The Lac Courte Oreilles Lakes Shoreline Assessment and Restoration Project

Purpose of the shoreline project

This article explains COLA's shoreline buffer project for the LCO lakes and provides meaning to the assessment map in the context of overall lake health. This article also provides direction on steps property owners can take to enhance or improve their shoreline buffer on their own, or how to seek grant funded buffer projects through COLA.

Riparian (a.k.a. shoreline) vegetation is crucial to water quality protection for innumerable reasons, including: phosphorus trapping and removal, sediment trapping, water temperature regulation, woody debris habitat for aquatic biota, and habitat corridors for water-dependent biota such as loons, eagles, amphibians, turtles, and some mammals, to name a few.

People live and vacation at the lake to hear loon calls carry across the water, and to see the sunset reflected in open water over a tree line silhouette. No one comes to the lake every summer hoping to spot more lawns and buildings across the way, to catch fewer or smaller fish, or to swim in murkier water than the year before. Property values, tourism, and water quality are inextricably linked. Shoreline buffers are crucial for the preservation of tourism revenue and property values. It's been shown that property values near lakes decrease with water clarity (Gibbs et al 2002; Poor et al 2001). Based on a 2010 COLA commissioned report by C. Bruce Wilson and others, the Hayward area economy is largely sustained by recreational dollars spent on water-based recreation. Furthermore, most home owners surveyed reported a notable decrease in water quality since purchasing their properties. So clearly, if we want our favorite local businesses to stay open, our water quality and scenery must keep up with the competition (i.e. nearby states and Canada). Studies have shown that sediment and phosphorus deposition increases with increasing shoreline development (Garrison & Wakeman 2000; Graczyk 2003). Some studies have specifically documented this occurring in Lac Courte Oreilles (Fitzpatrick et al 2003; Garrison & Fitzgerald 2005), as well as in Round, Whitefish, and Grindstone Lakes (Garrison 2005, 2006, & 2008).

The science of buffers

A study was performed in northeastern Wisconsin, near Eagle River, that measured runoff volume and nutrient concentration from lawn and wooded catchments on five shoreline properties for 23 months (Graczyk et al 2003). The results of this research are relevant to Lac Courte Oreilles due to various similarities: (1) climatic regime (2) lake origins (3) EPA Level 3 Ecoregion placement (4) Environmental phosphorus zone placement (Robertson et al 2006). Among others, some important results of the study were:

(1) Lawn sites yielded an order of magnitude more phosphorus and nitrogen than wooded sites due to a greater volume of runoff, even though lawn sites had shallower slopes.

(2) Median yield of total phosphorus from woods = 0.00246 lb/acre/yr

(3) Median yield of total phosphorus from lawns = 0.0256 lb/acre/yr
>Note: Ten times greater than the woods yield

(4) Soil type may be a better predictor of runoff volume than slope because the lowest slope in the study produced the most runoff, likely due to the fine-grained lacustrine soil at that site.

(5) Shade and evapotranspiration (root uptake) played an important role in soil moisture and soil temperature.

The Gracyk et al. study discussed above looked at runoff and nutrients from small catchments of a uniform cover type, "lawn" or "woods." In reality, shoreline properties are an assortment of cover types, including various impervious surfaces, lawns, wooded areas, random trees, mulch, sparse vegetation, cultivars, etc. It is also important to remember that there can be a cocktail of pollutants in runoff; even though this article is primarily discussing phosphorus, other contaminants to consider are house hold cleaners, chemicals and solvents, pesticides, herbicides, and vehicle fluids.   Shoreline vegetation can keep those pollutants out of the lake by intercepting the flow of runoff. This is why many shoreline buffers are often referred to as "filter strips." The molecules of phosphorus and many pollutants bind to sediment grains and get carried to water bodies in runoff water (Figure 1). Additionally, sediment carried in runoff will eventually muck up the lake bottom and bury the original substrate of sand, gravel, and rocks that many fish need to spawn. Aquatic insects and mussels are an important part of lake ecology and will also suffer from sedimentation of the lake bottom. Plus, who wants to wade out on a lake bottom of squishy muck?

