WETLAND DEVELOPMENT ON THE MODOC NATIONAL FOREST

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Abstract. Fifteen hundred acres of type III and IV wetland have been created in northeastern California on National Forest lands since 1968. Other natural wetlands, primarily types I and V presently exist. Development of new wetland includes the construction of low level earthen dikes with numerous artificial nesting devices which are described. Plantings of food and cover species have been tried on a small scale. Important waterfowl species, primarily Great Basin Canada geese (*Branta canadensis moffitti*) and numerous duck species are utilizing the project sites. One hundred ninety avian species are known to use the new developments whereas before construction 40-50 species were present. Nesting pairs of ducks have averaged 29 pairs per 100 surface acres of flooded wetland, while nesting Canada geese range between 9 and 19 pairs. Average costs for creation have been $88 per 100 acres.

INTRODUCTION

The value of wetlands is known by most informed ecologists. This wildlife habitat is some of the most productive on the face of the earth, and yet since the turn of the century California has lost over 88% of this resource (California Department of Fish and Game 1965). Of the remaining wetland, only about 10% is in public ownership. This leaves the remaining 90% to the whims of private speculation and control. Spring migration northward brings several million ducks and geese through northeastern California, many in search of suitable nesting and rearing habitat. This part of the state provides the bulk of the nesting populations of waterfowl within California.

In 1968, the U. S. Forest Service initiated a pilot program to encourage additional wetland habitat and waterfowl nesting opportunity. Funds and support for such a venture were limited. In 1972 a major stride was made with the private financial support of the California Waterfowl Association. Since then, other private, state, and federal funds have been allocated for this program. This paper describes the development techniques. Special recognition goes to Dr. Joe G. Sweet II, President of the California Water-

fowl Association for his efforts in gaining private support for this program. Recognition also goes to U. S. Forest Service personnel Gordon Heebner, Tex Scofield, Jack Kriesel, and Ed Schneegas for their efforts.

LOCATION

All projects are located on the Modoc National Forest in extreme northeastern California (Figure 1). The area of main interest is termed the Devils Garden Plateau and encompasses some 500,000 acres of public land. All work to date has been concentrated in three general project areas on the plateau.

Figure 1. Location of project on the Modoc National Forest in northeastern California.

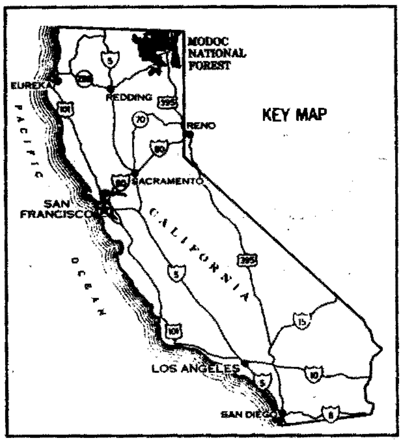

FIGURE 1

DESCRIPTION OF AREA

The development areas are representative of the Great Basin biome having a semi-arid climate with an annual precipitation average of 12 inches coming primarily in the form of snow. Summer temperatures in excess of 100° Fahrenheit and winter temperatures below zero are not uncommon. Soils are primarily volcanic in origin with significant amounts of clay in the upper horizons. The terrain is relatively flat with elevations between 4,500 and 5,000 feet. The general vegetation types represent widely distributed western juniper (Juniperus occidentalis) and some ponderosa pine (Pinus ponderosa). Major brush species include sagebrush (Artemesia spp.) and rabbitbrush (Chrysothamnus spp.). There are also a considerable number of perennial and annual grass species.

LAND USES

All areas described in this paper are within public ownership and administered by the U. S. Forest Service. The human population within Modoc county is approximately 7,000 and the general economy is centered around livestock and logging. All development areas are within permitted grazing allotment. Recreational use is light and primarily limited to deer, antelope, and waterfowl hunting.

