Delta Working Landscapes – Vegetative Buffer and Wetland Habitat Management Guide

September 2013

An Introduction to Vegetative Buffer and Wetland Management

This guide has been prepared to provide an overview of management techniques for vegetative buffers and wetlands habitats that were established as part of the Delta Working Landscape Program and identify additional resources for landowners who are considering implementing Working Landscapes projects.

This document is divided into two sections, each describing projects that require different plant species, establishment methods, and management protocols. The first section, vegetative buffers, presents a more intensive, small-scale approach often involving hand labor for planting, irrigation, and specialized methods of establishment. Native plants are used in this approach. The second approach involves the construction of larger-scale wetlands, an approach that includes site recontouring with heavy equipment, introduction of plants through transplanting of tule clumps or methods of seed application, establishment/water management techniques for precisely timed flooding and drawdowns, and mowing and herbicide application with large-sized equipment. Most of the plants favored by this approach are non-native species.

Section I: Vegetative Buffers

Vegetative Buffers Management

Several types of buffers are recognized in working landscapes: hedgerows, vegetated ditches and grassland enhanced levee slopes. As described below, each has specific opportunities, limitations and constraints, and environmental benefits.

Hedgerows

Hedgerows consist of closely spaced shrubs and trees that are planted to form a barrier or mark a boundary between properties and fields. Hedgerows are old concepts that date back several thousand years in Europe. In the context of Delta Working Landscapes, hedgerows are visualized as consisting principally of native shrubs and trees, with additional understory grasses and herbs that serve several functions: creation of wildlife habitat, buffers to restrict pesticide drift, and reduction of weeds by providing overstory competition.

Vegetated Ditches

The concept of vegetated ditches involves the planting of several species of native plants, such as grasses, sedges, rushes and non-invasive tules along embankments of ditches. Several benefits are conceived: reduction of sediment and pesticide transport from farm fields to wetlands and waterways; improvement of wildlife habitat; and reduction of herbicide use as the native perennial plants crowd out weeds.

Several kinds ditch environments are suitable for planting: deep water environments, mid slopes occasionally wetted by water transported from the fields, and upper upland slopes above the

seasonal water conveyance zone. The deep water environments can become quickly vegetated with tules (such as *Scirpus californicus or S. americanus*) and foster a sustaining environment needing little if any maintenance. Mid level slopes, especially re-contoured clean bank conditions, are especially amenable for planting with several species of native plants. Once established with native species they need little if any maintenance. Weedy ditch sites, compared to cleaned and re-configured slopes, are more problematic for plant establishment as weeds can seriously compete with planted species.

Landside Levee Restoration

Landside levee restoration involves the installation of native grasses and grass-like plants. Planting in this environment is an active habitat restoration approach involving various strategies, but it is one fraught with uncertain outcomes that may require adaptive management. Generally, this approach involves broadcasting seeds of native plant species and the judicious use of herbicides and mowing during the establishment phase. Once established, these sites still need ongoing maintenance to suppress weeds; this involves spring mowing and periodic and discriminating application of broad-leaf herbicides.

Plant Selection and Establishment

There are several categories of native plants to choose for planting vegetative buffer strips. These include: 1) grass and grass-like plants; 2) shrubs; 3) wetland plants; and 4) trees and shrubs. Table 1 summarizes these categories and species of plants and the following sections offer assistance in establishing and maintaining these native plant species.

Table 1. Recommended Native Plant Species for Central Valley Vegetative Buffer Projects

Restoration Type/Location	Vegetation Description	Common Name	Scientific Name
Levee slope/field edge	Grass	Creeping wildrye	*Leymus triticoides*
Levee slope/field edge	Grass	Deergrass	*Muhlenbergia californica*
Levee slope/field edge	Sedge	St. Barbara sedge	*Carex barbarae*
Field edge	Tree	Black willow	*Salix gooddinggii*
Field edge	Tree	Red willow	*Salix laevigata*
Field edge	Shrub	Mulefat	*Baccharis salicifolia*
Field edge	Shrub	Coyotebush	*Baccharis pilularis*
Wetland	Wetland plant	Three square	*Scirpus americanus*
Wetland edge	Wetland plant	Common rush	*Juncus effusus*
Wetland edge	Wetland plant	Baltic rush	*Juncus balticus*
Wetland	Wetland plant	Common tule	*Scirpus acutus*
Wetland	Wetland plant	California tule	*Scirpus californicus*

