DELTA WORKING LANDSCAPES

Public and Private Partnerships for Habitat

Delta Protection Commission

EXECUTIVE SUMMARY

The Delta Working Landscapes Program (Program) is a group of projects which demonstrate how farmers can integrate habitat restoration into farming practices.

The objectives of the Program are to improve the environmental quality of existing landscapes in the Delta; coordinate programs with local farmers; understand the social, economic, environmental and governmental policy hurdles and/or incentives to perform conservation practices; and communicate to farmers the advantages of implementing wildlife friendly agricultural practices.

The Delta Protection Commission was awarded a three year grant to construct the program through the California Bay-Delta Program in 2005. Program partners included Hart Restoration (Hart) and Ducks Unlimited (DU). Hart established vegetative buffers along irrigation ditch banks and hedgerow grass plantings. These plantings were designed to provide habitat for wildlife, improve water quality by reducing runoff of pesticides and sediment, enhance levee stability, and retard levee erosion. DU coordinated restoration enhancement projects which included creating seasonal and permanent wetlands on marginal farmlands. These projects provide waterfowl brooding habitat, a food source, and additional habitat sites which promote healthier waterfowl flocks.

To date, these projects total 312 acres of seasonal and permanent wetlands and 6.5 miles of enhanced levees and waterways. Many of the revegetated areas are thriving with native plant life, have been repopulated by wildlife, and filter agricultural drainage which improves water quality and enhances levee stability. Multiple species of waterfowl are using the restoration habitats for brooding and feeding as well as staying later into the season.

Challenges to Working Landscapes projects include prior long term use of pesticides and herbicides which have created a hostile environment for native plants and wildlife. Additionally, some cultural practices are not conducive to habitat creation such as practices which rely on herbicides instead of tillage. Furthermore, economic costs are affiliated with physical land alterations, and in some cases permit requirements are cumbersome.

Despite these challenges, successful public/private partnerships are possible. Working Landscapes projects can be expanded through better communication between policy and regulatory agencies and publicizing successful projects.

INTRODUCTION

The economic and resource value of the Sacramento-San Joaquin Delta (Delta) to California is over $6.5 billion[1], and is one of the State's most productive agricultural landscapes. Approximately 60 percent of California's water supply passes through the Delta. The Delta is home to over 700 fish and wildlife species, including numerous species of special concern, such as anadromous Chinook salmon (*Oncorhynchus tshawytscha*), Delta smelt (*Hypomesus transpacificus*), sandhill crane (*Grus canadensis*), black rail (*Laterallus jamaicensis*), northern pintail (*Anas acuta*), and several plants. The Delta's system of levees and waterways not only protects farmland and the urban periphery of the Delta, but also provides a recreational resource for millions of Californians who boat, fish, hunt, birdwatch, and more.

Today, the Delta is faced with many challenges, including: degradation of water quality from urban, industrial, and agricultural discharges; impacts of export pumps which cause reverse flows that effect migrating fish; invasive species which compete with native species for food; and invasive plants that clog Delta waterways. These and other factors have contributed to low fish populations, poor water quality, and limitations on water exports. Other environmental threats include levee stability, island subsidence, and urban encroachment. Levee habitat is controversial—regulatory agencies often conflict on habitat and maintenance. An example of this conflict is the standard, of the Army Corps of Engineers, of no vegetation on levees, while fish and wildlife agencies advocate for levee waterside habitat.

Working Landscapes is a program with projects designed to encourage public/private partnerships to implement practices that address some of these threats while sustaining and enhancing agriculture. The goals of Working Landscapes are to:

1. Improve the environmental quality of Delta farmlands through a variety of demonstration projects;
2. Understand the interplay of social, political and economic factors that hinder implementing these type of projects; and
3. Facilitate information exchange to encourage expansion of incorporating habitat projects in commercial agricultural practices.

[1] Delta Protection Commission, "Economic Sustainability Plan for the Sacramento-San Joaquin River Delta", January 19, 2012

The purpose of Working Landscapes is to encourage farmers to invest in habitat on farmland in a manner that is mutually beneficial to production agriculture and the Delta ecosystem. These farmlands not only produce food products for the State and Nation; but also provide opportunities for wildlife habitat, recreation, carbon sequestration, subsidence reversal, and water quality improvements. The Delta Protection Commission (DPC) Working Landscapes Program (Program) included developing hedgerows, ditch and levee plantings, as well as riparian and wetland habitats. These projects are demonstration projects that can be incorporated into ongoing farming operations.

