THE ROLE OF THE WILDLIFE REFUGE IN RELIEF OF VERTEBRATE PEST DAMAGE IN AGRICULTURE

JOHN B. COWAN, Manager, Gray Lodge Wildlife Area, California Department of Fish and Game, Gridley, California

Wildlife Refuges in the upper Sacramento Valley of California carry out a very significant role in the relief of wildlife problems to agriculture. The degree and diversity of vertebrate pest control effort by these refuges vary with local conditions and with environmental and budgetary limitations.

Both the California Department of Fish and Game and the U. S. Fish and Wildlife Service consider the relief of crop damage to agriculture one of their most important functions. This is demonstrated by existing programs at the Sacramento, Delevan, Colusa and Sutter National Wildlife Refuges and the California Fish and Game Gray Lodge Wildlife Area. Although the emphasis may vary on individual refuges, basically, operations are similar.

My remarks will give general reference to the roles of these wildlife refuges, but primarily will relate to one of these areas, the State Gray Lodge Wildlife Area. It has been my good fortune to have been associated with this wildlife refuge installation for the past 21 years.

Before discussing activities which relate to alleviating vertebrate pest damage to agriculture, most specifically, the waterfowl depredation problem, it is well to understand the history and evolvement of these wildlife refuges. Let us briefly review the pertinent history relating to the Sacramento Valley and the Gray Lodge Wildlife Area.

HISTORY

Early history records show that the floor of the valley contained broad expanses of "tulares" or tule marshes. Sediment accumulations intermittantly raised stream beds above adjacent lands. Annual floods were the rule. Banks overflowed and water was trapped in the numerous swales, pot holes, and lowlands. Bordering along water courses, riparian type habitat was common.

The vast marshes that existed then apparently produced adequate quantities of aquatic marsh food plants. Waterfowl were widespread, in great numbers, and able to forage for food without attracting undue criticism.

Today, when our Pacific Flyway waterfowl return from their breeding grounds in Canada and Alaska to their fall and wintering grounds in the Sacramento Valley, they find a much different environment than did their ancestors.

Man's construction of water drainage and supply systems, his leveling of lands, and intensive developments for a wide variety of agriculture products has left little native wildlife habitat. Today, most of the marshland habitat that does exist, particularly during the fall months, is found only on the State and Federal wildlife areas.

Wintering populations of ducks and geese in California are now supported on less than 10 percent of the wetlands available to them fifty years ago. Remaining wetlands continue to be reduced by more intensive agricultural and industrial developments.

Limited habitat and insufficient waterfowl protection during the early 1900's brought about Federal and State legislation aimed at preserving the dwindling waterfowl and marshland resources. In 1931, the State Division of Fish and Game purchased the 2540 acre Gray Lodge Gun Club. It was the first wildlife refuge established in the Sacramento Valley and became known as the Gray Lodge Refuge. Developments for marshland habitat gradually proceeded as it remained an inviolate sanctuary through 1952. With funds provided by the Wildlife Conservation Board from 1952 through 1955, this refuge was enlarged to its present size of 6800 acres. Continued improvement has established this as one of the most intensively developed wildlife areas in the nation.

GENERAL FUNCTIONS AND OBJECTIVES

Originally, the Gray Lodge Refuge, in addition to providing marshland habitat, was established as an inviolate sanctuary. Today, it functions more as a multipurpose recreational use area with the following prime objectives:

1. To provide a marshland-wildlife environment, with particular concern for waterfowl.

2. To provide and produce wildlife food crops in the form of desirable natural aquatics and agricultural cereal crops to lessen crop depredation and maintain healthy wildlife species.

3. To provide recreational opportunities, including controlled public hunting, wildlife photography and study, fishing, sightseeing, field trials, depredations hunts, and educational assistance.

