RECLAMATION OF CRANE ROOSTING HABITAT ON THE PLATTE RIVER AND RESTORATION OF RIVERINE WETLANDS

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ABSTRACT

Major changes have occurred along the Platte River in Nebraska since water diversion began in the 1860s. Historically the Platte was a mile or more wide and characterized by an unvegetated streambed bordered by prairie grasses and wetlands. With reduced peak flows, the channel narrowed, and woody vegetation became established over much of the former floodplain. Channel area has been reduced 50% to 85%. Channel width has been reduced even further, resulting in a loss of up to 97% of the roosting habitat for sandhill cranes *Grus canadensis* and whooping cranes *Grus americana*. In 1982, the Platte River Trust began a habitat rehabilitation and restoration program to maintain migratory bird habitat. In this paper, efforts to maintain roost sites and to recreate wetlands are discussed. A variety of experimental techniques have been used to clear trees and shrubs. The most effective method has been to clear woody islands and sandbars by shredding, followed by disking. Herbicides have been effective, but there is concern about their widespread application. The Trust has maintained about 25 km of river channel as roost habitat. In 1984, a project was started to restore wetlands adjacent to the active river channel. Cottonwoods were removed from a 160 ha tract. Fire, herbicides, and grazing will be used experimentally to control regrowth of woody species. Water control structures will maintain wetlands during the spring migration.

INTRODUCTION

The Platte River in Nebraska is a staging area for nearly 500,000 sandhill cranes each spring. The cranes rest and feed along the river for four to six weeks during their migration from wintering grounds in Mexico, New Mexico, and Texas enroute to their nesting grounds in Canada, Alaska, and Siberia. They spend their days in the fields adjacent to the Platte, dancing, loafing, and feeding on waste corn, earthworms, snails, and other invertebrates. Overnight the cranes roost on shallowly flooded sandbars of the Platte River. In addition to sandhill cranes, the remaining natural flock of whooping cranes, which now numbers 109 birds, migrates through Nebraska each spring and fall. Whooping cranes generally use the Platte as a stop-over habitat, spending one or two nights during migration. An estimated 7 to 9 million waterfowl and nearly 240 species of migratory birds use the Platte each year (Krapu 1981; Currier et al. 1985).

Major changes have occurred in the channel morphology and riparian vegetation of the Platte since water diversion for irrigation began in the mid 1800s (Eschner et al. 1981; O'Brien and Currier 1987). A reduction of peak discharge of more than 70% and storage of sediment in on-stream reservoirs are primarily responsible for these changes. Prior to 1860, the Platte was a braided stream, 2 km or more in width, characterized by a sandy, unvegetated streambed, and bordered by prairies, marshes, sloughs, and wetland meadows. Few trees grew along the river's course except in isolated draws and on scattered river islands. Today the river is dominated by stretches of narrow multiple channels, threading around permanently vegetated woodland islands. The active river channel has narrowed, allowing cottonwood *Populus deltoides* and willow *Salix exigua* to grow over much of the former floodplain (O'Brien and Currier 1987). Only a few segments of the original braided stream remain.

Habitat for cranes, waterfowl, and other migratory birds has suffered under these changes (Currier et al. 1985). Losses in channel width have caused some roost sites to be increasingly vulnerable to disturbance and predators; other sites have been completely eliminated. In some river segments, 97% of the roost habitat has been lost. To maintain the existing habitat for migratory birds, instream flows that provide adequate roost sites and maintain wide-open channels need to be designated on the Platte. In addition, enhancement and restoration of roost habitat will help to disperse the cranes and lessen the chance of a catastrophic event that could eliminate a major portion of the population. In this paper, reclamation and restoration programs undertaken by the Platte River Whooping Crane Trust are reviewed and evaluated, and recommendations are made for future management.

HABITAT PLAN

Platte River Trust

The Platte River Whooping Crane Habitat Maintenance Trust was formed in late 1978 in a court-approved settlement of a dispute over the construction of Grayrocks Dam

and Reservoir in Wyoming. The State of Nebraska and the National Wildlife Federation had sued the developers of the project, contending that the depletion of water upstream would affect the habitat for whooping cranes and other migratory birds in Nebraska. The Trust is charged with the responsibility for managing, maintaining, and restoring migratory bird habitat on the Platte. A $7.5 million endowment supports the Trust's programs to acquire land and water rights, to conduct scientific research, and to manage habitat for the benefit of migratory birds. Research and management programs are currently directed toward endangered and threatened species (bald eagle *Haliaetus leucocephalus*, whooping crane, least tern *Sterna antillarum*, and piping plover *Charadrius melodus*) and those species that occur in great numbers on the Platte (sandhill crane, ducks, and geese).

