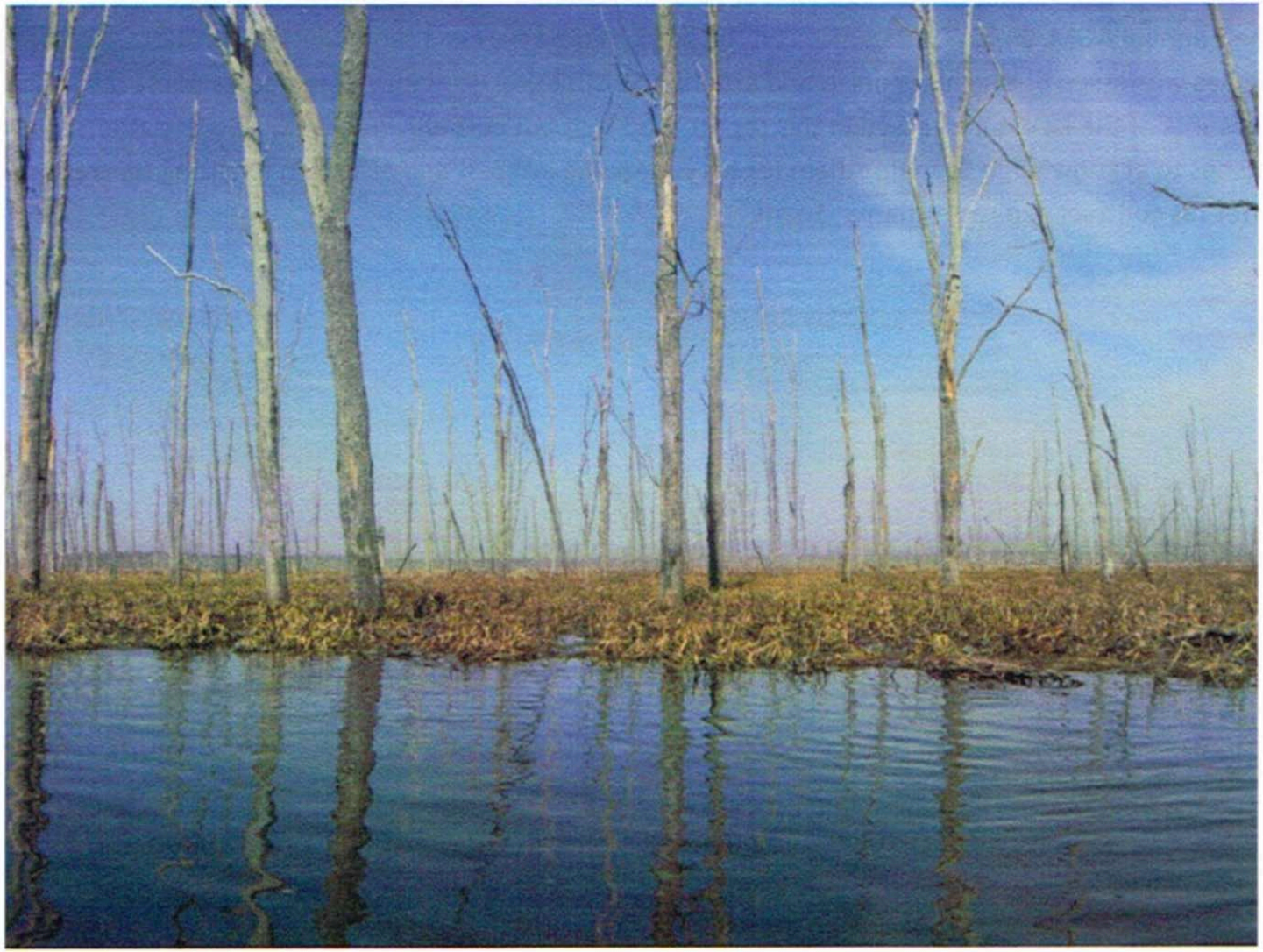
60 years of forest change in the Minesing Wetlands (1953-2013): Causal factors, ecological implications and recommendations for reforestation



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MRA comments and annotation in RED

1.0 Introduction

The Minesing Wetlands is internationally recognized as an area of unique biological diversity and ecological importance. Located in the heart of the Nottawasaga River watershed in Simcoe County (Figure 1), the wetland complex includes swamp, marsh, and fen communities, and is one of the largest wetlands in Southern Ontario.