These projects are critical to the sustainability of the Delta. Agricultural operations that incorporate habitat improvements benefit wildlife (waterfowl, songbirds and native insects), native plants, soils, and water quality. Habitat projects enhance the value of farmland, reduce cultural costs, and provide opportunities for diversifying farm revenue from tourism, hunting, and other recreational activities. Economic activities also extend to businesses in the Delta that provide food, lodging, and visitor amenities. Successful habitat restoration partnerships can appeal to a broader regional and statewide audience; which can result in increased interest in protecting and sustaining the Delta.

In 2005, the California Bay-Delta Program established projects that would assist farmers in integrating agricultural activities with ecosystem restoration. The DPC was awarded a three year grant to construct the Program which included a partnership with Ducks Unlimited (DU) and Hart Restoration (Hart). Both organizations were identified as partners due to their long history of ecosystem restoration and strong relations with land owners in the Delta.

The Program was designed to support the policies and goals across multiple agencies: CalFed, the State Water Quality Control Board, Department of Water Resources, and the DPC. Additionally, the program also supports Delta Vision's objectives to integrate agricultural activities with ecosystem restoration and the co-equal goals of water supply and habitat restoration of the 2009 Delta Reform Act.

The objectives of the Program are to:

1. Improve ecosystem quality, water quality, and levee system integrity by establishing wetlands and habitat buffers;
2. Demonstrate economic ways in which sustainable agricultural practices can improve ecosystem values;
3. Demonstrate to growers the economic benefits of using different cultural practices which improve water quality, and create water bodies or seasonally flooded areas that benefit wildlife and are compatible with existing cropping patterns;
4. Produce data on wildlife friendly farming that can assist other organizations working to restore habitat; and
5. Produce a document that can be a reference for establishing public/private partnerships for Working Landscapes.

PROGRAM IMPLEMENTATION

Hart served as the Program coordinator for habitat friendly farming demonstration projects. DU served as the coordinator for wetland farming demonstrations. Both have extensive experience with wildlife friendly farming practices throughout California.

Hart's projects included installing native plant buffers that separate farmland from waterways. These improve water quality, filter plant nutrients such as nitrogen and phosphorous, remove sediment, and reduce levee erosion. Additionally, the buffers can minimize the need for herbicides which can reduce ongoing maintenance costs. The projects involved planting of hedgerows and grass species in drainage ditches, landside levee restoration, and habitat restoration on areas of unused farmland.

DU wetland farming practices involved the construction of ditches with gradual levee slopes, and seasonal and permanent wetlands on marginal productive farmland. Projects provide wildlife habitat and refuge which promotes waterfowl nesting. Interior berms were constructed for flooding farmland which reduces soil oxidation, and suppresses weeds. Additionally, decaying plant matter in wetlands retards and can reverse subsidence.

