Fire in Relation to Waterfowl Habitat of the Delta Marshes

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THE Delta Marsh lies in south-central Manitoba, 75 miles north of the U.S. border. It is within the eastern edge of the Aspen Parkland, between the Great Plains of central North America and the coniferous forests of the Pre-cambrian Shield. The Aspen Parkland is an intermingling of the two major plant communities—forest and grassland. "The latter is dominant during periods of drought or repeated fires, while the forest encroaches upon grasslands in wet periods" (Bird, 1961).

The Delta Marsh borders the south shore of Lake Manitoba and is the largest of several marshland units in the Lake Manitoba basin. It is one of the finest waterfowl breeding and harvest areas on the Canadian Prairies. Between Lake Manitoba and the marsh proper, is a low, narrow ridge of sand covered by poplar, maple, ash and willow. Behind these woods, extending to the south, east and west, nearly as far as the eye can reach is an extensive stand of *Phragmites communis*, locally known as yellow cane. This vast cane bed is the matrix in which the marsh is set, being broken by the open waters of wide shallow bays and smaller sloughs. The larger bays are connected with each other and all find entrance to the lake by way of five channels cutting through the lakeshore ridge. Thus there is a constant rising and falling of marsh levels due to wind tides. This

tidal ebb and flow has been modified recently by wiers at the connecting channels. The sloughs are closed areas, their waters not connecting with the bays. The boundary separating marsh and prairie is determined by that land contour meeting the marsh water level at a particular time. This contour may vary between 810 and 816 feet above sea level, with the mean at approximately 812. Thus marsh and prairie are directly adjacent in the rich deep soils of the Portage Plains where a crop failure has never been known. Because of the agricultural activity thus generated, the Delta marshes are all that remain of the original native prairie in this region.

Within the marsh, *Phragmites* forms the climax vegetation. It grows on moist ground, but cannot thrive when its roots are covered by water throughout repeated growing seasons. Separating the *Phragmites* from the open water of bays and sloughs are beds of emergent vegetation, mainly hardstem bulrush (*Scirpus acutus*) and cattail (*Typha latifolia*). Some shallow basins within the stands of Phragmites are damp year-round but do not hold water. Here white-top grass (*Scholochloa festucacea*) becomes the dominant plant. There are also low ridges, breaking the *Phragmites* beds. On these and at the agricultural borders of the marsh, white-top grass also thrives on drier ground, thus showing a wide tolerance. In these dry meadows it mixes with aster (*Aster brachiactis*) and sow thistle (*Sonchus arvensis*). Foxtail (*Hordeum jubatum* L.) becomes prominant only under heavy grazing. White-top grass ranks next to *Phragmites* in abundance and its stands vary in size from a fraction of an acre to several hundred acres.

These white-top meadows are the major nesting areas for the dabbling ducks.[1] Sowls (1955: 67) found that 87 percent of his nests were in ungrazed white-top meadows. Here densities ranged from 1 nest to 2.1 acres to 1:2.6. Foote, Moore and Ward, in 1965, found densities as high as 1 nest to 2.9 acres in similar meadowland.

Phragmites beds on the other hand are nearly sterile. Only where their edges meet meadowland is *Phragmites* used by nesting ducks. Indeed, only at its edges is *Phragmites* used by blackbirds or any

[1] Mallard, pintail, gadwall, widgeon, shoveler, blue-winged teal and green-winged teal. White-winged scoter, redhead and lesser scaup sometimes nest in white-top meadows.

