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Restoration and Reclamation in Canada

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Canada is the world's second-largest country in land area, surpassed only by the Russian Federation. Diversity is the essence of Canada's geography with fertile plains suitable for agriculture, vast mountain ranges, lakes and rivers, and wilderness forests that give way to arctic tundra in the Far North. Principal natural resources are natural gas, oil, gold, coal, copper, iron ore, nickel, potash, uranium and zinc, along with wood and water (Canada 1999). Canada also has over 31,000 lakes and countless streams and wetlands, however urbanization and industrial development have placed severe stresses on these precious water resources. Presently, Canada is working to remedy this situation.

The Canadian Government has been active both internationally and domestically to preserve and protect the environment. Recent international efforts include their strong support of the United Nations Conference on Environment and Development (the Earth Summit), the creation of the Arctic Environmental Strategy to help preserve the fragile Arctic ecosystem, and the North American Waterfowl Management Plan. Collaboration with the United States to coordinate efforts to control pollution, improve water quality of the Great Lakes and to eliminate acid rain-causing emissions has been effective. Domestically, Canada has worked to shift management from sustainable yield to sustainable development of their forests. They are deeply involved in fish habitat restoration and railway corridor restoration. Canada has also created a national water policy to guide fresh water resources and have adopted the Federal Policy on Wetland Conservation in 1992. In this chapter of the Restoration and Reclamation Review, Canadian efforts of restoration covering both land and water from the Arctic to Lake Ontario in southern Canada are analyzed.

Arctic

Canada's arctic tundra accounts for 40 percent of the country's landmass, 65 percent of its marine coastline, and 30 percent of its freshwater resources. This is a highly fragile environment, and despite its remoteness, it is increasingly exposed to threats such as airborne pollutants originating hundreds or thousands of kilometers away and more locally, from anthropogenic disturbances. As humans have increased their exploration and use of the Arctic, many of these ecosystems have experienced significant damage and are under continual threat of more. Steng begins this chapter by focusing on the restoration of a High Arctic ecosystem, where the fragile vegetation may take up to 300 years to recover from disturbance. For example, about 30 years ago a bulldozer-type vehicle drove across a meadow on Devon Island (Forbes 1992). Steng reviews the efforts of Barrett and Forbes to restore the site. With all of the threats that continue to encroach on the Arctic, it is important to begin to understand what is involved in the recovery process of tundra.

Mid-Country

The next two chapters discuss restoration projects that occur throughout Canada. McCue discusses the restoration of harvested peatlands and Alfuth discusses Duck's Unlimited's involvement in prairie restoration.

McCue describes techniques used by the University of Laval and the Canadian Sphagnum Peat Moss Association to restore harvested peatlands. Two of the most common methods of harvesting are vacuum harvesting and block harvesting. Both of these methods can result in barren wastelands at their worst, and sparse regeneration at best. Many peatlands are nutrient poor environments that are almost entirely dependent on the atmospheric inputs for nutrients and water. This process may take as little as 3 to 7 years on nutrient rich peatlands and 30 years or even longer on nutrient poor peatlands. Options of peatland reclamation range from conversion of the land for agriculture to restoration for either wildfowl or revegetation. Methods include seeding spores, crop cover, hydraulic changes, and chemical applications. These methods improve the rate of revegetation and continued research will undoubtedly help prevent the loss of these peatlands.

Prairie restoration is the focus of Alfuth's paper, which discusses Duck’s Unlimited Canada (DUC) involvement in restoration. DUC is a private, non-profit conservation organization that has been involved with waterfowl habitat restoration since organization in the 1930’s. In long-term plantings on purchased lands, DUC uses native plants to create a persistent stand that is suited to the extremes of climate in the specific area. However, some problems with the DUC restoration efforts include occasional non-use of local seed sources for natives, lack of local seed availability, and gearing species composition toward waterfowl habitat rather than pre-agricultural conditions.

