackberry. Piles of previously pulled plants were moved to the front of the property for mulching. The student involvement resulted in increased awareness and interest in the project, and generated one additional student contact who expressed interest in continuing work at the wetland.

Objective B: 10 community members attend an educational outing on the site.

4.4.2 Open House

An Open House is scheduled for May 9, 2009 from 11am – 1pm on the property. Group members will be available to inform the community about the project, display the work that has been done, and answer questions. In preparation for the Open House, brochures will be made and a press release submitted to at least one local paper. Copies of documents and an herbarium notebook will be available for public viewing.

4.5 Goal 5: Create a Management Plan

Objective A: Outline short/long term goals regarding the educational use of the property.

Objective B:

1. Outline invasive/native plant species management
2. Produce guidelines and schedule for future management and restoration efforts

4.5.1 Restoration and Management Plan

A management plan was created and given to the McKinleyville Land Trust. The plan does not include the educational use of the property. The plan outlines recommendations for invasive and native plant species management, and includes a seasonal schedule of when work should take place.

4.5.2 Summary of Future Restoration and Monitoring

(See Appendix B for complete Restoration and Management Plan)

4.5.2a Suggested Monitoring and Evaluation Methods

Monitoring and evaluation of plant species should be on-going. Initial vegetation inventories can be enhanced with future evaluation of species abundance. It is expected that the diversity of the property's ecosystem will increase over time as invasive species are eradicated. In addition, animal and amphibian surveys can enhance the educational use of the property.

Vegetation surveys are usually performed using transect lines or 1 meter square quadrats. These can be placed randomly on the property to assess species percent cover and/or number of individuals. Because the wetland delineation was performed in a dry year, it is advisable to repeat the delineation in a more normal precipitation year.

4.5.2b Summary of 2- Year Restoration and Monitoring Plan

(See Appendix B: Restoration/Monitoring Schedule)

In the first 2 years, the primary objectives include removal of existing invasive species and the establishment of native species. The Restoration/Monitoring Schedule outlines a recommended seasonal schedule to facilitate these objectives. It is recommended that planting efforts occur in the Fall at the start of the rainy season, and that removal occurs in the spring prior to plants developing seeds. Periodic evaluation as to the success of efforts is included in the schedule. It is recommended that another vegetation survey be performed in Spring 2010. At this time, the success of the planted natives should also be evaluated. In addition, the pool area should be roped off each winter to protect amphibian eggs as they await the expansion of the pool for hatching.

4.5.2c Recommendations for Long-Term Restoration and Monitoring

Scotch Broom is an invasive legume with seeds that can remain in the soil seed-bank for 20-70 years. Himalayan Blackberry is an invasive, twining shrub that reproduces both asexually via "runners" and sexually via seeds dropped on-site or carried by birds. Each of these target invasive species are very resilient and will need to be monitored and removed as needed for 10 years until native trees, shrubs and understory have established sufficient dominance. Yearly removal and monitoring efforts will be necessary to assure the long-term success of a native, self-sufficient ecosystem.

5.0 Evaluation of Project

5.1 Volunteer Work Days

The organization of additional volunteer work days would have been an immense help to our project. On Saturday April 25th 2009 a group of 20 students attended an informational presentation and worked for roughly 45 minutes removing Scotch Broom and Himalayan Blackberry. The amount of material that was both removed and transferred to another area on our project site was astounding. The help of 20 additional individuals made the value of volunteer work days very apparent. Our project area would have experienced more invasive species removal and better efficiency in the removal process. Since the volunteers were well organized into groups who were chopping and transferring invasive species, the work went by efficiently and quickly. It would be for the sites benefit to include additional volunteer work days in the future. Furthermore, keeping these work days simple and offering some sort of incentive prevents workers from becoming discouraged and losing their motivation.

5.2 Invasive Species Removal

The Weed Wrench and machete's proved to be the most fundamental tools for removing Scotch Broom and Himalayan Blackberry. However, in the beginning of the removal process, our group was lacking additional tools that would have been very effective. A round headed shovel works great for loosening up large Scotch Broom plants and to disconnect major tap roots. The value of large clippers was also underestimated. Clippers provided a fast means to break large plants down to a workable size for the Weed Wrench. Our group utilized a small hand saw that did little to assist the removal process. A larger saw, hatchet, or an axe would have been a much better tool to use than a small hand saw. The density and volume of Scotch Broom on the project site is far too overwhelming for small scale gardening tools. The importance of wearing jeans, boots, and long sleeved shirts (preferably layered) cannot be overlooked when workers are trying to protect themselves from the sharp thorns of a Himalayan Blackberry bush.

5.3 Placement of Removed Materials

The initial removal point for our project quickly faded behind our group as we continued, and so did our pile of debris. How the high volume of organic material was going to be removed from our project site was an afterthought for our group. I believe our group highly underestimated the amount of organic material that we were capable of removing. For this reason, our pile of Scotch Broom and Himalayan Blackberry was hundreds of feet from the most logical removal point. Even though we had planned on removing the material, we failed to identify an efficient extraction point. On site mulching was the preferred alternative for disposal of the removed organic materials. Therefore, the debris only had to be moved to an open area in one corner of our project site. In hindsight, it would have been more efficient to gradually remove the material and place it in the mulching site. If it were not for the volunteer work group, much of the organic material would have been laboriously moved to the mulching site by our group members alone or even left behind. Even if the mulching alternative were not an option, it would have been a better strategy for our group to continuously remove material on a smaller scale. This would prevent our group from having to remove everything from the site at once which would have been a daunting task. I would recommend discarding of removed materials on a week to week basis to streamline the process and increase efficiency. This would also prevent the formation of fire hazards that may threaten surrounding residents.

5.4 Summary

Overall, our project was a huge success. The McKinleyville Land Trust Board is very pleased with the amount of work that was done on the property. The Board was very supportive of the process and allowed us to plan and complete the work as we saw fit. Sean and Clark put a collective 82 hours removing invasive species. When we realized the extent of the Scotch Broom and Himalayan Blackberry that had pile up after removal, we quickly submitted an email of possible disposal alternatives and the Board responded with full support of our preferred mulching alternative. They provided a mulcher and several volunteers to help with disposal.

In addition to the work completed this semester, we have facilitated continuing support from Professor Alison Purcell and her students in order to continue the restoration and maintenance of the Dow's Prairie Wetland. Lisa Rodgers will complete an additional vegetation survey and facilitate several more invasive species removal days over the summer.

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Appendix A: Wetland Delineation Report

McKinleyville Land Trust

Dow's Prairie Wetland

Delineation Report

Delineation Completed by:

Rachael Wiltrout, Steward Wilson, Blake Rouzer, Lisa Rodgers

Submitted by: Lisa Rodgers, Environmental Science Senior, HSU
5/7/2009

1.0 Introduction

1.1 Objective

The Dow's Prairie Wetland (DPW) is a 2.55 acre parcel located near the corner of Central Avenue and Grange Road in McKinleyville, Humboldt County, California. The land is owned by the McKinleyville Land Trust (MLT) and is registered as a conservation area under local zoning. The MLT authorized the following wetland delineation as part of an initial evaluation of the newly acquired parcel. The delineation report is intended to help establish a long-term restoration and monitoring plan that will restore and enhance the existing wetland. The site was visited on April 11, 2009. The delineation was performed by Humboldt State University students enrolled in a wetland soils course, and assisted and reviewed by Professor Joe Seney of the Natural Resources Conservation Service (NRCS) Vegetation identification was assisted by Teaching Assistant, retired from the Army Corps of Engineers (USACE).

1.2 US Army Corps of Engineers (USACE) Wetland Definition

(As described in the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region, April 2008.)

The USACE defines wetlands as "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." USACE delineates wetlands based on three indicators: 1. Wetland Hydrology, 2. Hydric Soil Indicators, and 3. Hydrophytic Vegetation.

1.2.1 Wetland Hydrology

Wetland Hydrology requires that soils are saturated to the surface (upper 25 cm) for at least 5% of the growing season, and that surface saturation occurred during 51 out of the last 100 years. According to the USACE Regional Supplement, "Wetland hydrology indicators provide evidence that the site has a continuing wetland hydrologic regime and that hydric soils and hydrophytic vegetation are not relicts of a past hydrologic regime." USACE designates 17 Primary hydrology indicators and 8 Secondary hydrology indicators. If a Primary indicator is met, the soil has wetland hydrology. Some obvious hydrology indicators are surface water, high water table and saturation. USACE requires that two Secondary indicators are met to meet the wetland hydrology parameter.

1.2.2 Hydric Soil

The USACE Supplement provides a definition of hydric soil as “soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.” Further clarification of this definition requires at least 20% organic matter content and saturation in the upper 50 cm, and ponding or flooding for at least 7 consecutive days of the growing season. The saturated conditions and microbial activity in the soil deplete the soil of oxygen. Anaerobic conditions result in soil characteristics that are present during both wet and dry season conditions. Hydric soil indicators include the accumulation of organic matter (due to lack of oxygen for decomposition) and reduction, accumulation and translocation of iron and other elements. A soil that meets the hydric soil definition for saturation ponding or flooding is hydric even if other indicators are absent. The USACE Regional Supplement describes 11 possible hydric soil indicators that apply to the soil studied in this report.

1.2.3 Wetland Vegetation

The USACE defines hydrophytic vegetation as “the community of macrophytes that occurs in areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to exert a controlling influence on the plant species present,” and “hydrophytic vegetation is present when the plant community is dominated by species that can tolerate prolonged inundation or soil saturation during the growing season.” Decisions are based on all species present rather than one indicator species. In order to evaluate the presence of hydrophytic vegetation on a site, ACOE recommends separating vegetation into the following four strata:

1. *Tree stratum* – Consists of woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.
2. *Sapling/Shrub stratum* – Consists of woody plants less than 3 in. DBH, regardless of height.
3. *Herb stratum* – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size.
4. *Woody vines* – Consists of all woody vines, regardless of height.

The Army Corps of Engineers (Corps) Wetland Delineation Manual designates plant species by wetland indicator status for the purpose of identifying jurisdictional wetlands. Results of nationwide surveys by state resulted in statistical occurrence of species. For delineation purposes, species are now given designations of Obligate (OBL), Facultative-Wet (FACW), Facultative (FAC), Facultative-Upland (FACU) and Upland (UPL). Species are considered “hydrophytic” if they have a FAC, FACW, or OBL designation.

Table 1: Frequency of Species Occurrence in Wetlands for Designation

| | |
|------|--------|
| OBL | > 99% |
| FACW | 67-99% |
| FAC | 33-67% |
| FACU | 1-33% |
| UPL | <1% |

Based on the nationwide surveys, plant species may have different designations in different states. The US Fish and Wildlife Service maintains a National Wetlands Inventory (1997) of plant species and wetland designation. The ACOE Regional Supplement utilizes three indicators: Dominance test, Prevalence index and Morphological Adaptations. If more than 50% of a site is dominated by OBL, FACW or FAC species, the site exhibits hydrophytic vegetation according to the Dominance Test. The Prevalence Index is used if the vegetation does not meet the Dominance Indicator. The Prevalence Index uses mathematical ranking to determine if a site has meets the hydrophytic vegetation parameter (See ACOE, 2008 for more detail).

1.3 Growing Season

Growing season can be designated in three different ways: hydroperiod (such as isomesic), biological zero, and frost-free days. The "isomesic" growing season in McKinleyville indicates a year-round growing season. Biological zero is designated as the time period when the soil temperature is greater than 5° C (41° F) in the upper 30 cm. Frost-free days indicate the time from above ground plant growth and development of vascular plants to when deciduous trees loose their leaves or herbaceous plants become brown. Both Wetland Hydrology and Hydric Soil indicators are dependent on the length of the growing season in a given area.

2.0 Setting

2.1 Study Area

The Dow's Prairie Wetland contains a seasonal pond. The pond is absent from May to November in normal rainfall years. It begins ponding in December and increases in size and infiltrates the vegetation around it to a maximum size each March or April. As precipitation levels decrease, the pond shrinks in size until it has completely dissipated in May.

Pond formation can occur from a few days of heavy rain. In late-March, 2009, the pond reached a maximum volume. In mid-April 2009, after several dry weeks, the pond had completely dissipated. However, in late-April, after only 3 days of rain, the depression again accumulated substantial standing water.

The 2.55 acre parcel was part of a family farm beginning in the 1950's, in more recent years, portions of the farm including the pond area were subdivided. The perimeter of the property contains mature *Pinus Contorta* trees that are remnant of a former Christmas Tree farm. Aerial photography from the mid-1960's show that the pond area was not under cultivation, this is likely due to the seasonal pond.

The property is bordered to the north by Grange Road, to the south by the former tree farm, to the east by the Dow's Prairie Elementary School field. To the west, dense vegetation consisting of a mix of *P. contorta*, *Cytisus scopularis*, *Rubus discolor*, and *Salix sp.* lies in between the property boundary and Central Avenue.

