Invasion and Control of Exotic Cattails in Wild Rice Stands in Ontario

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Introduction and Objectives:
Two species of wild rice are found in Canada (Aiken et. al, 1989). Southern wild rice (*Zizania aquatica* L.) is restricted to the lower Great Lakes where it is at the northern limit of its range in North America. The southern species has been largely extirpated by invasive carp and cattails. Northern wild rice (*Zizania palustris* L.) naturally occurs from the eastern seaboard of Canada inland to eastern Manitoba but its range has been extended westward through seeding efforts for commercial purposes. The open panicles of southern wild rice make it prone to seed loss and has no commercial value. This review describes the management efforts directed at both species. The particular issue of invasive cattails now affects the northern species and efforts are described to eliminate the potential catastrophic effect that occurred with the southern species.

The native species of cattails in Canada is *Typha latifolia*. Although the native species can form large monocultures in areas formerly occupied by a variety of other species, it is limited to depths of less than 25 cm. By comparison, the exotic, *Typha angustifolia*, or the hybrid, *Typha glauca*, can tolerate depths of up to 1.5 m (Grace and Harrison, 1986). *T. angustifolia* is thought to have spread from the eastern seaboard of North America inland to the Great Lakes in the late 19th century (Hotchkiss and Dozier, 1949). It has spread further westward in the 20th century. The distribution maps of Grace and Harrison (1986) show the species reached the Rainy River area by at least the time of their publication. The exotic cattails occupy the same niche as wild rice with the advantage of being a perennial and thus able to usurp the annual wild rice particularly when water levels increase from year to year. This invasive species is now having devastating effects on the largest stands of northern wild rice in the world (Lee, 2015).

Materials and Methods:
Study Locations: For southern wild rice, efforts were directed at re-establishing a self sustaining population of this species at the Royal Botanical Gardens in Hamilton, Ontario. The construction of a large carp barrier that prevented carp from entering the 320 hectare Cootes Paradise marsh, enabled re-vegetation to occur. Considered to be the historical dominant species, southern wild rice required a seed source. Surveys of reported sites of the species revealed only one source at Rondeau Provincial Park and seed was collected from this location. Cootes Paradise was assessed for suitable soil conditions and establishment of southern rice was conducted inside barriers preventing incursion of remaining carp. Planting success was evaluated and new establishment locations within the marsh selected.

For northern wild rice, efforts by the Seine River First Nation were directed at cutting cattails in Rainy Lake using a cutting bar apparatus attached to the front of their airboat. The culms of the cattails were cut at the sediment:water interface in the fall of

2014. The theory to the procedure is that removing the culms stops flow of oxygen to the rhizomes in the anaerobic sediment in winter, killing the plants (Sale and Wetzel, 1983). Results of the cutting trials were assessed in 2015 and effects on the nutrient regime of the underlying sediment where cattails were growing examined.

Results and Discussion:
Southern wild rice: Detailed analysis of soil conditions within Cootes Paradise revealed locations matching existing natural stands of southern wild rice. Small enclosures containing wild rice during the first year of production within the suitable areas were joined forming large enclosures. Rice seed was sufficient to enable complete coverage within the large enclosures by the second year. After ten years, a viable self sustaining population of southern wild rice exists in Cootes Paradise.

Northern wild rice: Cattail removal proved to be remarkably effective. In the areas that were cut, the cattails were completely eliminated (Fig. 1). Additionally, the native species that were present in the cut areas (water lilies, soft stem bulrush) were not affected and since these species were in low density, they had little effect on wild rice production. Adding to the success of the procedure, rice apparently remained viable in the seed bank in the area previously occupied by cattails. The cut area was completely filled with wild rice without seeding being required.

