Proceedings

Cattail Management Symposium

Fargo, North Dakota

February 12, 1992

SPONSORED BY
U. S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL DAMAGE CONTROL
DENVER WILDLIFE RESEARCH CENTER

AND

U.S. DEPARTMENT OF INTERIOR
FISH AND WILDLIFE SERVICE

WITH THE ASSISTANCE OF
NORTH DAKOTA STATE UNIVERSITY
FARGO, NORTH DAKOTA

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Symposium Chairman and Proceedings Editor

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OPENING COMMENTS

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On behalf of the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control and U.S. Department of Interior, Fish and Wildlife Service, welcome to the Cattail Management Symposium. We all recognize that cattail-choked marshes serve as roost sites for late-summer migrating blackbirds that damage millions of dollars of sunflower. At the same time, waterfowl production is probably reduced in these homogenous stands of dense cattails. We have a number of wetland researchers and managers scheduled to present their views on the role of cattail management for reducing sunflower damage and increasing waterfowl production. This symposium serves as a forum for participants to voice suggestions and concerns as we move forward with research designed to determine the environmental effects of using herbicides to manage cattail marshes.

Dr. Susan Haseltine, Director, U.S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center has graciously accepted the task of Moderator. Since we have 16 speakers, I ask that participants complete their presentations within the allotted time.

A SUNFLOWER GROWER'S VIEW OF THE BLACKBIRD PROBLEM

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Good Morning. I am Floyd Anderson, past chairman of the National Sunflower Association, a member of the Animal Damage Control Advisory Committee, and a small grain and sunflower producer from north central North Dakota.

It is an honor to open this conference and it is my role to place into perspective the reasons why I as a farmer am very excited about cattail control. First of all you are likely all aware that sunflower is an excellent food for birds. A significant sunflower seed market outlet is for 'birders' located throughout the U.S. However, we have millions of 'freeloaders' in the form of a variety of blackbird species that pass through parts of the Dakotas and Minnesota just prior to sunflower harvest. These birds find sunflower to be an excellent food source and they have become one of the major pest problems for a significant portion of sunflower producers.

We have a number of other pests in the production of sunflower. Some of the pests are very cyclical. Some can be expected to be a problem annually. With the exception of blackbirds, we have available inexpensive and functional methods for controlling all of these pests. However, for blackbirds, the shotgun or rifle is about our best option. Obviously these weapons are very dangerous and unfortunately not very effective.

We as producers have come to the realization that there will likely never be one solution to our blackbird problem. Rather we have to look to a variety of tools such as several forms of harassment, genetic alteration of the sunflower plant, production adjustments and altering the environment. We have approached all of these areas in the past with the exception of the latter. Altering environment for some might translate to draining wetlands. We know that is not a possibility. For Dr. George Linz and his people it means controlling cattails in dense cattail marshes.

Controlling cattails seems to many of us to be too simple. But for those of us who have been battling blackbirds for over a decade, we realize that the combination of a sunflower field and a sizeable cattail marsh with standing water is a formula for sizeable sunflower losses. Most of us have learned that we cannot plant a sunflower field next to such a marsh. In some cases five miles is too close.

We do consider cattail control in certain wetlands to be an important tool in our limited arsenal. I have been following the USDA research in Nelson County for the last several years and I must say that I am impressed with the results so far. There is no question in my mind that the best roosting habitat for the local and migrating blackbird is a dense canopy of cattails in standing water.

I also enjoy hunting ducks and geese. Obviously a cattail wetland is not going to have ducks or geese. We have lost a considerable number of very good goose resting areas to cattails in my area of Ramsey and Cavalier Counties.

By controlling cattails in certain wetlands, we have a situation where everyone but the blackbird wins. I, as a sunflower producer might further disperse the local and migrating blackbird. You as producers of waterfowl have better habitat and we as hunters have better access for hunting. There have not been many opportunities during the last two decades where both agricultural and wildlife interests have been able to claim victory. This is indeed a unique opportunity and we must take advantage of it.

It seems obvious to me, that by controlling cattails, we are enhancing a limited resource. As federal and state agencies and private wildlife groups involved in enhancement of wetlands, you will be sending a very strong message to farmers that you want the best use out of the existing wetlands and that you care about a major production problem. I think we can all agree that this can be an important ingredient to improved relations.

As we get rid of some cattails, I believe we will be getting rid of some long-standing animosities between farmers and wildlife interests. The winner, I believe, will be the wetlands and the desirable species of waterfowl.

Thank you and I look forward to an exciting symposium and I want to thank Dr. Linz and his people for their leadership in this research.

MAGNITUDE AND POTENTIAL SOLUTIONS OF BLACKBIRD-SUNFLOWER PROBLEM

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Animal Damage Control
Bismarck, ND

North Dakota sunflower growers account for approximately 69% of the sunflowers grown in the United States. In North Dakota, most of the sunflower crop is produced in the area of the state that provides favorable conditions for local blackbirds estimated at 2.8 million breeding pairs. This area also corresponds to the late summer migration path of an estimated 30 to 50 million blackbirds.

Ripening sunflower fields provide an excellent high energy food source for migrating flocks of blackbirds. Dense stands of cattails growing in prairie pot hole wetlands offer water, loafing, and roosting habitat that all combine to make an ideal situation for south bound blackbirds.

The U.S. Congress made money available beginning in 1986 for a hazing program to provide sunflower farmers with assistance to reduce blackbird caused sunflower damage. Hazing is conducted with supercub type aircraft and a crew of pilot and observer/gunner. Persistent low-level flying near the bird flocks with shooting as reinforcement, is used to move damaging blackbirds out of problem areas. Eleven aircraft logged 2483 hours hazing blackbirds in 23 ND counties from August 12, 1991, through October 4, 1991. During 1991, 800 requests were received from sunflower growers, the most requests since hazing began in 1986. A total of 12,912 hours have been flown during 6 years of hazing blackbirds in response to 3,882 grower requests. Sunflower damage recorded for the first 5 years of hazing was estimated at $10.1 million.

Avitrol treated cracked corn was distributed 2 years, 1986 and 1990. Scientific data indicated that Avitrol produces inconsistent results, therefore, it's use was discontinued. Frightening devices, including pyrotechnics and propane exploders to a lesser extent, were provided to farmers outside the hazing area in 1990 and 1991. Until the blackbirds are ready to fly south, the primary benefit of hazing and other frightening methods may be that damage is spread across a broader area.

With the realization that something else is needed that will have a longer term benefit, USDA/DWRC began cattail management research in 1989. Subsequently, Congress directed money in 1991 for a pilot cattail management project. The goal of cattail management is to remove a percentage of cattails from heavily infested wetlands to reduce the potential for formation of large concentrations of blackbirds, thereby reducing sunflower damage. Cattail management began in 1991 using DWRC research data for glyphosate (Rodeo) application rate (2.5 qt/A), optimum time for application (August), and recommended percentage of cattail reduction (70%). In 1991, 905 acres were aerially treated in North Dakota and 152 acres in South Dakota. The cattail management effort is viewed as an operational demonstration project to help research determine if cattail management is an environmentally safe and biologically prudent method for reducing sunflower damage.

Initial plans for 1992 are to treat marshes in North and South Dakota that were identified in 1991 as roost sites holding more than 5,000 birds. Approximately 2500 acres of dense cattail stands will be aerially sprayed in the operational demonstration project, and 500 acres will be treated in cooperation with the research project being conducted by the Denver Wildlife Research Center and North Dakota State University.

Cooperation and communication between agencies and organizations that have a stake in North Dakota wetlands is imperative to the success of cattail management. We should bear in mind that there is no single technique or method that will provide an answer. If cattail management is successful, it will continue to be necessary to maintain alternative techniques that will provide integrated sunflower damage management. With this in mind, hopefully cattail management can move forward while maintaining hazing at a reduced level, continuing to utilize other frightening tools, and working toward developing an effective avicide registration.

HISTORY OF CATTAILS ON THE PRAIRIES: WILDLIFE IMPACTS

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CATTAIL HISTORY

R. L. Stuckey (The Ohio State University, unpubl. ms.) provides a history of the genus Typha in North America. Common cattail (T. latifolia) is native to North America and appears in a North American flora as early as 1836. By 1888, the occurrence of the plant throughout North America was known. Two narrow-leaved cattails were also found in eastern North America in the 1830s: a native species named T. gracilis in 1836 by the Turkish botanist Rafinesque and an introduced European species named T. angustifolia in 1753 by Carl von Linne (Linneaus). By the 1850s, North American plant taxonomists merged these two narrow-leaved forms into a single species, T. angustifolia. Since this early merger, botanists have not considered the possibility of the existence of both a native and foreign narrow-leaved cattail. The status of North American narrow-leaved cattail as a native or introduced species, however, still is unknown and awaits a thorough analysis of its genetic affinity with European populations.

In the early 1980s, Ronald Stuckey and Douglas Salamon of The Ohio State University looked at many herbarium specimens and the botanical literature to determine the distributional history of narrow-leaved cattail, T. angustifolia. They found that earliest floras of northeastern states did not list the plant, but by 1820s the plant was present or rare (Stuckey and Salamon 1987). Before 1880, narrow-leaved cattail had been collected only in a few coastal wetlands along the north Atlantic seaboard, Louisiana, and California. By the late 1800s, the plant had migrated westward to the Great Lakes region along waterways, railroads, road ditches, and other areas where wetlands were disturbed or created. Narrow-leaved cattail continued expanding its range into areas west of the Great Lakes in the U.S. and Canada during the early and mid 20th century. First records of it in Wisconsin date back to the 1920s (Fassett 1930). In the 1930s, plants in Iowa spread rapidly into silted wetlands where higher mineral deposits raised soil salinities (Hayden 1939).

In North Dakota, no narrow-leaved cattail was noted during extensive surveys of wetland vegetation by federal waterfowl biologist Franklin Metcalf just prior to World War I (Metcalf 1931). He found few cattail-dominated wetlands in North Dakota during that period. The few stands of common cattail were in boggy areas around freshwater lakes. This suggests that prairie fires and grazing by large ungulates, two major ecological forces during pre-settlement times, could have been responsible for the restricted distribution of common cattail.

During the last fifty years, narrow-leaved cattail seems to have spread rapidly across much of the Great Plains. It was first collected in North Dakota at the Long Lake National Wildlife Refuge in 1942 by U. S. Fish and Wildlife Service biologist Neil Hotchkiss. Another Service employee, waterfowl biologist Merrill Hammond, found it at the Lower Souris National Wildlife Refuge in McHenry County the following year (Stevens 1963). In the early 1960s,

Service biologist Robert Stewart and I noted that most North Dakota wetlands dominated by narrow-leaved cattail were in the southeastern corner of the state. We were surprised to discover clones of narrow-leaved cattail growing along with alkali bulrush (Scirpus maritimus) in some brackish and subsaline wetlands in Stutsman County. By the 1970s we saw it in many wetlands in central North Dakota. About this same time, Robert Jessen, a waterfowl biologist with the Minnesota Department of Natural Resources, also expressed concern about the rapid increase in narrow-leaved cattail in western Minnesota wetlands formerly dominated by bulrushes (Robert Jessen, pers. commun.). Ditches and swales created by construction of modern highways in the United States likely helped narrow-leaved cattail spread into the Great Plains region (Stuckey and Salamon 1987). The plant now inhabits all states east of the 105th meridian, but was not recorded in eastern Montana as late as 1977 (Great Plains Flora Association 1977).

Even more noticeable in the prairie pothole region has been the great increase in wetlands dominated by the robust plant most botanists consider a hybrid between common cattail and narrow-leaved cattail. This plant is named T. x glauca, and Stuckey and Salamon (1987) believe its distributional history parallels that of narrow-leaved cattail. Hybrid cattail, a huge, nearly 3 m-tall plant, has many botanical and habitat characteristics intermediate between its parents (McDonald 1955; Stewart and Kantrud 1972; Grace and Harrison 1986). It was described in Europe during the late 1800s, but not well recognized in North America until the 1950s. I believe this plant started to spread rapidly throughout most of the prairie pothole region of North Dakota during the 1950s and is now the most abundant large hydrophyte in the state.

