CASE STUDIES IN SHORELINE REGENERATION

N.A. Harttrup and C.D. Wren

Ecological Services for Planning Ltd.
Guelph, Ontario

Introduction

A number of human activities can cause destruction of natural vegetation and habitat structure along shorelines of lakes and rivers. These activities include urban stormwater control (channelization of creeks), infilling of lake shoreline areas for creation of parks, streambank alterations at pipeline and road crossings to name only a few.

In addition to reducing erosion and thus, protecting water quality, shoreline rehabilitation and regeneration also increases habitat diversity for both aquatic and terrestrial wildlife and improves overall aesthetics; however, the definition of 'aesthetically pleasing' is quite subjective. For example in urban settings, people like to 'see' the creek or pond, therefore manicured lawns often dominate the shorelines and stream banks. Natural trees and shrubs which provide natural bank stability are often removed. For flood control in urban areas, streams are engineered and often appear as concrete channels or gabion-lined watercourses. From a biological perspective, none of the above conditions are particularly productive and habitat diversity is low.

In the following case studies, natural shorelines have been negatively impacted by human activity and rehabilitation options have been presented or implemented. These areas were selected as they include a variety of problem types, habitat types, and regeneration plans.

Case Study No. 1 Kapuskasing River

This case study describes some of the effects of log drives on the Kapuskasing River in northern Ontario and discusses the recommendations for rehabilitation of affected areas. The Kapuskasing River flows into the Moose River and subsequently in to Hudson Bay and has been used for logging since 1922. Due to environmental concerns, log driving is being phased out and has been virtually eliminated in Canada except in BC and the east coast. Next year will be the last year of log driving on the Kapuskasing River.

Trees are cut in winter, transported to the river's edge and piled on shore or pushed onto the ice to wait for spring break-up. The area where logs are delivered to the river are referred to as 'landings'. These landings can be up to 100-200m wide and 4km long. In spring, the logs are floated down river to the Spruce Falls mill.

As a result of log storage and the use of heavy equipment on the river banks, the landings have been stripped of vegetation and severe erosion (rutting) is occurring in some areas. ESP's study determined that approximately 20km of river shoreline are in this condition. Due to lack of vegetation, erosion and slumping of the river banks is occurring and substantial sediment movement into the water is visible following heavy rainfalls.

In addition to loss of vegetation, large quantities of branches, bark chips, etc. accumulate each year at the landings. This material is pushed back from the river's edge and the debris piles are up to 40' high covering vegetation and soils. The surface of these areas is extremely uneven due to erosion gullies and the height of the piles. Some attempts have been made to plant small trees on this material but it is a poor growing medium and there has been limited success.

Not surprisingly, the river banks at the landing areas are significantly different from the undisturbed shoreline areas.

Natural diversity of shoreline has been lost, resulting in loss of both aquatic and terrestrial wildlife habitats. Grasses are re-establishing on landings that have not been used for several years, indicating that natural regeneration is possible, however, it is a very slow process.

Each landing area was surveyed in detail and specific rehabilitation plans were developed with a goal of bank stabilization to reduce sedimentation and increase fish and wildlife habitat diversity. Much of the rehabilitation will consist of grading, fertilizing, mulching, seeding, and tree planting.

Deep erosion gullies should be graded to allow establishment of seed and planted trees. The bottom of these areas can be lined with a single layer of rock rip-rap to reduced erosion potential and if extended into the water, increase aquatic habitat diversity and availability. Bank erosion and slumping has reduced fish habitat in the littoral zone at the landings. Habitat enhancement can be achieved through the creation of submerged rocky shoals or the construction of small rock groynes to create quiet backwater areas, providing cover and nursery habitat.

The recommendations for regeneration of the landings have been accepted, however, implementation of these plans will not commence until after log driving on the Kap River ceases.

Case Study No. 2 Kempenfelt Bay

ESP conducted a fish habitat study for the City of Barrie to identify existing fish habitat and areas for potential habitat enhancement. Kempenfelt Bay historically supported a very healthy coldwater fishery of lake trout and whitefish. These populations have been reduced through deterioration of water quality due to eutrophication.