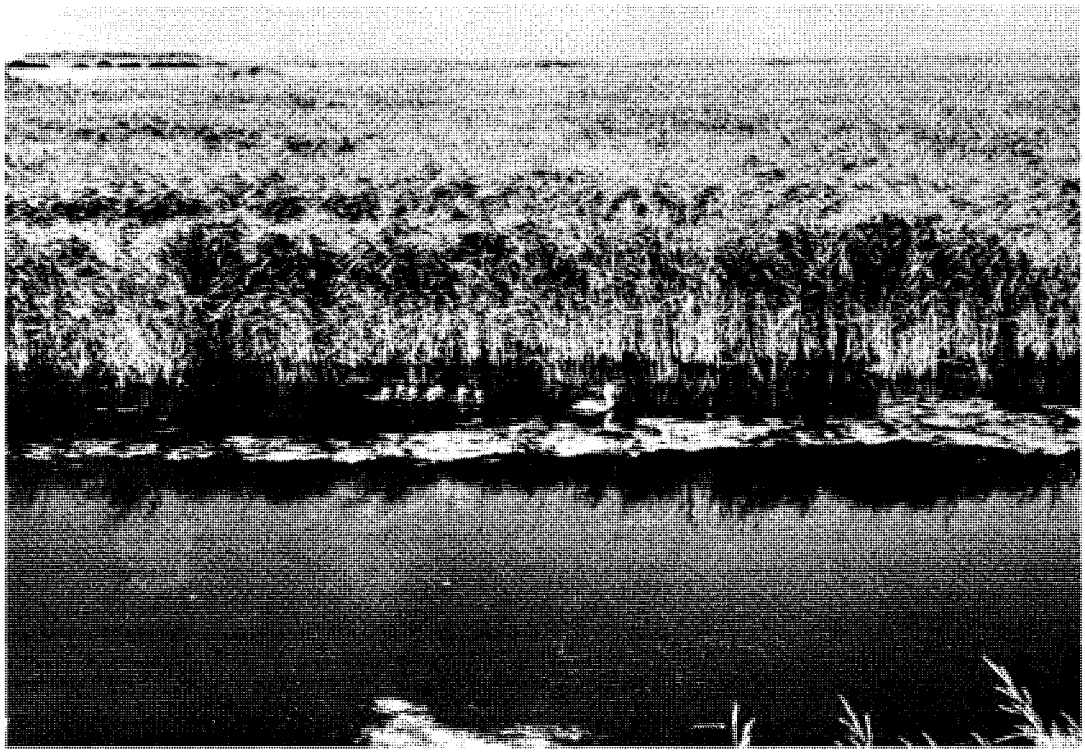

FIG. 2. These white-top meadows are the major nesting areas of the dabbling ducks.

other marsh wildlife except deer which seek it as escape cover. The heart of the *Phragmites* beds stand as empty of life as the great climax forests. Thus, management to increase available nesting range for ducks at Delta must be aimed at opening these stands of tall reeds. I have found fire to be the most effective, economical tool.

Fires were a normal and re-occurring process in the Aspen Parkland of Western Canada. There is a great deal of historical evidence for this on the parkland as a whole, some of which pertains to the Delta region. Wentzel in 1819 wrote of fire "having overrun the plains" of the Red River (Roe, 1951: 370). The same area is reported to have been burned in 1858 by Hind (1859:42) in a "vast conflagration extending for one thousand miles in length and several hundreds in breadth." Other fires which undoubtedly affected this region are described by Southesk (1859:139) as "constantly devasting this land."

There is conflicting evidence regarding the origin of prairie fires.

Roe (1951: 634) discussed prairie fires in terms of being deliberately set to attract buffalo to new green areas thus produced. Hind (1959) writes of fire being deliberately set by Indians as a signal and again as a means of managing buffalo herds. Undoubtedly fires were set to make travel easier for pedestrian Indians. But Denig (1855: 45) in reference to the Cree said "Firing the prairie is not a custom resorted by the Indians to facilitate hunting, as is generally supposed. Nothing they desire less and their laws to prevent it are severe in the extreme. . . . These fires mostly originate in the carelessness of hunters, travellers or from the petty malice of individuals. Occasionally it is done by passing war parties." In addition, lightning must have accounted for many fires. Roe (1951: 379) sums the whole most clearly, saying "fires were not exceptional occurrence."

The earliest modern fires sweeping the Delta marshes resulted from the activities of trappers. Burnt ground made easier travel. More than that, fire exposed muskrat houses and feeders, concentrating the animals in remaining cover. Fire also served to expose dens of mink, coyote and fox. With the arrival of agriculture, marsh fires were started by settlers burning meadowland to improve the quality of hay. These invariably escaped to run wild through the heart of the marsh. Occasionally fires resulted from simple carelessness.

Uncontrolled fires remained a normal part of the spring marsh through all the 1930s and 1940s. Fire-setting followed a pattern which accompanied the first warm, dry winds of April. The starting of one fire seemed a signal for another to begin, a ritual in which many people participated. Some fires were set simply to see the blaze, and on spring evenings the flames were sometimes so brilliant as to reveal migrant coots and other night travelers. Recently indescriminate burning has become less frequent. This is partially the result of a decline in trapping, which since 1955 has played a minor role in the native economy. But occasionally large scale fires still occur. In 1964, for instance, the mrash burned from early April until May 27, destroying nesting habitat over 13 sections of Crown land. This fire continued through the peak of the first hatching of ducks. Females and young were lost to fire which also destroyed many renestings. In 1965 the Manitoba Wildlife Branch published a notice

to all landowners, pointing out their responsibility in respect to the control of fire. Since then, no major fires have occurred.