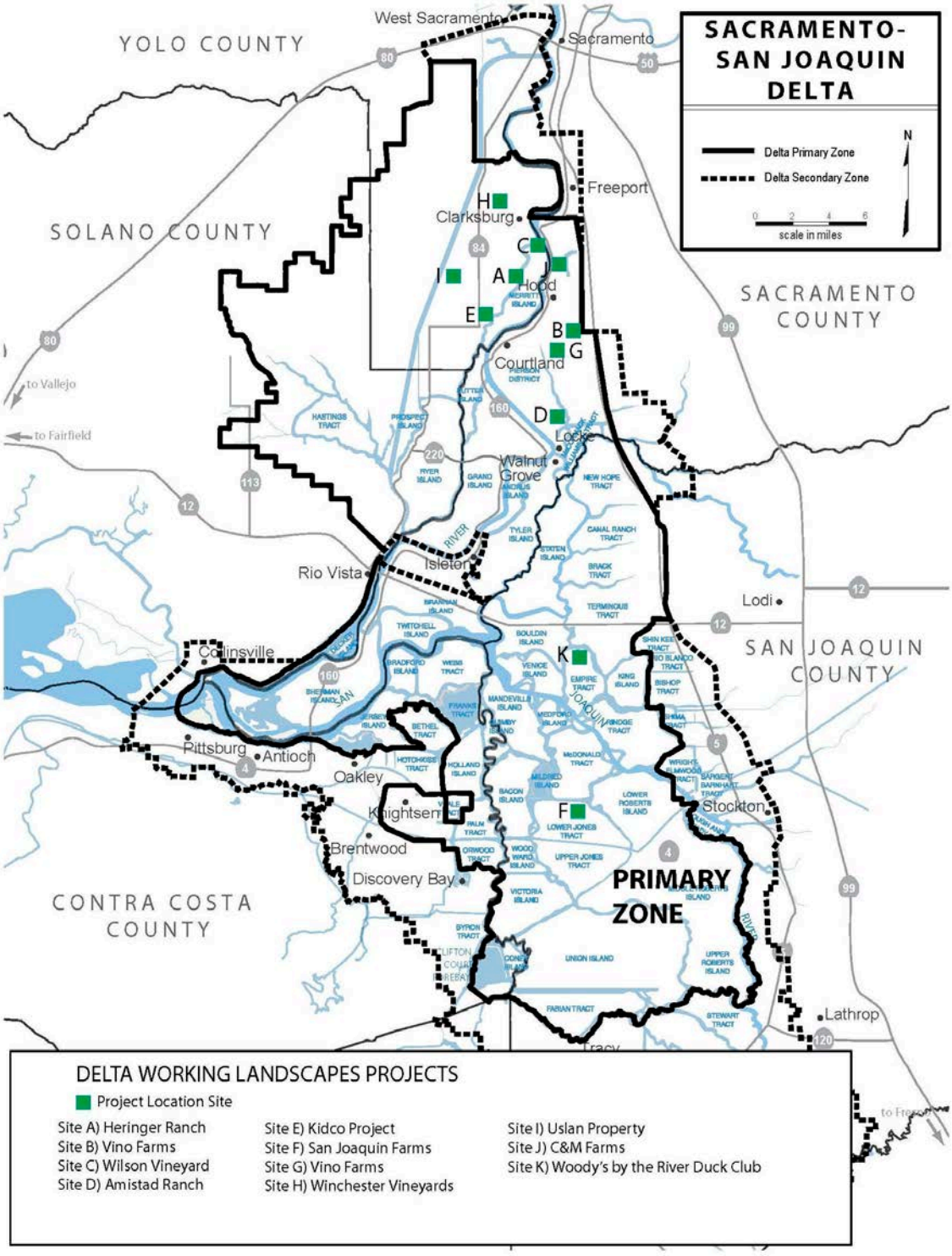
The objectives of the projects are to:

1. Improve the environmental quality of existing landscapes in the northern Sacramento-San Joaquin Delta;
2. Develop an educational mechanism and economic model to apply environmentally friendly farming practices to other Delta farmlands and stakeholders;
3. Facilitate environmental compliance by overcoming disincentives and increasing incentives for these types of projects; and
4. Coordinate with farmers to understand the social, economic, environmental and governmental policy impediments to performing conservation practices and to identify those incentives that encourage conservation practices.

To implement the Program, willing landowners were identified through existing networks, including reclamation districts, the Center for Land-Based Learning, and private duck clubs. Where appropriate, farmers were invited to observe established habitat projects on existing farms to see if these types of practices would be compatible with their operations. Interest levels were highest amongst duck clubs, grape growers, and younger farmers. Corn and commodity growers were generally less interested in participating.

The initial outreach identified 11 sites for the Program, all of which were in production agriculture with the potential to improve habitat. No easements, MOUs, fee purchases, or eminent domain was used.

Map of Program Locations



Four hypotheses were proposed regarding the economic costs and benefits of wildlife friendly agricultural practices:

- **Hypothesis 1:** Seed drilling is a less expensive method of native grass establishment than using of plug plants. To test this hypothesis, native grasses were planted using a drill planter and plug plants were transplanted on the same site. Effectiveness is measured by comparing the labor, costs, and the establishment of grass cover (measured by percent cover of natives vs. weeds).