Figure 1. Cartoon of pollutants "hitching a ride" on the grains of sediment during runoff events. Adapted from the *Journal of Environmental Science and Technology*, April 1989.

The LCO lakes shoreline assessment

The Total Maximum Daily Load (TMDL) study for LCO shows that shoreline properties and direct drainage areas contribute 1,933 lbs of phosphorus each year to LCO. In order to achieve the total phosphorus goal of 10 parts per billion lake wide average, we will need to reduce the 1,933 lbs by 517 lbs/year. LCO shoreline property owners can reduce nearly 200 lbs of phosphorus/year by enhancing or establishing buffers where none exist. The LCO Lake Management Plan (February 2011) set a goal of having 100% of properties on the LCO lakes with Sawyer County Ordinance compliant buffers.

The shoreline assessment was conducted to record existing shoreline conditions around the LCO lakes to identify properties where enhancement or establishment of shoreline buffers would move toward the 100% buffered properties goal, and thus achieve the reduction of 200 lbs of phosphorus discharge per year.

In the summers of 2012 and 2015, information on the extent of shoreline vegetative cover, erosion, slope, and seawalls was recorded about each waterfront property on the LCO lakes. Note that seawalls are installations of a wood or concrete wall directly between the water and land, not to be confused with retaining walls, which have land on both sides. Using Sawyer County tax parcel data, in all, 797 properties were rated. Photos were taken in an attempt to represent the important characteristics of each property. Points were assigned for each parameter based on visual estimates made of the properties from the water front. Then, those points were summed for each property, assigning it a representative, relative value for risk to lake health via runoff and/or habitat loss. The greatest amount of points possible, fifteen, represents areas where shoreline management is needed most on the LCO Lakes. The lowest amount of points possible, zero, are parcels that had a seemingly perfect riparian buffer at the time of data collection. This was a "from the water" assessment method, and therefore may not be a 100% accurate assessment for every parcel.   Properties were then grouped into five categories. Categorical divisions were made based on patterns of similarity regarding the level of management needed to achieve optimal shoreline buffer conditions. For practical purposes, the results were translated onto a color-coded map and made public on the COLA website.