Wetlands of the North Dakota portion of the prairie pothole region seem ideally suited for hybrid cattail. Most of these wetlands are of intermediate salinity and are often disturbed by tillage and siltation, especially around the shallow edges. In addition, many of these wetlands lay idle and are no longer grazed. This seems to allow cattails to replace native bulrushes. Many semipermanent wetlands in western Minnesota and the eastern Dakotas that were pastured a few decades ago and dominated by semi-open stands of hardstem bulrush (Scirpus acutus) are now idle and dominated by dense stands of cattails. The emergent vegetation in many other wetlands was often harvested for livestock forage and bedding. Many of these wetlands also are now idle and dominated by cattails.

EFFECTS ON WILDLIFE

The great increase in cattails has effects on many wildlife species in the prairie pothole region. Dabbling and diving ducks and their broods prefer wetlands with openings in the marsh canopy (see review by Kantrud 1986). Ducks seem to avoid wetlands with monotypes of deep-marsh emergent hydrophytes like hybrid cattail. Most studies of waterfowl I reviewed indicate that reductions in height and density of tall emergent plants generally increase use by breeding ducks. Whether these reductions are caused by fire, flooding, mowing, cultivation, insect damage, or grazing by muskrats or domestic livestock seems to make little difference. The increased use of semi-open prairie wetlands by ducks is probably from a combination of factors. These wetlands seem to have enough emergent cover to allow pairs to isolate themselves from conspecifics. These wetlands also usually contain open-water areas

dominated by submerged aquatic plants that provide easily accessible supplies of insects, molluscs, and crustaceans that are known foods of adult female ducks and their young. Use of wetlands by duck broods seems to increase with increased numbers of vegetative types at the edges of open water areas (Kantrud 1986). My review strongly suggested that most waterfowl worldwide favor feeding in shallow water areas where sunlight is not intercepted by tall emergent plants. Coots, grebes, terns, and rails also probably benefit from the presence of openings in the marsh canopy.

Some animals, however, have benefitted from the invasion of cattails into prairie wetlands. The thermal and escape cover provided by cattail-choked wetlands certainly seems to enhance the survival of wintering populations of white-tailed deer (Odocoileus virginianus) and ring-necked pheasants (Phasianus colchicus) in intensively cultivated areas where upland cover is scarce. Large numbers of migrant blackbirds (Icteridae) roost in cattail-choked wetlands, but we know little about use of these wetlands by other migrant birds.

Scientific management of prairie wetlands is in its infancy, and research needs are great. These needs have been complicated by changes that accrued to prairie wetlands because of fire suppression, differential grazing regimes, cultivation, mowing, changes in hydrology, siltation, pesticides, and other factors. We know little about the physical and biological environments preferred by most species of breeding waterfowl during different stages in their life cycle. This information should be obtained from habitats in high states of natural preservation. Long-term experiments of burning and grazing different wetland types, in which seasonality, frequency, and intensity of treatments can be varied and combined, are needed. Monitoring should follow to ascertain if the treatments cause changes to the physical and chemical environments of wetlands. Improved management practices are needed for prairie wetlands where water levels can be controlled.

Completion of this suggested research should give conservation agencies the predictive capabilities needed to effectively manage prairie wetlands on public and private lands.

LITERATURE CITED

Fassett, N.C. 1930. Preliminary reports on the flora of Wisconsin. VI. Panadanales. Wis. Acad. Sci. 25:183-184.

Grace, J. B., and J. S. Harrison. 1986. The biology of Canadian weeds. 73. Typha latifolia L., Typha angustifolia L. and Typha x glauca Godr. Can. J. Plant Sci. 66:361-379.

Great Plains Flora Association. 1977. Atlas of the flora of the Great Plains. Iowa State University Press, Ames. 600pp.

Hayden, A. 1939. Notes on Typha angustifolia L. in Iowa. Iowa State Coll. J. Sci. 13:341-351.

Kantrud, H. A. 1986. Effects of vegetation manipulation on breeding waterfowl in prairie wetlands--a literature review. U.S. Fish Wildl. Serv., Tech. Rep. 3.

McDonald, M. E. 1955. Cause and effects of a die-off of emergent vegetation. J. Wildl. Manage. 19:24-35.

Metcalf, F.P. 1931. Wild duck foods of North Dakota lakes. U.S. Dept. Agric. Tech. Bull. 221.

Stevens, O.A. 1963. Handbook of North Dakota plants. North Dakota Institute for Regional Studies, Fargo. 324pp.

Stewart, R. E., and H. A. Kantrud. 1972. Vegetation of prairie potholes, North Dakota, in relation to quality of water and other environmental factors. U. S. Geological Survey Prof. Pap. 585-D.

Stuckey, R.L, and D.P. Salamon. 1987. Typha angustifola in North America: A foreigner masquerading as a native. Ohio J. Sci., April Program Abstr. 87:2.

CYCLES OF CATTAILS IN INDIVIDUAL WETLANDS: ENVIRONMENTAL INFLUENCES

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ABSTRACT

A prairie wetland complex located in the eastern edge of the Missouri Coteau in south-central North Dakota was investigated from 1967 to 1992. The study was designed to define the hydrology of a prairie wetland complex, the role of hydrology in influencing wetland chemistry, and the combined influence of hydrology and chemistry on plant and animal communities. Wetland communities were determined by the position that each wetland basin occupied within the landscape with respect to elevation and the associated groundwater gradients that controlled dissolved salt concentrations. Wetland communities occupying basins located along hydrologic gradients were further modified by annual fluctuations in water level and dissolved salts, which established and maintained vegetative zones, and by long-term trends in climatic conditions, which cycled semipermanent wetlands between extremes of flooding and drawdown. Aquatic communities dominating the individual wetland basins reflected hydrologic and chemical gradients from landscape features. Knowledge of the physical and biological factors that determine the functions and values of natural wetland complexes is prerequisite to establishing a comprehensive management plan for manipulating wetland communities.

INTRODUCTION

The semiarid climate that prevails in the prairie pothole region interacts with the glaciated landscape to produce highly dynamic wetland complexes that cycle between extremes in wet and dry conditions over extended periods of time. Knowledge of the physical and biological factors that determine functions and values of natural wetlands is prerequisite to establishing a comprehensive wetland management plan. Unless wetland management guidelines are based on information derived from studies of the dynamics of natural wetland complexes, the process becomes one of trial and error with low probability of duplicating the functions and values of natural wetlands.

An interdisciplinary, cooperative study was initiated in the prairie pothole region of North Dakota by U.S. Fish and Wildlife Service biologists and U.S. Geological Survey hydrologists to define the hydrology of a prairie wetland complex, the role that hydrology plays in influencing wetland chemistry, and the combined influence of hydrology and chemistry on wetland plant and animal communities (Winter and Carr 1980, LaBaugh et al. 1987, Swanson et al. 1988). By combining the information derived from this study with a previous description of hydrology in the Cottonwood Lake Waterfowl Production Area (Eisenlohr 1972) it is possible

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to describe hydrologic trends and subsequent vegetative changes that have occurred over a 32-year period (1961-92). This paper describes the response of emergent vegetation, with emphasis on cattails (Typha spp.), to hydrologic trends observed in The Cottonwood Lake study area (CLSA).

THE STUDY AREA

The CLSA is located in Stutsman County near the eastern edge of the Missouri Coteau in south-central North Dakota (Fig. 1). This area was purchased by the U.S. Fish and Wildlife Service on August 6, 1963 to be managed as a waterfowl production area. The site at the time of purchase contained 281 acres of native grasses, 94 acres of wetlands, and 93 acres of cultivated land that was seeded to perennial grasses and legumes. The CLSA is bordered on the east and west by pasture, on the north by hayed land, and on the south by cultivated land. Most of the cultivated land has recently been enrolled in the U.S. Department of Agriculture Conservation Reserve Program.

The study area contains 10 semipermanently flooded basins (Stewart and Kantrud 1971), designated by the prefix "P" on Fig.2, and 8 seasonally flooded basins. All wetlands with the prefix "T" (Fig. 2) are seasonally flooded, with the exception of T2, which is semipermanently flooded. Seasonally flooded basins overflow into adjacent semipermanent basins during periods of high water. Wetlands T2 and P8 are integrated, semipermanent wetlands that routinely overflow into wetland P9. Wetlands P1, P6 and P7 are isolated semipermanent wetlands that are nonintegrated. Wetlands P2, P4 and P5 are semipermanent wetlands that integrate during periods of high water but, as a unit, are closed to surface outflow. Wetland P11, a semipermanent wetland located two miles to the west in a topographic low, functions as a hydrologic sump. Salts accumulate because dominant water loss is to the atmosphere. Semipermanent wetlands (with the exception of P11) are dominated by hardstem bulrush (Scirpus acutus) and cattails (Typha angustifolia, T. latifolia, and their hybrid T. X glauca). Wetland P11 is dominated by salt-resistant plants such as alkali bulrush (Scirpus maritimus) and sago pondweed (Potamogeton pectinatus). Seasonal wetlands that function as groundwater recharge areas are dominated by marsh smartweed (Polygonum coccineum) and slough sedge (Carex atherodes). Seasonal wetlands that receive groundwater contain higher concentrations of dissolved salts and are dominated by whitetop (Scolochloa festucacea). The wetland complex has not been grazed since 1966.

METHODS

This study was initiated in the spring of 1967. Wetland water conditions and the response of emergent vegetation to hydrologic trends were documented with staff and constant-recording water-level gages, ground and aerial photographs, and 0.25-m^2 plots of emergent vegetation located along randomly selected transects. Annual trends in wetland zonation were documented with vertical aerial low-altitude 35-mm color photographs. Plant species identifications within zones were confirmed by ground-truthing. Methods used to investigate wetland hydrology and chemistry on the study area are described by Winter and Carr (1980) and LaBaugh et al. (1987).

RESULTS AND DISCUSSION

The CLSA contains wetlands that varied in hydroperiod and salinity and, as a result, produced a variety of plant and animal communities over time. Wetland communities were controlled by: (1) the position each wetland basin occupied within the landscape with respect to groundwater gradients that controlled dissolved salt concentrations, (2) annual fluctuations in water level and dissolved salts that established and maintained vegetative zones, and (3) long-term climatic trends that cycled semipermanent wetlands between extremes of flooding and drawdown. Salt-tolerant species dominated as salt concentrations increased along topographic and hydrologic gradients.

Landscape features in concert with climatic trends dictated the biotic structure of the wetland complex by controlling basin hydrologic functions and their influence on water quality. Wetland basins located on topographic highs functioned as groundwater recharge areas, accumulated atmospheric water low in dissolved salts (dominated by calcium bicarbonate), and supported plant and invertebrate communities unique to a freshwater seasonal water regime (Stewart and Kantrud 1971). Cattails that invaded seasonal wetlands during periods of high water were eliminated during drought.

Basins located at intermediate levels in the landscape received groundwater that contained dissolved salts and lost water through evapotranspiration, groundwater recharge, and, on occasion, surface outflow. Basins that received groundwater tended to be higher in dissolved salts dominated by calcium and magnesium sulfates and bicarbonates, and supported plants and invertebrates typical of a semipermanent water regime (Stewart and Kantrud 1971). Cattail flourished under this water regime and achieved dominance following drawdown. Extended periods of drought increased the salt content of the water and, consequently, salt-tolerant species germinated during drawdown. As the water table dropped in response to extended drought, flow-through systems began to function as recharge areas. Rainfall flushed surface salts lower in the basin soil profile. Under these conditions salt concentrations were reduced at the surface allowing cattail seeds to germinate on sites that were previously too high in salt to support cattails.

