# CONVERTING RICE FIELDS TO NATURAL WETLANDS IN THE SACRAMENTO VALLEY OF CALIFORNIA

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*Abstract:* Remnant wetlands in the Central Valley of California play a critical role in supporting over 60 percent of all wintering waterfowl in the Pacific Flyway. Most losses of wetland have been due to development for agriculture, but recently there has been a modest reversal in this trend. More than 7,000 acres of rice fields have been permanently restored to natural wetlands in the Sacramento Valley as a result of U. S. Fish and Wildlife Service Programs. This included 4,300 acres in private lands under a conservation easement acquisition program and 3,100 acres on National Wildlife Refuges due to management changes. Techniques developed by biologists and managers while working with these wetland restoration programs were presented as step-by-step "cookbooks" for wetland owners or managers.

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Remaining wetland habitats in the Central Valley of California play a critical role in supporting over 60 percent of all wintering waterfowl in the Pacific Flyway (U.S. Fish and Wildl. Serv. 1978). These remnant wetlands have been estimated to comprise about 320,000 acres or approximately 8 percent of the original wetlands in the Central Valley (Frayer et.al. 1989).

Most wetland losses have been due to development for agriculture, primarily rice in the Sacramento Valley. However, in recent years there has been a modest reversal in this trend as over seven thousand acres of land has been permanently converted from rice fields to naturally vegetated wetlands in the Sacramento Valley. The U. S. Fish and Wildlife Service (Service) has been a leader in this wetland restoration through its Conservation Easement Program (Kramer and Helvie 1983), and by phasing out most of the lure crop rice on the Sacramento National Wildlife Refuge Complex.

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## BACKGROUND AND METHODS

The Service started a Sacramento Valley conservation easement acquisition program in the Butte Sink in 1980. A second project was started in the Willow Creek and Lurline Creek areas of the Colusa Basin in 1985 (Fig. 1). The original intent of this program was to preserve the remaining privately owned wetlands, but it also created an opportunity for the restoration of wetlands. During the 1970's, when waterfowl populations were high and hunting was good, many waterfowl hunting club owners converted their wetlands to rice fields as a source of supplemental income. However, when hunting success diminished in the 1980's, many owners saw the easement payment as a means of restoring their marsh. The payment was also extremely attractive to waterfowl hunters who sought to own hunting property but could not otherwise afford it. As a result of this demand, perpetual easements were acquired on 4,283 acres of wetlands converted from cropland on 46 separate tracts from 1980 through 1989.

Under this program, the landowner is required to convert the land to an early seral stage of wetland vegetation as a minimum requirement before acquisition of the easement is finalized. This conversion requirement created a demand for technical assistance from Service personnel on techniques of water management, mechanical manipulation, and earthmoving to best accomplish the restoration.

During this same period, the Service was in the process of converting refuge rice fields to wetlands. A cooperative farming program was used to provide rice as a lure crop on the Sacramento Refuge Complex until 1984. An average of 2,100 acres were utilized on the refuges annually by farmers as payment for providing 1,000 acres of unharvested rice as a lure crop under a share-cropping program. The Service changed from share-cropping to refuge maintenance crew farming in 1984 to increase wetland acreage by reducing the refuge acreage needed for farming. Between 1986 and 1989 much of the remaining rice acreage was also restored to wetland when it became apparent that rice was no longer necessary as a lure crop to prevent depredation by waterfowl. These management changes resulted in conversion of 2,800 acres of rice to naturally vegetated wetlands on the Sacramento Refuge Complex between 1984 and 1989. The remaining 300 acres will be converted in 1990.