Re-occurring fires performed a vital role in the marsh ecology through removal of dense stands of dead and decaying vegetation. Spring fire served also to maintain the climax status of Phragmites. Fire before the growing season did not kill the *Phragmites* roots, but effectively checked encroachment by trees along the marsh edge.

Besides the dominant spring fires, burning sometimes occurred during the summer. I believe that in pristine times summer fires were started by lightning in dry years. During the growing season, not only the humus was removed, but damage resulted to the roots (Ward, 1942: 297). More rarely, the peat of the marsh floor itself became ignited. Deep clear pools carved out in this manner attest to pre-historic fact of this process. Visual witness to it occurred in the dry 1930s.

To date there has been no final determination of annual deposition of plant debris on the Delta Marsh. However, studies are being conducted by the University of Manitoba under Dr. Jennifer M. Walker. In personal communication, March 4, 1968, Dr. Walker indicated that for *Phragmites* this may be as much as 210 grams per meter square and extrapolated for 5,000 acres of the Delta Marsh would equal 17,500 tons a year. In unburned areas, *Phragmites* humus now averages about 18 inches in depth. Ward (1942: 295) indicates this buildup to effect "permanent changes in contours" of sloughs. He wrote "Fourteen years ago I saw cattle drown in a slough which today, in the heart of *Phragmites*, is but a shallow depression. . . . Near my home 12 years ago was a thigh-deep slough the contours of which I could not locate last spring. . . ." Other local residents, still living, can remember sailing commercial fishing boats through creeks of the marsh edge which now fit the description by Ward. At selected points along the north shore of the large bays, filling by plant debris has extended the edges outward 60 feet or more since 1957. Summer fires of the pre-historic period must have exerted important influence in retarding the build-up of plant debris.

There are several aspects of uncontrolled burning unfavorable to marsh wildlife. Most important among these is destruction of nesting habitat during the waterfowl breeding season. In May 1939,

1,300 duck nests were destroyed in a fire that covered 10,4000 acres (U.S. Biological Survey 1939:7). While all the meadow nesting species are persistent re-nesters, they may be forced to concentrate in cover which is not burned. Here they may be more vulnerable to predation. Fires sweeping the marsh before May 10 chiefly affect the pintail and mallard; these early nesters use the dead overwintered stands of vegetation. Later-nesting species such as shoveler, blue-winged teal and gadwall make use of new growth which follows. However, fires after May 10 destroy the nests of all species, and may delay nesting until the time for renesting is past.

Large scale autumn burning may have a detrimental effect upon marshes through loss of their ability to catch and retain drifting snow. *Phragmites* and white-top capture drifts that add heavily to spring run-off. This water supply is lost when burning is complete. For areas such as Delta, where the average annual precipitation of 17.5 inches is exceeded by evaporation (McKnight, Dillon and Buhr, 1966: G-8), the ability of marsh vegetation to catch and hold snow can be vital to marsh survival.

CONTROLLED BURNING AS A MARSH MANAGEMENT TECHNIQUE

I have practiced burning as a management tool on the Bell Estate at Delta since 1947. This property covers between 3,500 and 4,000 acres of the north part of the marsh including 8 miles of Lake Manitoba shoreline. By far the largest part of the Bell lands are composed of shallow isolated sloughs, formed within the Phragmites matrix. While slough elevations vary, in general they are sufficiently above average levels so that most years the ground remains moist rather than holding water year round. This provides optimum conditions for the growth of *Phragmites* and white-top grass.

Two types of fire have been used at Delta. Spring fire which removes vegetation but does not affect re-growth, and summer fire which has lasting, sometimes permanent influence on re-growth. Spring fire must be completed before April 20 when mallard and pintail start nesting.[2] Summer fire may begin with the cessation of

[2] This may vary, depending on early or late springs. Nesting has started as early as April 10 at Delta.

nesting of the late gadwall and blue-winged teal. Sowls (1955: 86–87), Dane (1965: 75) and Oring (1966: 4) indicate the end of July as the close of nesting in the Delta region.[3] The primary purpose of spring fire is creation of more nesting edge for ducks. In the process it removes dense vegetation stands and intruding trees. Control of such woody encroachment is vital if prairie marshes are to remain in their pristine state. Summer fires on the other hand, have been directed primarily towards lasting changes in the plant community.

