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MANAGING CATTAIL MARSHES WITH GLYPHOSATE TO REDUCE BLACKBIRD POPULATIONS: 1990 UPDATE

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In the north-central United States blackbirds begin roosting in July in dense cattail (*Typha* spp.) marshes. Often blackbirds form roosts 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). However, these methods have limitations of cost, logistics, or limited effectiveness. 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). Dense cattail marshes have low invertebrate and benthic productivity and as a result are used little by waterfowl (Murkin et al. 1982). Breeding marsh birds respond positively to the creation of wetlands with interspersed emergent vegetation and water (Weller and Spatcher 1965, Nelson and Dietz 1966, Buele 1979, Murkin 1979). Various federal and state wildlife agencies (e.g., USFWS, Wisconsin Department of Nat. Res.) have removed or reduced dense cattails stands by using herbicides, mechanical destruction, burning, grazing, water level manipulation, and combinations of these techniques (Beule 1979, Murkin 1979, Murkin and Ward 1980, Kantrud 1986, Schultz 1987, Solberg 1989).

To our knowledge, no data have been published on the use of these modified wetlands by roosting blackbirds. Dispersing or reducing blackbird populations by altering their roosting habitat (i. e., cattails) may in turn disperse or reduce damage to sunflower. To determine the feasibility of this notion, we aerially sprayed 4 cattail marshes in August and September 1989 with the Rodeo formulation of glyphosate (Isopropylamine salt of N-phosphonomethyl glycine) (Rodeo is a registered trademark of Monsanto Company, St. Louis, MO). The U.S. Department of Agriculture does not endorse any product used in this study) (Linz and Bergman 1990). Here, we present data on the efficacy of aerially applied glyphosate on cattail marshes and compare the abundance of birds using these treated marshes in 1989 and 1990.

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Study Area and Methods

Test Sites

During August and September 1989, 4 marshes located in Nelson and Ramsey Counties, North Dakota, were aerially sprayed with glyphosate (Fig. 1, Table 1). Blegens, Command, and Wall-89 are Class IV marshes (semipermanent) with uniform stands of cattails (classification system of Stewart and Kantrud 1971). Rose is a 46 ha permanent lake (Class V) with an inlet composed of 16 ha which is surrounded by a fringe of cattail from 10-110 m wide.

Application

The amount of Rodeo sprayed on the test marshes in 1989 ranged from 5.8 l/ha (2.8 kg/ha active ingredient) to the maximum recommended application rate of 7.0 l/ha (3.4 kg/ha active ingredient) (Monsanto 1985a, 1985b) (Table 1). The herbicide was mixed in a 46.8 l/ha solution, containing 0.19 l/ha surfactant (Activator 90, Trademark of Loveland Industries, Inc., Greeley, CO.), 0.9 l/ha drift retardant, and sufficient water to bring the solution to final volume. No measurable precipitation contacted the treated plants for at least 6 hr after treatment as recommended by Monsanto (1985b).

Determining Efficacy

Each marsh was divided into 2 strata of equal width. Each stratum was divided into 15 m wide strips and 70% of the strips were randomly selected for treatment (Fig. 2) (Linz and Bergman 1990). Prior to treatment, we counted the number of live (green) cattail stems within 20 0.5-m^2 quadrats systematically placed along 4 randomly selected strips. The plots were marked with a numbered stake. Depth of water in the quadrats was determined by averaging the water depths at the four corners of the quadrate. In late July and early August 1990 the quadrates were reassessed for cattail density and water depth (Table 2). Paired-*t* tests were used to (1) assess differences between years in number of live cattail stems found within the quadrates in each marsh and (2) determine if water depths differed in the quadrates between years. Kruskal-Wallis test was used to test if cattail density and water depth differed between years among all marshes (SAS 1988:713-726).

Bird Censuses

In 1989 numbers of blackbirds using the test marshes were estimated by counting the birds as they departed the roost at sunrise (Meanley 1965), at least 2 times within 7-day

pre- and 7-day posttreatment periods. In addition, a population index of the bird species in each marsh was obtained between 0800-1100 hr at least 2 times during the pre- and posttreatment periods, by walking around the periphery of the wetland and recording all birds observed in the marsh and within 50 m of the marsh.