This paper presents techniques developed by

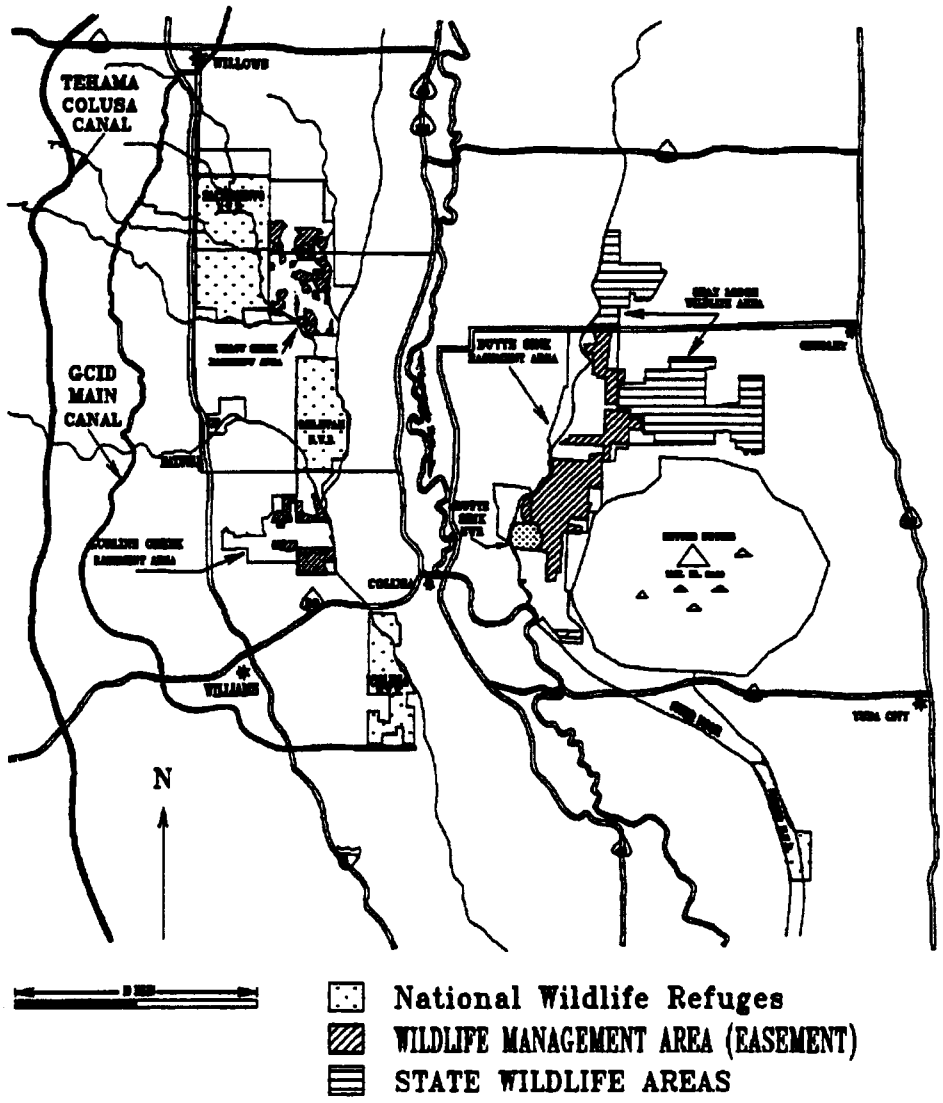


Fig. 1. Waterfowl habitat areas in the Central Valley of California.

Service biologists and managers in response to the demand for information by private wetland owners and the need to convert refuge rice fields. These techniques utilize well known wetland management principals including "Moist Soil Management" (F ed ' ks d T l 1982) d t

vegetated wetlands. Foremost is that they have an existing water control system. Most also have existing water rights or long-term contracts with water districts.

Another advantage is that rice field soils uall ta' ' tin F la rLeed, hatk fu 1

wetlands.

Converting rice fields to wetlands is a process which requires little more than application of water at the proper time(s) to establish natural aquatic vegetation in early seral stages. In fact, leveled rice paddies are well suited for production of dense stands of moist soil plants.

Establishment of a mature emergent wetland in a rice field is also relatively easy. However, the lack of topographic diversity encourages monotypic stands of emergent vegetation that require frequent rehabilitation to maintain desirable patterns and ratios of open water and emergent cover. For this reason, it is desirable to reestablish a more natural pond bottom by constructing channels and potholes and removing internal dikes where possible.

## SELECTION OF HABITAT OBJECTIVE

A preliminary step in the conversion process is to select the preferred habitat type for each available field. There are three primary types of managed wetlands attractive to waterfowl in the Central Valley: seasonally-flooded marsh, moist soil impoundments and permanently-flooded marsh. If possible, it is desirable to develop some of each in a wetland complex to optimize the diversity of habitat and waterfowl use. The distribution of habitat types in a wetland complex should be selected with an on-site knowledge of the water management system and waterfowl flight patterns. Following are descriptions of the three basic habitat types.