The Minesing Wetlands have been evolving since the retreat of North American glaciers 11,000 years ago, which left a large glacial lake (Lake Algonquin) that covered much of the Nottawasaga Valley (Simcoe Lowlands). Over time this lake drained northeastwardly toward the Ottawa Valley. Approximately 5,000 years ago, the Minesing lowlands were again inundated by rising lake levels in Georgian Bay (Lake Edenvale - Nipissing transgression). With the opening of the St. Clair River outlet, lake levels receded to present day levels and vegetation communities dominated by floodplain swamp forests, boreal forest and fen evolved over the emerging lowlands forming the Minesing Wetlands.

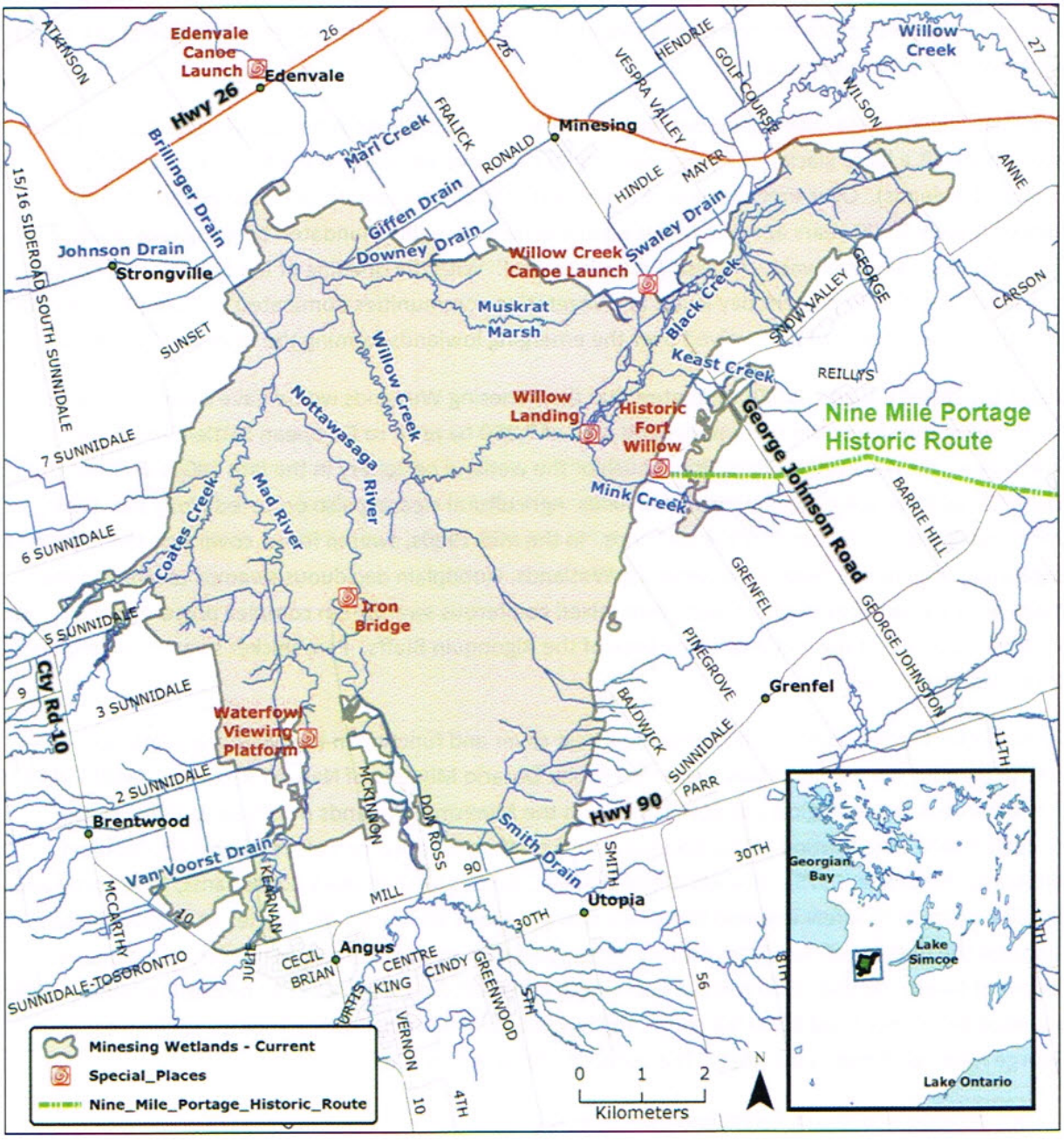
Ducks Unlimited Canada (2010) estimated that the Minesing Wetlands would have covered an area nearly twice the size of the current wetland area of 7,250 ha prior to European Settlement (Figure 2). Drainage works were undertaken along much of the wetland periphery in the late 1800s and into the 1900s to facilitate drainage of agricultural fields. Agricultural clearing also occurred along the wider, drier river levees in the heart of the wetlands. In the mid-1900s, swamp forest cover was the dominant vegetation community type in the Minesing Wetlands. Floodplain deciduous swamps comprised the majority of wetland cover with a significant mixed coniferous swamp/fen complex present in the southeast portion of the wetland at the base of the Algonquin Bluffs. Fen, thicket swamp and marsh cover was also present.

