 0030-0950/82/0003-0103 $2.00/0

VEGETATION CHANGES IN A LAKE ERIE MARSH (WINOUS POINT, OTTAWA COUNTY, OHIO) DURING HIGH WATER YEARS[1]

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ABSTRACT. High, uncontrolled water levels in Lake Erie marshes that occurred in late 1972 altered the distribution and abundance of plant communities. Large areas of moist-soil species, cattails (*Typha angustifolia, T. latifolia*), rose mallow (*Hibiscus palustris*), emersed plants (e.g., *Sagittaria, Scirpus, Cyperus, Carex*), blue-joint grass (*Calamagrostis canadensis*), and annual weeds (e.g., *Impatiens, Mimulus, Bidens*) were eliminated and replaced largely by open water. With fewer lush stands of food plants available, the attractiveness of the marshes to migrating ducks declined. Population levels of muskrats (*Ondatra zibethica*) decreased because food and cover plants were lacking. Numbers of breeding waterfowl were reduced due to inundation of nesting sites in upland grassy meadows.

OHIO J. SCI. 82(3): 103, 1982

INTRODUCTION

Water level fluctuations of Lake Erie have a pronounced effect on the natural vegetation of adjacent marshes. Short-term alterations, known as seiches, are common in Lake Erie, and extreme fluctuations of over 4.5 m have been recorded (Krecker 1928). Average water levels in Lake Erie peak in June or July and reach low points near the end of the calendar year (Langlois 1954). Long-term fluctuations (fig. 1) result from persistent low or high water supply conditions within the basin that culminate in extreme low levels, such as those in 1934-36 and 1964-65, or in extreme high levels, such as those in 1973-74. The level in June 1981 was 174.4 m above mean sea level, or about 41 cm below the all time high level of 174.8 m (R. L. Meeks, pers. comm.).

Most marshes on Lake Erie are maintained with dike systems that allow control of water levels. The high water levels in Lake Erie since 1972, coupled with severe storms from the northeast, destroyed dikes and subsequently altered the vegetative composition of the adjacent marshes. Without water-level control, drawdowns were impossible in marsh units previously drained on an annual or biennial basis. In this paper, we describe changes in various plant communities due to high water conditions and contrast floral composition of a marsh unit maintained under different management regimes.

Literature describing the original vegetation in the Lake Erie marshes is scarce. However, from various sources Andrews

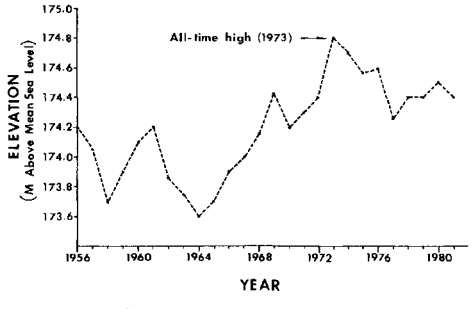

FIGURE 1. Lake Erie water levels (m above mean sea level), June 1956-81 (U. S. Department of Commerce 1982).

[1]Manuscript received 4 May 1976 and in revised form 12 March 1982 (#76-39).

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(1952) constructed a general picture of the then-undiked marshes. He wrote:

> On the shallow borders of the marsh, flooded only during periods of high water in winter, stretched meadows of blue-joint grass, interspersed with patches of cord grass and various sedges. Shrubs, such as silky dogwood, elderberry, buttonbush and swamp rose occupied drier sites. Cattail was probably the dominant vegetation of those portions of the marsh usually covered by shallow water. Large stands of reeds occupied similar areas, and bur-reed and bullrushes [sic] were common along the deeper margins. Where the water was deeper, wild rice, water-lilies, lotus and spatterdock composed the emergent vegetation. In the waterways and deeper portions of the marsh, wild celery, pondweeds, coontail and other submerged species were plentiful. These plant communities were not static and their boundaries shifted as the lake level fluctuated over a period of years. Although this was largely a progressive shifting to water of optimum depth, certain communities decreased in size at the expense of others.

STUDY SITE

The area studied was the Lattimore unit of the 1,700-ha Winous Point Shooting Club marsh, located in Ottawa County about 6.4 km southwest of Port Clinton, Ohio, at the southwestern end of Lake Erie near the upper end of Sandusky Bay. The Lattimore unit, about 32.4 ha in size, was enclosed by a dike and separated from adjacent marshland in 1956. It was managed separately until the surrounding dikes were damaged in late 1972, when the water level in the unit fluctuated with that in Lake Erie. Dike reconstruction on the Winous Point marshes began in 1976, and water level control in the Lattimore unit was achieved in 1978. By the end of 1981, 546 ha of marsh habitat had been restored.