### Seasonally Flooded Marsh

This is a mature emergent marsh which is flooded from fall (1 September - 1 October) through spring (1 April - 30 April) to simulate the historical water regime of many Central Valley wetlands and locally adapted wetland plants. Characteristic plants include emergents such as hardstem bulrush (*Scirpus acutis*) and cattail (*Typha* sp.) and moist soil plants such as swamp timothy (*Heleochloa schoenoides*) and smartweed (*Polygonum* sp.). This wetland type provides the greatest diversity of food and cover for wintering waterfowl and the best season-long hunting success in most club situations. This is the recommended habitat type for most smaller isolated fields and for at least 65 percent of larger wetland complexes.

The ratio of open water to tall emergent vegetation is highly variable depending on the type of waterfowl for which it is managed. In general, open marshes with less than 35 percent scattered emergent vegetation are most attractive to northern pintails (*Anas acuta*) and snow geese (*Chev hyperborea*) while more closed marshes with 40-60 percent emergent vegetation are most attractive to mallards (*Anas platyrhynchos*), and gadwalls (*Anas strepera*).

### Moist Soil Impoundment

This is an adaptation of a seasonally-flooded marsh which receives at least one summer irrigation to enhance production of the seeds of moist soil plants such as watergrass (*Echinochloa grusgalli*) and smartweed. These plots provide a large volume of high quality natural plant food for waterfowl. Their general appearance is more similar to a cultivated grain field than a marsh and season long hunting success is usually lower than in a marsh. Most large wetland complexes, such as National Wildlife Refuges, manage 15-20 percent of their ponds as moist-soil impoundments to provide a supplemental food source.

### Permanently-Flooded Marsh

This is a mature emergent marsh which is flooded year-long. This water regime provides the stable water levels, aquatic invertebrates and dense emergent vegetation required for waterfowl courtship and brood rearing. The general appearance of a permanent marsh is similar to a seasonal marsh though the emergents are often more dense and robust. Relatively dense emergent vegetation is desirable for a brood pond with optimum being 50-65 percent emergent cover and the remainder open water. Submergent plants such as pondweeds (*Potomogeton* sp.) are also typical.

For waterfowl nesting in the Central Valley, it is desirable to distribute small (5-25 acre) permanent marshes throughout a wetland complex on about 10 percent of the total land area. This allows optimum use of dense vegetation in uplands and drawndown seasonal marshes for nesting cover.

## CONVERSION PROCESS

Following is a step-by-step summary of the techniques used to convert rice fields to high quality wetlands.

## COMMON STEPS

After selecting a habitat objective, the first three steps in the conversion process are the same for all habitat objectives:

Year 1

1. Disc the field as soon as possible in the spring to eliminate harvester ruts and upland weeds, and to replenish the seed bank of moist soil plants at the surface. Delay this step until 1 July if vegetative cover is attractive to nesting ducks or pheasants. (This step is optional for land recently farmed, but desirable if fields are badly rutted, and necessary for fields which have lain fallow for one year or more.)

2. Flood for 5-10 days then drawdown. This is a special irrigation to promote germination of moist soil plants. It is preferably done between 1 May and 1 June, but can be done until 15 July.

3. Flood Irrigate (#1) for five days then drawdown. Do this when plants show water stress (wilting) or approximately six weeks after germination. Steps 2 and 3 are to produce some feed to attract waterfowl the first year.

## REMAINING STEPS

The remaining steps in the conversion process vary according to the habitat objective selected:

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|---|---|
| Moist Soil Impoundment - | go to A. |
| Seasonally Flooded Marsh - | go to B. |
| Permanently Flooded Marsh - | go to C. |

### A. Converting to a Moist Soil Impoundment

4. Flood irrigate (#2) approximately 6 weeks after the first irrigation. A second irrigation may be replaced by an early floodup prior to 1 September, especially if germination occurs after 1 June.

5. Floodup (15 September - 15 October). It is desirable to create open water lanes and potholes in mature moist soil impoundments by discing or mowing prior to final floodup. This practice increases waterfowl use early in the season by providing landing areas.

Year 2 and Successive Years

Maintain a moist soil impoundment water regime:

1. Hold winter floodup.

2. Drawdown between 1 May and 15 May to germinate plants.

3. Repeat steps 3-5 from year one.

### B. Converting to a Seasonally-Flooded Marsh

4. If plans include earthwork to remove interior dikes and construct channels potholes and islands; do this prior to transplanting bulrushes. The purpose of this work is to create topographic diversity and minimize the need for long-term emergent vegetation control. This is an optional but desirable step for a seasonally-flooded marsh. Maximum excavated water depths can be reduced to 18-24 inches in a reconstructed seasonal marsh because the tendency for emergent vegetation to spread is lessened by the water regime. Refer to Step 4 under converting to a permanently-flooded marsh for details.