In 1990, the blackbird populations in these marshes were estimated in August and September. A population index of all bird species using the marshes was obtained between sunrise - 1030 hr for each marsh 1 time during 7-13 June, 24 July-6 August, 20-23 August, and 15-16 September.

Populations of 4 groups of birds were used as indicators of possible detrimental or beneficial effects due to the application of glyphosate (Table 3). Briefly, Soras (*Porzana carolina*) and Virginia rails (*Rallus limicola*) require dense vegetation and are usually found on the ground; marsh wrens (*Cistothorus palustris*) are usually observed foraging in emergent dense vegetation; ducks (Anatinae) require open areas of water for foraging; shorebirds (Charadriidae, Scolopacidae, and Recurvirostridae) forage in shallow water in open areas of marshes. Kruskal-Wallis was used to determine if (1) the numbers of birds within each group differed between pre- and posttreatment censuses and (2) if the numbers of birds within each group differed between years.

Results and Discussion

Water depth within individual marshes changed significantly between 1989 and 1990 (P range = 0.0001-0.0107) (Table 2). However, when water depths were compared across marshes, water depth was the same between years ($\bar{x}$ = 12.7, SD = 18.8, X^2 = 0.5271, df = 1, P = 0.4678).

Evaluations of the treated marshes indicated that effective cattail control was achieved. Live cattail density decreased significantly between years within individual marshes (P range = 0.0001-0.0072) (Table 2) and across all marshes between years (X^2 = 5.398, df = 1, P = 0.0202). Some dead cattails from the previous year's growth were still standing in September but the majority had fallen into the water and were decomposing. We noticed small, very dense patches of immature cattails (<8 cm) growing where spikes of mature seeds had fallen into the water. In addition, dense stands of immature cattails (<30 cm) had begun to grow in areas of the marshes where the water had evaporated. Solberg (1989) also noted that cattails regenerated in dry marshes the year following treatment, whereas, wetlands with at least 30 cm of water remained free of cattail for at least 3 years. We will continue to annually assess the regrowth of cattail in the treated marshes until the cattails reach pretreatment densities.

Eliminating the dense cattail stands effectively eliminated the use of the test marshes as blackbird roosting sites. We estimated that in August and September 1989 101,000 ($\bar{x}$ = 25,250, SD = 30,875) blackbirds were roosting in the 4 treated marshes (Linz and Bergman 1990), whereas, 0 blackbirds were using these marshes in late summer 1990. No new roosts were found within 5 km of Wall-89 and Rose in late summer 1990. A new roost, harboring 16,900 blackbirds, was found within 500 m of Command and was

sprayed with glyphosate in late August 1990. We did not look for new roosts in the area surrounding Blegens.

The populations of 'indicator birds' did not change between pre- and posttreatment at individual marshes (X^2 range = 0.3333-1.349, df = 1, P range = 0.2454-0.5637) (Linz and Bergman 1990). Therefore, pre- and posttreatment numbers were averaged to obtain the population size of each group of birds in August 1989. Of the 4 groups of 'indicator birds', only the marsh wren population changed between 1989 ($\bar{x}$ = 28.6, SD = 6.3) and 1990 ($\bar{x}$ = 9.5, SD = 9.0, X^2 = 4.083, df = 1, P = 0.0433), a decrease of 67% (Table 3). This result may be related to the fact that marsh wrens glean insects from dense emergent vegetation. In 1991, we expect to find a further decline in marsh wrens and other species requiring dense cattail habitat (e.g., soras and Virginia rails) because most of the cattails killed in 1989 will have decomposed. These populations of birds should begin to rebound as cattails reinfest the marsh. In comparison, given adequate water, the number of ducks and shorebirds using the treated marshes may increase as more open water is available for foraging (Kaminski and Prince 1981, Murkin and Titman 1982).

Conclusions

We conclude that glyphosate (1) applied at 2.8-3.4 kg/ha from mid-August to mid-September effectively kills cattails and (2) treatments reduce habitat for species requiring dense vegetation (e.g., blackbirds, marsh wrens). Further, it appears that cattail will quickly reseed dry areas in treated marshes. The effect of cattail removal on species requiring open water (e.g., waterfowl) remains inconclusive.