For the past several years, management objectives in the Lake Erie marshes of Ohio generally have called for mid-May to late May drawdowns followed by reflooding in September or October to produce the best vegetation for waterfowl and other wildlife (Meeks 1969). Before 1972 the Lattimore study unit usually was drained in May and reflooded in September before fall waterfowl migration. Drawdowns were complete during 1956-62. No drawdowns were conducted during 1963-64 and 1967-70, but partial drawdowns were made in 1965, 1966, and 1971. Stabilized water levels (no drawdown) were maintained in 1972. Drawdown was impossible in 1973-75.

METHODS AND MATERIALS

The vegetation of the entire marsh unit was cover mapped in August 1973 and 1974. Aerial photographs from the Agricultural Stabilization and Conservation Service, U. S. Soil Conservation Service, and oblique photos taken with a 35-mm camera from a light aircraft were used in conjunction with ground reconnaissance for cover mapping. Cover type percentages were measured with a compensating polar planimeter or an acreage grid.

RESULTS

Cover types identified in the Lattimore study unit are shown in table 1. Management of the unit by total drawdown during 1956-60 produced vegetation in 1960 highly attractive to feeding ducks. Three of the most important waterfowl food plants in the Lake Erie marshes, nodding smartweed (*Polygonum lapathifolium*), Walter's millet (*Echinochloa walteri*), and rice-cutgrass (*Leersia oryzoides*), totalled 54.3% of the unit. Blue-joint grass meadows, which are important dabbling duck nesting habitat, covered 3.3% of the unit. Though annual weeds were present, they did not predominate. Only 5.1% of the marsh was open water.

Mud flats were not exposed in 1963-65; stands of nodding smartweed, Walter's millet, and rice-cutgrass did not appear, and annual weeds were eliminated. Large areas of shallow water favored expansion of cattail and rose mallow. By 1965, cattail stands more than quadrupled in size and rose mallow stands increased to cover 20% of the area (table 1). Stands of blue-joint grass expanded and became established on drier locations, and the amount of semi-aquatic species increased slightly. Over ⅔ of the unit consisted of open water.

TABLE 1

Percentage composition of the Lattimore study unit by vegetative cover type under 4 management regimes, Winous Point Shooting Club, Port Clinton, Ohio, 1960-74.

Cover Type	Year and management regime*			
	1960 controlled levels, drawdown	1965 controlled levels, partial drawdown	1972 controlled levels, no drawdown	1974 uncontrolled levels, no drawdown
Smartweeds (*Polygonum* spp.)	3.2		0.2	0.8
Cattails (*Typha latifolia* and *T. angustifolia*)	5.9	23.8	14.1	
Walter's millet (*Echinochloa walteri*)	8.9			
Emersed species**	6.5	7.4	4.2	0.2
Rose mallow (*Hibiscus palustris*)	9.9	21.1	15.6	
Annual weeds**	14.5		3.0	
Rice-cutgrass (*Leersia oryzoides*)	42.5			
Blue-joint grass (*Calamagrostis canadensis*)	3.3	6.1	3.2	
Spatterdock (*Nuphar advena*)	trace			0.2
Submersed aquatics**				trace
Woody species**			2.9	0.1
Open water	5.1	41.7	56.8	98.7

*Sources of data: 1960 Meeks (1963), 1965 Bandy (1965), 1972 Andrews (1973), 1974 Farney (1975).
**Emersed species: bur-reed (*Sparganium eurycarpum*), arrowhead (*Sagittaria latifolia*), soft-stem bulrush (*Scirpus validus*), river bulrush (*S. fluviatilis*), pickerelweed (*Pontederia cordata*), chufa (*Cyperus* spp.), needle-rush (*Eleocharis acicularis*), swamp loosestrife (*Decodon verticillatus*), dock (*Rumex* spp.), and sedge (*Carex* spp.). Annual weeds: sow-thistle (*Sonchus* spp.), touch-me-not (*Impatiens* spp.), swamp milkweed (*Asclepias incarnata*), monkey-flower (*Mimulus* spp.), stick-tight (*Bidens* spp.), boneset (*Eupatorium perfoliatum*), and fireweed (*Erechtites hieracifolia*). Submersed aquatics: water milfoil (*Myriophyllum spicatum*) and sago pondweed (*Potamogeton pectinatus*). Woody species: willow (*Salix* spp.) and cottonwood (*Populus deltoides*).

Management aims in 1972 called for no drawdown. Water depths of at least 30 cm were maintained over much of the unit and again no extensive mud flats were exposed. Smartweeds (primarily *Polygonum lapathifolium*) and annual weed stands re-established themselves, but stands of cattail, rose mallow, and emersed species decreased in size. Nearly 57% of the marsh unit was open water (table 1).