Habitat Complex

The Trust's principal management area is a 130 km stretch of the Platte between Overton and Grand Island, Nebraska. Major bridge crossings dissect this stretch of the river into 11 segments. Each segment seems to represent a distinct biological unit as cranes tend to avoid the disturbed habitat near the bridges. Extensive human disturbance in one segment near Kearney makes this an unlikely site for management. For the 10 remaining river segments, we have identified minimum specifications for suitable crane roost site complexes.

A minimum water-filled channel roost area 150 m in width and 3.5 km long should be maintained free of woody vegetation. The roost channel should be bordered by a 0.8 km wide buffer zone composed of open river channel or grassland. The buffer zone may also contain forest, especially where this vegetation type serves as a "screen" around disturbances. Forested areas, however, should be limited to one side of the river channel in order to maintain the open character of the roost. Within the buffer zone no human disturbances (e.g., buildings, roads) should be visible from the roost. Immediately adjacent to the roost channel should be 260 ha of grassland and a minimum of 40 ha of standing water wetlands. This grassland/wetland complex should be surrounded by a 0.8 km-wide disturbance-free buffer zone of cropland or grassland.

An additional 700 ha of grasslands, including 120 ha of wetlands should be located within 5 km of the roost channel. Grassland parcels should be a minimum of 32 ha in size. Cropland should also be included in the habitat complex, but no minimum area is specified because this component is not currently limiting in any segment.

The area and juxtaposition of the habitat components outlined above are based on existing roost site complexes at Mormon Island, Shoemaker Island, and Fort Farm Island, where sandhill cranes roost in large concentrations. If a roost site complex were to be established in each bridge segment, a suitable site would be available within 6.5 km of any point on the river. The distance between complexes would be no greater than 13 km.

Roost Site Characteristics

In addition to an open channel, specific roost site characteristics for sandhill cranes and whooping cranes have been described for riverine sites (Krapu 1981; Johnson and Temple 1980; Lingle et al. 1984; Lingle et al. 1986). For whooping cranes these are: 1) a wide water-filled channel, 155 to 365 m in width; 2) an unobstructed view from bank to bank as well as 200 to 350 m upstream and downstream; 3) slow flow, 2 to 6 km per hour; 4) shallow water, 5 to 130 cm in depth; 5) unvegetated sandy sediment on the river bottom; 6) at least 0.4 km from disturbances, or at least 0.2 km from a disturbance with a visual barrier; and 7) located within 4.8 km of a feeding site. Sandhill cranes require a similar roost, although they will tolerate channels as narrow as 50 m. The instream flow necessary to provide adequate roost habitat for whooping cranes and sandhill cranes is currently under study by the U.S. Fish and Wildlife Service, the U.S. Bureau of Reclamation, the Nebraska Game and Parks Commission, and the Platte River Trust. Preliminary findings suggest that a flow between 48 m^3/sec and 58 m^3/sec (1700 to 2000 ft^3/sec) is probably sufficient to provide roost habitat.

Feeding Habitat

On migration whooping cranes feed on grain and aquatic organisms such as frogs, fish, crayfish, and insects. Wetlands adjacent to the Platte provide aquatic organisms, but the numbers and size of these wetlands have declined greatly since the mid 1800s because of drainage and conversion to cropland. Sandhill cranes feed in wetland meadows, grasslands, and grain fields. They derive most of their nutrition (96% of the diet) from waste corn (Krapu 1981). Snails, earthworms, beetles, and other invertebrates comprise the remaining 4% of the diet. Although invertebrates account for little of the diet, cranes spend 42% of their time in alfalfa, wetland meadows, and grasslands where they derive these foods. Sandhill cranes also show a preference for grasslands with standing water in the immediate vicinity of the river roost (Krapu 1981; Iverson et al. unpublished).