Grass and grass-like plants

General Description. These species are selected because they eventually will dominant the sites to which they are adapted. The rhizomatous growth habitat of creeping wildrye (*Leymus triticoides*) and Santa Barbara sedge (*Carex barbarae*) allows the plants to fully occupy the sites where they are planted and in doing so precludes the establishment of unwanted weeds. Deergrass (*Muhlenbergia californica*) is not rhizomatous, and therefore does not spread vigorously, but since it becomes a large-sized grass at maturity, it can dominant the site by its mass, and thereby reducing competition.

Recommended Environments. These species do well on levee slopes, ditch borders and edges of fields. Of these species, deer grass and creeping wildrye are more drought tolerant than Santa Barbara sedge, but all three species do relatively well in dry conditions. In these environments it is highly recommended to attempt establishment in relatively clean, weed-free environments, at least to the extent possible. Many existing farmland environments will need extensive preparation work before any planting is contemplated.

Establishment Methods. These species typically have the option of planting by seeds or using living, container plants with a developed root system. The cost for seeds is far less expensive than buying container plants. However, planting by seed requires a very well prepared, clean site free of competing weeds. For establishment with seed application, the site must be thoroughly controlled for weeds as the young seedlings are difficult to establish, especially when competing with aggressive weedy species.

Site preparation includes initial grading and soil preparation and application of certain herbicides (especially pre-emergent). Another approach is to apply a contact herbicide after the first rains have germinated weed seeds. With weed initially controlled, then it is time for planting. To bury the seeds at the appropriate depth, a range drill should be used. This is a recommended approach on rather large projects where earth work and site preparation are feasible. However, even with this approach, the site may become infested with weeds.

Another approach is to plant established seedling or containerized plantings with developed root systems. The cost for these materials is higher than for establishment by seeding as described above. With containerized plants, one option is using small "plugs", which are cheaper, but being smaller in size they are potentially less likely to become established. The other option is to plant in somewhat larger sized containers, which is more expensive, but there is a greater likelihood of success. The process of installing container plants can be expedited by the use of hand held power augers to dig the planting holes, followed by installation by hand. A single person can plant anywhere from 200 to 800 plants per day, depending upon site conditions.

For either method, a fall planting after the first substantial rains is the best time of the year. Planting as late as March might seem feasible, but there may not be sufficient rains after late spring for successful plant establishment.

Maintenance Methods. Either method of plant establishment requires maintenance, especially at first. Weed growth can be controlled by a combination of spraying and mowing. Broad-leaved

weeds can be controlled by the application of herbicides that do not affect the grasses. Pest control advisors should be consulted regarding the appropriate selection of materials. Mowing should be done during mid to late spring (March through May) to reduce the height and competitiveness of potentially overtopping weeds, especially annual grasses not affected by previous herbicide treatment. A good rule of thumb is to mow the competing annual grasses before their flower heads have set seed. At least 2-3 years of these maintenance methods are required to fully establish the native grasses. However, even after this time period some maintenance is needed to prevent the sites from becoming weedy.

Wetland Plants

Wetland environments occur on many farm landscapes, such as ditches, canals and wet areas that may not support farming endeavors. A cautionary note is to not plant wetland species that can become too weedy, a condition which might prevent adequate drainage and flow thru of water in irrigation ditches. In these environments, smaller wetland plants are recommended, such as the rushes listed in Table 1. In larger canals with deeper water, larger tule-like plants may be used. Many wetland species (see Table 1) are rhizomatous and spread on their own after installation.

Recommended Environments. These plants can be installed along the wetland edge, as planting underwater is not feasible. Irrigation ditches and canals are ideal sites for establishment. However, a dilemma is that some environments are extremely weedy, or conversely, other sites are very clean because of prior use of herbicides. Sites that are excessively weedy can fail because of competition from weed growth. Prior cleaning of these sites is highly recommended. On the other hand, excessively clean sites may lack vegetative growth because of residual herbicides in the soil. Planting these sites is also not recommended as many native species are very susceptible to herbicides. The best results for establishing wetland plants is to install in relatively clean environments, including site preparation methods that include soil grading.