My early use of fire was confined exclusively to spring, and directed primarily towards *Phragmites*. The most successful spring fires are set on bright, warm days which have been preceded by similar weather. On dull days, fire refuses to run or burns only portions of the stems. Wind speed should not exceed 20 mph. Above that velocity fire may be carried across fire-guards or backfires and sweep across the top grass of wet sumps. The direction of the wind is important in case of running a fire in a desired direction.

The edges of bays and creeks form the major natural barriers to fire, and roads are equally effective. When these are not conveniently situated, control may be accomplished by backfire. Backfiring must be preceded by mechanical cutting and cleaning of a strip 20-30 feet in width. Fire is then applied to the upwind side. Careful attention must be given to prevent a backfire from becoming so large and hot that burning debris is showered downwind. In these operations I have always employed a minimum of 8 men, armed with pails and wet brooms. Water for firefighting is obtained either from surface supplies at hand, or from a tractor-drawn tank-wagon.

I have attempted to rotate spring fire so that only a portion of the Bell Estate is burned in a given year. Annual burnings have ranged from 320 to 720 acres. As an example of this technique, a series of fires begun in 1950 moved from west to east, completing coverage of the property by 1954. Thus a major portion of the nesting range remained available to ducks each year. Between 1955 and 1957 the Delta Marsh was under record high water levels and burning was impossible. However, it was reinstated in 1959 and 1960. Since 1960,

[3] Again flexible, depending on whether spring was early or late. In determining starting dates for my summer fires I had the aid of current nesting studies in gadwall and blue-winged teal.

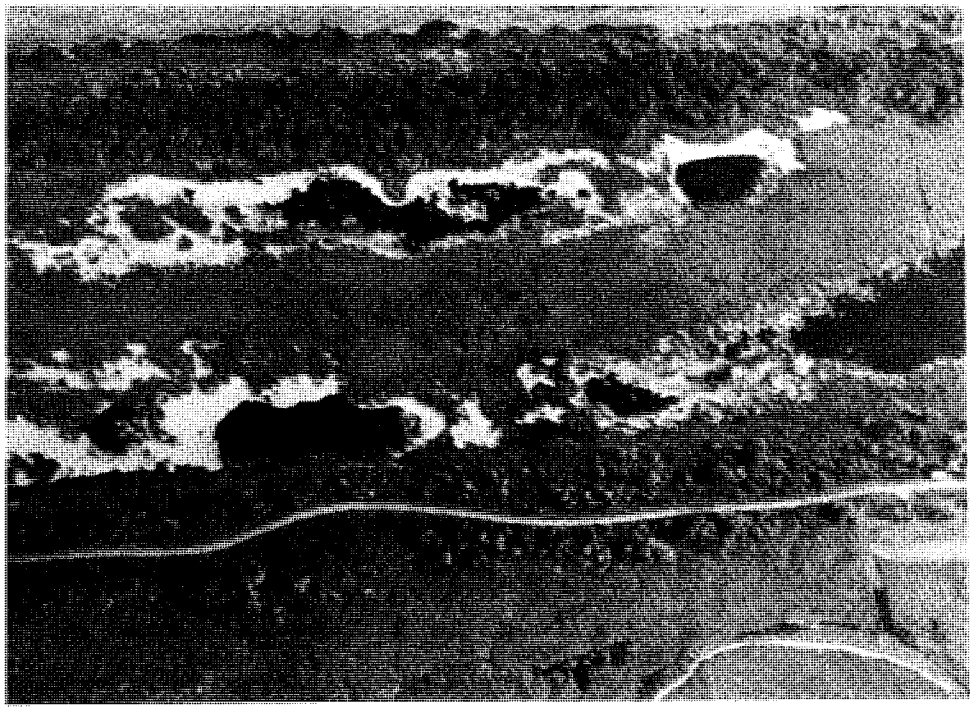

FIG. 3. Back Marsh 1961, before fire. Picture illustrates impenetrable stands of Phragmites.

FIG. 4. Back Marsh 1962. Fire of 1961 opened up Phragmites beds and, as shown here, are in effect vast areas of edge.