2.2 Climate

The average temperature in McKinleyville ranges from 45-55° F. Average annual rainfall is 102 cm to 153 cm with the majority of precipitation occurring from October to May (Soil Survey Staff).

2.3 Topography

The average elevation in Dow's Prairie is 283 feet above sea level (HRCG, 2004). The parcel map for the Dow's Prairie Wetland shows elevations ranging from 214-220 feet above sea level, and the school field elevations range from 224 to 228 feet above sea level. (See Appendix A for Parcel Map).

The Dow's Prairie Wetland has bowl-like topography. Contour lines are circular around the pool and elevation in feet above sea level decreases from 220 in upland areas to 216 at the wetland boundary to 214 near the center of the pool. The immediately adjacent school field topography decreases toward the pool from 228 to 222 feet. Because of this bowl-like topography, water runs into the pool basin from land immediately adjacent on all sides.

2.4 Hydrology

The property is located in the Dow's Prairie Sub-Basin which is bounded by Little River to the North and Mad River to the South. The sub-basin is a marine terrace drained by Mill Creek, Strawberry Creek, and White Creek. Groundwater formation occurs primarily in the western portion of the sub-basin and recharge is dependent on precipitation. The Sub-Basin is an important water source for local wells (HRCG, 2004).

2.5 Soil

The soil is characterized by the Natural Resource Conservation Service (NRCS) as Arcata series soils. This soil series consists of very deep, well-drained soils characterized by loamy, mixed, isomesic, Typic Hapludoll (Soil Survey Staff, 2009). At the soil taxonomic hierarchy of sub-order, "Udolls" are humid Mollisols. Mollisols are formed by the accumulation of calcium-rich organic matter from the dense root systems of prairie grasses, or in depressions where forest vegetation was present during formation. Mollisols have a dark surface horizon that is often 60-80 cm thick (Brady, 2002). The history of the Dow's Prairie Wetland suggests each of these may have contributed to the formation of the thick, dark surface horizon at the site. NRCS Soil Survey staff note that some Arcata series soils in the Dows Prairie area may have a thick dark layer (10YR 3/2) up to 4 feet deep. The soil has good drainage, slow surface runoff and moderately-rapid permeability. Recent soil sampling pits confirmed a thick dark surface horizon 50-100 cm thick. Underlying the upper horizon is a layer of weakly lithified sand-stone that contains gravelly material found at some locations. This weakly lithified sand-stone is poorly drained and may be contributing to temporary perching of precipitation and local runoff that creates the seasonal pond and surrounding wetland area.

2.6 Plant Community

California Native Plant Society (CNPS) Vegetation Series "Introduced perennial grassland series"

The site is dominated by the introduced (non-native) species, Creeping Bent Grass (*Agrostis stolonifera*) and is classified as "Introduced perennial grassland series" by the CNPS. This series is characterized as wetland habitat that is seasonally or permanently saturated with a shallow water table. The series is often considered part of the northern California coastal prairie and has a dominance of introduced grass species (CNPS, 2009).

Secondary Dominant Plant Species

Douglas' Spiraea (*Spiraea douglasii*) is intermixed with Creeping Bent Grass around the seasonal pond. These members of the Rosaceae family are herbaceous perennials that are 2-3 feet tall and form dense foliage that appears to dominate about 35% of the property. A volunteer from the CNPS reports that this is the largest *Spiraea* stand in the area.

In addition to *S. douglasii*, the site has been colonized by the invasive species *Cytisus scoperus* and *Rubus discolor*. These species are intermixed and dominate another 40% of the property.

3.0 Methods

The wetland delineation was performed based on the guidelines in the USACE Western Coast Regional Supplement (2008) methods and analysis. Sample soil pit placement was determined based on visual assessment of changes in vegetation on the property. The depth of the first 8 pits was determined by the thickness of the dark surface horizon. Soils were assessed, and horizons designated based on color and texture. Once it was determined that iron oxidized roots were the main indicator of wetland hydrology and hydric soil, pits were assessed based only on the root zone. Vegetation was assessed within a 1 meter radius of each soil pit. USFWS wetland designations were determined for each species identified, and the Dominance Test or Prevalence Index was applied to determine whether the sample pit met the hydrophytic vegetation criteria. To qualify as "Wet" each pit met all three parameters: Hydric Soil, Hydrology, and Hydrophytic Vegetation. If fewer than 3 parameters were met, the soil was designated as "Dry". Using ArcGIS, we hand-drew a wetland boundary between each pair of wet-dry pits along the vegetation stratum as viewed on the aerial photography.

4.0 Results

(See Appendix for Soil Profile Data, Vegetation Summary Tables and Field Sheets)

4.1 Wetland Hydrology Results

Each sample soil pit that was designated as "Wet" met the wetland hydrology indicator for Oxidized Rhizospheres Along Living Roots (C3). The roots had more than 2% iron oxide coatings.

4.2 Hydric Soil Results

Each sample soil pit that was designated as "Wet" met the hydric soil indicator for Redox Dark Surface (F6), based on iron oxidation on roots. The soil qualified for this indicator based on the 10 YR 2/1 color and greater than 2% concentrations along pore linings of root channels.

4.3 Hydrophytic Vegetation Results

Of the 14 plant species identified on the property, 13 have clear USACE designations, and of these, 4 are OBL, 3 are FACW, 4 are FAC, 2 are FACU and none are UPL. Vegetation was inadvertently overlooked at pit L1. The vegetation at each pit passed the Dominance Test for presence of hydrophytic vegetation.

5.0 Summary

The wetland boundary was determined based on indicators in 15 sample pits. Changes in vegetation from *Spiraea douglasii* to other species was the primary visual indicator for placement of sample pits. Wet and dry pits were identified in pairs and placed as close together as possible.

The wetland area of the property consists of the seasonal pond area and the *Spiraea douglasii* surrounding the pond area. Outside of the *Spiraea*, the vegetation changes to *Agrostus stolonifera* dominance, and is not wetland. The nonwetland area of property has a high percent cover of invasive species *Cytisus scoperus* and *Rubus discolor*. Soil in the wetland area has oxidized roots, whereas non-wetland soil does not.

The US Fish and Wildlife Service (USFWS), National Wetland Inventory map (See Appendix) shows wetland areas on the property. When underlain with our parcel boundary, and the wetland boundary we determined, the USFWS mapped wetland appears to coincide with our boundary, considering slightly inconsistent GIS coordinate systems.

Monthly precipitation from October 2008 to March 2009 is 83.6% of the 30-year average. The thick dark surface horizon may have masked other evidence of redoxomorphic features. According to Baker, 2002, oxidized roots are the best indicator for dark surface soils. Because the only visual indicator of hydric soil and hydrology was oxidized roots, it is possible that a slightly different wetland boundary would be evident in a normal precipitation year.

6.0 References

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Table 2: Plant Species within 1 meter radius of sample pits

| Plant Species | Indicator Status | Present at Pits: |
|------------------------------|------------------|--|
| <i>Carex obnupta</i> | OBL | X3 |
| <i>Potentilla anserina</i> | OBL | 8, 1 |
| <i>Selaginella</i> sp. | OBL | 10b |
| <i>Spiraea douglasii</i> | OBL | L3W, L3D, 9, 6, 8, 7, X5, 1, X3, X2W, 10a, 10b |
| <i>Agrostis stolonifera</i> | FACW | L3W, L3D, 9,8, X5, 1, X3, D4, X2W, 10a |
| <i>Alnus Rubra</i> | FACW | 10b |
| <i>Juncus effuses</i> | FACW | 9, 1, D4, 10a |
| <i>Lotus corniculatus</i> | FAC | D4 |
| <i>Plantago lanceolata</i> | FAC | 9, D4 |
| <i>Rubus discolor</i> | FAC | L2, 6, 7, X5, 1, X3, D4, 10a, 10b |
| <i>Rumex acetosella</i> | FAC | 10a |
| <i>Anthoxanthum odoratum</i> | FACU | 9, 6,8, 7, D4, 10b |
| <i>Taraxacum officinale</i> | FACU | 9 |
| <i>Cytisus scopularis</i> | NI | L2, |

Project Site: Dow's Prairie Wetland

Location: McKinleyville, CA

Sampling Date: 4/11/2009

Investigator(s): Rachael, Blake, Stuart, Lisa

Coordinates: North 40° Degrees
West 124°

58' Minutes
05'

| Loc. ID | Depth (cm) | Matrix | Redox Features | Text | Indicators | Notes | Coordinates (Seconds ") |
|-----------|------------|--------------------|---------------------|------|------------|---|-------------------------|
| 8 Wet | 0-26 | Color 10 YR 2/1 | Color 7.5 YR 4/6 | SIL | Soil F6 | NE Border Saturation at 35 cm | N 38.2 |
| | 26-44 | 10 YR 2/1 | | L | Hydr C3 | | W 56.4 |
| | 44+ | 10 YR 2/1 | | L | Veg Y | | |
| 7 Dry | 0-44+ | Color 10 YR 2/1 | Color % | L | Soil Hydr | NE Border | N 38.1 |
| | | % 100 | % Loc | | Veg Y | | W 56.4 |
| Wet | 0-22 | Color 10 YR 2/1 | Color 7.5 YR 4/6 | L | Soil F6 | NE Border | N 40.0* |
| | 22-39 | 10 YR 2/1 | | L | Hydr C3 | Capillarity at 39 cm | W 54.8* |
| | 39+ | 10 YR 2/1 | | L | Veg Y | | |
| Dry | 0-23 | Color 10 YR 2/1 | Color % | L | Soil Hydr | NE Border | N 40.0* |
| | 23-64 | 10 YR 2/1 | % 100 | L | Veg Y | Saturation at 50 cm | W 54.8* |
| | 64-68 | 2.5 YR 5/3 | 65 | LS | | | |
| X3 Wet | 0-33 | Color 10 YR 2/1 | Color 7.5 YR 4/6 | SIL | Soil F6 | West Border | N 38.7 |
| | 33-48 | 2.5 YR 3/1 | | L | Hydr C3 | Saturation at 48 cm | W 56.5 |
| | 48-62+ | 2.5 YR 6/3 | 50 | GrSL | Veg Y | Water at 62cm | |
| D4 Dry | 0-32 | Color 10 YR 2/1 | Color % | vfSL | Soil Hydr | West Border | N 38.0 |
| | 32+ | 10 YR 5/6 | % 100 | S | Veg Y | Dry example Weakly lithified sandstone | W 57.6 |
| | | | | | | | |

Project Site: Dow's Prairie Wetland

Location: McKinleyville, CA

Sampling Date: 4/11/2009

Investigator(s): Rachael, Blake, Stuart, Lisa

Coordinates: North 40° Degrees 58' Minutes
West 124° 05'

| Loc. ID | Depth (cm) | Matrix | Redox Features | Text | Indicators | Notes | Coordinates (Seconds ") |
|---------|------------|------------------------|---------------------------|------|--------------------------|--|-------------------------|
| X2 Wet | 0-32 | Color 10 YR 2/1 40 | Color 5 YR 4/6 60 Rhiz | L | Soil Hydr Veg F6 C3 Y | Wet example Capillarity at 32cm Water at 50cm | N 39.0 W 56.2 |
| | 32-50 | Color 10 YR 2/1 100 | 10 YR 4/6 10 Mtrx | Grl | | | |
| | 50+ | Color 10 YR 4/2 90 | | | | | |
| 10a Dry | 0-32 | Color 10 YR 2/1 100 | | L | Soil Hydr Veg Y | | N 38.8 W 56.8 |
| | 32-50 | Color 10 YR 2/1 100 | | L | | | |
| 10b Dry | 0-33 | Color 10YR 2/1 100 | | L | Soil Hydr Veg Y | | N 39.5 W 56.5 |
| | 33-45 | Color 10YR 2/1 100 | | L | | | |
| | | Color % | Color % Loc | | Soil Hydr Veg | | N W |
| | | Color % | Color % Loc | | Soil Hydr Veg | | N W |
| | | Color % | Color % Loc | | Soil Hydr Veg | | N W |



GRANGE ROAD (4M225)