4. To provide opportunities for carrying out pertinent wildlife research projects.

THE MAJOR PEST PROBLEMS

The Gray Lodge Wildlife Area is situated in Butte and Sutter counties, about two miles north of the Sutter Buttes and approximately ten miles southwest of Gridley. Adjacent to the refuge, and extending throughout much of the upper Sacramento Valley are extensive farming operations. Crop damage has occurred in varying degrees, particularly on crops of rice, barley, wheat, milo and permanent pasture. Major crop depredations can occur when large numbers of hungry ducks move on to unharvested rice fields, when coot, widgeon, or geese over-grade or "puddle-in" winter barley or wheat. In addition, these same birds, when conditions are right, may consume quantities of green feed intended as cattle forage. Large numbers of blackbirds and starlings may also feed on rice, milo, sudan, and other crops, particularly when these cereals have seeds in the "dough" stage. Large jackrabbit populations also may consume considerable intended cattle forage. The herding and frightening of wildlife pests is only part of the solution to these problems.

REFUGE FUNCTIONS HELPING TO ALLEVIATE CROP DEPREDATIONS

The activities which point out the role that wildlife refuges have undertaken to relieve damage to agriculture are many. Most have stood the test of time and scrutiny. Let us review and examine some of these activities as they have been carried out at the Gray Lodge Wildlife Area.

1. Provision of Attractive and Inviting Ponds
Good marsh ponds serve as lures to waterfowl by providing them with suitable places to rest and loaf.

2. Protection from Disturbance and Harrassment
The refuge provides an environment in which the birds are protected from disturbance and harrassment. Flight patterns more readily develop that bring the birds back to the refuge.

3. Vegetation Control Work
There is more habitat maintenance work than meets the eye around good productive marsh areas. Up to 30 species of waterfowl may frequent a Sacramento Valley marsh. Many of these species have different habitat preferences. For example, the pintail duck, which is the most numerous on the Pacific Flyway, prefers the large open pond - limited cover - type marsh situation. In contrast, the Mallard and Gadwall prefer heavier tule-pothole marsh cover environment. Good marshes must maintain an attractive balance in order to appeal to all the potential depredators.

Tules and cattails in this area are the dominant climax marsh plant. They may form solid stands in ponds, thereby eliminating open resting and loafing ponds. They also may crowd out some of the more beneficial food-producing aquatics.

On a rotating basis, approximately 500 acres of tule-cattail vegetation control work is carried out each year on the Gray Lodge Area. Following winter flooding, the tule marshes are drained. About mid-March, the old growth is burned off. Later in the spring, when the ground is dry enough, the field is plowed with heavy duty disc plows that cut under the tule roots and turn them over. The plowed area is left dry and the upturned tule roots bake in the sun through the summer months. Double discing of the field in late summer or early fall, along with harrowing, completes the control process. Water management and control are also important factors in maintaining a desirable marsh. Delayed fall flooding of loafing and resting ponds for example, limits growth of the climax vegetation plants. Earlier flooding, on the other hand, may stimulate many of the more desirable food producing aquatics which consequently enhances the value of the

pond area. Vegetation control work does not come cheap. The average cost to carry out this work on the Gray Lodge Wildlife Area is $20 per acre. The total annual expenditure for controlling 500 acres of tule-cattail is approximately $10,000.

4. The Production of Cereal Crops

Presently, this is a major function of the wildlife refuges of the Sacramento Valley. Ducks coming into the valley in early fall may have flown all the way from Canada or Alaska with few, brief stops in between. They are hungry upon arrival and move into the first feeding habitat they see. If this is the farmers prize rice field, both the birds and the rice grower may be in for trouble. The role of the refuge is to be as good a "marshland cafeteria" as possible. Today, it is well agreed, that while a bird is feeding on a refuge, it is not feeding on some farmer's crop.

Let us examine the effort of just one area to provide feed for the birds. A summary of the average number of acres of crops grown and marsh management work carried on during the past ten years at Gray Lodge is given in Table 1.

TABLE 1. VALUES OF WILDLIFE CROPS PRODUCED AT THE GRAY LODGE WILDLIFE AREA

Type of Crop	Annual Ave. Acreage	Value per 100 wt.	Average Yield per Acre	Approximate Total Pounds	Approximate Total Value Crop Produced
Millet	1200 acres	$2.00	2500 lbs.	3,000,000	$60,000.00
Milo	150 acres	$2.00	3000 lbs.	450,000	9,000.00
Corn, Sunflower, Sudan, etc.	25 acres	$4.50	2000 lbs.	50,000	2,250.00
Wheat, Barley	300 acres	$2.00	1500 lbs.	450,000	9,000.00
Marsh Aquatics	1500 acres	$1.50	600 lbs.	900,000	13,500.00
Total 3175 acres				4,859,000	
Approximate Total Value of Crops					$93,750.00

Providing waterfowl feed is certainly one of the most important roles of the wildlife refuge in relieving damage to agricultural crops.