Washed-out dikes prohibited all water-level control practices in 1973 and 1974. In addition to the absence of moist-soil plant species, annual weeds and blue-joint grass stands were eliminated completely. Though sparse stands of cattail and rose mallow occurred in 1973, none persisted in 1974 and emersed species were reduced to 5% of their 1972 abundance. Several small stands of *Polygonum coccineum*, an aquatic smartweed, became established. Other aquatic forms, both floating-leaved and submerged, reappeared. Yet, more than 98% of the marsh unit was open water and devoid of any emergent vegetation.

The drastic changes in vegetation coverage that occurred in 1973-74 were not confined to the Lattimore study unit. On the entire Winous Point marsh, nearly 75% of about 890 ha of diked marsh units and recurring stands of vegetation in shallow water areas of the bays was open water in 1974, an increase from 63% in 1973. Cattails decreased from 15% of the area

mapped in 1973 to 8% in 1974, a loss of more than 53 ha.

In 1974 probably less than 0.8 ha of rose mallow remained on the Winous Point marsh even though it was one of the dominant communities in pre-high water years (Lowden 1969). Emersed species made up less than 3% of the hectarage mapped in 1974, and bulrushes (*Scirpus validus* and *S. fluviatilis*) had nearly disappeared. Arrowheads, including the rare *Sagittaria rigida*, occurrrd in very limited stands in 1973. Even spatterdock (*Nuphar advena*) decreased in coverage due to increased wave action on the marsh. The wave action caused further loss of vegetation, increased water turbidity, and eroded inner banks of dikes.

DISCUSSION

The dramatic loss of vegetation during high water years seriously disrupted management of the marshes for migratory waterfowl. During 1973-74 mallards (*Anas platyrhynchos*) and black ducks (*A. rubripes*) were heavily dependent on domestic agricultural grains for sustenance (Farney 1975). Corn alone occurred in 55% and 16%, respectively, of the mallard and black duck gullets containing food examined in 1974. These high percentages indicated extensive use of distant, dry, upland fields as food sources. Few moist-soil plant species occurred on the Winous Point marsh; instead, strictly aquatic species such as algae, liverwort (*Riccia* spp.), duckweeds (*Lemna minor* and *Spirodela polyrhiza*), coontail (*Ceratophyllum demersum*), water milfoil (*Myriophyllum spicatum*), pondweeds, and bladderwort (*Utricularia vulgaris*) predominated both quantitatively and in percentage occurrence (Farney 1975). The poor habitat conditions probably slowed the fall build-up of migratory ducks at Winous Point and undoubtedly contributed to declined waterfowl use of the Lake Erie marshes during 1972-75.

Waterfowl nesting on the Winous Point marsh declined greatly in the high water years after 1972. Andrews (1952) estimated breeding pair densities at Winous Point in 1951 and 1952 to be 24 and 20 /km^2, respectively, but since 1952 the once-extensive blue-joint grass meadows have disappeared, and with them most dabbling duck production on the area. Isolated breeding mallards and blue-winged teals (*Anas discors*) were the only upland nesters observed on the marsh in 1973 and 1974. High water levels result in concentration of duck nests on dikes, where they are subject to high rates of predation and a high rate of nest destruction by flooding. The greater amount of available nesting habitat in low water-level years attracts larger numbers of breeding pairs (Bednarik 1963).

A drastic decline in the muskrat population at Winous Point coincided with the loss of emergent vegetation. Cattail, bur-reed (*Sparganium eurycarpum*), and softstem bulrush (*Scirpus validus*) are considered to be the most important muskrat foods on the marsh (Bednarik 1953, Meeks 1963). Loss of these plants likely contributed to the muskrat population decline. As many as 331 muskrat houses were counted on the Lattimore study unit in 1958 (Meeks 1963); no houses were observed on the unit in late 1974, though dens in adjacent dikes were undoubtedly present. Muskrat harvest by trapping on club property in 1974-75 totalled only 1,063 animals, a 6-fold decrease from the recorded catch of 6,604 in 1960-61 (unpubl. data, Winous Point Shooting Club).

Although most impacts of high water levels on the marsh environment were deleterious, some positive ecological benefits were realized. The periodic flooding brought about by long-term fluctuations in the Lake level contributed nutrient-rich silt to help maintain the fertility of the marshes (Kadlec and Wentz 1974).

ACKNOWLEDGMENTS. We thank the Winous Point Shooting Club for financially supporting this study and for providing living accommodations to the senior author, and Dr. R. L. Meeks, Club Superintendent-Biologist, for his assistance.

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