Concurrent Research (1990)

Three other studies using glyphosate were conducted in 1990. In an experiment designed to determine if altering cattail marshes reduces blackbird damage to sunflower, we randomly selected 8 cattail marshes for glyphosate treatment and 4 marshes for controls (untreated) and estimated the amount of blackbird damage to sunflower fields surrounding these marshes. Scientists from the South Dakota Cooperative Fish and Wildlife Service Research Unit, Brookings (SDSU, FWS) conducted a study on the response of invertebrates to glyphosate applied to 8 cattail marshes. These data are critical for evaluating the effect of glyphosate applications on the food source for waterfowl broods. Researchers from the Department of Crop and Weed Science, North Dakota State University (NDSU), Fargo, conducted small plot trials to assess the response of cattail to various application rates of glyphosate. Their objective was to find the most cost-beneficial application rates. Results from these studies should be available in 1991.

Future Research

Scientists from the Denver Wildlife Research Center, NDSU, and SDSU-FWS plan to continue research on the use of glyphosate and other herbicides for managing marsh vegetation. In 1991, we will continue to (1) determine the amount of habitat (i.e., cattails) that must be removed from a marsh to significantly reduce blackbird numbers, (2)

ascertain the rate of cattail reinfestation of treated marshes, (3) determine the response of invertebrates to various components of the Rodeo herbicide solution (i.e., glyphosate and surfactant), (4) determine the effect of removing cattails on bird populations, especially waterfowl, (5) evaluate the efficacy of various glyphosate application rates for killing cattail, and (6) determine the feasibility of altering blackbird roosting habitat for reducing blackbird damage to sunflower.

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Table 1. Description of wetlands in North Dakota treated with glyphosate during August and September 1989.

Wetland	Location Township, Range, Section	Wetland [a] Type	Date Treated	Total Area (ha) of Cattail (ac)	Area of (ha) Cattail Treated (ac)	Rate (l/ha) of Application (qt/ac)
Blegens	T155N, R67W, S14SW	Semipermanent	15 August	15 (37)	15 (26)	5.8 (2.5)
Command	T150N, R60W, S1NC	Semipermanent	29 August	9 (22)	6 (15)	6.8 (2.9)
Rose	T153N, R59W, S25NE	Permanent	29 August	4 (10)	3 (7)	7.0 (3.0)
Wall 89	T153N, R59W, S26WE	Semipermanent	9 September	4 (10)	3 (7)	6.8 (2.9)

[a] Classification system of Stewart and Kantrud (1971)

Table 2. Mean cattail density and water depth (cm) in 20 0.5-m^2 quadrats located in 4 marshes treated with glyphosate.

Wetland	Mean cattail density in 1989 (SD)	Mean cattail density in 1990 (SD)	P [a]	Mean water depth in 1989 (SD)	Mean water depth in 1990 (SD)	P [a]
Blegens	8.9 (7.2)	1.0 (2.6)	0.0002	0.0 (-)	7.7 (12.1)	0.0107
Command	11.4 (9.4)	0.2 (1.1)	0.0001	6.0 (11.7)	55.9 (45.5)	0.0001
Rose	11.5 (8.5)	0.2 (0.7)	0.0001	21.0 (27.2)	0.0 (-)	0.0027
Wall 89	7.2 (8.5)	1.2 (2.7)	0.0072	1.1 (4.2)	9.9 (15.5)	0.0084

[a] Paired t-test

Table 3. Numbers of birds observed in 1989 and 1990 in 4 cattail marshes treated with glyphosate in 1989.