Wetland basins located in topographic lows functioned as groundwater discharge areas, lost water through evapotranspiration, and concentrated salts dominated by sodium sulfate. These basins functioned as hydrologic sumps and supported plants and invertebrates that tolerated high salt concentrations. Cattails were restricted to groundwater discharge sites that were lower in dissolved salts than the open water. During drawdown, exposed salt crystals were removed by wind action and deposited in the upland. The influence of wind action on wetland salt concentration is being assessed.

Aquatic communities that dominated basins within the wetland complex reflected the hydrologic and chemical gradients that tracked landscape features. Semipermanent wetlands cycled between extremes in water level over time, from highs that eliminated emergent vegetation, to drawdowns that exposed mud flats, germinated seeds, and reestablished emergent vegetation. Basins with surface outflow maintained stable water low in dissolved

salts and supported floating mats of cattail. Basins closed to surface outflow tended to be highly dynamic in both water level and salt concentration as they responded to climatic trends. Seeds of salt-tolerant species germinated during drawdown, when specific conductance of the water approached 8,000 µS/cm. Cattails on the CLSA were controlled by elevated salt concentrations, flooding, and drawdown.

During this investigation (1967-91), three periods of drought (1973-74,1976-77 and 1988-91) initiated a trend in the wetland complex toward lower pond and ground-water levels. This trend, which periodically exposed wetland substrates and supported seed germination on exposed mud flats, caused all of the semipermanent wetlands in the complex to undergo dominance conversion from open water to dense, monotypic stands of cattail. The drought of 1973-74 converted wetland P4 from a basin dominated by open water to a monotypic cattail stand. The drought of 1976-77 converted four additional semipermanent wetlands on the site (P2, P3, P6, and P7) to monotypic cattail stands. The drought of 1988-91 caused the central open water zone of the remaining semipermanent wetlands to draw down and germinate cattails. Once the central zone of a wetland basin of the complex was dominated by cattail, the wetland never reverted to the open-water conditions observed during the early years of the investigation. Management techniques that can manipulate flooding, drawdown, and salt concentrations potentially will control cattail monotypes. Cattail-dominated wetlands are a major problem for managers in the prairie pothole region because they concentrate migrating blackbirds and lack the open water emergent cover ratios that are attractive to breeding waterfowl.

SUMMARY

A large segment of the semipermanently flooded wetland basins in the prairie pothole region are no longer influenced by fire or grazing factors that, in pristine times, acted in concert with hydrological changes to control wetland emergent vegetation. Many of the wetland basins in the prairie pothole region, however, are currently affected by tillage and runoff from cropland (Grue et al. 1986). The large volume of water released by wetland drainage has heightened the effect of runoff from cropland on the remaining basins; converting previously nonintegrated wetland basins to integrated drainage systems.

Integrated (flow-through) wetland basins that receive and discharge surface water have their maximum depth controlled by the elevation of the outlet. Suspended solids entering the basin are released and deposited in the basin substrate as water velocity decreases. This deposition process reduces the volume of water that wetlands can store by reducing mean depth. Hybrid cattails can tolerate deeper water than other cattail species and expand as the basins fill in and water depth decreases. The resulting wetlands are dominated by monotypic stands of cattail that cannot be managed by flooding unless the elevation of the outlets are increased.

A combination of wetland drainage, which accelerates integration of the remaining wetland basins, and soil erosion, related to runoff from cultivated fields, has converted previously nonintegrated wetland basins to silt traps that tend to be dominated by cattail as filling progresses. Once the natural cycle of flooding and drawdown that manipulates wetland

emergent vegetation has been eliminated by siltation, and cattails become dominant, management options are limited to physical or chemical control. Installing water-control structures at the outlet of basins that have been silted in, or excavating basin sediments to increase water depth for cattail control, is usually too costly especially when incoming waters carry heavy silt loads from cultivated fields. Unless wind and water erosion is controlled in the watershed, increasing water depth will only serve as a temporary solution to cattail dominance.

ACKNOWLEDGMENTS

Appreciation is extended to H. K. Kantrud, N. H. Euliss, Jr., and D. P. Fellows for critical review of this manuscript.

LITERATURE CITED

Eisenlohr, W. S., Jr. 1972. Hydrologic investigations of prairie potholes in North Dakota, 1959-68. U.S. Geol. Surv. Prof. Paper 585. 102pp.

Grue, C. E., L. R. DeWeese, P. Mineau, G. A. Swanson, J. R. Foster, P. M. Arnold, J. N. Huckins, P. J. Sheeham, W. K. Marshall, and A. P. Ludden. 1986. Potential impacts of agricultural chemicals in waterfowl and other wildlife inhabiting prairie wetlands: an evaluation of research needs and approaches. Trans. N. Amer. Wildl. Nat. Resour. Conf. 51:357-383.

LaBaugh, J. W., T. C. Winter, V. A. Adomaitis, and G. A. Swanson. 1987. Hydrology and chemistry of selected prairie wetlands in the Cottonwood Lake area, Stutsman County, North Dakota 1979-82. U.S. Geol. Surv. Prof. Pap. 1431. 26pp.

Stewart, R. E., and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. U.S. Fish Wildl. Serv. Resour. Publ. 92. 57pp.

Swanson, G. A. 1987. An introduction to the Cottonwood Lake area. Proc. N. D. Acad. Sci. 41:25.

Swanson, G. A., T. C. Winter, V. A. Adomaitis, and J. W. LaBaugh 1988. Chemical characteristics of prairie lakes in south-central North Dakota--their potential for influencing use by fish and wildlife. U.S. Fish Wildl. Serv. Tech. Rep. 18. 44pp.

Winter, T. C., and M. R. Carr. 1980. Hydrologic setting of wetlands in the Cottonwood Lake area, Stutsman County, North Dakota. U.S. Geol. Surv. Water Resour. Invest. 88-99 42pp.

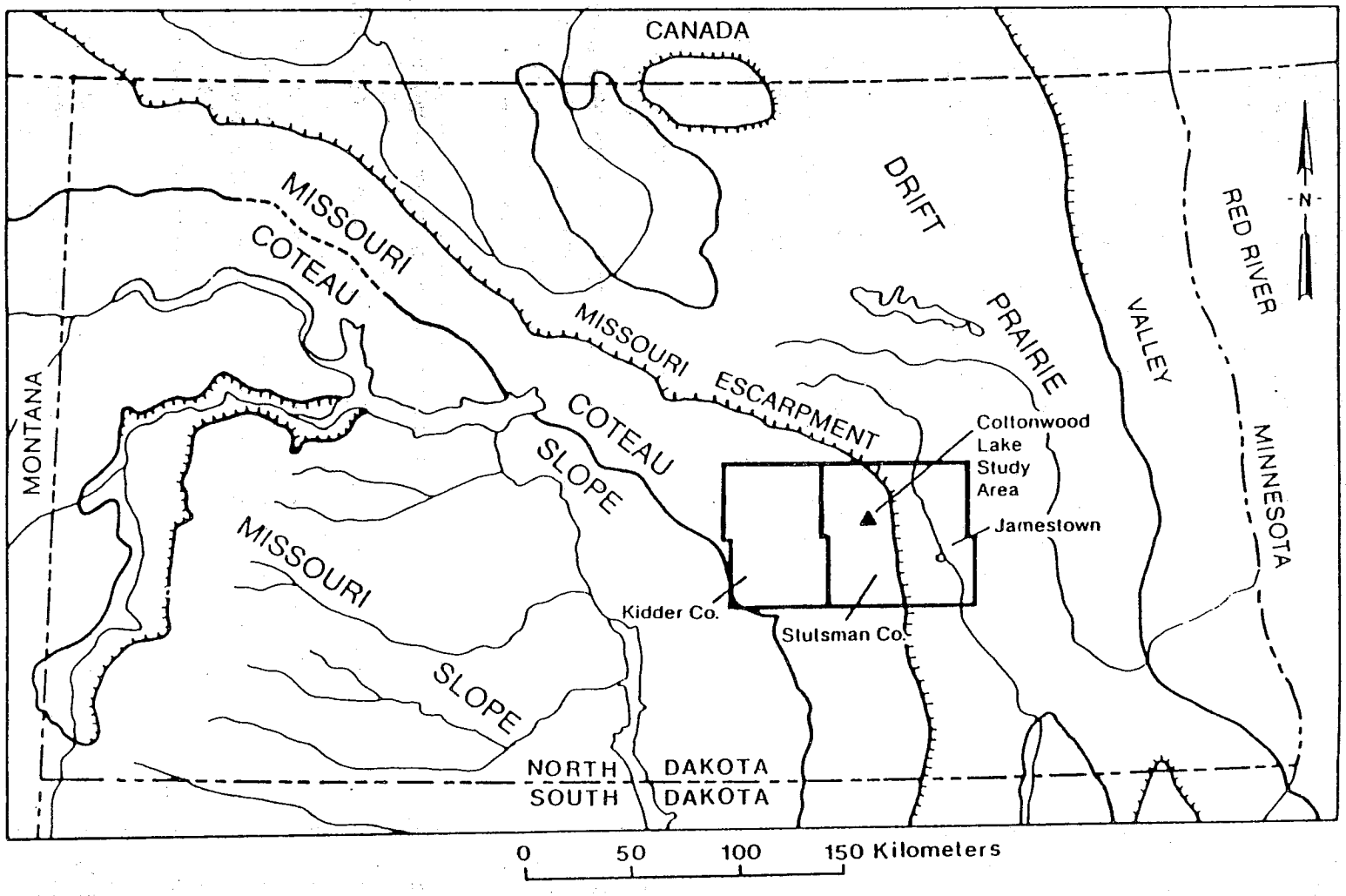

Fig. 1. Physiographic regions of North Dakota, and location of The Cottonwood Lake study area (Swanson et al. 1988).