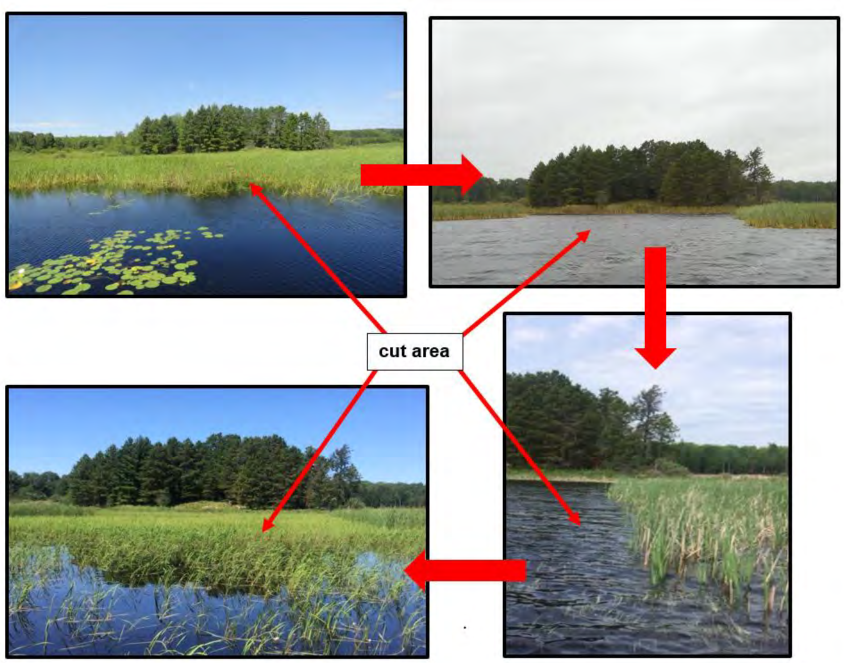

Figure 1. Sequence of cattail cutting trial on Rat River Bay, Rainy Lake. Upper left, prior to cutting cattails, upper right, after cutting, fall, 2014; lower right, spring, 2015 with rice in floating leaf stage; and lower left, re-established rice stand, fall, 2015.

The presence of cattails also had an effect on the underlying sediment (Table 1). Extractable nutrient values showed lower concentrations of P, NO_3, NH_4, and Mn in the cattail dominated area than the wild rice area while Ca, K, Na, Cu, Fe and Zn were all higher. Similar results were found for total nutrient and pore water nutrients. Plant tissue results showed that per 0.25 m^2, total C, total N, Ba, Ca, Cu, Mg, Mn, Na, P, S, Sr and Zn were all higher in the cattails' plant tissue compared to the wild rice study area. Perhaps most significant, there was a reduction in tissue nitrogen in the wild rice growing in the cut area where it exhibited chlorosis symptomatic of nitrogen deficiency.

Table 1. Extractable nutrients in sediment from cattails, natural wild rice and cut area.

Description	Mean	SD	Mean	SD	Mean	SD
Ext. Ca (µg / g)	1023.1	181.9	817.2	134.1	1150.0	168.5
Ext. K (µg / g)	5.9	2.2	5.9	4.1	10.1	4.4
Ext. Na (µg / g)	2.6	0.7	3.9	2.2	15.1	25.0
Ext. Cu (µg / g)	1.4	0.4	1.4	0.6	2.3	0.5
Ext. Fe (µg / g)	52.4	19.1	61.9	22.0	93.4	79.9
Ext. Mn (µg / g)	7.5	0.8	10.8	5.7	9.4	5.2
Ext. Zn (µg / g)	0.8	0.2	1.0	0.9	1.2	0.3
NH3+NH4 (µg / g)	0.7	0.3	2.3	1.0	0.6	0.4
N-NO3 (µg / g)	0.9	0.7	1.2	1.3	0.8	1.1
pH	6.0	0.1	5.6	0.1	6.0	0.0
Ext. P (µg / g)	13.3	3.7	8.3	5.0	7.8	4.1
Bulk Density (g/cm^3)	0.2	0.1	0.2	0.1	0.3	0.1

Conclusions:

Loss of southern wild rice stands was attributed mostly to invasive cattails but the possibility of additional remediation projects in Ontario for this species is unlikely. Northern wild rice, on the other hand, is a highly prized crop and intense interest in the species ensures its continued cultivation. Existing traditional stands are currently being reduced in size by invasive cattails. Underwater cutting of cattails prior to ice cover is a highly effective control practice and a method of stopping the extirpation of northern wild rice. Use of invasive cattails for remediation projects is inadvisable near wild rice areas.

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