PHYSICAL CHARACTERISTICS OF DEVELOPMENT SITES

The ten impoundments that have been constructed range from 40 to 300 surface acres with an average size of 150 acres. Depths of water during the nesting periods (March-July) range between 1 and 8 feet with an approximate average of 3 feet. The pH of the water in the impoundments ranges from 6.5 to 8.0 with an average of 7.5. General turbidity is low to moderate depending on the time of year and location. Peak water levels are usually reached by early March and from this point percolation and evaporation will consume approximately 30 inches of water during the remainder of the year. Seepage and percolation are low due to the surface clays in the soil.

BIOLOGICAL CHARACTERISTICS OF DEVELOPMENT SITES

The wetland types which are created are types III and IV (Shaw and Fredine 1956). Both emergent and submerged vegetation establishes readily. The most abundant aquatics are spike rush (*Eleocharis* spp.) sedge (*Carex* spp.) and rush (*Juncus* spp.). Pondweed (*Potamogeton* spp.) is the most common submerged species. A variety of invertebrates is abundant during the spring and summer. Two small species of snail (*Mollusca*) are the most common of the species.

The Canada goose generally begins arriving on the breeding areas by March 10th. The earliest nest that has been observed was on March 13th with the peak of nesting activity during early April. By mid-April the first pairs of breeding ducks begin arriving. Generally the mallard (*Anas platyrhynchos*) is the first species to arrive, followed by the pintail (*Anas acuta*). The peak of duck nesting activity is usually during late May.

INVENTORY

A complete inventory of both existing and potential wetland is of utmost importance. The wetlands under consideration are already publicly owned, thus a unique characteristic of the inventory is immediately evident. Preservation and acquisition are not paramount. Establishing the development potential is the key objective. The use of topographic maps and aerial photographs were used to map watersheds and drainage areas. These areas were field checked in early spring by the use of aircraft. Using precipitation and soil information, an estimation was made of the acre-feet of water available for impoundment. A preliminary field survey is made to determine possible dam locations. From these basic engineering data, one can evaluate the estimated cost of construction of the dam at various heights with the amount of water and surface configuration obtained. Priority is given to those areas having: (1) the least cost in comparison with the amount of water (2) configuration or edge (3) average depths of 2 to 4 feet and (4) natural islands. Inventory of potential development on the forest is still in progress and not yet complete. An estimated 20,000 acres of lands offer obvious opportunity for enhancement and development. About 75% of the existing wetlands are of a semi-permanent character. The massive Clear Lake-Tulelake basin lies to the northwest and Gooselake, which extends into Oregon, bounds the area to the east. Both these bodies of water are permanent.

METHODS AND MATERIALS

Dam Construction: The cost of the dike construction is the major financial element in development, therefore it cannot be over-emphasized that competent engineering assistance be obtained. For most development, the construction must take place during the late summer and early fall months to allow heavy equipment to work without becoming bogged down in mud. Dams are entirely earth filled. The borrow is obtained from the front of the impoundment to allow a deeper area for a minimum residual pool in the less permanent impoundments. Dam specifications will vary from place to place but generally base widths are about 24 feet and top of 8 feet. The recommended slope is 3:1. Soils are compacted during the construction by rollers and the use of water. The dam heights average 10 feet. Rock gabion spillways are constructed leaving a minimum of 2 feet of freeboard. It may be desirable to install headgates on the deeper impoundments to allow manipulation of water levels. Seeding of the dam with sod forming grasses is desirable to reduce erosion. Where nearby rock is available it may be desirable to use rip-rap on the face of the dam.

Natural Nesting Areas: During the planning stages, it is feasible to determine from maps how various water depths can create natural islands within the impoundment. The value of natural islands to waterfowl is well documented. Another technique is to channel through natural peninsulas creating additional islands.