HABITAT PRESERVATION

Geographical Database

To help identify suitable locations for roost site complexes in each bridge segment, the Trust developed a geographical information system database (GIS) in 1982. Land cover types including cropland, woodland, grassland, river channel, and disturbance features (e.g., roads, homesteads, and powerlines) were mapped from aerial photography in an area extending 5.5 km to each side of the river channel. Using a sandhill crane/whooping crane roost model developed by Armbruster and Farmer (1980), the database was analyzed to identify unobstructed river segments greater than 50 m in width for sandhill cranes and greater

than 150 m in width for whooping cranes. Based on the openness of the channel, isolation from disturbance, and proximity to feeding areas, the major roost complex in each river segment has been identified. Recent whooping crane sightings on the Platte lend support to the model since they have occurred primarily in areas predicted as the most suitable sites within a particular bridge segment.

Habitat Acquisition/Easements

The Trust's initial management efforts have been directed toward preservation of the remaining high quality roost and feeding habitat along the Platte. It is far easier and much less expensive to maintain roost sites and the adjacent wetland meadows than to reclaim these land types from degraded habitat. In addition, younger stages of woodland encroachment (5 to 15 years old) are easier to clear than old forest growth (40 to 50 years). In several bridge segments a roost complex can be maintained by clearing 3 to 8 m tall trees and shrubs from the floodplain surrounding the existing roost habitat. In other segments, however, 15 to 18 m tall (50 to 60 foot) forest trees will need to be removed to re-establish the roost complex.

The Trust currently manages about 2800 ha (7000 acres) of habitat through fee title and easements. The National Audubon Society manages an additional 480 ha bird sanctuary near Kearney, Nebraska. It is estimated that 10,000 to 12,000 ha (25,000 to 30,000 acres) of habitat will be required to complete the 10 roost site complexes. Today only 25% of this habitat is under protective management. Acquisition efforts have been directed primarily toward purchase of river roost sites and adjacent wetland meadows. Easements have been used to maintain buffer zones around the habitat complex and to protect grasslands from being converted to cropland. The Trust has been aided in its acquisition efforts by The Nature Conservancy through their fundraising and wetlands programs.

RECLAMATION AND MANAGEMENT

Maintenance of Riverine Roost

In 1982, the Trust began clearing tree and shrub communities from the river channel adjacent to two high-use roost sites near Mormon and Shoemaker Islands. Clearing was done in mid summer and early fall when discharge in the Platte was low and it was possible to drive equipment across river channels. Chainsaws and a 65 hp, 4-wheel drive tractor fitted with a heavy duty Bushhog mower were used in this initial clearing. A variety of mechanical and chemical techniques including shredding, shredding followed by disking or herbicide applications, and herbicide applications on standing vegetation, were experimentally investigated (Currier 1984). Vegetation at these sites ranged from 2-8 m in height and was composed of dense stands of 5-15 year growth cottonwood, willow, and false indigo *Amorpha fruticosa*. Trees were generally 8-10 cm in diameter, but occasionally 30-40 cm diameter trees were encountered. Because woodlands were relatively young at these sites, over 80 ha were cleared in a seven-week period (less than 400 man-hours).

Under this experimental phase, we were reluctant to purchase heavy equipment until a working methodology for clearing had been determined. Disking was therefore conducted under a contract with an equipment operator. A 90 cm notched-blade, 2-way disk and a D7 track-driven Caterpillar tractor were used. The disk was provided free of charge by Miller Manufacturing of Grand Island, Nebraska. The Caterpillar work ranged from $80 to $100 per hour, including a $5 per hour maintenance cost to replace the rollers on the tractor following a season of work. The sand on the riverbed is very abrasive to the under-carriage of track-driven vehicles, making maintenance costs very high.

The costs for the experimental treatments are listed in Table 1, and range from $194 to $459 per ha ($77 to $183 per acre). Shredding followed by disking was the most effective and environmentally acceptable treatment studied. Shredding alone was not effective in the control of woody plants. As little as eight weeks following shredding, tree and shrub regrowth was 0.5-1.0 meters in height. Subsequent shredding eliminated some regrowth, but 75-80% of the stumps remained alive. Shredding followed by either an application of Graslan (tebuthiuron) at a rate of 2.26 kg/ha or a 1 1/2 percent solution of Roundup (glyphosate) was also effective in controlling nearly 95% of the regrowth. Although herbicides are effective, we are not recommending widespread use because of uncertainties about their long-term environmental effects.