25' ROADWAY WIDTH

PARCEL 1
2.55 ACRES

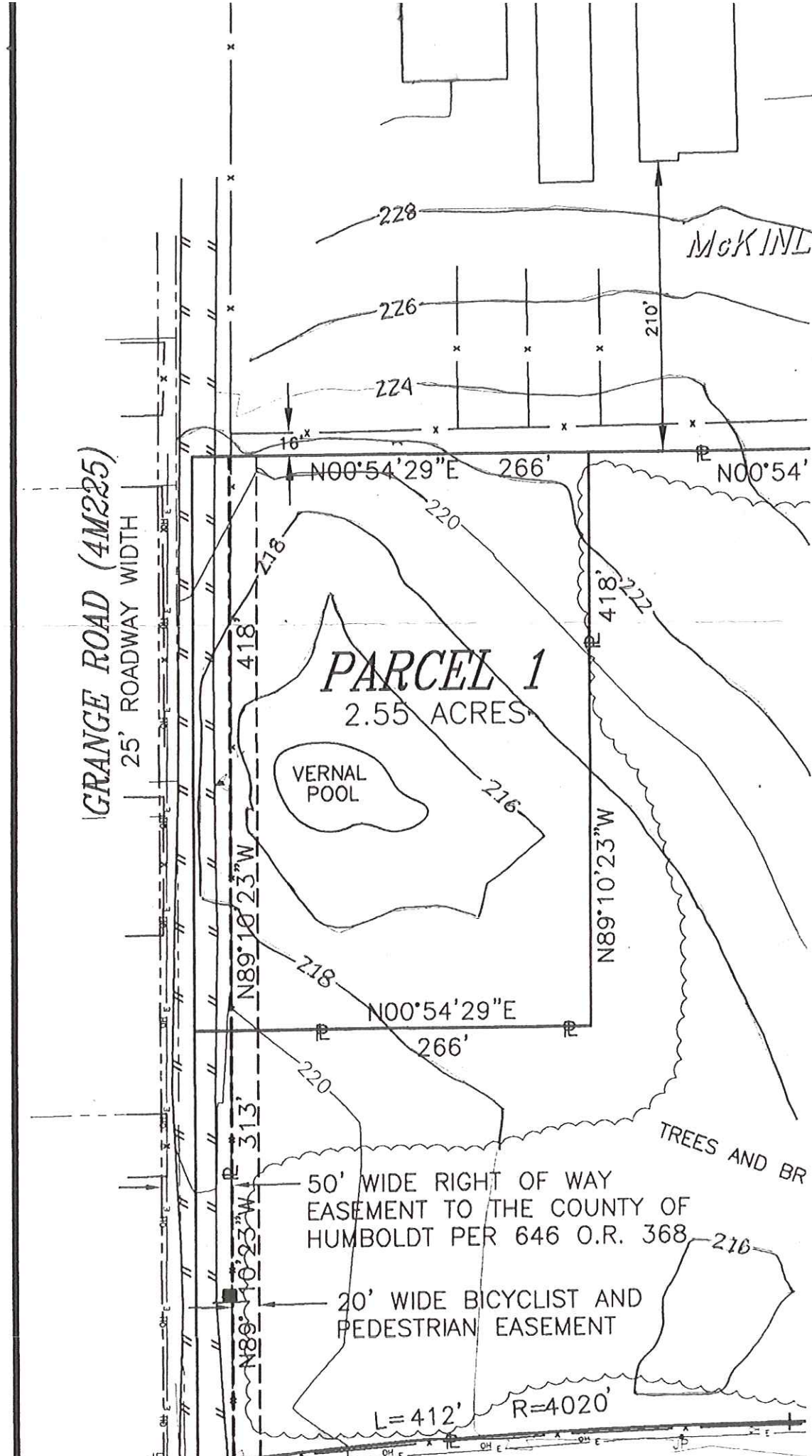
VERNAL POOL

McKINL

50' WIDE RIGHT OF WAY
EASEMENT TO THE COUNTY OF
HUMBOLDT PER 646 O.R. 368

20' WIDE BICYCLIST AND
PEDESTRIAN EASEMENT

L=412' R=4020'



Appendix B: Restoration and Management Plan

RESTORATION AND MONITORING PLAN

Dow's Prairie Wetland

McKinleyville Land Trust

May 7, 2009

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Spring 2009, Professor R. Hansis

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Submitted to:

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Introduction:

This restoration and monitoring plan is intended for the management and restoration of the 2.55 acre Dow's Prairie Wetland and Seasonal Pond near the corner of Central Avenue and Grange Road in McKinleyville, Humboldt County, California. Approximately 40% of the property was dominated by invasive species upon acquisition by the McKinleyville Land Trust in December 2008. As the result of a Spring 2009 initial removal effort, 20% of the land has been cleared of invasives. This report provides guidance for long term invasive species eradication and the introduction of native wetland plant species on the land.

In addition to enhancing and restoring the wetland habitat, the introduction of native species is intended to reduce the number of invasive individuals that re-colonize the disturbed areas where Scotch broom (*Cytisus scoparius*) and Himalayan Blackberry (*Rubus discolor*) have been removed. Native tree and shrub species, once established will shade out Scotch Broom that may be transported and reintroduced from colonies on adjacent properties. Native herb species will provide ground cover that reduces invasive colonization. In addition, a long-term removal regime must be implemented to eliminate "re-sprouts" and the remaining mature invasive species. Because Scotch Broom may remain in the soil seed bank for many years after the plants have been removed, a 10 year monitoring regime is recommended.

Background:

The Dow's Prairie property is located a few meters east of Central Avenue on Grange Road in McKinleyville. In the year 2000, the McKinleyville Land Trust began an eight year effort to acquire this unique property. The entire project includes 6 acres on the corner of Central Avenue and Grange Road. In December 2008, the McKinleyville Land Trust succeeded in the acquisition of 2.55 acres of the total 6 acres. The 2.55 acre parcel contains a seasonal pond and its acquisition is the first phase in the McKinleyville Land Trust's proposal to acquire the entire 6 acres. The site is intended to provide visibility of the land trust conservation process. The property is intended to be an educational site for the adjacent Dow's Prairie Elementary School and the general public. The second phase of the project includes the removal of exotic vegetation, the development of an interim and long-range plan, and the development of an amphibian school curriculum (McKinleyville Land Trust Project Description, 2000).

The Dows Prairie wetland is the site of a unique ecosystem, a seasonally-ponded wetland. Wetlands are among the most threatened ecosystems in California. The preservation and restoration of this McKinleyville Land Trust property provides an opportunity to preserve one of the few that remain.

Wetland Functions and Services:

(Reference: Professor Sharon Kahara lecture to HSU, SOIL 363 Class, March 2009)

Wetlands provide multiple functions within the geographical region where they are located. These include chemical, physical, hydrological and the sustaining of wildlife habitat. In addition, wetlands provide services such as storm water interception, water storage, ground water recharge, and sediment trapping. One important function of wetlands is the purification of water and interception of pollution within watersheds. Saturated conditions promote anaerobic activity in the underlying substrate of wetland ecosystems. Anaerobic microbes break down toxins so they become less damaging to downstream biota. Because wetlands sequester water in seasonal ponds, wetlands also provide valuable water storage and groundwater recharge. Flood prevention is another important service wetlands provide. The maintenance of riparian areas around rivers and streams helps to prevent sudden

inundation of rainwater runoff into developed areas. In addition to these important services, wetlands provide critical habitat for many amphibians, fish and birds. Waterfowl migration corridors include critical wetland breeding habitat for waterfowl.

Why not a Vernal Pool?

The site was previously referred to as a “vernal pool” wetland by the McKinleyville Land Trust, but upon further consideration, it was concluded that the site does not meet the parameters that define vernal pools. Vernal pools are episaturated, seasonal, freshwater wetlands (Richardson, 2001). Episaturation indicates that the soil surface is saturated from above either by precipitation and/or a perched water table that does not originate from groundwater or an underground spring. The pool fills with water from winter and spring rains and remains ponded for 4-5 months. When heavy rain ceases, the water in the pool evaporates.

There is currently not a clear definition of what constitutes a Vernal Pool. World-wide ecosystems referred to as Vernal Pools vary in size and species composition. Typical vernal pools in California occur in the Central Valley. These are underlain by claypans and duripans (a silica cemented soil horizon) (Richardson, 2001) that prevent deep percolation of the rainwater into the underlying ground water system. Typical vernal pools also form networks of proximate pools as precipitation fills one pool and then moves along interconnected surface channels and shallow ground water channels to successive pools in the area (Richardson, 2001). In addition, Vernal Pools are typically populated with rare, endemic herbaceous perennials specific to each pool area.

Although the property contains a seasonally-ponded depression, vegetation surveys have not revealed rare, endemic species and aerial photography has not revealed a network of pools in the area. Due to these factors, the lack of an underlying hardpan, and the geographical location of the pond, it is not a Vernal Pool.

Plant Community (See Appendix A for Tables listing plant species inventory)

California Native Plant Society (CNPS) Vegetation Series

“Introduced perennial grassland series”

The site is dominated by the introduced (non-native) species, Creeping Bent Grass (*Agrostis stolonifera*) and is classified as “Introduced perennial grassland series” by the CNPS. This series is characterized as wetland habitat that is seasonally or permanently saturated with a shallow water table. The series is often considered part of the northern California coastal prairie and has a dominance of introduced grass species (CNPS, 2009).

Secondary Dominant Plant Species

Douglas’ Spiraea (*Spiraea douglasii*) is intermixed with Creeping Bent Grass around the seasonal pond. These members of the Rosaceae family are herbaceous perennials that are 2-3 feet tall and form dense foliage that appears to dominate about 35% of the property. A volunteer from the CNPS reports that this is the largest *Spiraea* stand in the area.

Other Plant Species

(See Appendix A for complete list of identified plant species)

Wetland Delineation

A wetland delineation was performed on the property using the *Army Corps of Engineers, Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (April, 2008) methods and analysis. The delineation procedure includes 3 parameters: Hydric Soil, Hydrology, and Hydrophytic Vegetation. For delineation, vegetation is evaluated around each sample soil pit and so not all species on the inventory were included in this determination. The wetland delineation resulted in approximately 46% of the property mapped as wetland.

(See Appendix C for the complete Wetland Delineation Report)

Dominant Invasive Plant Species

Scotch Broom (*Cytisus scoparius*)

Scotch Broom is an invasive plant species in the Pacific Northwest and Eastern Coast of the United States and Canada. It is native to Central and Western Europe and was introduced as an ornamental plant in the 1800's. Leaves are small, alternate and compound with 3 leaflets. The leaves are often not noticeable, due to the dark green stems. The flowers are bright yellow, resemble sweet pea flowers and occur singly in axils of the leaves. Seed pods (legumes) are fuzzy on the edges, 1-2 in. (2.5-5 cm) long and will explode when mature. (GISD, 2005).

Scotch Broom grows well in areas that have cool, wet, winters. It grows well in direct sunlight. The plant produces many seeds protected with hard coats. When pods mature the seeds are ejected from the pods with an audible pop (SNP, 2009). The hard seed coats allow seeds to lie dormant from 60 to 80 years until conditions are optimal for growth.

Scotch Broom is usually spread by sticking to the wheels of trucks or tractors, or by birds, mammals or insects. In some areas ants collect the seeds of Scotch Broom aiding in their dispersal (OSU, 2009).

It is recommended that in ecologically sensitive areas Scotch Broom is removed manually. Manual removal consists of removing the entire plant including the majority of its root system. Small plants can be removed by hand while larger plants can be removed with the aid of shovels, picks or a patented tool called a *Weed Wrench*. The *Weed Wrench* is essentially a lever which attaches to the base of the plant and assists in removing the plant in its entirety. This tool is recommended for removing larger Scotch Broom. Removed plants can be left on site and composted or taken to a green waste disposal site. The removed material may also be mulched and used to cover trails or the removal area itself. This mulch prevents re-sprouting and aids native species in their re-colonization of areas once overrun by Scotch Broom. This pervasive species is tough to eradicate and requires years of follow-up removal to prevent reestablishment of Scotch Broom (USNPS, 2009).

Himalayan Blackberry

Himalayan Blackberry is the most pervasive of the invasive plant species at the Dow's Prairie Wetland property. The majority of the population exists along the eastern side of the property along the periphery of the *Spirea douglasii*. Most of the *S. douglasii* stand, and the pool area in its entirety have not been invaded.

Himalayan Blackberry is native to Eurasia and was introduced to North America in 1885 as a cultivated crop. It is often found in sensitive wetland habitats and is successful at crowding out all other vegetation (GISD, 2005). This is apparent at the Dow's Prairie Wetland where large portions of the property consist of entirely Himalayan Blackberry.

Himalayan Blackberry can be identified by thick stems which are 2-3 cm in diameter, thorns up to 1 cm, and leaves clustered in fives with white undersides. Stems can grow up to 4.5 meters in length, and are capable of rooting at the nodes when they arch back towards the ground. In the first-year shoots (primary cane) no flowers are produced. In the second year of growth, side shoots will emerge with smaller leaves in groups of three. The shrub will also begin to produce flowers in the late spring or early summer of the second year with five petals, usually pink or white, that are approximately 2-2.5 cm in length (GISD, 2005). The shrub produces fruits that are 1-2 cm in diameter and are black when mature. Birds distribute the seeds after eating the fruit and there is evidence suggesting that seed passage through a bird's digestive system increases seed viability (USNPS, 2009).

To remove Himalayan Blackberry the canes should be cut and the roots dug up when possible. Several years of follow-up removal of re-sprouting will be required.

Land Ownership/Covenants:

The parcel is registered with the County of Humboldt as a Conservation Easement. The Easement specifies the purpose of the easement as "... (enabling) the Property to remain undeveloped as a wetland study site and to remain as open space by preventing uses of the Property which will impair or interfere with those values." Construction of any kind, further subdivision, mineral extraction, dumping of any kind and separation of water rights are expressly prohibited by the Easement Deed. Allowable uses include: Installing and maintaining fencing, scientific and educational study uses, access trails, interpretive signs, acquiring land contiguous to the parcel, removal of invasive species, and planting of native species.