Earthen Mounds: Small earthen hills can be formed during construction with heavy equipment. The base is approximately 20 feet and tapers to 5 feet on the peak. The mounds should extend a minimum of 3 feet above the determined high water level. During construction a moat around the mound should be created which will further discourage nest predation. Compaction during construction is very important since mounds tend to settle and erode. An old 16" tire casing, short culvert section, or the end of a 55 gallon oil drum is placed firmly into the top of the mound to stabilize the nest site and to afford protection and concealment. A nesting material of straw is placed in the structure. The mound should be seeded with a sod-forming species of vegetation to reduce erosion.

Artificial Islands: These sites are similar to the mounds except larger and irregularly shaped. Often, several pairs of waterfowl will nest simultaneously on this structure.

Drum End Platforms: This device as described by Rienecker (1971) can be altered or mounted in the marsh several different ways. The basic design is the end of a 55 gallon oil drum mounted securely to a stand and placed in the marsh and a minimum of 3 feet above the high water level. Rock gabions secured around the stand have added greatly to their durability during wind and ice conditions. Holes must be made in the bottom of the drums to allow the passage of water that is collected. These devices are also described by Yocom (1952) and Brakhage (1965, 1966).

Half-Drum Platforms: The half-drum device is a modification of the drum end platform and is described by Rienecker (1971). In this case, the 55 gallon oil drum is split length-ways.

Tire Platforms: This device is constructed using juniper posts a minimum of 8" in diameter and set in the ground at least 3 feet. The post should extend 3 feet or more above the high water level. A half-inch plywood platform (3' x 3') is secured to the top of the post. A 16" tire casing is then bolted to the platform, creating the nest. Straw is placed in the interior of the casing to provide nest material.

Nest Baskets: This device is described in U.S. Dept. of Interior leaflet #4-70-10M (Northern Prairie Wildlife Research Center). The basket is basically a 26" diameter wire mesh cone mounted on a steel pole which is adjustable for water fluctuations. Nesting material is secured to the wire mesh.

Tree Nests: Several nests have been constructed by securing tires or drums to dead or downed trees within the impoundments. Live trees of at least 8" in diameter which are flooded may be sawed off and nesting platforms secured to the top. The root system of the tree provides an extremely secure base for several years.

Other Development Techniques

Gander Roosts: Often times a gander goose will occupy adjacent nest sites therefore reducing maximum nesting potential. Roosts tend to alleviate this by reducing territory sizes. Numerous construction methods can be used. Brakhage (1965) gives specifications for a roost termed "loafing log." Often during dam or mound construction, heavy equipment can be used to relocate large rocks to desired areas in the more shallow water. Ganders will accept them as roosts. Rocks provide a more secure roost than do the loafing logs where ice movement is a factor.

Potholes, Channeling, Planting, and Protective Fencing: These four management techniques have been tried only on a very small scale to date. Funds in the near future will be used to maximize their potential.

Pothole value to nesting waterfowl is well documented. Potholes are constructed either using explosives or heavy equipment. Meandering channels which will hold open water in an otherwise vegetatively closed marsh during the summer, appear to be very desirable to duck broods.

Planting of food and cover species has been limited to alkali bullrush (*Scirpus robustus*) and reed canary grass (*Phalaris arundinacea*). As mentioned earlier, the developments are within permitted cattle allotments. Protective fencing will be constructed to provide necessary residual nesting material and desirable cover in nesting areas during the season.

RESULTS AND DISCUSSION

Data has been gathered by the U.S. Forest Service since 1971 on all improvements while the California Department of Fish and Game gathered breeding pair count information on selected wetlands since 1955. This information provides the basis of the results. It is recognized that sample sizes are small and at this point may not be statistically valid. As this program progresses the data can be further refined and better function as a habitat management tool.

The longevity of all nesting development techniques are affected primarily by erosion, wind, and ice factors. The natural and peninsular islands are definitely more desirable both in terms of occupancy and longevity for both geese and ducks, however in many cases the opportunities for use of this technique are limited. The earthen mounds are the most desirable in terms of maintenance and initial construction, but they may be more vulnerable to predation than platform structures. The only predation of eggs has been avian. The examination of 210 goose nests does not indicate that there is any significant preference for one artificial structure over another. Minimum spacing of nests has been 200 feet. During the study period the numbers of structures increased from 19 to 124. Correspondingly, the percentage of occupancy of the existing sites increased from 74% to 91%.