Establishment Methods. These species are best installed by planting containerized plants with well developed root systems. As many of these plant develop good root systems at a relatively young age in their containers, using plants in relatively large containers (up to 1 gallon in size) is a good investment. Before planting, some water management of the ditches and canals is suggested. For example, drawing down water levels permits one to plant in moistened soil on the perimeter of the wetland; after planting, then water levels can be raised, which has the added benefit of nurturing growth. As these plants spread by vegetative growth, they will like fill in the entire site where suitable conditions exist.

Maintenance Methods. After this establishment period (perhaps up to one year), then little maintenance is normally required. Only certain kinds and amounts of herbicides can be safely sprayed; the landowner should consult with their appropriate pest control advisor.

Shrubs

On many farms the placement of trees and shrubs is problematic from the farmer's perspective. Tall trees may shade crops or get in the way of ditch and canal maintenance. In these situations, shrubs may offer some opportunities. Two species of the genus *Baccharis* are highly recommended: mulefat (*B. salicifolia*) and coyote bush (*B. pilularis*). Mulefat grows to a somewhat larger size, 8-12 feet tall; while coyote bush is generally 6-8 feet at maturity. Unlike willows, these two species are not very palatable to beavers, which can wipe out willow plantings.

Recommended Environment. Mulefat is hardy from dry sites to relatively moist ones. The preferred soil type varies from relatively sandy to clayey. Coyote bush is better adapted for dry slopes and upper ditch banks; it tends to thrive in lightly clayey to loamy soils.

Establishment Methods. Mulefat is easily established by cuttings from established shrubs. These cuttings should average about 12-18 inches long and about 1-inch or so in diameter. They should be buried about 2/3 their length in the soil. The holes can be dug with a power auger. The restoration strategy for Coyote bush involves planting young seedlings as rooted container plants that have been grown from seeds.

Maintenance Methods. Weeding and application of initial water is a must. To reduce the competitive affects of unwanted plants growing near the installed species, a 2-3 foot diameter area around the plant should be weeded. The use of landscape fabric to reduce weedy growth is also a good idea. Localized application of herbicides may be applied as long as drift is closely monitored. Irrigation for the first season or two is generally required. On a farm environment, this may be accomplished by use of a water truck or trailer. Alternatively, a drip irrigation system may be installed.

Trees

Only two species of trees are suggested, although many others could be added should the landowner take an interest. Many landowners are hesitant to plant tall trees as they get in the way of crop production or ditch management. For buffer plantings alongside ditches, canals and other wetland environments, red (Salix laevigata) and black (S. gooddinggii) willows are good choices in the Central Valley. They are hardy and do well in these environments.

Recommended Environment. Black willow thrives along ditches and canals in the Central Valley, especially in stagnant conditions with heavy soils. Red willow is more drought tolerant and does fine on sandy-loam soils.

Establishment Methods. Willows are easily planted from cuttings. These should be about 2-3 feet long, of which about 2/3 of the stem is inserted into the soil. Power augers are a good method for digging the holes. To reduce the competitive affects of unwanted plants growing near the installed species, a 2-3 foot diameter area around the plant should be weeded. The use of landscape fabric to reduce weedy growth is also a good idea. Localized application of herbicides may be applied as long as drift is closely monitored. Irrigation for the first season or two is

generally required. On a farm environment, this may be accomplished by use of a water truck or trailer. Alternatively, a drip irrigation system may be installed.

Section II: Wetland Habitats

Semi-Permanent Wetland Management

Semi-permanent wetlands provide a host of benefits for a plethora of wildlife. They provide a much needed source of water during hot summer months, as well as critical water for spring broods. This type of wetland typically has year round water with a persistent emergent vegetative community with areas of open water. Semi-permanent wetlands are utilized by waterfowl for brood-rearing, molting, loafing, foraging and predation avoidance.

Vegetation Management

Regular maintenance of the desired wetland vegetation will be necessary following its successful establishment. Semi-permanent wetlands which support quality wildlife habitat can be achieved in the long-term through proper maintenance and management of both wetland and upland vegetation. Ideally, the project should require only minimal management of wetland vegetation and limited annual management of upland vegetation. The desired wetland vegetation community consists of approximately 40% vegetative cover from emergent vegetation along upland transitions and submerged aquatic vegetation in the deeper water. The desired upland vegetation is perennial and annual grasses and forbs on the perimeter and interior berms and uplands.