	Rallidae [a]		Troglodytidae [b]		Anatinae [c]		Charadriidae Recurvirostridae Scolopacidae [d]	
Wetland	1989	1990	1989	1990	1989	1990	1989	1990
Blegens	4	7	32	21	22	84	62	89
Command	4	5	28	12	17	9	8	0
Rose	6	1	20	4	286	237	40	34
Wall 89	1	0	34	1	8	0	24	0
Mean (SD)	3.8 (2.1)	3.3 (3.3)	28.5 (6.2)	9.5 (9.0)	83.3 (135.3)	82.5 (109.7)	33.5 (30.8)	23.1 (42.0)

[a] Soras (Porzana carolina) and Virginia rails (Rallus limicola)

[b] Largely marsh wrens (Cistothorus palustris)

[c] Ducks

[d] Broadly defined as shorebirds

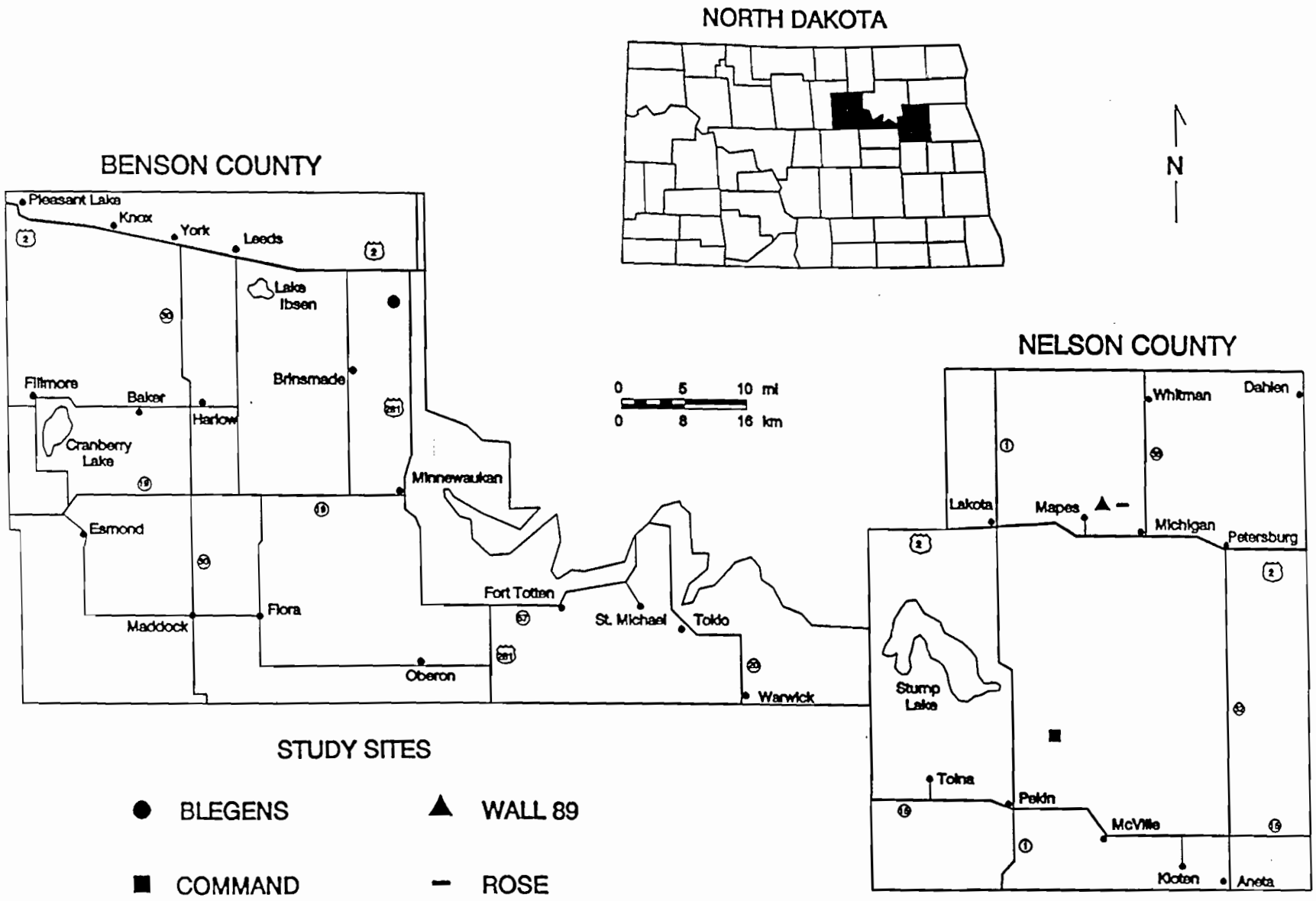

Fig. 1. Locations of wetlands treated with glyphosate during August and September 1989.