- **Hypothesis 2:** Establishment of native grass cover will reduce maintenance costs along ditches. To test this hypothesis, paired tests (same adjacent crop, farm, soil types and management approach) comparing native grass and weed populations were conducted on sufficiently lengthy areas (±1000 linear feet for each). Effectiveness is measured by comparing maintenance costs between grass covered and non-grass covered ditches.

- **Hypothesis 3:** Vegetated ditch banks will erode less than bare/weedy banks. Effectiveness is measured using erosion pins and visual inspections of the extent of bank failure.

- **Hypothesis 4:** Winter flooded agricultural fields have an economic benefit to the farmer. Effectiveness is measured by net economic gains from winter flooded fields (ease in spring tilling, reduction of noxious weeds) compared to non-winter flooded fields.

The objective is to have each restoration site fully functional within three years. Fully functional is defined as established desirable vegetation, presence of wildlife, decreased erosion, and/or fewer invasive species. Each site is evaluated to other sites with similar treatments to compare relative success of project implementation.

Farm operators and farmland were selected based on:

1. Personal knowledge of farmers representative of the area; which included a sampling of open ground, orchard, and vineyard types of agriculture.
2. Openness and willingness of the farmers to be involved.
3. A response of the potential farmers to the types of plants and their beneficial impact on the landscapes in question. At this step in the process some farmers were interested, while others were not.
4. Landscape settings on particular farms. Some landowners farm right up to the edge of their properties with little room for hedgerows and ditch plantings, so these farmers were not as receptive. Farmers with available space were most responsive.
5. Compatibility of proposed restorations with current farm practices.
6. Soil conditions suitable for adequate growth.
7. Absence of especially noxious weeds.

All participating landowners were interested in soil and resource conservation; all were interested in vegetated buffers that complemented their crops; and all had soil conditions suitable for establishing native plant buffers in areas that were not overgrown with invasive weeds.

The proposal called for the planting of 15,000 linear feet of native hedgerows and 20,000 linear feet of vegetated ditch banks. Participants were interested in planting native grasses in these buffer areas versus hedgerow types of plants (e.g., perennial shrubs and trees) which tend to require greater maintenance. Year one plantings included grasses and sedges, followed by some hedgerow plants as situations permitted. Prior to planting it was essential to coordinate with farmers to make sure ditches and levee slopes were prepared for fall planting. For installation purposes, these areas required initial weed management be performed by either disking, harrowing, or applying herbicides to troublesome weeds. Planting was made via seed (range drill on sandy slopes) and container plants (plugs on about one foot centers).

PROJECT DESCRIPTION

HABITAT FRIENDLY AGRICULTURE

Site A
Creeping wildrye (*Leymus/Triticoides*) and sedge grass (*Carex barbarae*) were planted along the interior slopes of Elk Slough in Clarksburg. The plantings help prevent levee erosion as well as vegetation to prevent burrowing animals.

Site B
Native grasses were planted along an irrigation ditch to reduce and filter runoff from adjacent vineyard. Grasses serve as valuable habitat for small birds. This site also contains a two acre wetland project.

Site C
Sedge and rush (*Juncus balticus, Juncus effuses*) grasses were planted along land slide slope of Elk Slough.

Site D
Native grasses were planted along the landside levee of Snodgrass Slough to help prevent erosion. Additionally, wildrye, sedge, and rushes were planted along the irrigation ditch to improve runoff.

Site E
Native grasses and vegetation were planted through irrigation ditches.

WETLAND PROJECTS

Projects involved the winter flooding of agricultural lands, creating seasonal and permanent wetlands. Seasonal wetlands included establishing structures for shallow flooding. Elevation differences within the farmland provide for different water depths and habitat types. Flooding depths were arranged to accommodate four to ten inches of water to provide optimal feeding conditions for birds and deeper depths were created to provide open water to inhibit tule growth. Permanent wetlands included building interior berms and levees to contain flooded waters. Permanent wetlands are a more cost effective and efficient water management program; however, these projects are at a greater expense to the landowner due to high cost of construction.

Site F
Project acreage included 134 acres total; 110 acres wetlands in four sites with 24 acres of adjacent upland. After implementation, fall/wintering season waterfowl were documented at the site.