Restoration Plan
(See Appendix B for Seasonal Schedule)

The goal of restoration at the Dow's Prairie Wetland is to reduce the abundance of all invasive species to less than 5% in 5 years and to <1% in 10 years. This will be achieved through removal efforts and the creation of a native, self-maintaining ecosystem. The restoration plan includes multiple year invasive species removal and native species planting efforts. Twenty-five percent (25%) of the property is occupied by invasive species in May 2009 following an initial removal effort that resulted in a 40% decrease in invasive species' dominated area. Future restoration efforts are to include: bi-yearly removal of "re-sprouts" in the cleared area, continued mature plant removal, and successive planting of native species.

Long-term monitoring is essential to the restoration efforts. Yearly vegetation surveys will track the persistence of invasive species, the survival of planted natives and the establishment of native species through natural succession. Vegetation surveys provide a monitoring tool that will assist in the evaluation and revision of this restoration and monitoring plan.

Suggested Invasive Species Removal Methods

It is recommended that in ecologically sensitive areas Scotch Broom is removed manually. Manual removal consists of removing the entire plant including the majority of its root system. Small plants can be removed by hand while larger plants can be removed with the aid of shovels, picks or a patented tool called a *Weed Wrench*. The *Weed Wrench* is essentially a lever which attaches to the base of the plant and assists in removing the plant in its entirety. This tool is recommended for removing larger Scotch Broom. Removed plants can be left on site (USNPS, 2009).

The most fundamental tool for Scotch Broom removal is the Weed Wrench. This apparatus comes in various sizes that can individually be matched up to the size of Scotch Broom plants present in an area. The most common size used in our removal project was the medium size. The local BLM did not have any of the large sized Weed Wrenches, but the medium size was effective in most cases. By chopping out surrounding foliage, the base of the Scotch Broom plant is uncovered. The Weed Wrench can be fit onto the base of a plant and the use of leverage jacks the plant, along with most of the roots, out of the ground. During times of high precipitation, the Scotch Broom plants could be push and loosened by two people. This was also an effective mode of removal for plants that were too large to fit the medium sized Weed Wrench around. It's also helpful to use a machete to narrow the base of the Scotch Broom plant in order to fit the wrench around the base. In several instances, the stalks would be split into several branches just above ground level. Typically, if the plant was too large in diameter for the wrench, the effective method of removal involved segmenting the base into individual smaller stalks that the wrench could fit onto.

With extremely large plants topping 10 feet, a combination of techniques must be utilized. In many cases, the plants were so large that they couldn't be moved. Therefore, by digging in the ground around the stock, the main roots would be exposed and then chopped with a machete. This would allow the entire plant to be moved and pushed in order to loosen the plant from the ground. In many instances, plants would be attached by only a couple of large roots. It is in this situation where two or more people must yank and pull on the entire plant, in unison, to achieve removal. This method also removes a large portion of the roots. The ideal time frame to implement this technique is directly following precipitation. The technique will remain a viable removal option for up to a week; depending on how fast the soil dries. If large roots remain in the soil after a plant has been removed, they can typically be pulled out with a moderate amount of effort. If the root is too large to be pulled out by hand, the Weed Wrench can again be utilized. By attaching the wrench to the root, the same principle discussed above can be applied to remove the root and prevent future re-sprouting.

Himalayan Blackberry is best removed with the use of machetes. The Blackberry stalks can be cut to the ground, and the roots severed and removed where possible. Re-sprouts should be removed often to prevent future proliferation.

Suggested Native Plant Introduction Methods

Our plan includes the (re) introduction of native plant species in areas where Scotch broom (*Cytisus scoparius*) and Himalayan Blackberry (*Rubus discolor*) were removed. There is very little vegetation left in this area, and in some areas the soil is bare because it was almost completely dominated by the invasive species. The patch of land cleared of invasive species can now be labeled as "disturbed habitat." Without proper management of native plant introduction, it will be re-colonized by the invasive species. Scotch broom thrives in full sun, so planting trees that will establish quickly and create shade will help reduce the re-establishment of Scotch broom in the removal areas.

Our research and additional consultation with the California Native Plant Society (CNPS), has resulted in a list of plants ideal for the cleared area. Willows (*Salix spp.*) are a fast growing deciduous tree species. They are a good option for several reasons. First of all, there are already Willow trees growing on site. Willows provide habitat for birds and attract pollinators. Cuttings from the existing trees can simply be stuck in the ground and they have high likelihood of survival. This makes them a very economical choice. The CNPS also recommended Red Alder (*Alnus rubra*), Big Leaf Maple, (*Acer macrophyllum*) as trees that establish quickly and provide significant shading. Twinberry (*Lonicera involucrata*), a deciduous shrub is already growing at the edge of the forest on site and may be a good option. Some evergreen shrubs such as the hardy Silk Tassel (*Garria elliptica*) or Pacific Wax Myrtle (*Myrica californica*) would be a wise addition to help with shading all year. There are several surviving Sword Ferns (*Polystichum munitum*) that were growing under the removed Scotchbroom, and many others in the shaded south border of the property. Introducing more of these ferns is recommended in future years when more shade is established. Seashore Lupine (*Lupinus littoralis*) is suggested for its hardiness. Wild Strawberry (*Fragaria chilensis*) makes an excellent ground cover and spreads quickly. Native grass seeds could be planted but will have low survivorship this late in the season.

Planting Methods

Most plants should be spaced at approximate 5 foot intervals, and willows can be more closely spaced. A mixture of tree species with approximately 40% Willow, 40% Red Alder and 20% big leaf maple will create diversity and have high survivorship. Wild Strawberry should be planted in between trees. 1-3 Silk Tassels and/or Pacific Wax Myrtle may also be a wise addition to create year round shade, thereby increasing moisture retention. Willow propagules can be made by taking cuttings from individuals on site. One gallon or 3-5 gallon starts are recommended for other tree species. To ensure high survivorship regular watering will be necessary through the May to October dry season for this year and intermittent watering will likely be necessary for the next year to ensure high survivorship. The property has evidence of a deer population and the animals are likely to feed on Alder and Myrtle saplings. Appropriate fencing will be required, and will be placed around each individual or cluster of trees.

Mulching all of these plants is important in ensuring their survival. Mulch retains moisture and prevents re-sprouting of invasive species. Mulch can easily be obtained on site by using dead grass. Composted or chipped Scotchbroom, when cut prior to seeding, may provide an onsite, nitrogen rich mulch.

In the long-term, after the invasive species eradication plan is complete, aquatic plants can be introduced around the pool. This will provide additional habitat for amphibians as well as help the pool retain moisture. Possible future aquatic plants include: Yellow eyed grass, Douglas Iris, Red flowering Currant, and Salal.

The CNPS recommended Freshwater Farms (Owner Rick) and Humboldt Fish Action Council, a non-profit (Contact Susan Isaacs) as sources for free seedlings. Freshwater Farms will donate roughly 20 Red Alders, 5-6 Big leaf Maples and 20-30 Wild Strawberries.

Several Willow (*Salix sp.*) cuttings from the existing trees on the property were planted in Spring 2009.

(See Appendix A for complete list of recommended native species for reintroduction.)

Suggested Monitoring and Evaluation Methods

Monitoring and evaluation of plant species should be on-going. Initial vegetation inventories can be enhanced with future evaluation of species abundance. It is expected that the diversity of the property's ecosystem will increase over time as invasive species are eradicated. In addition, animal and amphibian surveys can enhance the educational use of the property.

Vegetation surveys are usually performed using transect lines or 1 meter square quadrats. These can be placed randomly on the property to assess species percent cover and/or number of individuals.

Because the wetland delineation was performed in a dry year, it is advisable to repeat the delineation in a more normal precipitation year.

Summary of 2- Year Restoration and Monitoring Plan

(See Appendix B: Restoration/Monitoring Schedule)

In the first 2 years, the primary objectives include removal of existing invasive species and the establishment of native species. The Restoration/Monitoring Schedule outlines a recommended seasonal schedule to facilitate these objectives. It is recommended that planting efforts occur in the Fall at the start of the rainy season, and that removal occurs in the spring prior to plants developing seeds. Periodic evaluation as to the success of efforts is included in the schedule. It is recommended that another vegetation survey be performed in Spring 2010, and at this time, the success of the planted natives should also be evaluated. In addition, the pool area should be roped off each winter to protect amphibian eggs as they await the expansion of the pool for hatching.

Recommendations for Long-Term Restoration and Monitoring

Scotch Broom is an invasive legume with seeds that can remain in the soil seed-bank for 20-70 years. Himalayan Blackberry is an invasive, twining shrub that reproduces both asexually via "runners" and sexually via seeds dropped on-site or carried by birds. Each of these target invasive species are very resilient and will need to be monitored and removed as needed for 10 years until native trees, shrubs and understory has established sufficient dominance. Yearly removal and monitoring efforts will be necessary to assure the long-term success of a native, self-sufficient ecosystem.

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Appendix A: Plant Lists

Table 1: Pre-Existing Non-Invasive Species List

| Species | Common Name | Wetland Designation | Location on Property |
|---|-------------------------------------|---------------------|--------------------------------------|
| Tree Stratum | | | |
| <i>Malus sylvestris</i> | Apple | none | Non-Native (1 individual) |
| <i>Pinus contorta</i> | Lodgepole pine | none | South and West border |
| <i>Pseudotsuga menziesii</i> | Douglas-fir | none | South-east corner |
| <i>Salix spp.</i> | Willow | FACW-OBL | North border |
| Shrub Stratum | | | |
| <i>Lonicera involucrate</i> <i>var. ledebourii</i> | Twinberry | FAC | One individual found along new trail |
| <i>Rosa sp.</i> | | | |
| <i>Rubus ursinus</i> | California blackberry | FAC | South-west central |
| <i>Spiraea douglasii</i> | Spiraea | OBL | Central property |
| Herb Stratum | | | |
| <i>Agrostis stolonifera</i> | Creeping Bent Grass | FACW | Most dominant |
| <i>Anthoxanthum odoratum</i> | Sweet Vernal Grass | FACU | Not Native |
| <i>Carex obnupta</i> | Sedge | OBL | |
| <i>Cynodon dactylon</i> | Bermuda grass | FACU | |
| <i>Fragaria chiloensis</i> | Beach strawberry | none | East edge |
| <i>Juncus effusus</i> | Soft rush | FACW | Central property |
| <i>Lathyrus sp</i> | Wild Pea | | |
| <i>Lotus corniculatus</i> | Bird's Foot Trefoil | FAC | |
| <i>Plantago lanceolata</i> | English plantain | FAC | Not native |
| <i>Polystichum munitum</i> | Sword fern | none | South border |
| <i>Potentilla anserina</i> <i>spp. pacifica</i> | Cinquefoil | OBL | Pool area |
| <i>Raphanus raphanistrum</i> | Wild Radish ("Jointed Charlock") | none | East border |
| <i>Rumex acetosella</i> | Sheep sorrel | FAC | Not native |
| <i>Vicia gigantea</i> | Vetch (native) | none | Property borders |
| <i>Taraxacum officinale</i> | Dandelion | FACU | |
| <i>Vicia spp.</i> | Vetch | | Property borders |

Table 2: Invasive Species List

| Species | Common Name | CNPS List | Location |
|-------------------------------|----------------------|-----------|---------------------------|
| <i>Cotoneaster franchetti</i> | Cotoneaster | B | South border |
| <i>Cytisus scoparius</i> | Scotch broom | A | East, South, North border |
| <i>Ilex aquifolium</i> | English holly | A | South border |
| <i>Rubus discolor</i> | Himalayan blackberry | A | All borders |

Table 3: Native Species for (Re) Introduction

| Species | Common Name | Wetland Designation |
|-----------------------------|--------------------|---------------------|
| Tree Stratum | | |
| <i>Acer macrophyllum</i> | Big Leaf Maple | FAC |
| <i>Alnus rubra</i> | Red Alder | FACW |
| <i>Salix sp.</i> | Willow species | OBL-FACW |
| Shrub Stratum | | |
| <i>Garrua elliptica</i> | Silk Tassel | none |
| <i>Myrica californica</i> | Pacific Wax Myrtle | FAC |
| <i>Lonicera involucrata</i> | Twinberry | FAC |
| Herb Stratum | | |
| <i>Fragaria chilensis</i> | Wild Strawberry | none |
| <i>Lupinus littoralis</i> | Seashore Lupine | none |
| <i>Polystichum munitum</i> | Sword Fern | none |