Based on the findings, nesting developments should be constructed in the following priorities: 1) Natural islands 2) Peninsular islands 3) Earthen mounds 4) Elevated nesting structures. Waterfowl production on these developments is summarized in Tables 2 and 3. The development costs have averaged $88 per 100 acres of flooded land (Table 4).

It is concluded that northeastern California has a unique opportunity for wetland enhancement and creation on both public and private lands and that efforts should be made to encourage such work to the betterment of wetland habitat in the Pacific flyway.

NESTING SUMMARY
1971 - 1974

ISLAND OCCUPANCY	100%
NEST STRUCTURE OCCUPANCY	85%
NEST PREDATION	2%
NEST DESERTION	9%
CLUTCH SIZE (ave.)	5.7

TABLE 1

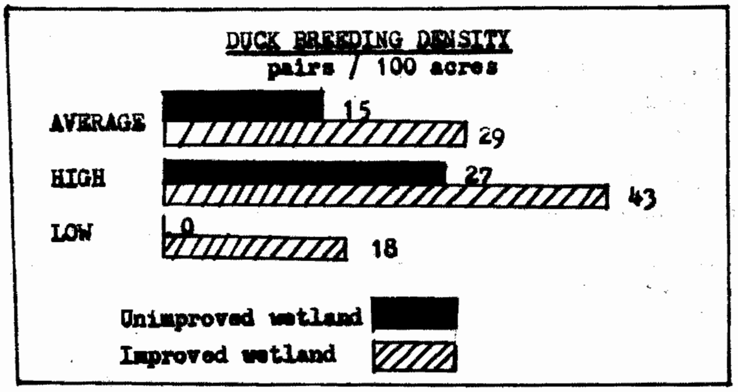

TABLE 2

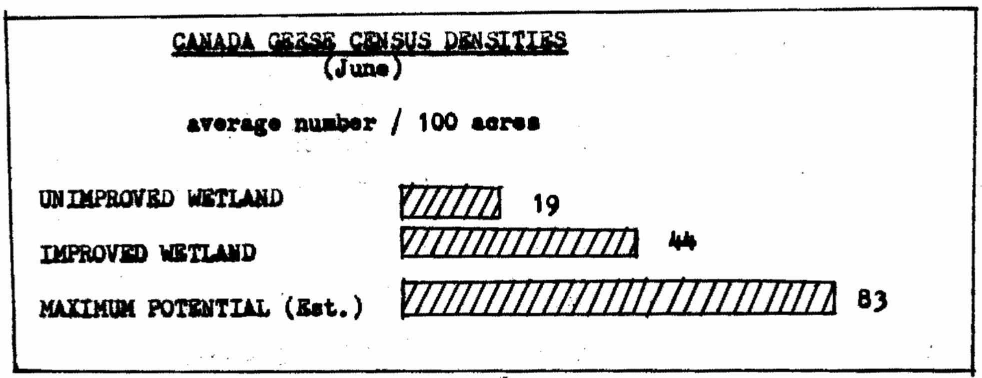

TABLE 3

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TABLE 4. ITEMIZED DEVELOPMENT COSTS

IMPROVEMENT	UNIT	*ESTIMATED LIFE EXPECTANCY	APPROX. COST RANGE
Impoundment	Acre	50-100 years	$45 - $140
Nesting Mound	Each	10 years	$10 - $ 50
Gander Roost	Each	10 years	$25 - $ 30
Nesting Platform	Each	10 years	$40 - $ 50
Peninsular Island	Acre	50 years	$20 - $ 35
Nesting baskets	Each	15 years	$15 - $ 20
Pothole blasting	Each	20 years	$25 - $ 30
Food and Cover Planting	Acre	10 years	$10 - $ 30

*Replacement or repair would be necessary at the end of the estimated term.