Site G
Project acres included creating two acres of unmanaged wetland habitat on an existing drainage channel. Waterfowl observed at the site after project completion included mallards (*Anas platyrhynchos*), and gadwalls (*Anas strepera*).

Site H
Project acreage included two sites consisting of six acres of managed seasonal wetland as well as enhancing 2700 lineal feet of lake-fringe wetland habitat. Project site was once leveled agricultural corn field with multiple drainage and irrigation ditches. Some bird use is expected for fall/winter 2012-13 and an increase in bird use is expected the following wintering season.

Site I
Project acreage included two sites totaling 10 acres, consisting of six acres on managed semi-permanent wetland, two acres of managed seasonal wetland and two acres of associated upland habitat. The project site was once a leveled dichondra field with multiple drainage and irrigation structures. Crop production in the project vicinity was limited. Minor bird use is expected for fall/winter 2012-13 and an increase in bird use is expected the following wintering season.

Site J
Project acreage includes three acres of managed seasonal wetland. The project area is marginally producing wheat and alfalfa. Some bird use is expected in fall/winter 2012-13 and an increase in bird use is expected the following wintering season.

Site K
Project acreage included construction of agricultural berms surrounding two corn fields to support fall and winter flooding of the corn fields. Berms were constructed around two 70 acre fields resulting in over 10,000 lineal feet of berm and 140 acres of fall/winter flooded corn. Many different species of waterfowl were observed using the fields during the fall and winter of 2011-2012.

BARRIERS AND STRESSORS

HABITAT FRIENDLY AGRICULTURE

Obstacles to successful installation of plants along ditches, farm borders, and levee slopes include herbicide residue, weed infestations, soil conditions, economic factors, and landowner commitment to ongoing maintenance.

Farm operation practices influenced farmers' receptivity to projects. Farmers with annual crops (e.g., corn or wheat) in the central Delta have not been receptive because their method of weed control generally consists of broad scale aerial application of herbicides. This is detrimental to the survival of native plants and has affected the outcome of some of the projects. In one instance, despite the farmer communicating to the reclamation district about the location of new native plant installations, the hired contractor none-the-less sprayed and killed several thousand native grasses. Long term application of herbicides also affects the quality of the soils to support native grasses. Soil build-up of chemical residues renders many irrigation ditches and levee slopes unsuitable for planting.

Farmers in the north Delta growing perennial crops such as wine grapes were the most receptive to these projects. Vineyards are particularly sensitive to herbicide drift and therefore wine grape growers are more discriminating about herbicide usage and look for alternative weed control methods. Some vineyards permit perennial grasses to be grown between grape rows, while in other vineyards the rows tilled or the weeds are controlled chemically.

It is difficult to establish native grasses at excessively weedy sites. Locations overgrown with weeds such as rank species of common blackberry (*Rubus fruticosus*) and other perennial plants are not easily converted to native plant communities. The success of establishing native grasses varies with soil types which range from sandy, to loam, to hard packed clay. Loamy soil sites are the most suitable for planting success.

Economic factors that affect the success of a project include the types of planting methods used and ongoing maintenance costs. Planting methods used included: direct seeding (least expensive), small seedling plugs, and larger well rooted container stocks (most expensive). The suitability of these different methods varies with site conditions. Considerable site preparation is required for direct seeding to work. This involves re-contouring of levee and ditch banks, extensive soil tillage, and/or application of preemergent herbicides—and few sites were suitable for this approach. Reclamation districts and flood control agencies are hesitant to alter levee slopes and the prior cleaning of sites with herbicides can be problematic in the vicinity of

sensitive crops such as grapes. Seeds and seedlings are more sensitive to soils with residual herbicides than larger, established plants. Seeding was done, however, along a re-contoured ditch at Site B which appears successful. Despite the cost, container stock plants are hardier for sites where competition from weeds is a major obstacle to plant establishment.

There is some cost associated with establishing native grasses. There is some cost associated with establishing native grasses, some controlling of non-native species and some ongoing maintenance that may follow. This is a cost and time commitment of the farmer which impacts the willingness to commit to habitat projects.