During the past ten years, an average of 1200 acres of millet or watergrass has been grown on Gray Lodge annually and left for the birds to harvest. Millet crop yields (from test plot studies at Gray Lodge) show that 1600 to 3600 pounds per acre are produced and that approximately 2500 pounds per acre is the average yield here, as it is on the Federal Wildlife Refuges. Past studies on individual waterfowl food requirements indicate that one duck will consume an average of about seven ounces of food per day. Thus, one acre with a food yield of 2500 pounds would feed approximately 5700 birds for one day or one duck with 5700 dinners.

By the end of October the critical rice depredation period is over as normally by then 80 percent of the rice has been harvested. Waste rice in harvested fields is generally available to the birds on a gratis basis. In fact, in a majority of cases, when the rice field is harvested and the duck season starts, ducks that were public enemy number one quickly become a good thing for the recreation-minded farmer.

In addition to the millet (watergrass) duck feed grown on Gray Lodge, approximately 1500 acres of various natural aquatics are grown annually in permanent ponds and marsh managed field areas. These are considered multi-purpose wildlife areas. The permanent ponds are the major marsh bird nesting areas and they as well as the managed marshes, provide nesting and loafing grounds in addition to some feed for the birds. The natural aquatics and native forage foods of these ponds provide an average of 600 pounds of waterfowl food per acre. One acre, therefore, can feed about 1370 ducks for one day. Thus the 1500 acres of these ponds at Gray Lodge are significant living quarters.

Fall barley and wheat are also planted (See Table 1. for average annual acreage). These crops serve primarily as green pasture for geese, coot, and widgeon during the winter season. These cereals are grown on the dry land areas. Their role in lessening forage

damage to adjacent farm lands varies in effectiveness from year to year. Most fields with these crops are generally grazed so heavily that at maturity, stands are thin and spotty. Approximately 150 acres of dry land milo are also grown annually. This crop is planted in the spring on our better and lighter soils, in patches of twenty to forty acres. The ground is well tilled and the moisture trapped. This crop is grown primarily to cut down depredations by foraging blackbirds and starlings. Milo is the "ice-cream" plant for blackbirds when seeds are in the dough stage. Sandhill cranes and pheasants particularly find milo a most desirable winter food. Blackbirds at times and under certain conditions can be equal to waterfowl as severe depredating pests. Blackbird feeding requirements may be as demanding as northern pintails. Some years patches of safflower, sudan, field corn, and sunflower have been planted. These crops augment the dry land milo as multi-species wildlife food.

SPECIAL DEPREDATION HUNTS

Since 1962, special controlled depredation hunts have been held during the month of February on the Gray Lodge Wildlife Area in order to cut back certain wildlife populations that were causing damage or were a threat to adjacent agricultural crops. Jackrabbit shoots were held from 1962 through 1967. Coot depredations hunts have been held since 1965. The 1965 through 1967 hunts were open to both coot and jackrabbits. During these hunts, a total of 5441 hunter permits were issued and approximately 4505 rabbits and 39,215 coot were killed. Approximately 5,000 acres were hunted each year and generally coincided with the area that had been open to waterfowl shooting during the previous hunting season.

The most recent coot shoot, held just two weeks ago, was our most effective. We issued permits to 785 hunters during the two day hunt in which about 9360 coot were killed. Some years, excess hunters are permitted to hunt on neighboring farms. This year, approximately 100 hunters shooting on the Cassidy Brothers and Mont Justeso ranches killed an estimated 1000 coot. The total kill of this hunt, therefore, exceeded 10,000 birds.

We found (by a random hunter survey) that, on the average, each hunter expended 3.5 shells per coot killed. Most shotguns used were 12 gauge. This indicates that it took about 35,000 shells to down the 10,000 birds. Today, shells cost an average of 14.5¢ each, consequently over $5,000 in shells alone were expended on this coot shoot.