Appendix B: 2 Year Restoration/Monitoring Schedule

2-Year Restoration/Monitoring Schedule

| | | | |
|-------------|-----------------------|--|-----------------------------------|
| SUMMER 2009 | | | |
| June/July | Monitoring | <p>Task: Vegetation inventory of annual herbaceous species</p> <ol style="list-style-type: none"> Samples for Herbarium Notebook Written documentation of annual species present | Responsible Party: Lisa Rodgers |
| | Restoration | <p>Task: Removal of re-sprouted invasives from initial removal area</p> | |
| FALL 2009 | | | |
| October | Restoration | <p>Task: Removal of Scotch Broom and Himalayan Blackberry</p> | Responsible Party: HSU Students |
| November | Restoration | <p>Task: Plant native trees</p> <ol style="list-style-type: none"> Nursery donates 20 Alders, 5 Maples; additional Willow starts from on-site Trees are planted in areas where invasive species have been removed | Responsible Party: HSU Students |
| December | Monitoring | <p>Task: Rope off pool area to protect amphibian species</p> | Responsible Party: HSU Students |
| SPRING 2010 | | | |
| March | Restoration | <p>Task: Removal of Scotch Broom and Himalayan Blackberry</p> <ol style="list-style-type: none"> Removal of invasive re-sprouts in existing cleared areas First-time removal of additional mature invasives | Responsible Party: MLT Volunteers |
| | Monitoring | <p>Task: Remove pool barrier</p> | Responsible Party: MLT Volunteers |
| April | Monitoring/Evaluation | <p>Task: Vegetation Survey</p> <ol style="list-style-type: none"> Assess total % cover of species along all strata based on Table 1 and Table 2 of the Restoration and Monitoring Plan, 2009 Evaluate the health of planted natives and success of efforts to date and revise Plan as needed | Responsible Party: MLT Volunteers |

| | | | | |
|-------------|-----------------------|--|-----------------------------------|--|
| FALL 2010 | | | | |
| October | Restoration | Task: Removal of Scotch Broom and Himalayan Blackberry a. Includes removal of re-sprouts b. Mature invasive species now 100% removed | Responsible Party: MLT Volunteers | |
| November | Restoration | Task: Plant native trees a. Trees are planted in areas where invasive species have been removed b. Shrubs can be integrated into planting plan | Responsible Party: MLT Volunteers | |
| December | Monitoring | Task: Rope off pool area to protect amphibian species | Responsible Party: MLT Volunteers | |
| SPRING 2011 | | | | |
| March | Restoration | Task: Removal of Scotch Broom and Himalayan Blackberry 1. Removal of invasive re-sprouts in existing cleared areas | Responsible Party: MLT Volunteers | |
| April | Monitoring | Task: Remove pool barrier | Responsible Party: MLT Volunteers | |
| April | Monitoring/Evaluation | Task: Vegetation Survey 1. Assess total % cover of species along all strata based on Table 1 and Table 2 of the Restoration and Monitoring Plan, 2009 2. Evaluate the health of planted natives and success of efforts to date and revise Plan as needed | Responsible Party: MLT Volunteers | |
| FALL 2011 | | | | |
| October | Restoration | Task: Removal of Scotch Broom and Himalayan Blackberry | Responsible Party: MLT Volunteers | |
| November | Restoration | Task: Plant native understory species a. Understory species from the CNPS recommended list can be planted b. Additional trees are planted in areas where invasive species have been removed | Responsible Party: MLT Volunteers | |
| December | Monitoring | Task: Rope off pool area to protect amphibian species | Responsible Party: MLT Volunteers | |
| SPRING 2012 | | | | |
| April | Monitoring | Task: Remove pool barrier | Responsible Party: MLT Volunteers | |
| April | Restoration | Task: Evaluate the health of planted natives and success of efforts to date and revise Plan as needed Task: Remove re-sprouts | Responsible Party: MLT Volunteers | |

Appendix C: Alternatives

Alternatives:

Alternatives were generated and then weighed based on pros and cons using a (+), (-), (0) rating.

Goal 2: Remove Invasive Plant Species**Alternative 1: Manual Removal (Preferred Alternative)****Pros:**

- Time frame of implementation is flexible.+
- Cheap means of removal.+
- Has a low impact on the project site versus mechanical removal.+

Cons:

Entire root system is unlikely to be removed.

- Time consuming and Laborious.-
- Disposal and transport of organic material.-

This is our most viable option since it is cost effective and has a relatively low impact on the site. Regardless of our inability to completely eradicate the invasive species, it will allow the reintroduction of native species who will compete with the invasive.

Alternative 2: Mechanical Removal**Pros:**

- Quick form of removal.+
- More effective at removing the entire root system.+
- Less likely to see re-sprouting.+

Cons:

- High impact on the site.-
- Expensive due to costs associated with machinery.-
- Availability of machinery and volunteers is limited.-
- Difficult to obtain compensation necessary for mechanical removal.-
- Noise impacts to surrounding residents.+
- Accessibility and parking issues arise for larger trucks and trailers. -

Cost and impact alone prevent this mode of removal from being viable whatsoever. Our group doesn't have an adequate budget to afford heavy machinery and access to the work area is extremely limited to vehicles.

Alternative 3: Biological Removal (Use of animals and/or insects)**Pros:**

- Less manual labor involved.+
- Possible long term management solution.+
- Generally, a low cost when compared to mechanical removal.+

Cons:

- Potential for various unknown impacts.-
- Re-sprouting is possible if entire root system isn't removed.-
- This option may not be effective since little research has been done on biological control factors for Scotch Broom and Himalayan Black Berries-

Due to the lack of research and the availability of viable biological control factors, this option isn't a being considered. Furthermore, there have been problems with indirect impacts of biological controls that could potentially do more harm than good.

Goal 3: Reintroduce Native Plant Species

Alternative 1: Planting Native Species Propagules/Seeds (Preferred Alternative)

Pros:

- Propagules would be more successful at sustaining life than sprouts from seed.+
- Propagules would establish themselves quickly.+
- Quick on-site transplanting. +

Cons:

- Cost associated with propagules/seeds.-
- Regular watering is needed for the 1st year.-
- Predator deterrent measures would need to be taken.-
- Labor associated with monitoring, planting, and maintaining. -

This option allows our group to control planting of native species and use this advantage to give the propagules the best opportunity to establish themselves. This is also an active process which will yield more success than natural spreading. Even with maintenance needs, the general success with actively introducing native plants will be more successful overall.

Alternative 2: Natural Spreading by Succession

Pros:

- Inexpensive since no propagules/seeds need to be purchased.+
- No labor input required.+
- No monitoring and maintenance required.+

Cons:

- High risk of invasive species being re-introduced since Scotch Broom and Himalayan Black Berries has decade's worth of viable seeds in the soil and due to the pervasive nature of Scotch Broom and Himalayan Black Berries.--
- A slow process which would leave soil exposed and increase the likelihood of re-establishment of invasive species.--

This option is too passive of a method and introduced natives will likely succumb to aggressive invasive species. Also, due to the nature of Scotch Broom and its large seed banks in the area, it is unlikely the introduced natives will establish before they are choked out by invasive species.

Goal 4: Increase Community Awareness of the Sensitive Ecosystem

Alternative 1: Volunteer Work Days (Preferred Alternative #1)

Pros:

- More work will be done and in a shorter time frame.
- Generate increased community awareness.
- Offers chances for networking (potentially offer a solution to future monitoring and maintenance.)

Cons:

- Need for an incentive.-
- High impact due to foot/vehicle traffic.-
- No restrooms nearby.-
- Scheduling conflicts.-

The value in having a community workday is immense. It will give surrounding residents an idea about what is going on at the site, how they can implement the same ideas on their own property, and bring general awareness about invasive species to the public.

Alternative 2: Informative Signs (Preferred Alternative #2)++

Pros:

- Raise awareness for visitors to the site.+
- Prevents negative damage to sensitive areas. +
- Promotes the establishment of permanent trails.+

Cons:

- Attract a lot more attention.-
- Cost associated with making the signs.-
- Maintenance of signs and replacement when needed.-
- Opportunity for vandalism.-

Alternative 3: Use of Flyers--

Pros:

- Creates awareness.+
- Time consuming activity.-

Cons:

- Waste-
- Cost of paper/printing.-

Alternative 4: Informational Meeting++

Pros:

- Education increases likelihood of finding volunteers.+

Cons:

- Time needed to organize+
- Where to hold the meeting?-

Alternative 5: Physical Barriers at the site--

Pros:

- Decreases the impact on sensitive areas.+
- Prevents motorized vehicles from disturbing the site.+

Cons:

- Attracts new attention-
- Maintenance issues.-
- Inhibit wildlife trails.-

Alternative 6: Door to Door--

Pros:

- Increase awareness+
- Opportunity to generate more volunteers+

Cons:

- Annoyance and disturbance to local residents.-
- Timing issues.-
- Time consuming -

HSU Webmail

ljr22@humboldt.edu

Disposal of Invasives Removed from Dow's Prairie Wetland

Tuesday, April 21, 2009 8:42:01 PM

From: ljr22@humboldt.edu
To: RIMSON@aol.com

Dear Gina,

Because the other members of my group have been working hard to remove Scotch Broom and Blackberry from the Dow's Prairie Wetland, we have quite a large pile ready for disposal.

Please forward the following alternatives to the Board for discussion. We would like to take action on the disposal of the removed invasive plants no later than Saturday, May 2, 2009.

Some Alternatives we are considering:

1) Mulching On-Site (Preferred)

Mulching the Broom and Blackberry on-site is the most sustainable option. The nitrogen rich mulch can be used for weed control around the new trees and on paths. The mulch contains little to no seeds because the plants were cut while flowering. Any remaining mulch can be put in a discrete place on the land and covered in black plastic so it can compost for future use or for use at other sites.

The cost of this alternative is: \$140 to rent a gas powered mulcher, Possible cost of \$40 for chain saw if needed for large pieces
HSU Senior Project Group will provide a truck for towing the mulcher, and associated cost of gasoline.

2) Hauling to Arcata Green-Waste Site in Group Member's Truck

This would require 3-5+ trips in a truck. Associated costs are gas, time. Cost \$60 for gas, possibly Green-Waste disposal fees.

This alternative is not preferred because we feel the multiple vehicle trips and landfill-type disposable will have a greater environmental impact than Alternative 1.

3) Truck Caravan to Arcata Green-Waste Site with Land Trust Volunteer Help

This would require 3-5 volunteers with trucks for hauling. This may result in greater land-fill disposal costs if volunteers are not Arcata residents with curb-side service. Volunteers would donate gas and time.

4) On-site Composting Without Mulching

The plant intact material could be covered with black plastic and composted on-site.

However, we fear that this may pose a fire hazard. A wrong choice by a local child, or a very hot day may contribute to fire. In addition, the pile would be unsightly and may take a long time to fully break down. Minimal cost.

Thank you for your consideration.

Sincerely,

Lisa Rodgers, Sean Galvas, Eli, Clark

Appendix D: Time Sheets

| Date | # of hours | Task |
|----------------------|-------------------------------|---|
| 2/9/09 | Total: 2 | Walk property, met Nancy |
| 2/11/09 | Total: 1 | 2 nd property visit |
| 2/16/09 | 1 1 Total: 2 | Group meeting Indiv. development of Goal/Obj |
| 2/23/09 | Total: 2 | Group meeting |
| 2/25/09 | Total: 6 | Research, Background statement |
| 3/1/09 | Total: 3 | Vegetation collection 1 |
| 3/2/09 | Total: 2 | Group develop Prob/Background |
| 3/4/09 | Total: 2 | Group brainstorm Goals/Obj |
| 3/9/09 | Total: 2.5 | Group develop Goals/Obj |
| 3/11/09 | Total: 2.5 | Grp Develop/Rate Alternatives |
| 3/23/09 | Total: 1 | Group meeting |
| 3/28/09 | 2 2 2 5 Total: 11 | Research, report Vegetation collection 2 MLT Dinner Research, report |
| 3/31/09 | Total: 2 | Draft outline to MLT |
| 4/6/09 | 1 6 Total: 7 | Group meeting Plant lists, report edit and consolidation |
| 4/8/09 | Total: 2 | Report compilation |
| 4/10/09 | Total: 1 | Delineation Preparation |
| 4/11/09 | 7 2 Total: 9 | Delineation Dig Start Mit/Mon Report |
| 4/12/09 | Total: 1 | Invasives Removal |
| 4/20/09 | Total: 2 | Group meeting |
| 4/22/09 | Total: 1/2 | Invasive removal |
| 4/23/09 | Total: 1/2 | Delineation Report |
| 4/25/09 | 4 2 5 Total: 11 | Invasive removal/ Purcell class visit PowerPoint Presentation Simultaneous Project report, Restoration/Monitoring Plan |
| 4/26/09 | 1 2.5 Total: 3.5 | MLT Board Meeting Restoration/Monitoring Plan |
| 4/27/09 | 1 2 Total: 3 | Group Meeting Report Revision |
| 5/2/09 | Total: 3 | Final removal/mulching |
| 5/4/09 | Total: 1 | Group meeting |
| 5/5/09 | Total: 7 | Wetland Delineation Report Final |
| 5/7/09 | Total: 5 | Report format, finish Alternative Section, Format timesheets, etc |
| 5/9/09 | Total: 3 | MLT Open House |
| PROJECT TOTAL | 98 | |