WETLAND PROJECTS

Wetland restoration projects also faced obstacles in addition to ongoing maintenance and economic factors: conversion of farmland to wetlands, permitting requirements, and terms of commitment. Many growers were interested in providing wildlife habitat but were not willing to pull land out of production. Areas in which agricultural production was limited was found on a couple of farms, but managed wetlands were difficult to construct in these instances due to groundwater and soil conditions

Environmental permitting was overcome by the development of a programmatic California Environmental Quality Act document and the utilization of other programmatic permits. Many of the project actions fell under agricultural exemptions and ongoing reclamation district operational permits.

Some project participants preferred short term commitments, so that if their life situation changed they would not have to deal with the issue of passing on a conservation easement or long term commitment to the next land owner, and would be able to sell their land for full value. An additional benefit of short term commitments is that if crop prices rose high enough, it would make sense to put low yield land back into production. It is noted that none of the landowners had the intention to do such things, but short term commitments provide the peace of mind that the projects would not put additional burdens on the land.

Once the design and agreements were underway many landowners were receptive to the projects and wanted to contribute more land for larger and more diverse habitats. Several have indicated that they are interested in doing more projects in the future. The interest from the landowners to undertake the projects generally derived from either an interest in conservation or in recreation. This interest overcame economic concerns related to the conversion of farmlands to wetlands and projects maintenance costs. On both accounts landowners were willing to provide cost share or resources towards the projects. Where financial cost sharing was not feasible in-kind services were permitted, such as pre-construction land prepping, use of previously purchased water control structures, construction labor, and ongoing maintenance.

MATERIALS, METHODS, RESULTS

HABITAT FRIENDLY AGRICULTURE

Plant materials were installed in the fall of 2010, the winter and spring of 2011, and the fall and early winter of 2011. On five different ranches, 15 sites totaling approximately 58,330 linear feet, were planted with nearly 100,000 plants along ditch banks and levee slopes. The species planted included creeping wildrye, sedges, and rushes.

Where possible, some form of weed control was practiced. The results have largely been successful, but the outcome has varied from one site and ranch to another. The more successful outcome has occurred on the "cleaner" sites using the larger-sized plant materials. Starting from "clean" has shown higher plant survival rates.

The levee slopes at Site C have been well managed with few invasive weeds. Going into the second season the installed plants were healthy, and with the benefit of late rains, the prospects for survival look very good. Another very successful site is the levee slope of Site D. The levee slope had been aggressively treated with herbicides. Where large seedling plugs were planted the survival rate was higher than compared to areas planted with seeds or small seedlings. The seeds or planted areas with smaller materials were less successful due to the apparent residues of herbicides.

At Site A, the plantings with small seedling plugs fared poorly. The lack of success may be attributed to competition with annual grasses, compacted soils, and herbicide drift or residues.

Weedy sites planted with larger materials have done relatively well despite plant competition. The plants installed along the ditches at Site B are surviving, but will do better with selective use of broad-leaf herbicides until the plants are well established. Close coordination with the farming operations is needed since the nearby grape plants are sensitive to herbicides.

Wetland plants that have been installed in the wetted perimeters of ditches have done quite well, such as at Site H and the ditch along Site G.

Most of the plantings have been successful, but long term success will depend upon some level of minimal management on the part of the farmers.

WETLAND PROJECTS

Restoration projects were designed by the DU delta bio-engineering team. The DU biologist and engineer met with growers and conservationists to outline restoration opportunities on the landscapes, and the necessary components of the projects. A preliminary cost analysis was developed and an appropriate match contribution was discussed with the land owner. DU wrote proposed project descriptions and submitted the proposal to the DPC and Ecosystem Restoration Program grant administrator for additional review. DU then wrote a Site Specific Agreement with the landowners outlining methods of payment, roles, and responsibilities of each party. Once the Site Specific Agreement was fully executed DU engineers and biologists began to fully design the projects and develop the wetland restoration plans. Restoration plans included the survey of existing conditions and grading details, habitat niches, and guidance on how to manage and maintain wetland restoration projects.

Although no two wetland restoration projects are identical, several features are similar. Wetland projects generally consisted of managed seasonal wetland units and permanent wetland units. The difference is the duration of water present which dictates vegetation species and stratum, which in turn provides different values to wildlife.