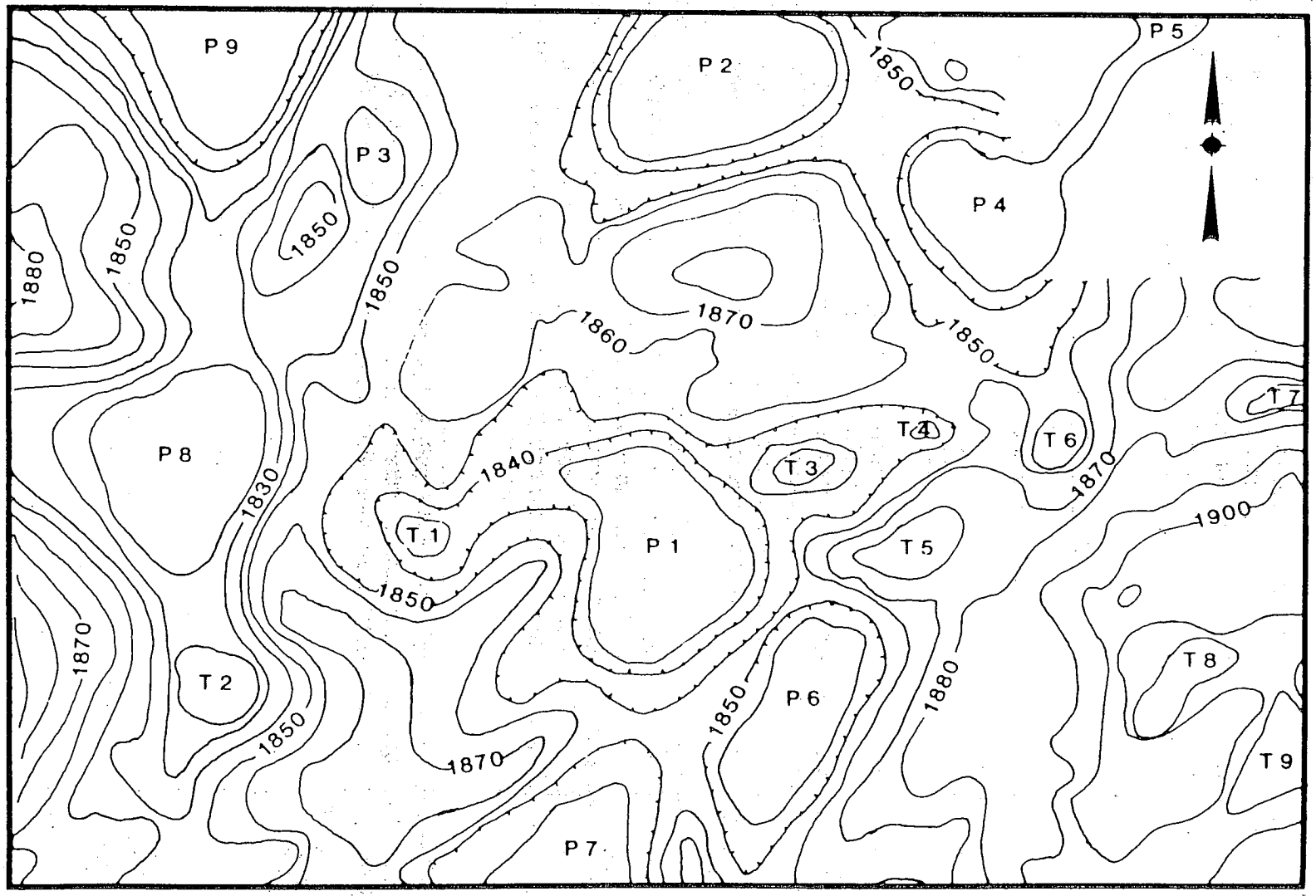

Fig. 2. Location of wetlands (lettered depressions) on The Cottonwood Lake study area (Swanson 1987).

CHEMICAL TREATMENT OF MONODOMINANT CATTAIL STANDS IN SEMIPERMANENT WETLANDS: DUCK, INVERTEBRATE, AND VEGETATION RESPONSE

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ABSTRACT

The feasibility and effectiveness of glyphosate herbicide to create openings in dense monodominant stands of cattail in semipermanent wetlands and the response of breeding and over-water nesting ducks and aquatic invertebrates to the chemical treatments were studied in northeastern South Dakota. Four wetlands were treated with glyphosate in 1985 by fixed-wing aircraft and were compared to cattail-dominated wetlands and wetlands with a neutral interspersion of cattail and open water in a Randomized Complete Block Design. Pre, post-, and between-treatment comparisons were made between 2 application patterns treated in 1986. Breeding duck use, over-water nest densities and success, aquatic invertebrate abundance and diversity, and vegetational changes were compared between the wetland categories.

Glyphosate effectively controlled cattail, however, treatment duration was related to the water regime. Aquatic invertebrate abundance was neither enhanced nor adversely affected by glyphosate treatments, however, aquatic invertebrate diversity was greater in 1987 in the glyphosate-treated wetlands. Breeding duck use was greatest in glyphosate-treated wetlands, particularly the treated wetlands with the highest cattail-open water interspersion. Over-water duck nest densities were greatest in glyphosate-treated and cattail-dominated wetlands and lowest in wetlands with a natural cattail-open water interspersion. Variations in nesting success were primarily influenced by weather.

Creation of openings in dense monodominant stands of cattail with aerial application of glyphosate increased available breeding duck habitat and enhanced access to over-water nesting cover. Recommendations are presented for improving breeding duck habitat in cattail-dominated wetlands with glyphosate.

LITERATURE CITED

Solberg, K. L. 1989. Chemical treatment of monodominant cattail stands in semipermanent wetlands: duck, invertebrate and vegetation response. M.S. Thesis, South Dakota State Univ., Brookings. 105pp.

EVALUATING RODEO[R] HERBICIDE FOR MANAGING CATTAIL-CHOKED MARSHES: OBJECTIVES AND METHODS

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In Minnesota, North Dakota, and South Dakota, blackbirds begin roosting in dense cattail marshes during July. These birds often roost near sunflower fields and eat significant amounts of sunflower seed (Hothem et al. 1988, Otis and Kilburn 1988). Frightening and dispersal techniques are available to reduce the sunflower damage caused by blackbirds (Dyer and Ward 1977, Bomford and O'Brien 1990); however, these methods have limitations because of cost, logistics, or limited effectiveness (North Dakota Agricultural Statistics Service 1990). Thus, new management techniques for reducing blackbird damage to sunflower are needed.

The loss and degradation of habitat have been identified as major waterfowl management problems in North America (United States Fish and Wildl. Serv. and Canadian Wildl. Serv. 1986). Marshes deteriorating from cattail invasion are used infrequently by waterfowl, in part, because of low invertebrate and benthic productivity (Murkin et al. 1982). Generally, breeding bird populations respond positively to the creation of marshes with interspersed emergent vegetation and water (Weller and Spatcher 1965, Nelson and Dietz 1966, Beule 1979). As a result, federal and state wildlife agencies (e.g., U.S. Fish and Wildlife Serv., Wisconsin Department of Nat. Res.) often frequently fragment dense cattail stands with herbicides, mechanical destruction, burning, grazing, water level manipulation, and combinations of these techniques (Beule 1979, Murkin and Ward 1980, Kantrud 1986, Schultz 1987, Solberg 1989).

Other investigators have reported on the effect of modified cattail marshes on blackbird nesting (Beule 1979, Schultz 1987, Murkin et al. 1989). To our knowledge, only Linz et al. (1992) have reported on the response of roosting blackbirds to fragmented cattail marshes. Dispersing or reducing congregations of blackbirds by altering their roosting habitat (i.e., cattails) may in turn disperse or reduce damage to sunflower.

In 1989, Linz et al. (1992) began studying the use of Rodeo[R], an aquatic herbicide (registered trademark of Monsanto Company, St. Louis, MO; Monsanto 1990) for fragmenting cattail marshes. Rodeo[R] is a post-emergent, nonselective herbicide, containing the active ingredient isopropylamine salt of glyphosate (N-(phosphonomethyl) glycine). The U.S.

Department of Agriculture does not endorse Rodeo^R or any other product used in this study. Assessments of the treated marshes in 1990 indicated that Rodeo^R killed the cattails and blackbirds no longer used these marshes as roost sites. These promising results lead to an increased research effort to develop this method of eliminating blackbird roosts.

In 1990 and 1991, we continued to investigate the effects of cattail fragmentation on bird populations by comparing bird counts from 16 Rodeo^R-treated cattail marshes and 8 untreated cattail marshes. Our objectives were (1) to determine the feasibility of fragmenting dense cattail marshes to discourage the establishment of blackbird roosts, (2) to assess the response of breeding and migrating bird populations to altered cattail marshes, and (3) to assess the usefulness of this technique for reducing or dispersing sunflower damage. Here, we describe our research objectives and methodology and discuss preliminary observations.

STUDY AREA AND METHODS

Our study marshes are in Benson, Nelson, Grand Forks, and Walsh Counties, which are located in the prairie pothole region of North Dakota. In 1990, we selected 12 semipermanent cattail marshes (2 - 10 ha; classification of Stewart and Kantrud 1971), that contained water, had abundant cattail, and historically or potentially could harbor blackbirds. These marshes were randomly assigned 70% or 90% areal spray coverages with Rodeo^R or were untreated. In 1991, we selected 12 additional cattail marshes (5 - 32 ha) and randomly designated each marsh to 1 of 2 treatments (50% or 70% areal spray coverages) or were untreated.

Application

The herbicide solution was applied at 46.8 L/ha, containing 5.8 L/ha Rodeo^R (2.8 kg/ha glyphosate), 0.2 L/ha surfactant (Valent X-77 Spreader, Trademark of Valent U.S.A. Corporation, Greeley, CO), 0.4-0.6 L/ha drift retardant (Chem-trol, Trademark of Loveland Industries, Greeley, CO), and sufficient water to bring the solution to final volume. A fixed-winged spray aircraft began on the marsh edge and alternated between treating 15 m strips and skipping either 15, 6, or 2 m strips for 50%, 70%, or 90% treatments, respectively. Marshes were sprayed in mid- to late July. Measurable precipitation did not contact the treated plants for at least 6 hr after treatment.

Determining Herbicide Efficacy

Prior to treatment, each marsh was divided into 2 strata of equal width. We divided each stratum into 15 m strips and 1 strip was randomly selected for assessment of cattail density. A transect was established in the center of each selected strip and 10-0.25 m^2 quadrats placed along the 2 transects. The quadrat interval was obtained by dividing the total length of both transects by 10. The location of the first quadrat was a random distance in meters between the marsh edge and quadrat interval. The remaining plots were located at uniform intervals along the transect. We will count the number of live (green) cattail stems and measure depth of water within the quadrats for at least 2 years posttreatment. Additionally, aerial photos are taken of all study marshes and computer analyzed for

vegetation and water coverage.

Bird Censuses

During August, we counted blackbirds as they exited the test marshes at sunrise and as they entered to roost in the evening (Meanley 1965). In 1990, blackbirds using the 12 test marshes were counted between sunrise and 1030 hr, 1 time during the following the dates: June, July, and August. The observer(s) started counting blackbirds, waterfowl, and wading birds from the highest point near the marsh (e.g., hilltop). After completing this count, the observer(s) walked around the perimeter of the marsh recording all other species seen or heard in the marsh and within 25 m of the marsh.

In 1991, we used a fixed-radius point count method of estimating birds using test marshes (Hutto et al. 1986). Eight count points were established around the perimeter of the marsh within 5 m of the marsh vegetation (usually cattails). The count point intervals were determined by dividing the circumference of the marsh by 8. The location of the first point was a random distance between a designated corner of the marsh and count point interval. The remaining points were systematically placed around the marsh. At each count point, 2 observers waited 1 minute and then recorded all birds seen or heard during a 5 minute count period. Birds were counted 1 time during June, July, and August. We recorded new birds discovered while moving between count points for completeness but did not include these birds in our analysis. Marshes were censused in random order. The censuses were not conducted in rain or if winds exceeded 24 km/hr.

Damage Assessments

Sunflower fields surrounding each study marsh treated in 1990 were randomly selected for damage assessments. We divided each field into 4 strata, 1 row was randomly selected from each stratum, and 24-1.5 m plots were proportionally distributed among the 4 rows based on their length. Plot interval was determined by dividing the total length of the row by the number of plots assigned to that row. The location of the first plot in each row was a randomly selected distance between the field edge and the plot interval. The diameter of each head and undeveloped center was measured to the nearest cm with a measuring tape (Hothem et al. 1988). The area of seed (cm^2) missing from the head was estimated using a gridded plastic template (Dolbeer 1975).

RESULTS AND DISCUSSION

Efficacy of Spray Applications

Under the environmental conditions of northeastern North Dakota, Rodeo^R herbicide applied at 5.8 - 7.0 L/ha in July and August effectively controls cattails for at least 2 years. Rodeo^R applied at 4.7 L/ha significantly reduced cattail density after 1 year. Comes and Kelly (1989) found glyphosate applied at 3.4 kg/ha (equivalent to 7.0 L/ha Rodeo^R) in mid-September was optimum for controlling cattails in a seasonal flowing drainage ditch in central Washington. In August 1985 and July 1986, Solberg (1989) aerially applied Rodeo^R at 7.0

and 8.8 L/ha on cattail marshes in South Dakota and achieved nearly 100% control of cattails. Cattails regenerate quickly on both mud-flats and shallow water (<30 cm) marshes (Solberg 1989, Merendino and Smith 1991); whereas, wetlands with at least 30 cm of water will remain free of cattail for several years (K. Higgins, pers. commun., U.S. Fish and Wildlife, Brookings, South Dakota). We observed small, dense patches of immature cattails (<8 cm tall) growing where spikes of mature seeds had fallen into shallow water. In addition, dense stands of taller (<30 cm) seedling cattails grew in mud-flat areas of the marshes. In one marsh, these patches of cattails reached 120 to 150 cm height after 2 years but did not flower.