Lisa's Project Time Sheet

Sean's Project Task Log

| Task Performed (Enter Task Performed Below) | Date (Month/Day/Year) | Time Spent On Task | | Required Project Time Remaining | |
|--|--------------------------|--------------------|---------|---------------------------------|---------|
| | | Hours | Minutes | Hours | Minutes |
| Met With Nancy of The MLT | 2/9/2009 | 1 | 0 | 99 | 0 |
| Found and Downloaded DEM, NAIP, and boundary .shp file to ArcMap | 2/15/2009 | 2 | 0 | 97 | 0 |
| Determined Coordinates for Property Boundaries and developed a surveying method | 2/21/2009 | 3 | 0 | 94 | 0 |
| Group Meeting | 2/23/2009 | 2 | 0 | 92 | 0 |
| Checked out and learned to use GPS | 2/27/2009 | 2 | 0 | 90 | 0 |
| Bought marker flags and marked property boundaries | 2/28/2009 | 2 | 30 | 87 | 30 |
| Collected Plant Samples w/ group | 3/1/2009 | 3 | 0 | 84 | 30 |
| Group Brainstorm Goals/obj | 3/4/2009 | 2 | 0 | 82 | 30 |
| Conducted Scotch Broom research and worked on Problem Statement | | 2 | 0 | 80 | 30 |
| Pulled Scotch Broom and Himalayan Blackberry w/ Clark | 3/15/2009 | 5 | 0 | 75 | 30 |
| Created a Google Doc to streamline group performance | | 1 | 15 | 74 | 15 |
| Created the Project Task Log Spreadsheet to maximize organization within the group | | 1 | 30 | 72 | 45 |
| Acquired Soils Data and Added it to ArcMap/Conducted Soil Research | 3/18/2009 | 3 | 0 | 69 | 45 |
| conducted research on the Northern Red Legged and Pacific Chorus Frogs | 3/19/2009 | 1 | 45 | 68 | 0 |
| Group Meeting | 3/23/2009 | 2 | 0 | 66 | 0 |
| Meeting in Class | 3/25/2009 | 0 | 50 | 65 | 10 |
| Consulted with Susan Marshall about Soil and read soil 1965 Soil Survey Book to better understand the Soil .shp. | 3/27/2009 | 1 | 15 | 63 | 55 |
| Pulled Scotchbroom and Himalayan Blackberry | 3/29/2009 | 5 | 0 | 58 | 55 |
| Discuss Implementation Strategies and allocated duties | 3/6/2009 | 0 | 50 | 58 | 5 |
| Removed Scotchbroom and Himalayan Blackberry | 4/4/2009 | 5 | 0 | 53 | 5 |
| Removed Scotchbroom and Himalayan Blackberry | 4/5/2009 | 5 | 0 | 48 | 5 |
| Developed Implementation Strategy | 4/8/2009 | 0 | 50 | 47 | 15 |
| Went to Don's Rentals to inquire about chainsaw and wood chipper | 4/11/2009 | 0 | 20 | 46 | 55 |
| Removed Scotchbroom and Himalayan Blackberry | 4/11/2009 | 5 | 0 | 41 | 55 |
| Removed Scotchbroom and Himalayan Blackberry | 4/12/2009 | 5 | 0 | 36 | 55 |
| Removed Scotchbroom and Himalayan Blackberry | 4/18/2009 | 5 | 0 | 31 | 55 |
| Removed Scotchbroom and Himalayan Blackberry | 4/19/2009 | 5 | 0 | 26 | 55 |
| Group Meeting | 4/20/2009 | 1 | 0 | 25 | 55 |
| Invasives Removal With Group and A. Purcell's Class | 4/25/2009 | 6 | 0 | 19 | 55 |
| Group Meeting | 4/27/2009 | 1 | 0 | 18 | 55 |
| Chipped Scotchbroom with Clark, Lisa and Wayne | 5/2/2009 | 4 | 0 | 14 | 55 |
| Edited Draft 5 of Group Paper | 5/3/2009 | 1 | 30 | 13 | 25 |
| Further Researched and Wrote Section on Himalayan Blackberry | 5/3/2009 | 1 | 30 | 11 | 55 |
| Created 3D Model of Project Area | 5/4/2009 | 1 | 0 | 10 | 55 |
| Met With Group To Discuss Presentation | 5/4/2009 | 0 | 50 | 10 | 5 |
| Prepared and Discussed Presentation Slides With Clark | 5/5/2009 | 1 | 0 | 9 | 5 |
| Discussed Final Paper Preparation With Group | 5/6/2009 | 0 | 15 | 8 | 50 |
| Finished Resources Page | 5/7/2009 | 0 | 20 | 8 | 30 |
| Hosted Open House | 5/9/2009 | 3 | 0 | 5 | 30 |

**Total Hours Spent On Project
94 hrs. and 30 min.**

Clark's Project Task Log

| Task Performed (Enter Task Performed Below) | Date (Month/Day/Year) | Time Spent On Task | |
|---|--------------------------|--------------------|---------|
| | | Hours | Minutes |
| Met With Nancy of The MLT | 2/9/2009 | 1 | 0 |
| Found Arial Photographs of Project Site | 2/17/2009 | 2 | 0 |
| Researched Criteria for delineating a wetland. | 2/18/2009 | 3 | 0 |
| Group Meeting | 2/23/2009 | 2 | 0 |
| Further Research on wetlands and vernal pools | 2/26/2009 | 2 | 0 |
| Checked out First Weed Wrench and Tried on Scotch Broom | 2/28/2009 | 2 | 30 |
| Collected Plant Samples w/ group | 3/1/2009 | 3 | 0 |
| Group Brainstorm Goals/obj | 3/4/2009 | 2 | 0 |
| Conducted Scotch Broom research and worked on Problem Statement | | 4 | |
| Pulled Scotch Broom and Himalayan Blackberry w/ Sean | 3/15/2009 | 5 | 0 |
| Additional Scotch Broom Research and Info. Added To Google Doc. | 3/16/2009 | 1 | 15 |
| Met with Group to Discuss Strategies for Implementation | 3/18/2009 | 1 | 0 |
| Researched Scotch Broom Removal Techniques | 3/18/2009 | 2 | 15 |
| Researched Sensitive Species in the McKinleyville Area | 3/19/2009 | 2 | 45 |
| Group Meeting | 3/23/2009 | 2 | 0 |
| Meeting in Class | 3/25/2009 | 0 | 50 |
| Went again to BLM to pick up Weed Wrench and | 3/26/2009 | 0 | 15 |
| Pulled Scotchbroom and Himalayan Blackberry | 3/29/2009 | 5 | 0 |
| Worked on Alternatives for Project | 3/30/2009 | 0 | 50 |
| Removed Scotchbroom and Himalayan Blackberry | 4/4/2009 | 5 | 0 |
| Removed Scotchbroom and Himalayan Blackberry | 4/5/2009 | 5 | 0 |
| Developed Implementation Strategy | 4/8/2009 | 0 | 50 |
| To BLM again to check out Weed Wrench | 4/10/2009 | 0 | 15 |
| Removed Scotchbroom and Himalayan Blackberry | 4/11/2009 | 5 | 0 |

| | | | |
|--|-----------|--------------|------|
| Removed Scotchbroom and Himalayan Blackberry | 4/12/2009 | 5 | 0 |
| Removed Scotchbroom and Himalayan Blackberry | 4/18/2009 | 5 | 0 |
| Removed Scotchbroom and Himalayan Blackberry | 4/19/2009 | 5 | 0 |
| Group Meeting | 4/20/2009 | 1 | 0 |
| Removed Scotchbroom and Himalayan Blackberry | 4/25/2009 | 6 | 0 |
| Group Meeting | 4/27/2009 | 1 | 0 |
| Chipped Scotchbroom with Clark, Lisa and Wayne | 5/2/2009 | 4 | 0 |
| Typed up Removal Techniques and "What We Could Do Better." | 5/3/2009 | 1 | 45 |
| Met with the group | 5/4/2009 | 1 | 50 |
| Gathered info. On Mechanical and Biological removal techniques | 5/4/2009 | 1 | 15 |
| Met With Group To Discuss Presentation | 5/4/2009 | 1 | 50 |
| Prepared and Discussed Presentation Slides With Clark | 5/5/2009 | 1 | 0 |
| Open House @ the Project Site | 5/9/2009 | 3 | 30 |
| | | 89 | 7.92 |
| Project Total | | 96.92 | |

Eli's Project Task Log

The "Time Spent On Task" columns and the "Required Project Time Remaining" will be calculated

| Task Performed (Enter Task Performed Below) | Time Spent On Task | | | Required Project Time Remaining | | |
|--|--------------------|-------|---------|---------------------------------|---------|--------------|
| | Days | Hours | Minutes | Hours | Minutes | Minutes |
| Met with Nancy MLT | | 1 | 0 | 99 | 0 | 0 |
| group meeting | | 2 | 0 | 97 | 0 | 0 |
| plant samples with group | | 2 | 0 | 95 | 0 | 0 |
| group brainstorm goals objectives | | 2 | 0 | 94 | | |
| research restoration | | 10 | 0 | | | |
| Jeff Dunk meeting and Chagahcho research | | 2 | 30 | 92 | | 30 |
| Remove Broom and Blackberry | | 1 | 15 | | | |
| group meeting | | 2 | 0 | | | |
| other group meetings | | 6 | 0 | 86 | | 30 |
| plant collection and keying | | 4 | 0 | 82 | | 30 |
| plant keying | | 4 | 15 | | | |
| Photography and Plant ID | | 3 | 10 | 79 | | 20 |
| CNPS consultation | | 2 | 15 | 77 | | 5 |
| removed Scotchbroom Himalayan Blackberry | | 1 | 30 | | | |
| Broom moving, willow planting/mulching, ace | | 4 | 0 | 73 | | 5 |
| Native Flora Regeneration Plan | | 3 | 30 | 69 | | 35 |
| developed implementation strategy | | 0 | 50 | | | |
| Move Broom, plant Willows | | 2 | 30 | 67 | | 5 |
| remove scotchbroom, himalayan blackberry | | 1 | 30 | | | |
| outer trail maintenance | | 2 | 45 | 64 | | 20 |
| water willows, pull weeds, photography | | 1 | 45 | | | |
| group meeting | | 1 | 0 | | | |
| Edited Native Flora Regeneration Plan | | 1 | 30 | | | |
| Work with Purcell's class | | 1 | 30 | 62 | | 50 |
| group meeting | | 1 | 0 | 61 | | 50 |
| chipped scotchbroom | | 1 | 30 | 60 | | 20 |
| group discuss presentation | | 0 | 50 | 59 | | 30 |
| made powerpoint | | 3 | 30 | 56 | | -4.26326E-13 |
| pick up trees in Eureka | | 1 | 0 | | | |

Appendix E: Project Process Materials

To Do's

2/11/09

- ① Survey property (GPS) - Sean
- ② Identify invasives - Clark
- ③ Identify soils for
wetland delineation (Lisa)
- ④ Obtain DEM - Sean
- ⑤ Is this a vernal pool?
- ⑥ Which native species can/should be
introduced? - Group / Lisa
- ⑦ Make restoration checklist
- ⑧ How many wetland site/ vernal pools
in Humboldt?
- ⑨ Bird species/animals inhabit vernal
pools?
- ⑩ What plant species attract these animals
- ⑪ Focus on restoration portion of
management plan.

Key Objectives:

- ① Develop a short-term management plan
* Focus on restoration
- ② Removal of invasive species
- ③ Introduction of native species

Problem Statement:

I Vernal pools in general

II McKinleyville Property

* (A) Property has invasive species

- ① Scotch broom
- ② English holly
- ③ Non-native blackberry
- ④
- ⑤

..... presence of these species has eliminated native flora

(B) Property is intended as an educational model

① Trails need to be placed to avoid sensitive species

② Native species need to be cultivated and labeled for public education

* (C) There is no current management plan for the property

Goals

Limit motorcycle access

Goal: Protect/encourage ^{native} amphibians

increase number

con: don't have enough
info to know what
is carrying

Goal: Increase community awareness

Obj: of the sensitive ecosystem
4 interpretive sign on site

Obj: 10 community members attend
a meeting

Obj: 10 community members help
with invasive broom removal

Goal: Removal of invasive species

Obj: Remove 80% of Scotch Broom

→ Obj: Decrease access to pool
by 80%

Obj: Maintain existing amphibian
populations (long-term)

Goals / Objectives

What? When?

Action: Objectives (are quantifiable)

- ① Delineate wetland
- ①a Identify existing plants/animals
- Species list
- ② Remove invasive species Scotch Broom
 - ① Locate tools to aide in removal
 - ② Solicit help from Land Trust, School and Community
- ~~③ Cultivate native species~~
 - ① Plan several days of organized removal

Goals:

- ① Map property
 - includes boundaries
 - wetland vs non-wetland
 - existing vegetation
 - ~~- future desired vegetation~~
 - ~~- trails~~
- ② Generate list of perennial species
- ② ~~Restore native species~~
Remove Scotch Broom
- ③ Create ^{Restoration} Management Plan
 - Interim ~ what we will do
 - Long-term ~ future recommendations
 - ~~± with Objectives for future~~
 - ①a annual Scotch Broom removal in Feb/March
 - ①b 50 ft buffer on adjacent property
 - ②a Removal of himalayan blackberry/english holly
 - ③ Clear over growth around deciduous trees

Solutions

April 11 (11-3)
Work Day!
feed people

* staking off areas for protection

interpretive signs x4

? fencing property?