Regardless of the wetland type, projects generally contained a perimeter berm to promote flooding within the wetland unit, swales and potholes to manage the depth and location of open water and to control emergent vegetation, and water control structures for management of wetland surface water depths and drainage.

The wetlands were constructed by experienced contractors utilizing large excavation equipment. Contractor work included the supply of all labor, material and equipment required to complete the excavation, hauling and placement of earth materials for the construction of created islands, embankment fills, and the excavation of swales and potholes as shown on the restoration plans.

Specific construction work included:

- Disking of borrow and embankment areas
- Excavation of suitable material from swales and potholes
- Moisture conditioning of embankment material
- Placements of embankment fill areas
- Excavation and base preparation for water control structures and pipe
- Excavations of suitable material from borrow areas for embankment backfill
- Backfill of water control structures and pipe with compacted fill
- Tie-in of backfill embankment to existing improvements
- Installation of precast concrete water control structure weirs
- Installation of corrugated HDPE pipe
- Installation of wood stop logs

All wetland projects have been considered successful and landowners are satisfied with the overall outcome of the restoration. Each site has seen an increase in wildlife abundance and species diversity. There is additional interest in opportunities to conduct future restoration.

Wildlife observed with the restoration projects included but was not limited to: American wigeon (*Anas americana*), cinnamon teal (*Anas cyanoptera*), gadwall, green-winged teal (*Anas crecca*), northern shoveler *(Anas clypeata*), mallard, wood duck (*Aix sponsa*), and white-fronted goose (*Anser albifrons*), and northern pintail. Vegetation present in wetlands included smartweed (*Polygonum spp*), Japanese millet (*Echinochloa spp*), watergrass (*Bulbostylis barbata*), broad leaf cattails (*Typha latifolia*), hardstem bulrush (*Schoenoplectus californicus*), hardstem bulrush (*schenoplectus spp*), Santa Barbara sedge (*Carex barbarae*), bent grass (*Agrostis exerata*), black willow (*Salix nigra*), creeping wildrye, rush, and other various willow species.

LESSONS LEARNED

Success or failure seems to be related to the size, structure, and management of the farming operation. Small family-run farms may not have the time or the financial resources to break away from farming operations to conduct environmental enhancements, compared to larger farms with more resources.

Certain types of farming operations are more amenable to planting native species along ditches and levee slopes. Large scale open field commodity crops (such as corn and wheat) are less likely to be compatible with these environmental enhancements as broad herbicide application (sometimes done by airplane) is incompatible with native plant survival. Vineyards seem to be more compatible with planting native species as herbicide application is done in a more controlled manner.

Soil conditions affect the success of establishing grassland habitat. Certain soils such as coarse sand or fine clay are more difficult for plant growth. Extremely sandy conditions are often the result of former dredging operations that pile sandy river bottom materials onto levee slopes. These materials are often derived from former hydraulic mining activities which brought course materials downstream from the gold mining regions to the Delta. Heavy clay soils are often the result of dredging from ditches as these materials are then placed on ditch and levee banks. The most ideal soil composition is a well-balanced loam, which may be difficult to locate.

It is difficult to establish grassland habitat in extremely weedy conditions. Sites with rank species of blackberry and other perennial plants are not easily converted to native plant communities. Several years of weed control (often through spraying of herbicides) is required to prepare the site for planting. If native plants are installed within a weedy community, then competition with the weedy species reduces the success of the planted species.

Past and ongoing land management practices can affect the successful establishment of grassland habitat. In particular, sites with long histories of herbicide application make for difficult conditions for establishing native plant populations.

Soil moisture availability is important for successful revegetation of native plants. Planting of moisture loving plants along ditches can be very successful as compared to planting on dry slopes. Planting success along ditches is dependent upon the timing and seasonality of water availability. There is a narrow window of opportunity for success. Plantings should occur during the middle of fall after sufficient rains. Starting earlier or waiting for a later date requires expensive pre-irrigation or post-irrigation. These factors must be understood in planning for revegetation projects.

Some general weeding or mowing is required to reduce weed competition. Planting into annual grass communities is more feasible than planting into coarser weed communities as the former can be more easily controlled through mowing. The presence of rank weed species

requires hoeing or the application of herbicides which can be expensive and jeopardize the survival of native plant species.