Flooding for Emergent Vegetation

Wetland vegetation management through control of water depths is the most effective tool for controlling vegetation growth in permanent wetlands. This tool not only provides the conditions for optimal spread of desirable vegetation, but can also limit its spread to create the desired mixture of emergent vegetation to open water. In general, water depths of less than 12 inches during the growing season will promote seed germination and have little control of rhizomatous vegetation. Water depths in this range are optimal to encourage the growth of emergent vegetation. Water depths between 12 and 36 inches will prevent germination but allow for the spread of vegetation by rhizomes. Once the desirable vegetation community is established, water depths during the summer season should be maintained in this range to limit continued spread of emergent vegetation. Water depths of greater than 36 inches will prevent seed germination as well as the spread of emergent vegetation via rhizomes. Persistent water depths of greater than 36-inches during the growing season will eventually eliminate emergent vegetation from these deep flooded areas. Water depths in the conveyance channels should be maintained in this range to maintain water conveyance capabilities.

Aquatic Invertebrates

Semi-permanent wetland can be managed to provide aquatic invertebrates through water level control as well as their association to vegetation type. Semi-permanent wetlands can play a vital role for pre-nesting, breeding, and molting waterfowl. As waterfowl shift from Fall/Winter migration into breeding, their dietary needs change as well. Typically, as female waterfowl begin the breeding cycle their food needs change from high carbohydrate foods to those that are higher in protein and calcium. This nutritional change is required to develop a new clutch of eggs. Aquatic invertebrates such as

Fairy Shrimp (*Artemia salina*) and water fleas and other Crustacea as well as insects provide the necessary dietary needs to support waterfowl in this transition.

Managing Draw Downs

Wetland draw downs are an important management tool for permanent wetlands. A wetland under draw down conditions mimics a drought cycle with the intent to reinvigorate wetland nutrient cycles and stimulate vegetation growth. Draw downs will depend on site conditions and may not be necessary for a period of up to 7 years following establishment of desired vegetation community.

Beginning in the fourth year, following the establishment of the desired vegetation community, each wetland unit should be drawn down and completely dried on a rotating schedule for several months of the growing season (May through September). This management technique would occur every 5-7 years to reinvigorate the marsh, to control problematic vegetation by mowing or herbicide application, as a best management practice to limit mosquito production, and/or to repair berms and water control structures as needed.

Habitat Islands and Riparian Vegetation

Habitat islands are an important component of a Semi-Permanent wetland. Islands have a diverse array of species, habitat structure and eco-tones. As such, careful consideration of flooding depths and duration must be evaluated for each unit during fluctuation of water levels. Generally, Tules respond faster to water fluctuations than trees or shrubs. Due to the rhizome root system, if Tules are flooded out by depths greater than 2.5-3 feet, populations can recover quickly by reducing the flooding depth and promoting new germination. However, with woody species the flooding tolerances are less. Generally, wetland tree and shrub species as well as riparian species prefer saturated to slightly inundated condition. Surface water conditions resulting in significant flooding of trees and shrubs for durations longer than a several days in the summer and a few weeks during the winter months may kill woody species permanently. Increases in water depths for non-native invasive species control and or promotion of other native wetland plant communities should be limited to the tolerable constraints of the woody species during normal practices. A good indicator of the limits of tolerable conditions can be noted by observing signs of stress from the trees and shrubs located in the deepest flooded areas of each unit. Signs of stress can include yellowing or browning of leaves, twig dieback or buds failing to open.

Irrigation of Islands

During hot summer months when irrigation water is readily available, increasing surface water elevations to irrigate habitat islands may be beneficial for tree, shrub and herbaceous species survival as well as non-native species control. After vegetation establishment, surface water elevations should be increased by 0.5 to 1 foot for about 1 week during summer months. The irrigations will also help control upland invasive species like Himalayan blackberry (*Rubus armeniacus*), perennial pepperweed (*Lepidium* sp.), and cocklebur (*Xanthium strumarium*).