During our regular waterfowl season, duck hunters only take about 600 coot. Summary data on the Gray Lodge Wildlife Area depredations hunts is presented in Table 2.

TABLE 2. COOT AND JACKRABBIT DEPREDATION HUNTS - SUMMARY DATA. Held on the Gray Lodge Wildlife Area from 1962 to 1970.

Date	Total Hunters	Jackrabbits	Coots Bagged
1962	211	1641	Not hunted
1963	254	657	" "
1964	224	631	" "
1965	1294	841	7755
1966	904	492	5090
1967	704	243	6450
1968	434	Not hunted	5000
1969	631	" "	5560
1970	785	" "	9360
Total	5441	4505	39215

PUBLIC HUNTING OPERATIONS

Controlled public hunting on wildlife refuges in some measure aids in the relief of duck damage. The annual harvest of waterfowl on refuges statewide has climbed to nearly one-quarter million birds, taken by slightly over 100,000 hunters. On Gray Lodge Refuge, for example, approximately 11,000 hunters bag an average of 25,000 birds. Controlled hunting for waterfowl helps hold these bird populations in balance, helps relieve farmers from possible hunter tresspass, and also provides the opportunity for recreational hunting. Thus, wildlife hunting areas provide locales where hunter-harvest can be carried out.

COOPERATIVE RESEARCH

Various cooperative and coordinating wildlife research projects are presently carried out on the Gray Lodge Wildlife Area. These include past and/or present studies on selection and propagation of various marsh plants, wildlife management techniques, blackbird flight patterns, and life histories and nesting studies of other species. Food habit studies have been completed on dove, pheasant, blackbirds, jackrabbits and on most waterfowl species. These studies help managers understand the biological factor relating to pest damage control.

CROP COSTS AND VALUES

The financial support for our wildlife refuges comes almost entirely from the hunters of this state through their purchases of sporting arms, ammunition and hunting licenses. Consequently, they deserve a good measure of credit for making possible the existing wildlife refuge programs.

Analyses of the average yields, production costs, and economic values of the wildlife food grown during the past ten years at Gray Lodge have been summarized in Tables 3 and 4.

TABLE 3. COSTS OF PRODUCING WILDLIFE FOODS AT THE GRAY LODGE WILDLIFE AREA

Type of Crop	Annual Ave. Acreage	Ave. Production Cost per Acre	Total Ave. Cost
Millet	1200	$18.00	$21,600.00
Milo	150	12.00	1,800.00
Corn, Sunflower, Sudan, etc.	25	12.00	300.00
Wheat, Barley	300	7.00	2,100.00
Marsh Aquatics	1500	12.00	18,000.00
Vegetation Control	500	20.00	10,000.00
Fall Flood Ponds	2000	3.00	6,000.00
Bulk Feed Put Out	(During severe depredations years)		
Total (Approximately total Cost)	5675 acres		$59,800.00

TABLE 4. GRAY LODGE WILDLIFE AREA WATERFOWL FOOD REQUIREMENTS THROUGH THE RICE HARVEST SEASON

Period of Food Requirement	Average Daily G.L. Waterfowl Population	Number of Duck Days in Area	Approximate Acres of Millet Needed 1/
Aug. 15-30	20,000	300,000	55
Sept. 1-15	40,000	600,000	105
Sept. 16-30	75,000	1,125,000	200
Oct. 1-15	150,000	2,250,000	400
Oct. 16-31	300,000	4,500,000	800
Total Estimated Acres of Millet Needed		8,775,000	1560

1/ With crop yield estimated at 2500 pounds per acre.

Annually, an average of 3175 acres are farmed and/or managed for wildlife food production. This acreage produces around 4,850,000 pounds of feed. This food at market value is conservatively estimated at over $93,000.

The average mallard and pintail food consumption is seven ounces per day. The 4,850,000 pounds of wildlife food provided at the Gray Lodge Area annually, therefore, could supply around 11 million duck feeding days. All of this feed is not readily available duck food, but it does indicate the significance of the crops presently produced at this wildlife area.

Approximately $60,000 is expended annually at Gray Lodge to provide this food, and habitat. This is about 30 percent of the total budget. With the above cost and production figures in mind, it is evident that wildlife refuges do carry out a significant role in vertebrate pest control.