The most successful environment for ditch and levee slope enhancements include: 1) better quality soils (such as loams); 2) inherently cleaner sites with fewer rank and/or perennial weeds; and 3) certain cropping environments, such as larger vineyards with farm managers who share these environmental goals.

The size of the planting materials influenced survival. Generally, the larger the plant the greater the likelihood of survival, and seed use is not recommended except for weed free and tilled sites.

Although the cost for permanent wetlands is generally higher than for managed seasonal wetlands there is an economy of scale for both. Permanent wetland units require deeper excavation to keep the unit from becoming solid cattails which can tolerate inundated conditions up to two feet. Excavation for open water areas need to be three feet or deeper to maintain open water. When doing construction in areas that are marginal for agricultural use, a higher water table is typically present. Under these conditions de-watering techniques are used; however, it requires more effort and results in higher project costs.

The cost of restoration is high and can be difficult for private landowners to undertake on their own without some financial assistance. An incentive or cost sharing approach may be necessary to overcome the economic costs of wetland projects. Cost sharing programs should consider revenue opportunities that may come from the project and/or the availability to allow public access for nature based recreation.

PROJECT SUMMARY

Working Landscapes is a program designed to encourage public and private partnerships to implement projects to improve the ecology of the Delta while sustaining and enhancing agriculture. The goals of the Working Landscapes are to:

1. Improve the environmental quality of Delta farmlands;
2. Understand the interplay of social, political, and economic factors that hinder public/private environmental projects; and
3. Encourage the expansion of incorporating habitat projects in commercial agricultural practices.

Over 6.5 miles of habitat, including native grasses and hedgerow plantings, were established along ditch banks and levees. These projects were designed to provide habitat, improve quality of agricultural drainage water, provide levee stability, and retard levee erosion.

Established permanent and seasonal wetlands totaled 312 acres. Wetlands were designed to provide waterfowl habitat for brooding and serve as a food source. Projects also retarded subsidence and improved marginal farmland.

Though the results of the projects were mixed or are still being evaluated, successes were observed in the establishment of both grassland buffers and hedgerows, and in seasonal and permanent wetlands. Successes were observed in the repopulation of wildlife, filtering of agricultural discharges, reduction in levee erosion and cultural costs to control noxious weeds.

A challenge to Working Landscape projects is identifying landowners across the broad spectrum of Delta agriculture who are willing to participate in incorporating habitat friendly agricultural practices into traditional agricultural practices. Field crop operators were less likely to participate than vineyard operations. This is primarily because field crop operators rely on herbicides as part of the cultural practices, while vineyards are sensitive to many herbicides. Additional challenges include potential capital costs associated with site preparation and ongoing maintenance costs necessary to sustain habitat and the potential necessity of permits and oversight by regulatory agencies.

Successful habitat projects must be multi-year. In order to have operators receptive to multi-year projects clear benefits must be identified. These can be reduced tillage and chemical use over the long term; additional revenue opportunities from hunting or wildlife viewing; better levee stability; and reduced regulatory oversight because of improved water quality from agriculture drainage.

In order to be successful over the long term, the value of establishing habitat must be great enough that private operators are willing to establish them without dependence on public assistance. However, in the near term until benefits are fully understood, it will be necessary

for public/private partnerships to continue to have financial incentives for operators to participate. As part of sustaining habitat development, other non-financial incentives, such as regulatory relief and permitting reform should be explored.

There is value to the Delta in using public/private partnerships to establish habitat as part of ongoing agricultural practices. Land that remains in commercial production continues to be on the property tax rolls contributing to local government and community as compared to the cost of placing land under public ownership to provide habitat at the expense to the local economy and local government. Fostering new habitat is consistent with the co-equal goals of the 2009 Delta Reform Act and contributes to the economic sustainability of the Delta.

The success of public/private partnerships is dependent on flexibility and innovation on the part of partners to meet site specific needs. There should be specific conservation objectives and goals, and an understanding of the economic barriers/opportunities that farmers face and above all partners should be able to adapt to changing circumstances.

Sustainability of the Delta, maintaining its uniqueness, and its role in the State's ecology depend on all of us, as partners, to make habitat compatible with agriculture.