Ontario

Ontario is the most heavily populated province in Canada and contains diverse water resources. Abutting the Great Lakes, Ontario also is home to thousands of smaller lakes. Because Ontario's water resources are used for agriculture, recreation, industry, and energy production, impacts to the province’s water resources affect society and the natural ecosystem. In this chapter, Rossini discusses the restoration of a marsh in western Lake Ontario affected by physical, chemical and biological factors. It has also been observed that smaller lakes and wetlands in Ontario have been impacted by the introduction of carp, as described by Somerville in this chapter.

Rossini describes the initial stages of the Remedial Action Plan for Cootes Paradise, a 400-hectare shallow water marsh located in Hamilton Harbor, on the west end of Lake Ontario. Cootes Paradise is a severely degraded area within the harbor and is the second most important staging area for waterfowl on the lake. Natural tilting of the lake and regulation of lake water level with locks, along with point source (sewage treatment facilities, and storm water overflow) and non-point source pollution have resulted in the deterioration of the marsh. The existing water levels are nearly too high to support emergent aquatic vegetation in the marsh, thus the restoration plan focuses on revegetating aquatic plants that are tolerant of the current water levels. Eventually, the plant community will serve as nursery habitat for desired fish species such

as crappies, pike, and bass. Rossini points out the importance of an integrated approach between agencies and a cooperative structure between professionals and community volunteers.

Somerville compares techniques used for the control of carp, *Cyrinus carpio*, an invasive exotic species present in Ontario. Carp were introduced into southern Ontario in 1880 for food and their economic value, but they quickly escaped and became established throughout the Great Lakes basin. As large bottom feeding fish, carp increase turbidity and uproot aquatic vegetation. Somerville discusses four methods of carp control: fishways, exclosures, water-filled dams to de-water the site, and partially submerged fences. Essentially all of these methods look to prevent carp from entering certain areas by mechanical means. In regions where carp have been successfully excluded, revegetation of the area can be up to 95% in one year.

Mining and Industry Restorations

The final two chapters discuss the impact of mining Canada's mineral resources. LeMay examines five gravel pit restorations and their successes. Although not generally considered a precious ore, gravel is a widely used and sought after material. In the final chapter, Shaw describes the vast array of problems present in Sudbury, Ontario due to smelting of ores and improper disposal.

In the five examples of gravel pit restoration, LeMay describes different methods used for restoration of abandoned sites last mined between 5 and 100 years ago. The different sites used different restoration techniques and brought forth some important ideas such as the importance and type of vegetative cover, the presence of refugial populations, and the need for remediation. The gravel extraction sites studied were varied in their size, previous use (and possible contamination), and intended use, also modifying the restoration techniques used. The key to successful forest restoration is knowing the previous ecosystems that existed on-site, what the current site is capable of sustaining, keeping an open mind to creative solutions, and realizing the intended use of the final restoration.

Not only is the excavation process of mining harmful to the environment, but as Shaw points out, the refining and manufacturing processes can have catastrophic effects on the environment. The city of Sudbury, Ontario has been severely polluted by smelting processes that carry metals such as copper, nickel, and aluminum into the air and deposit on the soil and water. For twenty-five years, residents of Sudbury have worked to improve the air quality, revegetate the land, improve plant health, control erosion, and restore lakes. Liming was used in both the soil and water to raise the pH to acceptable levels and fertilization was required to promote plant growth. Currently, vegetation conditions are closer to forested pre-settlement conditions of the region. Shaw points out how important monitoring is to the process of restoration. Fortunately, through the efforts of the multi-disciplinary technical advisory committee, summer work crews, volunteer efforts, and industry itself, the region is now becoming an example of how degraded lands can be reclaimed. The cooperative work of these groups has resulted in the development of innovative techniques and successful reclamation efforts.

The key factors crucial to the effective restoration of degraded sites are the involvement and education of the community, multi-disciplinary approaches, and the cooperation and

collaboration of industry, government, academia, and the public. With continuing threats of population expansion to natural areas, the need to continue to maintain and restore disturbed sites becomes more and more important. Greater awareness of this situation among Canadians through education and direct involvement can create concern about the environment and spur efforts to preserve the environment with both policy collaborative projects with countries throughout the world.

References

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