* obstructions to entry paths
to prevent motorcycles

↑ additional problem under
community education

Increase community awareness

- signs
- hold educational meeting/event
on site

Make clear trails into and
around pool / property

How to maintain long-term amphibian
populations?

Removal of invasive species

Manual weed wrench, shovel

Mechanic back hoe

Biological planting shade species
insect introduction

E-mail Docs Again

NRPI 410: AGENDA
Monday, April 20th
2 pm

- ✓ 1. Saturday, April 25th, 2:30-4pm Allison Purcell's class (19 people) at MLT Pool
 - Invite Dr. Hansis
 - Weed wrench confirmation ✓ **Weed wrenches on Friday*
 - Discussion *Small → Mud is better*
2. Sunday, April 26th, 7pm MLT Board Meeting Invite
 - Location - *Call Gina → group attends or just for banking?*
 - Mitigation Bank
 - Monitoring Plan.
 - Mulching and natives? ✓
3. Possible "Pond Opening" meeting this week
 - Pond Opening is Saturday, May 9th from 11-1, invite Dr. Hansis
4. Monitoring Plan
 - Eli's native planting plan - *Wed April 29th after MLT meeting?*
 - Schedule I wrote ✓
 - Other ideas ✓
5. Wetland Delineation Update
 - Aerial photo shape file *(NAD 83) → 1965 Soil Survey*
 - Other delineation info *Cite shapefile*
6. To Do List
 - Look at current report
7. Other Topics for discussion
 - Hours comparison (for early weeks to help remember)
 - * Next meeting compile pictures for presentation

Natives } Deer fencing → \$ cost, watering regime commitments

Mulching } \$140/day 6" diameter
 } chainsaw \$40/day
 } * chaps / goggles / hearing

NRPI 410: AGENDA
Monday, April 27th
2pm

1. MLT Meeting Report----APPLAUSE!!!!
 - \$20 mulcher, small may go under tree, 12 noon, Saturday, May 2nd
 - Price Ace Hardware just in case
 - Seedlings planted next fall due to lack of watering capabilities
 - Eli—Please contact nursery and ask about donations in fall
2. OPEN HOUSE REMINDER
3. Wednesday, more removal, block road entrance, possible neighborhood/school canvassing
4. Timesheets
 - Work hours for broom pulling....ie budget for Summer Workers
 - Comparison for beginning of semester
5. NRPI 410 Report Commitments???
6. PRESENTATION

Section at end: what have you learned / what done differently

DRAFT 3

Proposal for HSU Senior Project Activities at the McKinleyville Land Trust Wetland Property

Problem Statement:

The invasive species', Himalayan Blackberry and Scotch Broom, currently occupy approximately 35% of the Dow's Prairie property. The unique and sensitive properties of the ecosystem are currently unknown to the local community. There is currently not a management plan for invasive species and restoration for the Dows Prairie Property.

Outline of Goals, Objectives and Implementation:

Goal 1: Delineate Wetland

Objective A: Sample and identify 90% of plant species on property.

Objective B: Soil 363 group will dig soil pits to identify and map soil in GIS.

Implementation:

1. Utilizing the Army Corps of Engineers Wetland Delineation Manual (1987), wetland boundaries on the property will be identified and mapped.

Target Date: April 20, 2009

Goal 2: Remove Invasive Plant Species

Objective A: Remove 50% of the current Scotch Broom population.

Objective B: Remove 50% of the current Himalayan blackberry population.

Implementation:

1. Physical removal of Scotch Broom will take place on weekends in March and April.
 - a. Weed wrench, machetes, pruners and shovels will be used to remove existing Scotch Broom when possible and eliminate flowering parts when full removal is not possible.
2. Physical removal of Himalayan Blackberry will take place at a future date
 - a. Blackberry will be pulled out by the roots when possible, or clipped to the ground when full root removal is not possible.

Target Date: May 2, 2009

Goal 3: Reintroduce Native Plant Species

Objective A: Introduce 3-5 native plant species

Implementation:

1. Under assistance by a representative from the California Native Plant Society (CNPS), recommendations will be made for the introduction of native species.
2. Specific number of propagules, locations for planting, and costs will be determined and submitted with the final report to the McKinleyville Land Trust.

Target Date: May 2, 2009

CASILL
Naip-2005
County
mosaic
Humboldt
County
USFWS

Goal 4: Increase Community Awareness of the Sensitive Ecosystem

Objective A: 10 community members help with invasive plant species removal.

Objective B: 10 community members attend an educational outing on the site.

Implementation:

1. Lisa will attend the McKinleyville Land Trust Annual Dinner 2009
 - a. An announcement will be made regarding Scotch broom removal and an Open House tentatively scheduled for May 9, 2009.
 - b. A contact list will be collected at the dinner and all interested parties will be notified of the upcoming events.
 - c. The educational outing will be the Open House where attendees will be informed of the work at the pool property to date, the nature of the unique ecosystem and the recommendations for future management.
 - d. Brochures will be distributed at the Open House and a press release submitted to the North Coast Journal with Board approval.

Target Date: May 9, 2009

Goal 5: Create a Management Plan

Objective A: Outline short/long term goals regarding the educational use of the property.

Objective B:

1. Outline invasive/native plant species management
2. Produce guidelines and schedule for future management and restoration efforts

Implementation:

1. Make arrangements with McKinleyville Land Trust for an annual broom/blackberry pulling event.
2. Create informational and interpretive signs to be posted permanently on the property
3. Place "roping of the Vernal Pool" on the Land Trusts December Agenda

Target Date: May 9, 2009

General Actions Not Covered in Above Implementation:

1. Integrate property into HSU professor Allison Purcell's restoration curriculum
2. On-going utilization of the property as a model of wetland and restoration in cooperation with the Land Trust and professors at HSU

Introduction:

The Dow's Prairie wetland is located a few meters east of Central Avenue on Grange Road in McKinleyville. In the year 2000, the McKinleyville Land Trust began an eight year effort to acquire this unique property. The entire project includes 6 acres on the corner of Central Avenue and Grange Road. In December 2008, the McKinleyville Land Trust succeeded in the acquisition of 2.55 acres of the total 6 acres. The 2.55 acre parcel contains a seasonal pond and

its acquisition is the first phase in the McKinleyville Land Trust's proposal to acquire the entire 6 acres. The site is intended to provide visibility of the land trust conservation process. The property is intended to be an educational site for the adjacent Dow's Prairie Elementary School and the general public. The second phase of the project includes the removal of exotic vegetation, the development of an interim and long-range plan, and the development of an amphibian school curriculum (McKinleyville Land Trust Project Description, 2000).

The Dows Prairie wetland is the site of a unique ecosystem, a seasonally-ponded wetland. Wetlands are among the most threatened ecosystems in California. The preservation and restoration of this McKinleyville Land Trust property provides an opportunity to preserve one of the few that remain.

There are many species of plants found at the Dows Prairie property; some are native and some are invasive. Our goal is to identify which species are native to the area and which are invasive. Our intention is to remove the invasive species Scotch Broom, and prevent further encroachment by recommending an invasive species management plan.

Wetland Functions and Services:

Wetlands provide multiple functions within the geographical region where they are located. These include chemical, physical, hydrological and the sustaining of wildlife habitat. In addition, wetlands provide services such as storm water interception, water storage, ground water recharge, sediment trapping and carbon sequestration.

One important function of wetlands is the purification of water and interception of pollution within watersheds.

Wetlands provide critical breeding habitat for waterfowl, and 95% of commercial fishery harvest depends on wetlands that act as spawning nurseries. Some types of fish require up to 5 years to reach maturity and the presence of habitat is crucial to their survival into adulthood.

Flood prevention is an important service wetlands provide. The maintenance of riparian areas around rivers helps to prevent sudden inundation of rainwater runoff into developed area. In addition, the presence of coastal salt marsh and mangrove ecosystems have been shown to provide a buffer against hurricanes. Coastal erosion is prevented by the presence of vegetation on dunes and cliffs.

Because wetlands sequester water in seasonal ponds, ----groundwater recharge.

Wetlands trap sediment that may otherwise enter lakes, rivers or the ocean and cause abnormally high levels of turbidity. Upon entering the wetland, water velocity is slowed and sediments are deposited.

Carbon sequestration and peat....

Vernal Pools:

The site was previously referred to as a "vernal pool" wetland by the McKinleyville Land Trust. Vernal pools are episaturated, seasonal, freshwater wetlands (Richardson, 2001). Episaturation indicates that the soil surface is saturated from above either by precipitation and/or a perched water table that does not originate from groundwater or an underground spring. The pool fills with water from winter and spring rains and remains ponded for 4-5 months. When heavy rain ceases, the water in the pool evaporates.

The McKinleyville pool meets hydrologic and hydric soil indicators of a wetland (ACOE, 2008). Soil at the site consists of a thick layer of dark, loamy, soil material. The subsoil consists of a layer of lithified sandstone containing iron-oxide concentrations. It is the lithified sandstone that perches the seasonal precipitation to form the pool. Much of the 2.55 acre site can be designated a wetland based on the Army Corps of Engineers Wetland Delineation Manual.

Although the property contains a seasonally-ponded depression, due to the type of subsoil and the geographical location of the pond, it may not be appropriate to refer to it as a Vernal Pool. There is currently not a clear definition of what constitutes a Vernal Pool. World-wide ecosystems referred to as Vernal Pools vary in size and species composition. Typical vernal pools in California occur in the Central Valley. These are underlain by claypans and duripans (a silica cemented soil horizon) (Richardson, 2001) that prevent deep percolation of the rainwater into the underlying ground water system. Typical vernal pools also form networks of proximate pools as precipitation fills one pool and then moves along interconnected channels and shallow ground water channels to successive pools in the area (Richardson, 2001). In addition, Vernal Pools are typically populated with rare, endemic herbaceous perennials specific to each pool area. Vegetation surveys have not revealed such rare, endemic species and aerial photography has not revealed a network of pools in the area.

Biota On-Site:

The property has evidence of several animal populations. Frogs can be heard and eggs were found in February ground surrounding the pool. Although no detailed wildlife analysis was performed, there is evidence of deer (as decimated carcass), voles, gophers and birds. Furthermore, the Red Legged Frog and the Southern Torrent Salamander are recognized as sensitive species and have been identified in nearby areas.

The plant community on-site consists of both native and invasive species, a few of which are listed by the California Native Plant Society as problematic invasives. Among the invasives are Scotch Broom, English Holly, Cotoneaster and Himalayan Blackberry.

Scotch Broom is usually spread by sticking to the wheels of trucks or tractors, or by birds, mammals or insects. In some areas ants collect the seeds of Scotch Broom aiding in their dispersal(<http://extension.oregonstate.edu/catalog/html/pnw/pnw103/>).

Scotch Broom:

Scotch Broom is an invasive plant species in the Pacific Northwest and Eastern Coast of the United States and Canada. It is native to Central and Western Europe and was introduced as an ornamental plant in the 1800's. Leaves are small, alternate and compound with 3 leaflets. The leaves are often not noticeable, due to the dark green stems. The flowers are bright yellow, resemble sweet pea flowers and occur singly in axils of the leaves. Seed pods are fuzzy on the edges, 1-2 in. (2.5-5 cm) long and will explode when mature. (<http://www.invasive.org>).

Scotch Broom grows well in areas that have cool, wet, winters. It grows well with ample sunlight. The plant produces lots of seeds protected with hard coats. When pods mature the seeds are ejected from the pods with an audible pop.

(<http://www.soundnativeplants.com/PDF/Scotch%20broom.pdf>). The hard seed coats allow seeds to lie dormant from 60 to 80 years until conditions are optimal for growth.

(<http://extension.oregonstate.edu/catalog/html/pnw/pnw103/>,
<http://www.nps.gov/archive/redw/scotchbr.htm>).

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It is recommended that in ecologically sensitive areas Scotch Broom is removed manually(http://www.mattole.org/pdf/SB_plan_app_07_removal_techs_060823.pdf). Manual removal consists of removing the entire plant including the majority of its root system. Small plants can be removed by hand while larger plants can be removed with the aid of shovels, picks or a patented tool called a *Weed Wrench*. The *Weed Wrench* is essentially a lever which attaches to the base of the plant and assists in removing the plant in its entirety. This tool is recommended for removing larger Scotch Broom. Removed plants can be left on site (<http://www.nps.gov/archive/redw/scotchbr.htm>).



tncinvasives.ucdavis.edu/photos/wrench3.jpg



sanjuan.wsu.edu/noxious/images/WeedWrench72.1.jpg

Alternatives:

Goal 2: Remove Invasive Plant Species

Alternative 1: Manual Removal (Preferred Alternative)

Pros:

- Time frame of implementation is flexible.
- Cheap means of removal.
- Has a low impact on the project site versus mechanical removal.