Roundup applied to standing shrubs resulted in 85% to 95% control. There were problems in uniformly applying the herbicide in this treatment, most likely accounting for the slightly lower rate of control. It is recommended that

Treatment	Area ha (acre)	Dollars per hectare[a]					Total cost per ha (acre)
		Labor	Administration	Maintenance	Fuel and Chemical	Equipment[b]	
Shred	56 (140)	38	10	40	8	110	$206 (82)
Spray	7 (17)	25	8	20	48	93	$194 (77)
Shred + Disk	10 (25)	200	25	88	20	110	$443 (177)
Shred + Spray	9 (23)	63	18	60	115	203	$459 (183)
Total Area	82 (203)						

Table 1. Costs associated with various treatments in the experimental clearing operations at Mormon and Shoemaker Islands in 1982.
[a]Acre conversions have been provided to aid land managers in the U.S. who use English Units.
[b]Costs based on a $37,000 investment with an estimated 4-year life.

a colored dye be used in the spray solution if this treatment is to be used. Graslan was applied by hand-held applicators in a pelleted form, and was more uniformly distributed than the Roundup. Graslan controlled over 95% of the standing shrubs. No specific cost calculation was made for the standing shrub treatment, however, since the costs are essentially the same as those for shredding followed by herbicide treatment. Although standing trees and shrubs are killed by the herbicides, they must still be removed in order to provide unobstructed views from the roost site. If shredding must be done anyway, a more effective method is to shred first and then apply herbicides to regrowth.

In 1983 we purchased a large 125 hp "Klearway" to help with river clearing operations. The Klearway has two 180 kg flywheels each with two 2.5 cm thick blades, on a front-mounted articulated cutter head. The machine is driven through the vegetation, chipping trees and shrubs up to 120 cm in diameter. The Klearway cost about $110,000 and was originally designed for the maintenance of woodlands beneath transmission lines. With the Klearway we were able to clear less accessible sites and larger trees than with the tractor and Bushhog.

In combination with high flows in the Platte, shredding followed by disking not only controlled the vegetation on river islands, but also completely eliminated some islands elevated as much as 1 m above the streambed. With this methodology about 25 km of river channel have been cleared and maintained during the past five years. New seedlings continue to develop on the streambed, but subsequent disking every two to three years, at an estimated cost of less than $250 per ha ($100 per acre), should maintain roost sites indefinitely.

Because clearing increases unobstructed channel width, new roost areas may be provided adjacent to cleared islands. The islands themselves provide little additional roost habitat because they are generally elevated above the riverbed (1 m). If these islands are scoured from the bed or are flooded during high river stages, they can provide additional roost sites. During flooding, they may provide the only roost sites because adjacent areas may be too deeply covered by water for roosting.

Reclamation of Riverine Wetlands

In 1984 the Trust began a program to convert a portion of forested floodplain into a wetland meadow complex consisting of an open-channel roost site and adjacent grasslands with surface water sloughs. The site chosen for this work was located near Elm Creek, just downstream of the Kearney Diversion Canal. The river channel near the diversion (north side) has remained a fairly open, treeless channel with an unobstructed width of 0.4 km. Maintenance and enhancement of this roost site are currently underway using the clearing and disking techniques described earlier in this paper.

To the south of this channel is an area of former riverbed, approximately 160 ha in size, which is now dominated by 40 to 60 year old cottonwoods, with an understory of rough-leaf dogwood *Cornus drummondii*, willow *Salix rigida*, red cedar *Juniperus virginiana*, hackberry *Celtis occidentalis*, green ash *Fraxinus pennsylvanica*, and Russian olive *Elaeagnus angustifolia*. Several sloughs parallel the main river channel at this site. These sloughs are supplied primarily by water seeping under the diversion dike. At high river discharges between 340 to 570 m^3/sec (12,000 to 20,000 ft^3/sec), surface water flows across the site. Before 1938, this area was characterized by an open, treeless river channel, bouded by wetland meadows to the north and south. As water levels declined in the Platte, water levels in the adjacent wet meadows also declined. There is little potential for reclamation of these former wet meadows at Elm Creek, because they are no longer in close proximity to the roost channel (over 1.2 km from the roost) and they have a limited water supply. The lower elevation floodplain forest is more suitable for rehabilitation.