5. Transplant Hardstem Bulrushes (Tules)

   a. Depending on the desired proportion and distribution of emergent vegetation, select one or two sites per acre in the fields to be converted.

   b. Prepare each site with a front-loader by excavating a hole 10-15 ft long, 1-1.5 ft deep, and one loader width wide.

   c. Locate a source of bulrushes in an existing marsh nearby. With a front-loader or backhoe, remove clumps of bulrushes (including the underground rhizomes and above-ground stems) and transplant them in excavated holes. Transporting bulrushes is most efficiently done with a flatbed truck or a flatbed trailer.

   d. Backfill the hole around the roots.

6. Floodup

Floodup within 7-10 days of bulrush

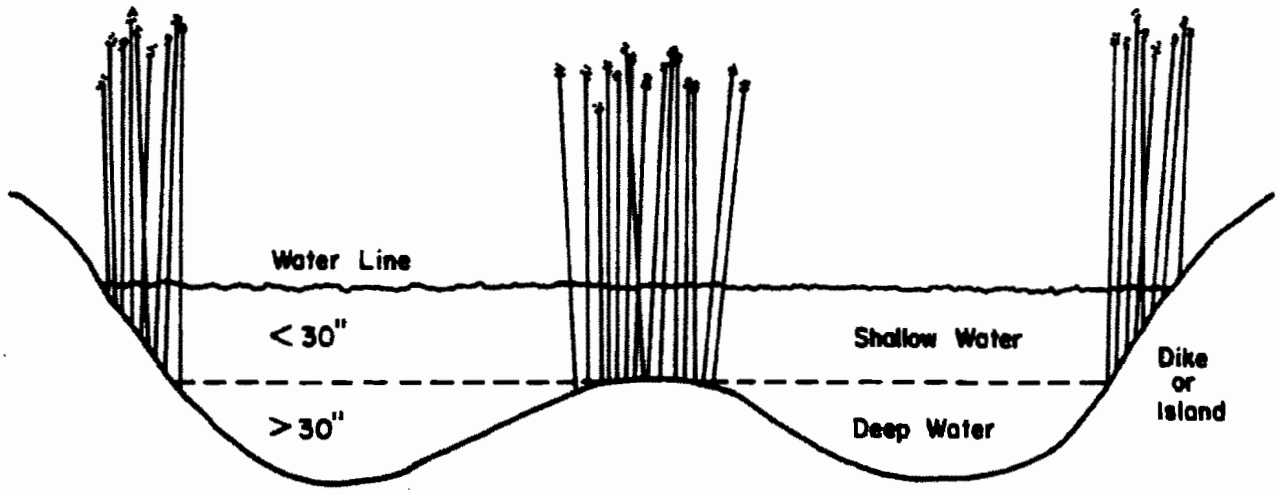


Fig. 3. Cross-section diagram of proper water depth for open water and emergent cover in relation to surrounding upland areas.

for open water and emergent cover areas in relation to surrounding levees and upland areas (Fig. 3). The deep water areas should be interconnected and slope upwards so that the lowest point is at the outlet structure to allow complete drainage of the pond. This is important because pools of shallow water left standing due to incomplete drainage during the growing season will eventually be colonized by emergent vegetation.

Other considerations in development of a permanent pond include need for an independent water control system, size, and location, especially the proximity to suitable upland nesting cover. Permanent ponds with no suitable nesting cover within a one mile radius will receive little brood use.

5. Transplant Hardstem Bulrushes (Tules)

Year 1

Refer to Step B. 5

Year 2

If bulrush transplants are adequately distributed, maintain floodup through the growing season and the next winter to provide optimum growth conditions. If not, drawdown between 1 July and 15 July and repeat steps 5 and 6 from Year 1.

Year 3 and Successive Years

If emergent cover meets the objectives, begin permanent flooding. Permanently-flooded marshes gradually lose productivity and attraction for waterfowl as nutrients become bound in the vegetation and organic muck on the pond bottom. For this reason, marshes should be drained from spring through fall once every 4-5 years to recycle the nutrients.

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