Cattails killed in 1989, were still present in September 1991, but the majority had fallen into the water. Mason and Bryant (1975) reported dead cattail (Typha angustifolia) shoots collapse after 2 years and take an additional 2 years to decompose completely. Burning the dead cattails in the fall or spring following treatment may be an effective way of rapidly creating openings in treated marshes. Additionally, reducing the amount of litter in the marsh may lessen any adverse effects on water quality caused by the decomposition of large amounts of vegetation.

Bird Populations

Our data indicate fragmenting solid stands of cattails with herbicide reduces their use by fall-migrating blackbirds. We speculate that dispersing blackbirds may dissipate and reduce sunflower damage. However, studies are needed to quantify sunflower damage patterns before formulating specific management recommendations.

Populations of marsh wrens and rails appear to decrease with the reduction of cattails, probably because these birds require dense emergent vegetation for foraging and nesting. We expect these populations of birds will begin to rebound as cattails repopulate the marsh. Preliminary analyses indicate the number of ducks and shorebirds did not differ between treatment and control marshes 1 year after treatment. This result is not unexpected since the dead cattails were still standing after one year. Additionally, ducks and shorebirds are probably correlated with water levels and cattail densities. Generally, marshes with dense stands of tall emergents are used less by waterfowl than marshes with interspersions of open water and emergent vegetation (Kantrud 1986). Normal water levels coupled with broken stands of emergent vegetation should increase the number of adult and young waterfowl using the test marshes (Kaminski and Prince 1981, Murkin et al. 1982). Marshes with high water levels and those that are dry probably will not harbor many shorebirds.

Economics of Using Rodeo^{R}

If managing cattail marshes proves effective in dispersing blackbirds, individual growers may substantially reduce sunflower losses. Rodeo^{R} may be cost-beneficial, especially if costs are amortized over a number of years. For example, if a 10 ha (25 A) cattail marsh harbors 20,000 blackbirds and each bird eats 14 g (1/2 ounce) sunflower per day (a conservative estimate, Besser 1979), this flock will eat 280 kg/day (617 lb/day) at a cost of $61.70/day (@ $0.10 lb). Over 30 days, the birds may damage 8,400 kg (18,518 lb) of sunflower at a cost of $1852.00. Cost of aerially applying Rodeo^{R}, using 5.8 L/ha (2.5 qt/A), is

about $151.00/ha ($61.00/A). Most of the cost (88%) is for the herbicide. The cost of treating 70 to 100% of a 10 ha marsh with 5.8 L/ha Rodeo^R is $1057 - $1510. If the treatment is effective (i.e., a blackbird roost does not form), individual growers may recoup their costs for treating the marsh in 1 year. Moreover, we expect that properly applied treatments will effectively control cattails for several years. Additionally, the sunflower grower may enhance the value of the marsh by improving the habitat for marsh birds, especially waterfowl (Kantrud 1986, Solberg 1989).

Preliminary Recommendations For Applying Rodeo^R

The U. S. Department of Agriculture, Animal and Plant Health Inspection Service, North Dakota Animal Damage Control and U.S. Department of Interior, Fish and Wildlife Service have received funding for demonstrating the use of Rodeo^R for controlling cattails used by roosting blackbirds (Louis Huffman, North Dakota Animal Damage Control, Bismarck, ND, pers. commun.) and for improving waterfowl habitat (Michael McEnroe, Wetland Habitat Office, Bismarck, ND), respectively. Therefore, we advance the following (albeit preliminary) recommendations: (1). For maximum cost-effectiveness, limit treatment to cattail marshes containing water and traditionally harboring large numbers of birds. The water will slow regrowth of cattails by inhibiting reproduction by seeds. (2). Apply Rodeo^R at 5.8 L/ha (2.5 qt/A). Under normal growing conditions, this rate should be adequate to kill the majority of the cattails (Cal Messersmith, Department of Crop and Weed Science, North Dakota State University, pers. commun.). (A 100 gal tank solution contains 12.5 gal Rodeo^R, 2 qt surfactant, 5 qt drift retardant, and sufficient water to bring to final volume). (3). At least 70% of the cattail should be killed by alternately spraying 15 m (50 ft) wide strips and skipping about 6.4 m (21 ft) between strips. Data gathered to date indicate that blackbirds will not roost in marshes with narrow strips of live cattail. (4). Although we have evidence that Rodeo^R applications sprayed from mid-July to early September effectively kills cattails, ideally treatments should be made from August until first frost. This timing will (1) maximize herbicide efficacy, (2) decrease the possibility of spray drift damaging small grain crops, and (3) avoid most young waterfowl broods.

CONCURRENT AND FUTURE RESEARCH

In 1990-91, Henry (1992) conducted field and laboratory studies on the response of aquatic invertebrates to Rodeo^R herbicide. She found no difference in the number of invertebrates surviving in untreated and treated marshes. Laboratory experiments corroborated the field tests.

In 1992, scientists from North Dakota State University and Denver Wildlife Research Center plan to (1) gather data on the efficacy of managing blackbird roosting sites for dispersing and reducing sunflower damage in 23 km^2 blocks in southeastern North Dakota, (2) assess the effects of using Rodeo^R on marsh water quality, aquatic invertebrate populations, breeding bird populations, and winter cover for gallinaceous birds, and (3) continue to evaluate the response of cattails to various application rates of Rodeo^R.

MANAGEMENT IMPLICATIONS

Our preliminary data indicate that fragmenting solid stands of cattails with herbicide, reduces their use by fall-migrating blackbirds. Additionally, restoring marshes choked with cattails to a 70:30 balance of open water and emergent vegetation may enhance the value of these marshes for other wildlife. We speculate that dispersing blackbirds may dissipate and reduce sunflower damage. Dispersing the damage over a larger area may result in more slightly damaged heads; however, these heads may compensate for seed loss by producing heavier seeds (Sedgwick et al. 1986).

LITERATURE CITED

Besser, J. F. 1979. Capability of red-winged blackbirds to damage ripening sunflower. Bird Damage Res. Rep. No. 113. Denver Wildl. Res. Ctr. 4pp.

Beule, J. D. 1979. Control and management of cattails in southeastern Wisconsin wetlands. Dept. Natural Res. Tech. Bull. 112. 41pp.

Bomford, M., and P. H. O'Brien. 1990. Sonic deterrents in animal damage control: A review of device tests and effectiveness. Wildl. Soc. Bull. 18:411-422.

Comes, R. D., and A. D. Kelley. 1989. Control of common cattail with postemergence herbicides. J. Aquat. Plant Manage. 27:20-23.

Dolbeer, R. A. 1975. A comparison of two methods for estimating bird damage to sunflowers. J. Wildl. Manage. 39:802-806.

Dyer, M. I., and P. Ward. 1977. Management of pest situations. Pp. 267-300 in Granivorous birds in ecosystems. J. Pinowski and S.C. Kendeigh (ed.). Cambridge Univ. Press, Cambridge. 431pp.

Henry, C. J. 1992. Effects of rodeo herbicide on aquatic invertebrates and fathead minnow. M.S. Thesis, South Dakota State Univ., Brookings. 63pp.

Hothem, R. L., R. W. DeHaven, and S. D. Fairaizl. 1988. Bird damage to sunflower in North Dakota, South Dakota, and Minnesota, 1979-1981. U.S. Fish Wildl. Serv. Tech. Rep. 15. 11pp.

Hutto, R. L., S. M. Pletschet, and P. Hendricks. 1986. A fixed-radius point count method for nonbreeding and breeding season use. Auk 103:593-602.

Kaminski, R. M., and H. H. Prince. 1981. Dabbling duck and aquatic macroinvertebrate responses to manipulated wetland habitat. J. Wildl. Manage. 45:1-15.

Kantrud, H. A. 1986. Effects of vegetation manipulation on breeding waterfowl in prairie wetlands - a literature review. U.S. Fish Wildl. Serv., Fish Wildl. Tech. Rep. 3. 15pp.

Linz, G. M., D. L Bergman, and W. J. Bleier. 1992. Progress on managing cattail marshes with Rodeo^{R} herbicide to disperse roosting blackbirds. Proc. Vertebr. Pest Conf. 15:56-61.

Mason, C. F., and R. J. Bryant. 1975. Production, nutrient content, and decomposition of Phragmites communis Trin. and Typha angustifolia L. J. Ecol. 63:71-95.

Meanley, B. 1965. The roosting behavior of the red-winged blackbird in the southern United States. Wilson Bull. 77:217-228.

Merendino, M. T., and L. M. Smith. 1991. Influence of drawdown date and reflood depth on wetland vegetation establishment. Wildl. Soc. Bull. 19:143-150.

Monsanto. 1990. Rodeo^{R} Aquatic Herbicide: Complete directions for use in aquatic and other noncrop sites. Monsanto Co., Agri. Prod., St. Louis, MO. 44pp.

Murkin. H. R., and P. Ward. 1980. Early spring cutting to control cattail in a northern marsh. Wildl. Soc. Bull. 8:254-256.

Murkin, H. R., R. M. Kaminski, and R. D. Titman. 1982. Responses by dabbling ducks and aquatic invertebrates to an experimentally manipulated cattail marsh. Can. J. Zool. 60:2324-2332.

Murkin, H. R., R. M. Kaminski, and R. D. Titman. 1989. Responses by nesting red-winged blackbirds to manipulated cattail habitat. Pages 673-680 in R. R. Sharitz and J. W. Gibbons, eds. DOE Symposium Series No. 61. USDOE Office Sci. Tech. Info., Oak Ridge, TN.

Nelson, N. F., and R. H. Dietz. 1966. Cattail control methods in Utah. Utah Dep. Fish Game Publ. 66-2. 31pp.

North Dakota Agricultural Statistics Service. 1990. Blackbird evaluation survey. Cooperative Extension Newsletter, Fargo, ND. 2pp.

Otis, D. L., and C. M. Kilburn. 1988. Influence of environmental factors on blackbird damage to sunflower. U.S. Fish and Wildl. Tech. Rep. 16. 11 pp.

Schultz, B. D. 1987. Biotic responses of Typha-monodominant semipermanent wetlands to cattle grazing. M.S. Thesis, South Dakota State Univ., Brookings. 92pp.

Sedgwick, J. A., J. L. Oldemeyer, and E. L. Swenson. 1986. Shrinkage and growth compensation in common sunflowers: refining estimates of damage. J. Wildl. Manage. 50:513-520.

Solberg, K. L. 1989. Chemical treatment of monodominant cattail stands in semipermanent wetlands: duck, invertebrate, and vegetation response. M.S. Thesis, South Dakota State Univ., Brookings. 105pp.

Stewart, R. E., and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. Bureau Sport Fish and Wildl. Resour. Publ. 92. 57pp.

United States Fish and Wildlife Service and Canadian Wildlife Service. 1986. North American Waterfowl Management Plan. United States Department of Interior and Environment Canada. 19pp.

Weller, M. W., and C. E. Spatcher. 1965. Role of habitat in the distribution and abundance of marsh birds. Iowa Agric. Home Econ. Exp. Stn. Spec. Rep. 43. 31pp.

EVALUATION OF RODEO™ (GLYPHOSATE) EFFICACY FOR CATTAIL MANAGEMENT

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INTRODUCTION

Cattails are perennial hydrophytes commonly associated with marshes, lake edges, drainage ditches, and other wetlands in North Dakota. Cattails are part of the natural habitat for wetland ecology. However, cattail infestations may reduce water movement in drainage ditches and reduce oxygenation and microbial activity in lakes and wetlands.