Cons:

Entire root system is unlikely to be removed.

- Time consuming and Laborious.
- Disposal and transport of organic material.

This is our most viable option since it is cost effective and has a relatively low impact on the site. Regardless of our inability to completely eradicate the invasive species, it will allow the reintroduction of native species who will compete with the invasive.

Alternative 2: Mechanical Removal

Pros:

- Quick form of removal.
- More effective at removing the entire root system.
- Less likely to see re-sprouting.

Cons:

- High impact on the site.
- Expensive due to costs associated with machinery.
- Availability of machinery and volunteers is limited.
- Difficult to obtain compensation necessary for mechanical removal.
- Noise impacts to surrounding residents.
- Accessibility and parking issues arise for larger trucks and trailers.

Cost and impact alone prevent this mode of removal from being viable whatsoever. Our group doesn't have an adequate budget to afford heavy machinery and access to the work area is extremely limited to vehicles.

Alternative 3: Biological Removal (Use of animals and/or insects)

Pros:

- Less manual labor involved.
- Possible long term management solution.
- Generally, a low cost when compared to mechanical removal.

Cons:

- Potential for various unknown impacts.
- Re-sprouting is possible if entire root system isn't removed.
- This option may not be effective since little research has been done on biological control factors for Scotch Broom and Himalayan Black Berries

Due to the lack of research and the availability of viable biological control factors, this option isn't a being considered. Furthermore, there have been problems with indirect impacts of biological controls that could potentially do more harm than good.

Goal 3: Reintroduce Native Plant Species

Alternative 1: Planting Native Species Propagules/Seeds (Preferred Alternative)

Pros:

- Propagules would be more successful at sustaining life than sprouts from seed.
- Propagules would establish themselves quickly.
- Quick on-site transplanting.

Cons:

- Cost associated with propagules/seeds.
- Regular watering is needed for the 1st year.
- Predator deterrent measures would need to be taken.
- Labor associated with monitoring, planting, and maintaining.

This option allows our group to control planting of native species and use this advantage to give the propagules the best opportunity to establish themselves. This is also an active process which will yield more success than natural spreading. Even with maintenance needs, the general success with actively introducing native plants will be more successful overall.

Alternative 2: Natural Spreading by Succession

Pros:

- Inexpensive since no propagules/seeds need to be purchased.
- No labor input required.
- No monitoring and maintenance required.

Cons:

- High risk of invasive species being re-introduced since Scotch Broom and Himalayan Black Berries has decade's worth of viable seeds in the soil and due to the pervasive nature of Scotch Broom and Himalayan Black Berries.
- A slow process which would leave soil exposed and increase the likelihood of re-establishment of invasive species.

This option is too passive of a method and introduced natives will likely succumb to aggressive invasive species. Also, due to the nature of Scotch Broom and its large seed banks in the area, it is unlikely the introduced natives will establish before they are checked out by invasive species.

Goal 4: Increase Community Awareness of the Sensitive Ecosystem

Alternative 1: Volunteer Work Days (Preferred Alternative #1)

Pros:

- More work will be done and in a shorter time frame.
- Generate increased community awareness.
- Offers chances for networking (potentially offer a solution to future monitoring and maintenance.)

Cons:

- Need for an incentive.
- High impact due to foot/vehicle traffic.
- No restrooms nearby.
- Scheduling conflicts.

The value in having a community workday is immense. It will give surrounding residents an idea about what is going on at the site, how they can implement the same ideas on their own property, and bring general awareness about invasive species to the public.

Alternative 2: Informative Signs (Preferred Alternative #2)

Pros:

- Raise awareness for visitors to the site.
- Prevents negative damage to sensitive areas.
- Promotes the establishment of permanent trails.

Cons:

- Attract a lot more attention.
- Cost associated with making the signs.
- Maintenance of signs and replacement when needed.
- Opportunity for vandalism.

Alternative 3: Use of Flyers

Pros:

- Creates awareness.
- Time consuming activity.

Cons:

- Waste
- Cost of paper/printing.

Alternative 4: Informational Meeting

Pros:

- Education increases likelihood of finding volunteers.

Cons:

- Time needed to organize
- Where to hold the meeting?

Alternative 5: Physical Barriers at the site

Pros:

- Decreases the impact on sensitive areas.
- Prevents motorized vehicles from disturbing the site.

Cons:

- Attracts new attention
- Maintenance issues.
- Inhibit wildlife trails.

Alternative 6: Door to Door

Pros:

- Increase awareness
- Opportunity to generate more volunteers

Cons:

- Annoyance and disturbance to local residents.
- Timing issues.
- Time consuming

Discussion:

Goal 1: Delineate Wetland

Objective A: Sample and identify 90% of plant species on property.

Non-Invasive Species

Table 1 describes the non-invasive species found on the property. The "Stratum" and "Wetland Designation" is based on the Army Corps of Engineers (ACOE) manual Chapter 2: Hydrophytic Vegetation Indicators. Vegetation indicators are used to assess the "assemblage of plant species growing on a site, rather than the presence or absence of particular indicator species." Wetland plant species are designated by the U.S. Fish and Wildlife Service, National Wetland Inventory as: OBL, FAC, FACW, FACU, and UPL. These designations are determined by state and some wetlands may lack any of these indicators. In order to evaluate the presence of hydrophytic vegetation on a site, ACOE recommends separating vegetation into the following four strata:

1. *Tree stratum* – Consists of woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.
2. *Sapling/Shrub stratum* – Consists of woody plants less than 3 in. DBH, regardless of height.
3. *Herb stratum* – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size.
4. *Woody vines* – Consists of all woody vines, regardless of height.

The wetland designations used in the ACOE Regional Supplement are: Obligate (OBL), Facilitative with Wet and Upland modifiers (FAC, FACW, FACU), and Upland (UPL). The ACOE Regional Supplement utilizes three indicators: Dominance test, Prevalence index and Morphological Adaptations. If more than 50% of a site is dominated by OBL, FACW or FAC species, the site exhibits hydrophytic vegetation according to Indicator 1(See ACOE, 2008 for more detail).

Table 1: Pre-Existing Non-Invasive Species List

| Species | Common Name | Wetland Designation | Location on Property |
|------------------------------|-----------------------|---------------------|-----------------------|
| Tree Stratum | | | |
| <i>Pinus contorta</i> | Lodgepole pine | none | South and West border |
| <i>Pseudotsuga menziesii</i> | Douglas-fir | none | South-east corner |
| <i>Salix spp.</i> | Willow | | North border |
| Shrub Stratum | | | |
| <i>Rosa sp.</i> | | | |
| <i>Rubus ursinus</i> | California blackberry | FAC | South-west central |
| Herb Stratum | | | |
| <i>Agrostis stolonifera</i> | Creeping Bent Grass | FACW | Most dominant |

| | | | |
|--|-------------------------------------|------|------------------|
| <i>Carex sp.</i> | Sedge | | |
| <i>Cynodon dactylon</i> | Bermuda grass | FACU | |
| <i>Fragaria chiloensis</i> | Beach strawberry | none | East edge |
| <i>Juncus spp.</i> | Rush | | Central property |
| <i>Lathyrus sp</i> | | | |
| <i>Polystichum munitum</i> | Sword fern | none | South border |
| <i>Potentilla anserina</i> <i>ssp. pacifica</i> | Cinquefoil | none | Pool area |
| <i>Raphanus raphanistrum</i> | Wild Radish ("Jointed Charlock") | none | East border |
| <i>Spiraea douglasii</i> | Spiraea | OBL | Central property |
| <i>Vicia gigantea</i> | Vetch (native) | none | Property borders |
| <i>Vicia spp.</i> | Vetch | | Property borders |
| | | | |

Invasive Species

Table 2 describes the invasive species found on the property. The California Native Plant Society (CNPS) lists invasive species as "A" or "B". An "A" designation indicates that a species is most harmful, and a "B" designation indicates that a species is of concern.

Table 2: Invasive Species List

| Species | Common Name | CNPS List | Location |
|-------------------------------|----------------------|-----------|---------------------------|
| <i>Cotoneaster franchetti</i> | Cotoneaster | B | South border |
| <i>Cytisus scoparius</i> | Scotch broom | A | East, South, North border |
| <i>Ilex aquifolium</i> | English holly | A | South border |
| <i>Rubus discolor</i> | Himalayan blackberry | A | All borders |

Objective B: Soil 363 group will dig soil pits to identify and map soil in GIS.

Goal 2: Remove Invasive Plant Species

It is recommended that in ecologically sensitive areas Scotch Broom is removed manually (http://www.mattole.org/pdf/SB_plan_app_07_removal_techs_060823.pdf). Manual removal consists of removing the entire plant including the majority of its root system. Small plants can be removed by hand while larger plants can be removed with the aid of shovels, picks or a patented tool called a *Weed Wrench*. The *Weed Wrench* is essentially a lever which attaches to the base of the plant and assists in removing the plant in its entirety. This tool is recommended for removing larger Scotch Broom. Removed plants can be left on site (<http://www.nps.gov/archive/redw/scotchbr.htm>).

Objective A: Remove 50% of the current Scotch Broom population.

Objective B: Remove 50% of the current Himalayan blackberry population.

Goal 3: Reintroduce Native Plant Species

Objective A: Introduce 3-5 native plant species

Our plan includes the (re) introduction of native plant species in areas where Scotch broom (*Cytisus scoparius*) and Himalayan Blackberry (*Rubus discolor*) were removed. There is very little vegetation left in this area, and in some areas the soil is bare because it was almost completely dominated by the invasives. The patch of land cleared of invasive species can now be labeled as "disturbed habitat." Without proper management of native plant introduction, it will be re-colonized by the invasive species. Scotch broom thrives in full sun, so planting trees that will establish quickly and create shade will help reduce the re-establishment of Scotch broom in the removal areas.

Our research and additional consultation with the California Native Plant Society (CNPS), has resulted in a list of plants ideal for the cleared area. Willows (*Salix spp.*) are a fast growing deciduous tree species. They are a good option for several reasons. First of all, there are already Willow trees growing on site. Willows provide habitat for birds and attract pollinators. Cuttings from the existing trees can simply be stuck in the ground and they have high likelihood of survival. This makes them a very economical choice. The CNPS also recommended Red Alder (*Alnus rubra*), Big Leaf Maple, (*Acer macrophyllum*) as trees that establish quickly and provide significant shading. Twinberry (*Lonicera involucrata*), a deciduous shrub is already growing at the edge of the forest on site and may be a good option. Some evergreen shrubs such as the hardy Silk Tassel (*Garria elliptica*) or Pacific Wax Myrtle (*Myrica californica*) would be a wise addition to help with shading all year. There is one surviving Sword Fern (*Polystichum munitum*) in the area **where Scotch broom has been removed**, and many others in the shaded south border of the property. Introducing more of these ferns is recommended. Seashore Lupine (*Lupinus littoralis*) is suggested for its hardiness. Wild Strawberry (*Fragaria chilensis*) makes an excellent ground cover and spreads quickly. Native grass seeds could be planted but will have low survivorship this late in the season.

Planting Methods

Most plants should be spaced at approximate 5 foot intervals, and willows can be more closely spaced. **Some mixture** of all these species would be ideal. It would be economical and appropriate to plant more Willow because propagules are easily cut from the individuals on site. One gallon to 3-5 gallon starts will be recommended for other tree species. Watering

Objective B: 10 community members attend an educational outing on the site.

Goal 5: Create a Management Plan

Objective A: Outline short/long term goals regarding the educational use of the property.

Objective B:

1. **Outline invasive/native plant species management**
2. **Produce guidelines and schedule for future management and restoration efforts**

Restoration/Monitoring Schedule:

Summer 2009:

June: Monitoring (Land Trust volunteers)

1. Vegetation inventory of annual herbaceous species
 - a. Samples for Herbarium Notebook
 - b. Written documentation of annual species present

August/September: Fund Raising

1. Fundraising activities for the acquisition of native plant species for introduction to the property.

Fall 2009:

October: Monitoring and Removal (Professor Purcell's class)

1. Vegetation inventory of annual herbaceous species
 - a. Samples for Herbarium Notebook
 - b. Written documentation of annual species present
2. Removal of Scotch Broom, Himalayan Blackberry and English Holly

November: Planting of Native Species (HSU Student volunteers)

1. Plant (#individuals) of 3-5 tree/shrub species in the former Scotch Broom inundation areas.

December: Monitoring (Land Trust Volunteer)

1. Roping-off of pool in preparation for the rainy season

Spring 2010:

February: Removal/Monitoring

1. 2nd Annual Vernal Pool invasive removal day (prior to flowering of invasives)... but stay out of the pool area as the frogs are laying their eggs now.

2. How are the new Native species doing?

March: Monitoring

1. Remove pool rope barriers because pool will be very large soon

Summer 2010:

July/August: Monitoring

1. Do the new Natives need some watering?