At Elm Creek, the shrub understory was initially cleared with the Klearway. Then trees were felled with chainsaws. The larger trees (about 25% of the forest) were cut and sold for lumber for pallets and packing material. Most of the trees were too small to be used for lumber and were piled and burned. Some trees were left uncut along the river channel, adjacent to some sloughs, and on a few ridges to provide "islands" of habitat for roosting raptors, herons, and other migrants. Less than 10 ha (6%) of the forest was left uncut. Shrub communities will be maintained on a few sites through periodic mowing or shredding.

Forest clearing is an expensive operation. It involved the purchase of a number of pieces of heavy equipment in addition to the Klearway, including a 125 hp Steiger tractor, a skid-loader, a 2-yard frontend loader, a semi-tractor with a trailer and dump box, a heavy-duty notched-blade farm disk, a pickup truck, and several heavy-duty saws. We employed a three-man work crew for fieldwork and equipment maintenance. It has taken more than three years to clear the 160 ha at this site. Costs associated with the clearing totalled $1815 per ha ($726 per acre). The most substantial costs were for labor ($660/ha) and equipment expenditures ($465/ha). Equipment costs were distributed over a ten year estimated life. Costs for administration ($325/ha), maintenance ($235/ha), and fuel ($103/ha) were moderate.

Proceeds from the sale of lumber ($14,900) offset some of the operational costs. After consideration of this income, final costs were $1720 per ha ($688 per acre). The lumber operation was an attempt to use efficiently the natural resources at the site. In practical terms, however, the lumbering slowed the clearing work and provided so little income that it was not worth the time and effort. Costs of clearing could be reduced substantially if trees were simply felled, piled, and burned.

Clearing is only the first step in maintaining treeless grasslands adjacent to the river channel. Much of the cleared area at Elm Creek now has 1 to 2 m high shrub and tree regrowth. A combination of shredding, burning, herbicide applications, and grazing techniques will be used to control this regrowth. Experimentation with burning has met with limited success, primarily because there is so little cover to carry a fire. Most burns have been too cool to

arrest woody growth. The site has been fenced and plans for grazing are currently underway.

Double cutting, or repeated shredding of regrowth, will also be investigated as a technique to deplete below-ground energy reserves of plants and eventually kill woody regrowth. This treatment is most effective in mid-summer when plants are actively growing. Herbicides will be employed only as a last resort in controlling regrowth, because of our concern for long-term persistence of toxins.

Water control structures will be placed at the downstream end of the Elm Creek tract in order to establish semi-permanent wetlands during crane migration. These structures will consist of low-level dikes, less than 2 m in height, probably with an adjustable irrigation riser to control water levels, and an emergency spillway to accommodate occasional floods. A ground survey has been conducted to determine the most effective location for these water control structures. We will probably employ a stepwise plan, constructing a single dike and examining the extent of the created wetland before proceeding with additional work. Applications are currently being filed with the U.S. Army Corps of Engineers to allow the use of fill material in a wetland. We hope approval of the permits will allow construction to begin in the fall of 1988. No cost estimate is available yet for this work.

Once water control structures are in place and regrowth is under control, long-term monitoring programs are planned. These programs will involve studies to investigate the response of plant communities, aquatic invertebrates, and migratory bird populations to fluctuations in water levels in re-created wetlands. Results of these studies will provide a baseline for future wetland restorations elsewhere on the Platte.

CONCLUSION

Although forest clearing is expensive, it is the only alternative in some river segments if roost sites and adjacent wetlands are to be maintained. It is within the Trust's economic means to clear small tracts of woodland along the Platte, but it will not be an easy task, nor will we complete it quickly. We remain confident, however, that adequate roost site complexes can be maintained with the clearing and disking techniques described in this paper. It is uncertain, however, if instream flows vital to the continuing existence of migratory birds on the Platte will be maintained. Several additional projects to divert water from the Platte are currently being considered by governmental agencies. We hope that no further water allocations will be granted until instream flows for wildlife are designated. We are pleased that the delegates to the 1987 International Crane Workshop unanimously approved a resolution to that effect. It is the Trust's goal that through responsible water and habitat management, the Platte River will continue to provide a place for cranes, waterfowl, and other migratory birds long into the future.

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