Cattails provide an excellent habitat for blackbird nesting in the spring and roosting in the fall during migration. Blackbirds feed on nearby sunflower in the fall. Annually, 2 to 5% of the crop is lost to predation by blackbirds. Blackbirds have become a major pest for Upper Midwest sunflower growers. Reducing cattail stands located near sunflower fields should reduce losses due to feeding by blackbirds.

Cattail control is difficult due to the large rhizome system that enables the plant to reestablish rapidly after top-growth is killed. Several carbohydrate depletion techniques such as mowing, crushing, burning, and discing have been used to control cattail but with limited success. Herbicides provide the most effective control method.

The objective of this research was to evaluate cattail control with Rodeo™ (glyphosate) applied at various rates and cattail growth stages, with several adjuvants, and with or without diammonium sulfate.

MATERIALS AND METHODS

General Procedures

One experiment to evaluate Rodeo (glyphosate) for cattail control was established in a drainage ditch near Fargo, ND, in 1987. Treatments were applied with a backpack sprayer. Three similar experiments were established in Fisk Lake and Dion Marsh near Lakota, ND, in 1990. Treatments were applied with an all-terrain-vehicle-mounted sprayer. Total spray volume was 8 gal/A unless otherwise indicated. The plots were 10 by 30 feet in a randomized complete block design with four replications. Cattail control was determined the following growing seasons by visual evaluations compared to an untreated control (0 percent control = no visible density reduction; 100 percent control = no live stems visible).

Drainage Ditch at Fargo

Rodeo at 1.5, 2.3, and 3 qt/A plus X-77 surfactant at 0.5% v/v was applied in 8 and 24 gal/A total volume on June 19, July 27, and September 3, 1987.

Rodeo Rate and Cattail Growth Stage at Lakota

Rodeo at 1, 1.5, 2, and 2.5 qt/A plus X-77 surfactant at 0.5% v/v was applied to cattail at the 7- to 8-leaf stage on July 5, the flowering stage on July 30, the catkin-development growth stage on August 16, and the mature-catkin growth stage on September 4, 1990.

Diammonium Sulfate at Lakota

Rodeo at 1.0 and 1.5 qt/A was applied alone and with diammonium sulfate at 0.6 and 1.2 lb N/A. Cattail control was compared to that from Rodeo at 2.5 qt/A plus X-77 surfactant at 0.5% v/v (labeled rate). The treatments were applied to cattail at the flowering growth stage on July 31, 1990.

Adjuvants at Lakota

Rodeo at 1.0 and 1.5 qt/A was applied with two spray adjuvants; Li-700 and X-77 at 0.5% v/v. Cattail control was compared to that from Rodeo at 2.5 qt/A plus X-77 surfactant at 0.5% v/v (labeled rate). The treatments were applied to cattail at the flowering growth stage on July 30, 1990.

RESULTS

Drainage Ditch at Fargo

Cattail control 1 yr after treatment was good to excellent with Rodeo at 2.3 and 3 qt/A (88 to 93%) and was fair with Rodeo at 1.5 qt/A (76%). Rodeo usually controlled cattail better when applied at 3 qt/A than 2.3 qt/A, but the increased control by the additional herbicide probably was not cost-effective. The best application time appears to be from late July to early September. Spray volume did not influence cattail control, but using 8 gal/A rather than 24 gal/A would reduce surfactant and application costs.

Rodeo rate and cattail growth stage at Lakota.

Generally cattail control was lowest with Rodeo at 1 qt/A (about 68%) and was similar with Rodeo at 1.5 to 2.5 qt/A (80 to 93%). Thus, Rodeo above 1.5 qt/A may not be necessary for cattail control. Cattail control averaged over Rodeo rates tended to be best when Rodeo was applied in late July and poorest when applied in early July, although differences between the last three application dates (July 30, August 16, September 4) were small. Cattail emergence was poor in early 1990 due to drouth conditions, so cattails tended to be small, which may account for the reduced control by Rodeo applied on July 5, 1990.

Diammonium sulfate.

Cattail control on June 27, 1991 at Dion Marsh and Fisk Lake were not homogeneous, so the data were not combined. Cattail control data collected on August 27, 1991 are from the Dion Marsh only, because treatments in Fisk Lake could not be distinguished visually from the untreated check.

Cattail control at Dion Marsh (> 97%) was much greater than at Fisk Lake (30 to 60%). Generally cattail control was better with Rodeo at 1.5 qt/A (75%) than at 1 qt/A (50%) with or without diammonium sulfate. However, diammonium sulfate at 1.2 lb N/A may have antagonized Rodeo at Fisk Lake.

Adjuvants at Lakota.

Cattail control data collected on June 27, 1991 at Dion Marsh and Fisk Lake were not homogeneous, so the data were not combined. Cattail control was less at Fisk Lake (> 90%) than Dion Marsh (15 to 75%). Cattail control tended to be greater with Rodeo at 1.5 qt/A (45%) than 1 qt/A (30%) regardless of the adjuvant. When Rodeo at 1 qt/A was applied, cattail control tended to increase when Li-700 adjuvant was used instead of X-77. However, when Rodeo at 1.5 qt/A or greater was applied, control was similar with all adjuvants evaluated.

DISCUSSION

There are several possible explanations for the differences in cattail growth between Dion Marsh and Fisk Lake. Cattail residue at Fisk Lake was burned in the fall of 1989 so snow cover during the winters of 1989-90 and 1990-91 was reduced; thus, "winter kill" of some cattail roots may have occurred. Cattail density at Fisk Lake increased dramatically from seedlings in July 1991 after several inches of rainfall were received in late June and early July 1991. Fisk Lake is a mud flat and is very shallow where the experiments were established so it dried out rapidly, whereas Dion Marsh is deeper and water did not retreat as fast.

One possible weakness of this research was that Rodeo was applied to long narrow plots, so encroachment of cattail rhizomes from untreated plants adjacent to the plots may have contributed to rapid cattail reestablishment. Perhaps Rodeo at 1.5 qt/A would provide adequate control when encroachment from untreated plants is prevented by treating the entire drainage ditch or wider strips within a marsh. The cost per acre would be reduced by one-third with Rodeo applied at 1.5 qt/A rather than at 2.3 qt/A.

Weed control is the process of preventing weed growth and/or reducing the density to an acceptable level. Cattails have a large rhizome system that enables the plant to regrow after the top-growth is killed. Depending on effectiveness of the herbicide treatment and marsh site characteristics, especially water depth, cattail reestablishment may occur within 1 yr or may take 3 to 4 yr. Therefore, treatments should be evaluated for 2 to 3 yr after application before strong conclusions are made about the treatment. The research presented in this report is

based on 1 yr of data and herbicides were applied during a drought, so the data should be interpreted with caution.

SUMMARY

Generally, Rodeo™ at 1.5 qt/A or greater controlled cattail similarly (80 to 93%) so Rodeo rates above 1.5 qt/A may not be necessary. Cattail control was achieved with Rodeo applied at any time during the growing season, but late July tended to be the optimal time for cattail control. Diammonium sulfate added to Rodeo did not improve cattail control and may be antagonistic to Rodeo. When Rodeo was applied at 1.5 qt/A or greater, cattail control was similar with all adjuvants evaluated.

USING GIS TO ANALYZE WETLAND BASINS IN NORTHCENTRAL NORTH DAKOTA

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AND

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A major requirement for effective habitat management is the knowledge of the physical and vegetative attributes within an ecosystem. These data are unique to each ecosystem, and gathering these data is time consuming and expensive. The advent of affordable Geographical Information Systems (GIS), now available for use in personal computers, gives ecologists a new and powerful tool.

GIS is a combination of hardware and software capable of analyzing spatial and temporal changes occurring over large geographical areas. The GIS software package created by MicroImages[1] Inc., Lincoln, Nebraska, allows for overlaying of various cartographic components on a digitized map image. There can be several overlays on one map image. For example, the overlays can be soil type, elevation, slope, aspect, hydrology, ground cover, vegetation composition, and land use. Databases (e.g., Lotus 1-2-3), containing pertinent information on individual components of land features, can be attached to the overlays. Additionally, statistics from these data can be generated on such variables as perimeters, areas, and fractal dimensions (area:perimeter ratios) for objects of interest within the map image.

We are using GIS to monitor the effects of herbicide application to cattail-choked wetland basins in North Dakota. Dense stands of cattail (*Typha* spp.) often serve as roost sites for large aggregations of migrating blackbirds (*Icterinae*) in August and September. Elimination of roost-site vegetation by the application of herbicides or other methods (e.g., burning and cutting) has the potential to move blackbirds, which often cause extensive agricultural damage on a local scale (Otis and Kilburn 1988). Starting in 1989, Linz et al. (1992) treated cattail-choked wetlands in northcentral North Dakota with RODEO®, a glyphosate-based herbicide. Research on the environmental effects of altering the vegetative composition within the treated wetlands continues. The objectives of our study are to: (1) use GIS to estimate cattail densities and vegetation coverages in blackbird roosts and (2) use

[1] Use of any product mentioned in this report does not constitute an endorsement.

GIS to monitor the regrowth of cattail in wetlands treated with RODEO®.

We extend our thanks and appreciation to the following persons: Mark Hewitt for his able piloting, and Paul Nyren and Lew Cowardin for their advice on color infrared photography.

STUDY AREA AND METHODS

The study area is in the Drift Plains physiographic region of northcentral North Dakota. The region is characterized by flattened or gently rolling terrain and numerous, shallow, wetland basins. A majority of the tillable land is dedicated to either wheat, barley, or sunflower production.

Control and treated wetlands in Benson, Nelson, Walsh, and Grand Forks counties were photographed from a fixed-winged aircraft at 305-457 m above ground level. All photographs were taken vertically from a port cut in the belly of the aircraft. Flight speeds were between 117-145 kph. Missions were flown on cloudless days between 1100-1500 h to achieve maximum light intensity and sun-angle. In addition to the pilot and photographer, a copilot was used to direct the overlapping flight paths needed to photograph the larger wetlands. The wetlands were photographed with a 60% forward overlap between successive photographs and a 20% lateral overlap between adjacent flight strips (Higby et al. 1987, Lo 1986). We used Kodak Ektachrome Infrared Film Type IE 135-36 and a 35 mm, motor-driven, SLR Cannon EOS650 camera with a 50 mm lens. A Kodak Wratten #12 filter was placed over the lens to subtract blue light. The film speed was set at 100 ASA, and the camera shutter speed was 1/500 sec. Test photography of the wetlands indicated that CIR photographs should be underexposed 1.5 *F*-stops below the recommended light reading for white light. The majority of the photographs were taken at a *F*-stop of 5.6. Unexposed film was stored at 0^{0} C in a freezer, with a relative humidity of 40-60% (Flowerday 1982, Graham and Read 1986). Film was removed from the freezer 4 h before use and allow to warm up to room temperature. The exposed film was shipped over-night mail to Precision Photo Laboratories, Dayton, Ohio; this laboratory uses the EA-5 developing process for CIR film. The film was mounted as slides and digitally scanned into the computer with a Nikon LS-3500 35 mm film scanner. Micro-image Processing Software was used to obtain areal coverages of vegetation and open water within each marsh. Additionally, vegetation species were identified by the color differences produced by the CIR. Wetland basins that were photographed were ground-truthed to correlate the information acquired through CIR photography and to obtain physical measurements for verification of photographic scale.