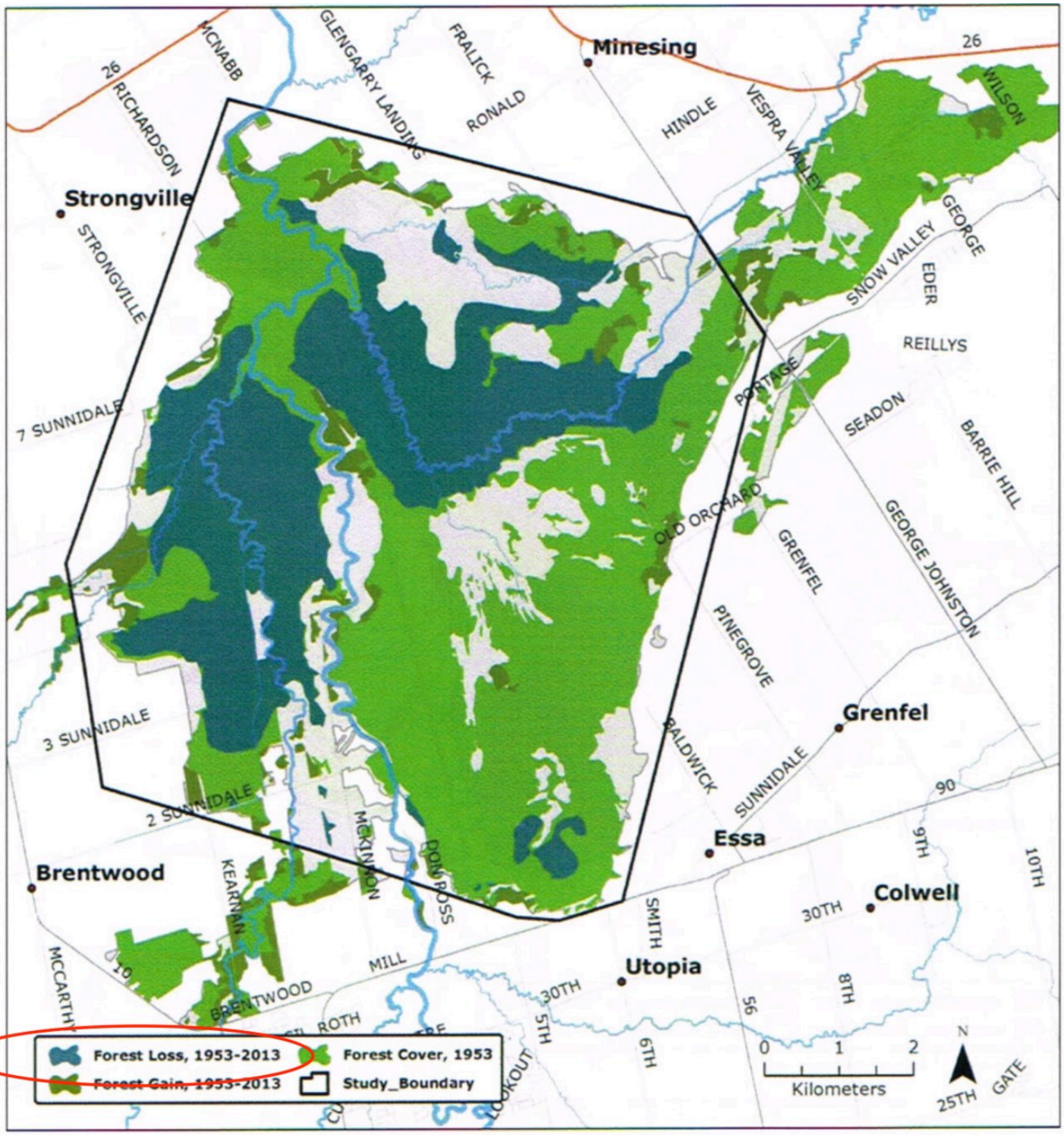
Several reports have highlighted changes in forest cover and function in the Minesing Wetlands. A master plan for the wetlands was presented to the Ontario Ministry of Natural Resources (MNR) in 1974 that described the ecological and social history in the Minesing Wetlands (Moriyama, 1974) and ecological land classification of the deciduous and coniferous forest complexes across the wetland landscape (Bobbette, 1975). A study of the Willow Creek watershed (AAA Consultants, 1977) provided a detailed account of forest loss and hydrology changes along Willow Creek. Bowles et al. (2007) also reported the dieback of floodplain swamp forests and shift to open marsh. However, a systematic review of forest loss over time has not been undertaken for the core area of Minesing Wetlands (roughly bounded by County Road 90 to the south, Highway 26 to the north, County Road 10 to the west and George Johnston Road to the east). The purpose of this report is to:

- provide a review of forest loss over time;
- assess potential causal factors associated with forest loss;
- identify the implications of forest decline on wetland features and functions;
- assess the future trajectory of forest loss; and,

- provide recommendations for watershed planning and stewardship, wetland monitoring and floodplain forest reforestation

Figure 1: Minesing Wetlands and Vicinity





Blue areas indicate the forest losses. These two areas are along the Madd River and Willow Creek

Summary of Forest Change in the Minesing Wetlands 1953-2012

- 1,860 ha of deciduous forest loss within the study boundary
- 240 ha of forest gain within the study boundary (220 ha deciduous forest, 20 ha coniferous forest)

timber in the Minesing Wetlands "was now beginning to die and the Swamp was becoming a menace to the health of the neighbourhood."

The 1964 Nottawasaga Valley Conservation Report (Department of Energy and Resources Management, 1964) describes post-settlement shifts in vegetation that likely reflected changing floodplain hydrology acting as a precursor to eventual forest loss. In particular the report notes that "The region drained by the Mad River where it flows into the main Nottawasaga was covered with a series of tamarack, cedar, spruce and birch swamps." "This has changed considerably since the original (presettlement – author's note) survey. The cover on this area is presently a hardwood forest, mainly of silver maple, elm and ash." This suggests a shift from mixed conifer swamp (with relatively stable flow and nutrient regimes) to a deciduous swamp adapted to fluctuating flow regimes and higher sediment/nutrient loading. Based on remnant conifer swamp cover along the east edge of the Minesing Wetlands near Fralick Road, similar changes may have been occurring concurrently within the Willow Creek portion of the wetland. Further research utilizing original pre-settlement surveys could shed further light on shifts in forest community composition.

AAA Consultants (1977) prepared an assessment of watershed conditions for Willow Creek that stated increases in water discharge and sedimentation was the result of upstream drainage alteration that had reduced the flood storage capacity and moisture regime of the wetland. They also observed that this change was beginning to impact plant biology, especially tree composition and viability as noted with the tree die-off of the bottomland forest around Willow Creek. Moriyama (1974) pointed out that due to historical land clearing and drainage alteration there was an increase in the intensity of sedimentation runoff into the Minesing Wetlands resulting in the formation of levees along forested areas and creating a backlog of water levels in lower lying areas. The result was longer periods of inundation and die-off of non-water tolerant plants (Moriyama, 1974). Decline of deciduous forests would have reduced evapotranspiration during the growing season resulting in greater persistence of wet conditions, which likely exacerbated floodplain forest decline.

4.1.2 Levee Breaks/Crevasse Splays

Building on Moriyama's (1974) work, the Minesing Wetlands has acted as a "delta" for receiving river systems since the recession of post-glacial Lake Algonquin (approximately ten thousand years ago). Naturally aggrading river systems would have developed from centuries of sediment transport into the wetlands. These systems are characterized by natural levee development and levee breaks (avulsions) often referred to as "crevasse splays" (Keddy, 2010). In some areas (i.e. along the Mad River north of Concession 2), levees were further enhanced by farmers to protect farmland from spring flooding.

Changes in land use during the settlement period increased sediment transport to the wetland and likely resulted in further channel bed aggradation. Increased channel bed aggradation may have increased incidences of levee breaks (crevasse splays), which, in turn, would have resulted in locally wetter conditions in floodplain forests beyond the levees.

In addition to channel bed aggradation, extreme floods as well as log and ice jams also trigger crevasse splays (Keddy, 2010). Hurricane Hazel in 1954 triggered extreme flooding/sediment deposition and no