The bay also supported warmwater species including northern pike, largemouth bass and muskellunge. These populations have largely been reduced due to habitat destruction including infilling of wetlands and shoreline alterations. The study concluded that man-made structures (i.e. breakwalls) make up 58% of the City's waterfront. As a result, the shoreline is very straight and sterile in many areas, resulting in a very 'hard' shoreline and a general lack of overhead cover and shoreline diversity.

There are areas where the shoreline vegetation is still present, however, in some areas local residents have removed trees along an embankment to maintain their view of the lake. This has resulted in bank erosion, loss of soil and sedimentation into fish habitat.

Natural shorelines are quite irregular with small bays, rocks and overhanging vegetation. There are still some areas like this along the city's shoreline. ESP developed concept plans that can be applied to existing "sterile" shoreline or can be used to enhance fish habitat if shoreline alterations are necessary during new development projects. The plans provide a more natural-looking shoreline and enhance fish habitat through increased diversity. There are some large undeveloped tracts of property where we proposed that shoreline habitat enhancement be integrated into future development.

To create more natural attributes creation of small peninsulas and embayments and tree-planting at the waters edge was recommended. These features are created through dredging and filling, ultimately look more natural and enhances fish habitat. The lee side of peninsulas would provide protected areas for species such as northern pike and minnows and nursery habitat for a number of fish species. The windward side could be constructed of rock rubble which would provide smallmouth bass habitat and potential lake trout spawning habitat. Currently, the only lake trout spawning that occurs in Kempenfelt Bay takes place on the marina breakwall.

Submergent rock "islands" placed offshore will provide underwater structure, attracting smallmouth bass and other species. The specific design of these concepts must consider local flow patterns and wave action prior to detailed design and construction.

The base of these structures would be made of large rock which would be capped with soil. Grasses, shrubs and trees would be planted which will eventually stabilize the soil and provide shade and cover to fish species, utilizing the lake's littoral zone. Similar structures have been constructed in Thunder Bay Harbour.

These concepts have been presented to the City of Barrie and Ontario Ministry of Natural Resources where they were received with interest and enthusiasm. Final approval and implementation is dependent on future development plans and municipal budgets.

Case Study No. 3 Parliament Hill

In 1983, ESP prepared a plan to stabilize the steep slope at Parliament Hill on the Ottawa River. ESP provided alternatives for slope rehabilitation and gave detailed solutions for management with vegetation using native species. ESP conducted an inventory of slope conditions, mapped soil types, erosional features, and conditions of existing vegetation and prepared a plan for stabilization and rehabilitation of the slope. The bank was very unstable with obvious soil erosion and continual loss of vegetative cover.

The presence of fallen structures, debris and garbage added to the unsightly appearance of the slope and regeneration was not occurring due to lack of leaf litter accumulation, poor species diversity, and continued pedestrian access. The master rehabilitation plan outlined detailed recommendations for vegetation establishment involving planting of deep-rooted native trees, shrubs and ground covers using specialized planting techniques designed for steep and unstable slopes. One of the key aspects of the re-vegetation plan was the use of only indigenous plant species.

The benefits of vegetation management include:

- deep-rooted plants stabilize upper layers of soil;
- diverse ground cover protects soil from erosion; and
- species diversity assures long term stability and aesthetic appeal.

The slope was divided into management areas depending on specific problems and conditions. Log grating was constructed on the steepest slopes, while fascines, terraces and stop logs were some of the techniques used elsewhere on the slope. The log grid (grating) was secured to the slope using live pegs, 60 cm long. The grating was filled with topsoil, seeded, and trees and shrubs were planted.

The project was successful resulting in a stable bank increased species diversity and natural regeneration.

Summary

Revised approaches to development and available rehabilitation techniques and materials can be used to successfully regenerate degraded shoreline areas while at the same time, protecting water quality and enhancing habitat for fish and wildlife.

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