RESULTS AND DISCUSSION

MIPS was able to distinguish approximately 100 shades of color per slide. Dense, healthy cattail was represented by various shades of dark red. As the density of the cattail decreased, the signature would range from a rust color to a reddish-olive color, depending on the species composition of the understory (e.g., composite or dead cattail from previous years and water depth). Dead cattails had CIR signatures ranging from blue to light-green. Apparently, enough color separation exists in CIR to distinguish freshly killed cattails (green)

from cattails killed in previous years (pale blue). If the density of living cattail was sparse, the dead vegetation in the understory would dominate and yield a green color; the resolution would have to be increased to detect low-density cattails. Dryland vegetation surrounding the cattails was bright red to hot pink and easily distinguishable from vegetation located directly in the wetland. One species of composite (aster) found in dry marshes had a color very similar to healthy, moderately dense cattail; this species was found in 2 dry marshes growing in alkaline soils. Both bare ground and alkaline soils were white in CIR. The signature for phragmites (*Phragmites maximus*) was light pink and separable from cattail. Duckweed (*Lemna* spp.) was grayish-white. Open water was black. The resolution for solid objects (e.g., waterfowl nesting platforms, rocks) was approximately 0.25 m^2.

FUTURE RESEARCH

We plan to continue developing GIS as a tool for identifying factors related to the establishment of blackbird roosts in cattail marshes. In particular, research quantifying the relationship of cattail marshes, ripening sunflower, and blackbird numbers is needed. GIS computer software will enable scientists to analyze large, complex data sets involving many habitat variables. Only after we understand these variables in relation to sunflower damage patterns, can a comprehensive integrated pest management plan be developed and implemented.

LITERATURE CITED

Flowerday, A. D. 1982. Low-altitude infrared photography as a crop management tool. Pages 379-386 in C. J. Johannsen and J. L. Sanders, eds. Remote sensing for resource management. Soil Conserv. Soc. of Am., Ankeny, Iowa.

Graham, R., and R. E. Read. 1986. Manual of aerial photography. Butterworth & Co Ltd, Boston. 346pp.

Higby, L., D. Thompson, and A. Ward. 1987. Improving census by aerial photography — an inexpensive system based on nonspecialist equipment. Wildl. Soc. Bull. 15:438-443.

Linz, G. M., D. L. Bergman, and W. J. Bleier. 1992. Progress on managing cattail marshes with Rodeo herbicide to disperse roosting blackbirds. Proc. Vertebr. Pest Conf. 15:56-61.

Lo, C. P. 1986. Applied remote sensing. Longman Publ., New York, N. Y. 393pp.

Otis, D. L., and C. M. Kilburn. 1988. Influence of environmental factors on blackbird damage to sunflower. U. S. Fish Wildl. Tech. Rep. 16. 11pp.

EFFECTS OF RODEO HERBICIDE ON AQUATIC INVERTEBRATES AND FATHEAD MINNOWS

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ABSTRACT

Waterfowl prefer wetlands with about a 50:50 ratio of emergent vegetation to open water. Growth of dense monotypic stands of cattail has contributed to loss of wetland habitat and to the declining trends of some waterfowl populations. Rodeo herbicide (glyphosate) may be an effective chemical tool for altering emergent vegetative cover, but little is known about its effects on nontarget organisms such as aquatic invertebrates that are important as a food source for waterfowl. The objectives of this study were to evaluate the effects of Rodeo on the survival of aquatic invertebrates in wetlands, and to determine in the laboratory the acute toxicity of Rodeo and the associated surfactant and drift retardant used in aerial treatment.

I evaluated the effects of Rodeo on the survival of six species of invertebrates and fathead minnows by placing them in enclosures in eight North Dakota wetlands that were aerially treated with Rodeo at 5.8 L/ha and in four that were untreated. The number of animals alive and dead were then counted up to 21 days post-treatment. Probit analysis was used to figure regression coefficients and median lethal times, and a t-test was used to detect differences. Water samples were collected prior to treatment to test for presence of agricultural chemicals and after treatment to test for the presence of glyphosate. Limnological conditions were also monitored.

In field trials, no significant differences ($P>0.05$) occurred in mortality rates of invertebrates between treated and reference wetlands. A significant difference did occur in mortality rates of fathead minnows, however deaths of fathead minnows were attributed to factors other than the herbicide treatment.

Laboratory static acute toxicity testing was done on the same species to determine EC50's or LC50's of Rodeo, X-77 Spreader, and Chem-Trol both individually and in mixtures. Rodeo alone and the field application mixture of all three chemicals were rated as practically nontoxic (100-1000 mg/L), X-77 as moderately toxic (1-10 mg/L), and Chem-Trol as an insignificant hazard (>1000 mg/L). The field application mixture was significantly more toxic than Rodeo by itself with X-77 being the most toxic component. I found no evidence of synergistic effects among the three chemicals. The most toxic EC50 for Rodeo of all species tested was 485 times the highest concentration of glyphosate (0.600 mg/L) found in wetland water samples.

I concluded that the benefits to waterfowl by restoring degraded habitat through the use of Rodeo outweigh the limited chance of invertebrate populations being greatly reduced or eliminated as a result of the treatment. Recommendations are given for future research and for managing cattails in wetland complexes with Rodeo herbicide.

LITERATURE CITED

Henry, C. J. 1992. Effects of Rodeo herbicide on aquatic invertebrates and fathead minnows. M.S. Thesis, South Dakota State University, Brookings. 63pp.

USING FIRE TO MANAGE CATTAIL MARSHES

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ABSTRACT

Fire played a historical role in maintaining a diverse marsh habitat. However, due to fire suppression and fragmentation of the original of expanse of prairie and wetlands, many marshes have declined in biodiversity and have become choked with cattail.

Current management strategies mostly deal with short term goals. Many will not use fire due to sometimes poor responses the year after fire. It took thousands of years to create what we have today, and we must focus on long term objectives that will benefit the entire ecosystem. Many want a "quick fix" and one that they will not have to repeat. However, we must understand that ecosystems do not function this way. It was the continual disturbance of marshes that kept them healthy and productive.

Currently, we are researching several aspects of fire in cattail marshes. Some of these include:

1. Comparing cattail and wildlife responses to spring and fall burns.

2. Determine if cold weather burning can be accomplished through the use of gelled fuel in terratorches. This may allow us to burn at times when upland areas will not burn, thus decreasing risk and the number of personnel needed to conduct the burn.

3. Identify situations when cattail roots and tubers can be consumed and attempt to predict stem burndown. Predicting stem burndown will be helpful in areas that can be flooded in order to increase the control of cattail.

4. Determine the short and long term effects of fire and heat pulses on soil and biological systems.

CATTAIL MANAGEMENT: THE NORTH DAKOTA GAME AND FISH DEPARTMENT PERSPECTIVE

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Blackbird depredations on agricultural crops have been a problem for a long time, and a great deal of discussion has occurred over the years on possible methods of controlling populations to reduce the level of the depredation problem. For years I heard talk of studying methods of blackbird population control through the use of sterilants, poisoning, or rendering birds susceptible to death from exposure by spraying roosts with a detergent-type chemical. Most of these proposed solutions were aimed at the wintering ground roosts, and none have proven, at least to my knowledge, to be socially, economically or environmentally feasible.

Now, with the recent discussion on the potential of using cattail control in this region of the continent, many people are again excited that the possibility exists to control blackbird depredations. In addition, wildlife interests are looking at cattail control as a means of developing partnerships with agriculture, where cattail-choked wetlands can be opened up to provide increased value to waterfowl and reduce the potential for large blackbird roosts at the same time. Certainly, with the low existing populations of many waterfowl species, virtually any management tool that can improve habitat and potentially increase production should be fully explored and tested.

A key benefit to this type of management is the development of partnerships between the agricultural and wildlife sectors. You would have to have been sleeping the past five years to not be aware that development of partnerships in attaining goals is a national, and local, buzzword. Too often, people perceive that the goals and objectives of agriculture are mutually exclusive from the goals and objectives of wildlife interests. Those of you familiar with my background know that I firmly believe that notion to be hogwash! Every day, wildlife agencies and landowners are working together to develop projects that are good for the land, good for the landowner, and good for wildlife. When opportunities to develop partnerships arise, we need to work together to capitalize on them. We need to join together at every opportunity to prove to the skeptics that profitable agriculture and abundant wildlife can coexist with a minimum of conflict.

The jury is still out on whether cattail management and control will actually reduce blackbird depredations overall, or whether this project will simply spread out the birds so a larger number of landowners each receive a "tolerable" amount of depredations, in contrast to a few landowners receiving a larger amount, or intolerable, amount of depredations. We believe that this area needs to be more fully explored and understood.

The official position of the North Dakota Game and Fish Department on the subject of cattail management and control is that of cautious support. I say that our support is cautious because of the large number of unknowns relating to the overall effects of the project. As the managing agency for the State's wildlife species, it is prudent that we are cautious about a

management strategy that could have adverse effects to resident species if not properly controlled and conducted. We also want to assure that the program provides the best benefits possible to waterfowl populations.

We're aware, of course, of the research projects about to be conducted under George Linz and Dr. Bleier at North Dakota State University. We will work with NDSU on these projects as funding and manpower permits, to help answer key questions relating to cattail management. Many of our questions regarding potential effects on pheasants, waterfowl and water quality will hopefully be addressed through this research.

Allow me to highlight some specific concerns relating to cattail management. First, there is little empirical data in the literature specific to the value of cattails for overwintering resident wildlife in North Dakota, primarily pheasants and deer, and to a lesser extent, gray partridge and sharp-tailed grouse. Some data does exist from the 1950's and early 1960's for pheasants, though it is limited in scope. Through naturalistic observations every wildlife biologist in the state will confirm that cattails are an important, and sometimes critical wintering habitat component. Unfortunately, some of the most intensively farmed areas of the state are also the areas where cattail marshes may be the only quality habitat remaining. It is these areas where blackbird management may be the most needed, and cattails may be the most critical in terms of winter cover for deer, pheasants, furbearers and other wildlife.

The lack of quantitative, hard data on cattail values for wintering wildlife makes it difficult for us to advise agricultural interests on "when to say when", or "how much control is too much", in terms of losing survival habitat for resident wildlife. When discussing this issue with one of our big game management biologists, he stated, "I understand the need for striking a balance with this issue, but everyone needs to realize that every acre less of cattail in some areas will also mean an acre less of deer wintering habitat".

There are areas in the state where deer are known to traditionally yard up for the winter, often within or adjacent to large cattail marshes. These deer will come to the yarding area for miles around, and whether or not large scale cattail control occurs in these areas could spell the difference between survival and catastrophe.

Pheasants, now the State's most popular game bird, require dense, thick, and tall winter cover adjacent to adequate food supplies to survive the ravages of a "normal" North Dakota winter. The recent mild winters and 3 million acres of Conservation Reserve Program land in the State have resulted in excellent winter survival. As the CRP contracts begin expiring in 1996, it is believed that at least some of this acreage will go back into agricultural production. As this occurs, the value of cattail marshes to wintering wildlife will only increase.

We are pleased to see that the NDSU studies will include a component that looks at the water quality of cattail controlled marshes during the time that the dead cattails are undergoing decay. The decaying cattails could result in anaerobic conditions in the marshes. Although we don't know exactly how it works, avian botulism is known to thrive under anaerobic conditions. so we need to carefully monitor the results. A number of other little

understood factors are included in the outbreak and spread of avian botulism, so we are uncertain as to potential risks.

The potentially beneficial aspects of opening cattail choked wetlands for increased waterfowl use are exciting. We've all seen marshes so choked with cattails that their contribution to waterfowl is diminished. The best control configuration to maximize waterfowl benefits will also be the most difficult to obtain. In other words, block or strip spraying would have lesser value to waterfowl than creation of a mosaic pattern of cattail and open water. Obviously, block or strip spraying with a fixed wing aircraft would be easiest and most efficient. We believe "patchwork" approach to spraying, perhaps by helicopter, would create the best waterfowl habitat, but would also be the most expensive and inefficient in terms of providing the highest return on the Agriculture Department's investment. Perhaps this is an area where wildlife agencies and the Agriculture Department should explore joint funding to develop this mosaic pattern, at least in areas that appear to have the most to gain in terms of waterfowl enhancement.