Supplemental Planting

For restoration projects it is common to see mortality of planted woody species. Generally there can be anywhere between 20-50 percent mortality of planted woody species. It is very important to replant areas that are prone to erosion. It is also important to continue to establish a diverse vegetative component throughout the project area. Supplementing transitional areas such as berms and islands with additional plantings can be achieved during normal maintenance of berms. Typically, willow tree and shrub branches will need to be trimmed along the access portions of the berms. This maintenance should be conducted during the late fall and winter months when possible. During these months branches can be cut into "Stakes" which can then be planted in areas where additional plantings are desired.

Seasonal Wetland Management

Typically, working landscape seasonal wetlands are designed and built to be managed as moist-soil wetland units. This type of wetland management promotes the germination of specific types of plants by drawing down a flooded wetland at specific times within the growing season, generally in Early, Mid or Late Spring. By managing water levels through the use of water control structures, the manager can promote a variety of plants that provide a high carbohydrate food source, necessary for the high energy demands of flight, for migratory waterfowl. Plant species such as crabgrass (*Digitaria spp.*), millet (*Echinochloa spp.*), smartweed (*Polyganum spp.*), and swamp timothy (*Heleochloa schoenoides*), etc. contain vital carbohydrates. Waterfowl utilize these food sources during wintering periods to replenish body fat consumed in migration flight. By winter flooding the vegetation and subsequent seed heads, the food source becomes available to ducks and geese, as well as a variety of other water-birds.

Managing Draw Downs

Wetland draw downs are a critical management tool for seasonal moist-soil wetlands. Draw downs reinvigorate wetland nutrient cycles and stimulate vegetation growth. A host of factors can be involved to fine tune the date for draw down, such as number of frost free days, ambient air temperature, soil temperature, rainfall and evapo-transpiration. The resources listed above can act as a great starting point for management techniques. Other factors for determining when the best time to draw down wetlands may come from biological indicators. As an example, many wildlife area managers begin to draw down wetland units at the first sign of seed germination on the edge of the inundated or wetted areas.

In addition to timing of draw down, the rate of draw down can be an important factor. Generally, in the Central Valley including the Delta, a slow draw down is preferred over a rapid draw down. Slow draw downs promote better germination and develop better root systems. However, this is a direct conflict with the Mosquito vector best management practices (BMPs). A good strategy is to set up a meeting with your local Mosquito Vector district to talk about a mutually beneficial strategy.

Winter Bird Use

Many factors influence bird use. Many of these factors may be out of the managers' control. However, the most critical component is to make sure that bird use opportunity is present. If bird populations in the area are high, and the wetland is not attracting birds, evaluate the water depth

within the wetland unit. Many first time managers flood their wetland units too deep. It is important to keep in mind that dabbling ducks preferred foraging depth of 0 to 12 inches. Each bird species is a little different, for example Cinnamon Teal prefer depth of 2 to 4 inches while Mallard ducks prefer depths of 3 to 7 inches. Having shallowly flooded areas of varying depths will promote greater species diversity and greater opportunity for wildlife use.

Irrigation of Wetland Unit

During hot summer months when irrigation water is readily available, it may be necessary to provide irrigation or multiple irrigations to support vegetation within the wetland unit. Irrigations typically occur by flooding the wetland unit up for a short duration during summer months. Irrigation requirements will depend on seasonality, depth of groundwater, and ambient temperatures. Biological indicators such as wilting, yellowing, drying of seed or flowers are indicative of plant health and good signs for when wetland plants need to be irrigated. The irrigations will also help control upland invasive species like Himalayan blackberry (*Rubus armeniacus*), perennial pepperweed (*Lepidium* sp.), and cocklebur (*Xanthium strumarium*).

Vegetation Maintenance

Periodic maintenance of vegetation, including mowing and control of noxious and/or invasive plants will be required for the project. Annual control of weedy vegetation will be required to promote the desired wetland and upland vegetation communities and avoid and control exotic/invasive species.

These exotic/invasive species include Himalayan blackberry (*Rubus armeniacus*), common reed (*Phragmites australis*), perennial pepperweed (*Lepidium* sp.), cocklebur (*Xanthium strumarium*), and other species as identified in the field. Each of these species has the capability to overtake both wetland and upland communities. Deeper water levels within the wetland area will help to control the spread of these species. These species can be problematic if not controlled vigorously along the edges of the wetland areas.