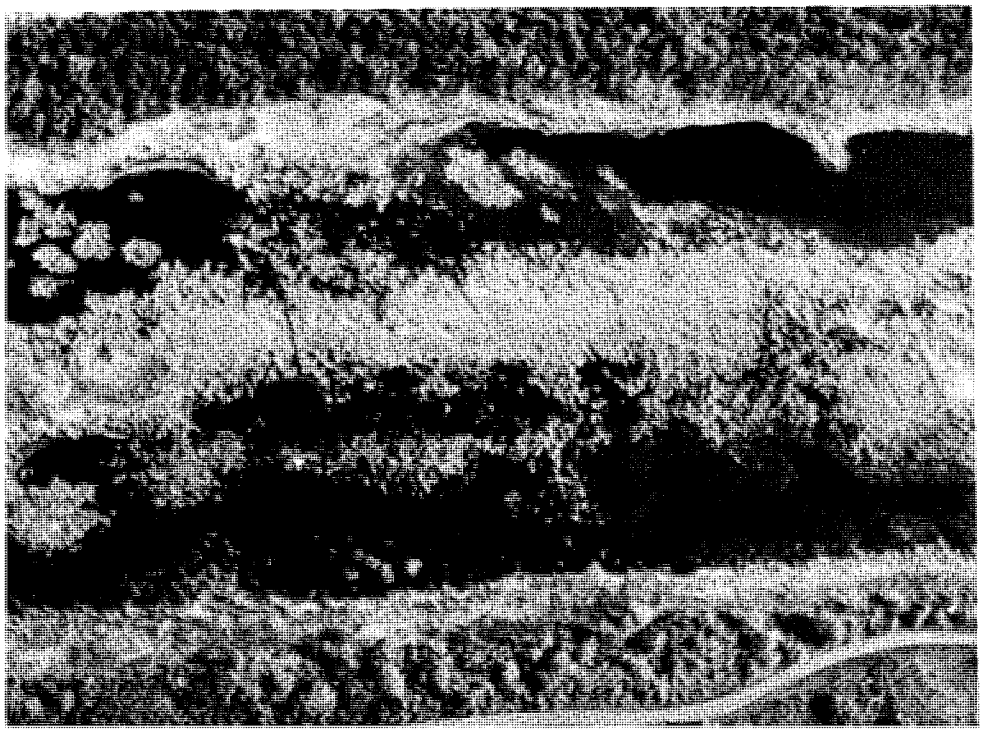

FIG. 5. View of 1964 burn. To the left of it is the 1961 burn.

FIG. 6. Comparison between Phragmites burned in 1961. Burned area to the left of road; unburned to the right.

studies of vegetation ecology, waterfowl nesting and the raccoon by university students at Delta have precluded burning. Today, much of the *Phragmites* matrix shows evidence of this pause by impenetrable density at many points, and by large scale tree intrusion. If conditions are suitable, spring fires will be resumed in 1968.

My first summer fire was in 1961 in the Back Marsh, a 96-acre managed unit, directly east of the station headquarters. Control and stabilization of water levels were established here in 1953, and in the years immediately following, the Back Marsh was the most productive area of its size on the Bell Estate. Fine hunting was assured there in autumn, and in spring it produced record crops of muskrat, as for example, 948 pelts in 1955. During this period, the Black Marsh had interspersion of *Phragmites* and white-top in about equal amount, with cattail and hardstem bulrush as pond fringes. By 1959 this was no longer true, and the interspersion of cover changed to dominant, impenetrable stands of *Phragmites*. The area was no longer economical to manage from the standpoint of either gunning or muskrat. In the winter of 1960 the decision was taken to open the *Phragmites* stands by fire, and through it perhaps return the area to former productiveness.

The fire was set on the afternoon of July 14, in 90°F temperatures and with a south wind under 15 mph. Smoke from this fire could be seen a distance of 16 miles, indicative of the cover through which it burned. I had 9 men to direct and control the fire. There were no unusual difficulties in this, and by 5:00 pm the Back Marsh had been burned over. Preceding this burn were drainage and pumping operations to make the ground as dry as possible. These began the first week of May.