In additional to use of chemical control of cattails, we encourage continued experimentation of other methods. Discing, burning, grazing, winter cutting, summer cutting, and shearing of cattails at various times of the year may provide blackbird roost and reproduction controls. A lot of research has been done by other states in the efficiency and success of cattail management for wildlife enhancement, and we firmly believe that these tools should all be considered on a case-by-case basis where control is desired. Chemical control will not be universally accepted by landowners or the public. We are willing to work with agricultural interests to improve the diversity of monotypic cattail stands by whatever means is most effective for a given situation. With the national attention currently focused on agricultural chemical use, we believe that relying entirely on chemical control of cattails could be short-sighted and a long-term mistake.

Finally, we believe that if larger blocks that include several wetlands require control, the higher the odds are that a negative impact to resident wildlife could result. Until more data is available, we recommend that cattail control on as few wetlands within a given block as possible, and that in any given marsh be limited to fifty percent of the cattail acreage in that marsh, or less. There is some information from some studies conducted by the Department in the 1950's and 60's that indicates that the larger cattail marshes may have the most value to wintering pheasants. One can instinctively conclude that the larger the cattail marsh, the more value it would have for wintering wildlife. When considering possible impacts to pheasants, then, fifty percent control of a 200 acre marsh <u>may</u> be acceptable, but <u>any</u> control on a 10 acre marsh could possibly be too much. Again, the need for more and better information...

The North Dakota Game and Fish Department supports the concept of controlling blackbird roosts and improving marshes for waterfowl through cattail management. We express cautious support because there are areas where we don't have much information and more data is needed. We'll participate in the research projects as manpower and funding permits, and intend to provide input and advice wherever and whenever possible.

In closing, I'd like to urge the following: When we all go out to our respective constituents or clients and discuss the potentials of cattail management, we need to remind them of several things:

1. Cattails aren't inherently "bad." They serve valuable functions to mankind through filtering nutrients out of marshes, provide winter cover for resident wildlife, provide waterfowl and non-game habitat, and probably other values we're not even aware of.

2. Cattail management isn't a "noxious" weed program. It does appear to have promise from a standpoint of blackbird management and waterfowl enhancement. We don't want to send the message out that "the only good cattail is a dead cattail," thereby creating an atmosphere of wholesale cattail destruction.

3. We need to be cautious during implementation of the operational aspect of the cattail management program until more data on the potentials and pitfalls has been collected and analyzed.

If we jointly pursue answers to the questions I've raised, I believe that cattail management is indeed a tool at our disposal that can result in a win-win situation for wildlife and agricultural interests.

CATTAIL MANAGEMENT: VIEWS OF THE U.S. FISH AND WILDLIFE SERVICE

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Thank you, George, for giving me the clean-up position today. As the last speaker, I will guarantee that I will stay ahead of schedule.

For all the reasons discussed earlier today by Hal Kantrud and George Swanson; changes in fire and grazing regimes, siltation, hybridization, and maybe the recent drought; cattails or more specifically, hybrid cattails, are more prevalent in wetlands today. Hybrid cattails have been a benefit to the species of wildlife attempting to survive in North Dakota over the winter, white-tailed deer, ring-necked pheasants, some furbearers. North Dakota natives can attest to that.

We have seen a reduction in the attractiveness of certain wetlands to waterfowl because of increased cattail. Some wetlands are simply too choked with cattails to provide much duck or marsh bird habitat. However, these cattail choked wetlands provide excellent habitat for breeding blackbirds in the summer and blackbird roosts in the fall.

In 1987, the U.S. Fish and Wildlife Service began enhancing wildlife habitat on private lands under a program called the North Dakota Wildlife Extension Program. The program is now national in scope and has been renamed "Partners in Wildlife." Aldo Leopold, the father of wildlife management, several generations ago said the future of wildlife management was on private lands. The Partners for Wildlife Program gives the Service the opportunity to develop cattail management projects on private lands. George Linz described his research today as developing control methods for blackbirds with secondary benefits for ducks. We are using cattail control to improve marshes for waterfowl and marsh birds with a secondary benefit of blackbird control.

In North Dakota, the Service put cattail control in our menu of private land projects in 1989. We have been on Governor Sinner's Blackbird Task Force since that time. Larry Kleingartner, Executive Director of the North Dakota Sunflower Association, gave our initial efforts on cattail control some good coverage in the Sunflower Association Magazine.

Our cattail management efforts have criteria. We are not looking to eliminate cattails from all wetlands. Cattails are important winter cover for resident game and furbearers, and provide nesting substrate for canvasbacks, redheads, grebes, and other marsh birds.

McEnroe

The following is a brief summary of the history and guidelines for our cattail management program:

1. Cattail control or management is primarily an issue in the eastern half North Dakota;

2. We verify that sufficient winter cover exits in the local area before removing cattails,

3. Typically our extension agreements with private landowners are written to treat only 50 to 70 percent of a wetland in order to create a good interspersion of open water and emergent vegetation. We typically treat wetlands 20 to 100 acres in size that are 100 percent choked with cattail.

4. In 1989 we tried shearing or mowing cattails over the ice in the winter. Costs ran about $50 to $100 per acre.

5. In 1990 and 1991, with the drought and resultant dry wetlands, we added double discing to our menu of cattail techniques. Costs were roughly $10 to $14 per acre.

6. In 1991, we treated up to 300 acres of cattails with Rodeo herbicide. Costs were approximately $65 per acre. This year we plan to treat up to 1,000 acres of cattail choked wetlands with Rodeo at an estimated cost of $65,000. The funds will be split evenly among the five Wetland Management Districts in the eastern half of the State; Devils Lake, Valley City, Arrowwood, Kulm, and Tewaukon.

In addition, the Kellys' Slough Wildlife Project in Grand Forks County received a $20,000 grant from Cargill and the National Fish and Wildlife Foundation and has the potential for a $20,000 grant in 1992. Cattail management is one of thirty-five action items identified in the Kellys' Slough Action Plan.

Between 1989 and October 1991, the Service has treated 146 wetlands totalling 3424 acres for cattails. This averages to about 25 acres per treated area. Most of the treatments have involved burning the dead cattails in the spring and discing the dry wetland during the summer. We treated about 225 acres with Rodeo in 1991, have mowed and sheared cattails on several hundred acres in 1989. We have tried some crowd grazing on cattails following research guidelines developed at South Dakota State University.

In addition, the Service is working with George Linz in his cattail management research. In Nelson County, George's study area, many of the Service's fee-owned Waterfowl Production Areas are study areas for his research. Quite possibly, all our Waterfowl Production Areas with cattail problems and water are in George's study, either as treatment areas or as controls without treatment. George's study is increasing in scope and quite likely his research in the southeastern portions of North Dakota will involve additional Waterfowl

Production Areas.

In conclusion, the Service is going to continue with our cattail management activities. Our emphasis will be on the creation or rehabilitation of duck and marsh bird habitats with a secondary benefit of reducing suitable blackbird roosting cover. With the recent use of Rodeo herbicide, we have an additional tool to use for cattail management. The Service is not, and cannot eliminate all blackbird roosts or blackbird problems. Most of our techniques are temporary, lasting 3 to 7 years. This agrees with Kent Solberg's data and Craig Schnell's observations made earlier today.

There was little runoff in 1990 or 1991 to see what effect mowing or burning and discing had on treated cattails. We won't see the effects of our 1991 Rodeo applications until later in 1992, and won't see the effects of our 1992 treatments until 1993. Based on some of George Swanson's data, we will probably quit shearing and mowing cattails, but will continue to use burning and discing on dry wetlands.

One thing is certain; there are no 100 percent solutions, but with proper application we can manage cattails in a manner that enhances waterfowl and marsh bird habitat, while at the same time maintaining sufficient cover and habitat for the various species that have come to use cattail-choked wetlands. There are probably twenty 5 percent solutions for cattail, waterfowl, and blackbird problems.

ORAL PRESENTATIONS

The following administrators provided brief oral presentations that were largely policy oriented.

Gary Larson
Associate Deputy Administrator
USDA/APHIS/ADC
Washington, D.C.

R. Craig Schnell, Dean
Graduate Studies and Research
Administration
North Dakota State University
Fargo, ND

Dale Henry
Associate Wetland Manager
U.S. Fish & Wildlife Service
Denver, CO

Douglas Hansen, Chief
Wildlife Division
North Dakota Game and Fish
Bismarck, ND

SUMMARY

George M. Linz

Much information was presented and discussed during this symposium. Thanks to all the speakers and participants for providing information throughout the meeting. I will summarize some major points made by the participants.

First, symposium participants agreed that blackbirds can severely damage sunflower during late-summer migration. Usually sunflower fields located closest to major roost sites are the most vulnerable, creating a situation whereby some sunflower growers receive a disproportionate amount of damage. Surprisingly, the physical and biological characteristics of blackbird roost sites have not been quantified. However, we do know that blackbirds migrating through the prairie pothole region prefer cattail-choked, semipermanent marshes that contain water.

Second, waterfowl use of marshes is limited by dense, tall emergent vegetation (i.e., cattails). Narrow-leaved cattails, which now dominate many marshes, did not invade the entire pothole region until the 1960s and 1970s. Soil erosion has resulted in the siltation of many wetlands, creating shallow basins preferred by cattails. Additionally, prairie fires and grazing by large herbivores no longer control emergent vegetation. The task of finding effective, environmentally safe, and cost-effective methods of managing marsh vegetation is challenging. Quantitative data are needed on the long-term effects of using various marsh habitat management techniques (e.g., burning, grazing, mechanical, and chemical alteration) on the flora and fauna of manipulated marshes.

Third, while the aerial application of aquatic herbicides is one method of quickly reducing cattail densities, widespread use of herbicides will not be accepted by various resource agencies without rigorous testing of their environmental effects. In the mid-1980s, researchers in South Dakota tested the herbicide glyphosate (Rodeo^{R} formulation) for managing cattail marshes in South Dakota. Waterfowl numbers on the treated marshes increased significantly. These positive results lead to the current extensive research effort aimed at developing the use of glyphosate for fragmenting cattail marshes. Recently conducted laboratory acute toxicity testing indicated that glyphosate is practically nontoxic and the surfactant used with the chemical is moderately toxic. Field trials showed that aerially applied Rodeo^{R} does not effect invertebrate populations. A study designed to answer questions on the effects of decomposing vegetation on water quality should be completed in 1993. Field studies assessing the response of migratory bird populations to altered cattail marshes should be completed in 1993. The effects of fragmenting dense cattail stands on the survival of ring-necked pheasants will be determined from 1992-94. These studies are critical before developing and implementing cattail marsh management plans.

Finally, blackbirds damage 1% to 2% of the sunflower crop each year. If the damage were spread evenly among sunflower growers, these losses would be relatively insignificant. However, about 15% of sunflower growers estimate they incur losses greater than 10%. If a 100 acre field has a production potential of 2,000 lb/A, a 10% loss (@ $0.10/lb) will cost an owner about $2000. Losses of this magnitude may warrant the use of an integrated pest

management strategy which may include (1) planting bird-tolerant sunflower, (2) reducing cattail density at local roost sites, and (3) using harassment techniques.

ACKNOWLEDGMENTS

Staff at the Denver Wildlife Research Center, North Dakota Field Station and Department of Zoology, North Dakota State University contributed greatly to the success of the symposium. Dave Bergman used his considerable computer skills to create the cover for the symposium proceedings. Diane Reff spent many hours making arrangements, typing correspondence, and organizing the proceedings. Thanks to the North Dakota and Minnesota Chapter of the Wildlife Society for advertising the symposium agenda. Finally, Dr. Sue Haseltine did an excellent job as moderator.