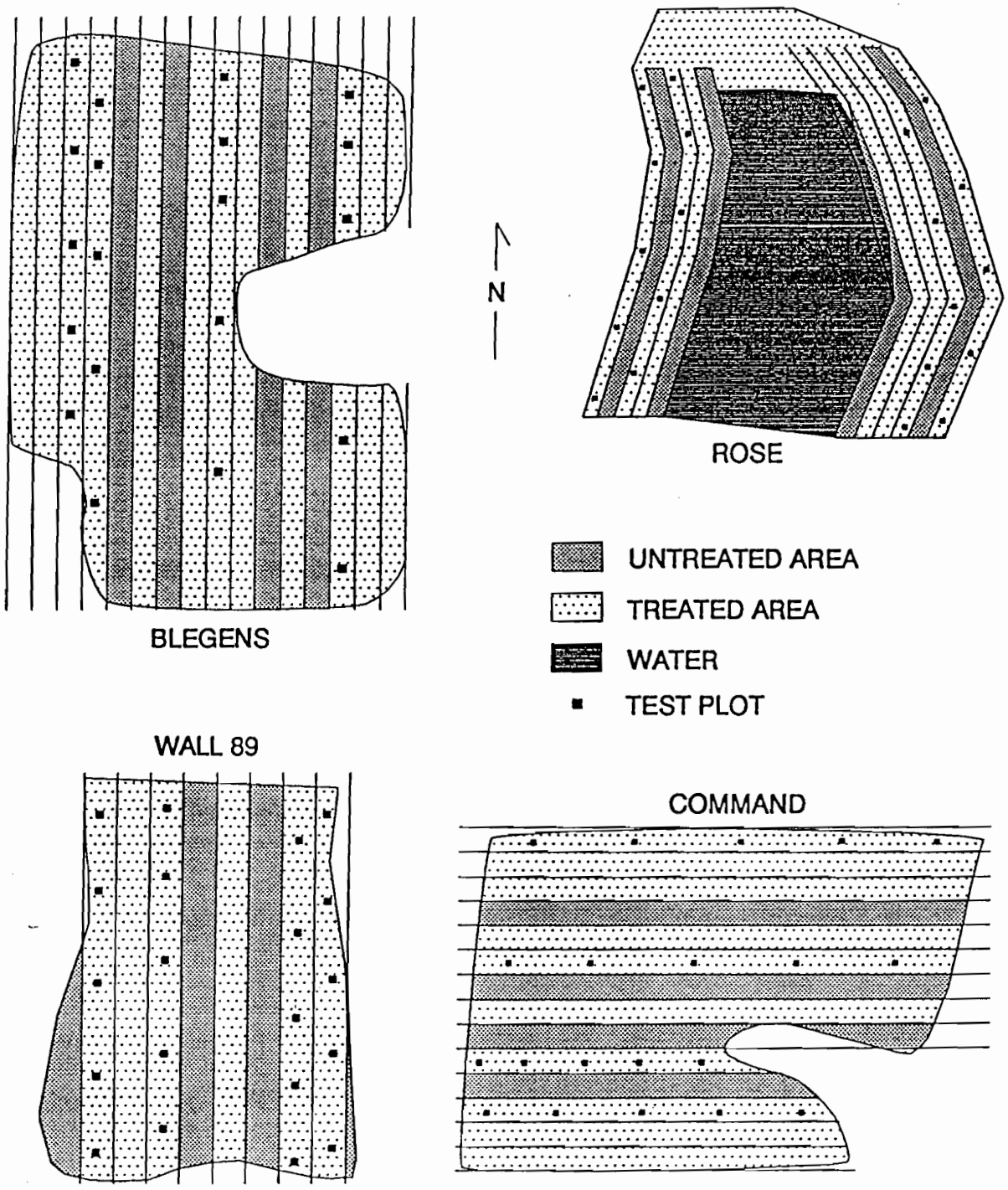

Fig. 2. Diagram of 4 wetlands treated with glyphosate showing treated and untreated 15 m wide strips and locations of 0.5-m^2 quadrats.