Regeneration of *Phragmites* began 5 days after the burn and continued until frost. However, in that time it reached only about half its normal height and was reduced in stem density by about two-thirds. It did not regain pre-fire heights and densities until 1964, indicating lasting effect on the roots. In this more open state the *Phragmites* beds of the Back Marsh were in effect vast areas of edge, easily entered by all forms of wildlife. The area was more heavily used by nesting ducks and autumn gatherings of waterfowl. There followed an immediate response by waterfowl and muskrat. On

September 25, 1961, for instance, during the week flooding was completed, 2,500 ducks were counted in the Back Marsh. In the spring of 1963, 412 muskrats were trapped in this area and 420 were trapped there in 1964.

With the knowledge of the Back Marsh at hand, I similarly treated a 160 acre tract in 1964. This area lay immediately east of the 1961 burn and was also under water control. As before, firing was preceded by an extended period of ditching and pumping to dry out the soil. While this fire was directed primarily at *Phragmites* it also burned through very extensive and dense meadows of white-top. It was set on the afternoon of July 21 and accompanied by the controls as discussed previously. No untoward difficulties arose, and by nightfall the job was complete.

Both *Phragmites* and white-top were green 5 days after the fire and 4 inches high within 10 days. Neither plant returned to pre-fire status before frost. *Phragmites* reached average heights of 22.7 inches and white-top 19.5. In comparison they exhibited heights of 84.2 and 37.4 inches respectively in unburned sample plots. Stem density of the new growth was also markedly reduced as determined by 22 x 14 inch counting frames. *Phragmites* dropped from 29.6 to 10.5 and white-top from 54.8 to 14.3. All data gathered with a 22 x 14 inch counting frame. Samples were random and in sets of 20. Sampling in 1965 covered only growth of that year on the assumption that previous normal samples suffice for comparison. In this opened state, *Chenopodeum rubrum*, an important duck food, established itself among both the *Pragmites* and white-top, and bore seed.

In the first full growing season white-top exceeded its pre-fire abundance at 69.2 stems per counting frame, although at 29.7 inches continued reduced in height. Apparently white-top growth in that area was stimulated by fire. *Phragmites* on the other hand, stayed depressed in both density and height, at 5.7 stems per frame and 50.3 inches high. Although further detailed measurements were not taken, *Phragmites* clearly remained reduced through 1967 in many areas of the burn with white-top intruding upon it.

Two other summer fires were set in 1964. The first in Round Pond, a 10-acre isolated sump on the east end of the Bell Estate which had never been burned in at least 30 years. Stands of *Phrag-*

mites there could not be penetrated on foot. This burn was carried out in conjunction with mechanical cutting of the Phragmites roots. Fire was set July 24, and on August 2, *Phragmites* re-growth was 4 inches. At this point, almost the entire surface of Round Pond was cut 10 inches deep with a tractor-powered Rotovator. There was a further regeneration of *Phragmites* which, in this case, did not exceed 48 inches before autumn. However, the plant was obviously much reduced in density, so much so that on re-flooding, water could be seen anywhere among its stands. This opening effect remains apparent five seasons later. In the interval, Round Pond has been more productive of muskrat and waterfowl than it was prior to the 1964 treatment.

During the late summer of 1964 I also used burning as a duck nesting research technique. In a study being conducted by the Delta Waterfowl Research Station, it was essential to determine the exact number of nests on a range of nesting cover. The fire was set there on August 10 and covered an area of 120 acres, all white-top meadow. It burned slowly and cleanly, obviously at some points destroying peaty deposits. The duck nests were revealed by the nest cups usually conspicuous with their fragments. As in all other summer fires to date, plant regeneration began soon after the burn. Again *Chenopodeum rubrum* established itself within the regenerating white-top and remains there to date revealing in this case a weakening in the white-top stand.

I was unable to accomplish the deep peat burns as described by Ward (1942:297) because of the higher water levels of the 1950s and early 1960s. There was, however, some small burning of peaty humus in the 1964 fires which killed *Phragmites* and white-top roots as shown by the intrusion of *Chenopodeum.* I do not consider that opening of solid white-top meadows as undesirbale. Although prime nesting cover of the marsh edge, there is evidence that it is enhanced for nesting by breaking of solid stands.

This discussion has dealt with burning as a practical management technique in the manipulation of marsh cover. There is yet much to be learned and it is my hope that future studies conducted at graduate school level will test my findings, and enlarge the understanding of the role of fire in this environment. I feel that it is of

vital importance we obtain this knowledge. Unless the large marshes of Manitoba are managed for waterfowl with fire as a major tool they will cease to serve their primary purpose. Indeed, within a short time they may cease to exist as marshes.

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