In areas in which mowing is not practical, chemical control using an herbicide labeled for application in wet environments is recommended. Glyphosate formulated herbicides are effective for controlling annual weeds as well as common reed if applied correctly. Perennial pepperweed can be controlled with imazapyr or chlorsulfuron formulated herbicides. Himalayan blackberry can be controlled using triclopyr in dry areas. All herbicide applications must follow application rates and procedures identified on the packaging label, and will be applied by a certified/licensed applicator.

Wetland vegetation will need to be controlled if plant coverage expands beyond 80% or if the swales and potholes become overgrown with emergent vegetation. Aerial photos can be used to evaluate the percentage of vegetation coverage. Any unit with a vegetation problem will need to be drawn down and dried to allow mower access.

Upland vegetation on the tops of berms should be mowed annually to provide vehicular access to water control structures for regular maintenance, and access by larger equipment for special maintenance needs. Upland vegetation should not be mowed during the avian nesting season between March 1 and June 30. If mowing is necessary, the area should be inspected to identify nests and nests avoided if possible.

Pest Management

Pest management is often a necessary management activity for manipulated wetlands in the Central Valley and Sacramento-San Joaquin Delta regions. Mammalian and invertebrate pests can be problematic for the successful operation of the project and achievement of projects goals; therefore, pests must be controlled when warranted.

Mammals

Wetlands and riverine habitats in the Delta are preferred habitats for muskrats, skunks and beavers. These rodents can damage wetland management infrastructure by burrowing into berms, levees, and around water control structures. If left unchecked, these excavations can ultimately compromise the structural integrity of the water management infrastructure.

To minimize the potential damage these rodents can have on water management infrastructure, several of the berms have been designed with 3:1 side slopes. Gradual slopes limit burrowing activity compared with steep slopes such as a 1:1. For berms constructed at 3:1 slopes, annual inspection is necessary to fill any burrows.

Beavers are instinctively drawn to the sound of flowing water. When the source of the sound is located, beavers will attempt to build a dam and halt the flow of water. Water control structures will need to be cleared of any debris that may prevent adequate water flow.

Mosquitoes

Wetlands in the Central Valley and Sacramento-San Joaquin Delta are well known for their capabilities to produce mosquitoes. Sacramento-Yolo Mosquito and Vector Control District (SYMVCD) regularly inspects and controls mosquito larvae within the Delta using larvacide control methodologies. In an effort to minimize mosquito production, the SYMVCD and the San Joaquin County Mosquito and Vector Control District have been active participants in the planning process.

With the current threat of West Nile and the potential spread of the H5N1 avian influenza, using water and habitat best management practices (BMPs) to limit the growth and spread of mosquitoes is important.

For more information on BMPs for working landscape projects, contact the local vector control and mosquito abatement district.

Contra Costa Mosquito and Vector Control District
155 Mason Circle
Concord, CA 94520
925-771-6196
http://www.contracostamosquito.com

Sacramento-Yolo Mosquito and Vector Control District
8631 Bond Road
Elk Grove, CA 95624
1-800-429-1022
http://www.fightthebite.net/

San Joaquin County Mosquito and Vector Control District
7759 S. Airport Way
Stockton, CA 95206
209-982-4675
http://www.sjmosquito.org

Solano County Mosquito Abatement District
2950 Industrial Court
Fairfield, CA 94533
707-437-1116
http://www.solanomosquito.com

Section III: Additional Resources

Several publications and resources are available for the finer details of vegetative buffer, wetland and waterfowl management.

Hedgerows for California Agriculture

Available online: http://caff.org/programs/bio-ag/hedgerows/

Bring Farm Edges Back to Life: A Landowner Conservation Handbook

Excerpt available online: http://www.yolorcd.org/documents/FarmEdges_page1-7_000.pdf

A Guide to Wetland Habitat Management in the Central Valley

Available online: http://www.dfg.ca.gov/lands/waterfowl/docs/WetlandinCentralValley.pdf

Wetland Management for Waterfowl: A Handbook

Available online:

http://www.ms.nrcs.usda.gov/technical/NRCS%20Wetland%20Mgt%20for%20Waterfowl.pdf

Waterfowl Management Handbook

Available online: http://www.nwrc.usgs.gov/wdb/pub/wmh/wmh.pdf

A Guide to Tracking and Understanding the Resources and Wildlife on Your Land

Available online: http://www.yolorcd.org/documents/monitoring_your_farm.pdf