Results of assessment

The histogram below shows the results of the assessment's priority calculations (Figure 2). Fortunately, most properties (481) appear to already be at or near optimal shoreline buffer conditions (Categories 1 and 2). This suggests that maintenance and conservation efforts of these buffers will be as important as restoration efforts to LCO's future. The 314 properties in Categories 3, 4, and 5 are properties where shoreline buffer enhancement or establishment are necessary to reduce sediment and phosphorus discharge to the LCO Lakes. The category groupings were made as follows:
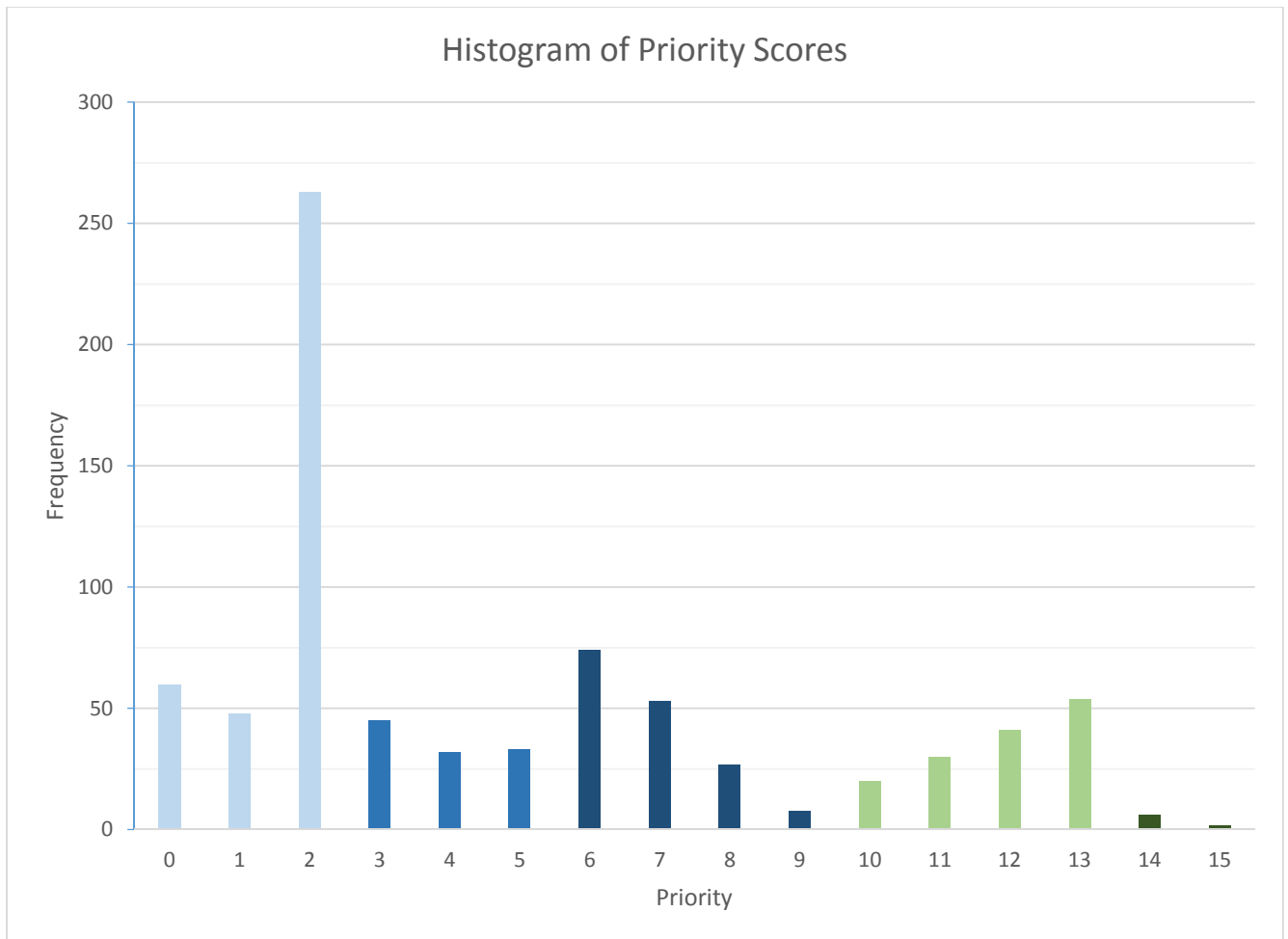
Category 1: priority score = 0-2

Category 2: priority score = 3-5

Category 3: priority score = 6-9

Category 4: priority score = 10-13

Category 5: priority score = 14-15

Figure 2. Frequency of LCO shoreline properties in each of the fifteen priority scores. Bar colors represent the category group.

General category descriptions

Category 1- Fully vegetated buffer; various slopes; little erosion noticed; no seawalls. Category 1 properties were found all over the two lakes, with the least frequency in the central basin (northern and southern shoreline).

Category 2- Most with fully vegetated buffers, but also steep slopes and erosion or a seawall, or both. Some with less vegetated areas, but shallower slope and no seawalls, and few with erosion. Most of LCO's seawalls were found on properties in this category. None with substantial areas of lawn in the buffer zone. No notable distribution pattern of Category 2 properties.

Category 3- Most with areas of lawn centrally located on the property, bracketed by fully vegetated areas between properties. The nuance in this group mostly lies in the width of the vegetation that exists on either side of the lawn area, ranging from 5-30 feet. Many properties in this category had moderate to steep slopes and erosional features. Most erosion found was mild shoreline erosion of sand/sandy soils seemingly due to wave activity and lack of strong roots along the lawns. Some upland areas were candidates for sheet erosion, often with bare soil that slopes into the lake, likely boat launches. No

notable distribution pattern of Category 3 properties except that little to none were found in the southwest corner of Big LCO.

Category 4- All properties with substantial areas of lawn in the buffer zone, bracketed mostly by 0-10 feet of vegetation, although few properties did have as much as 20 feet of vegetated area along the edges (property lines). Even though the properties with mostly lawn tended to have shallower slopes than their more wooded counterparts, more erosion was found on the mostly-lawn properties due to likely occurrence of sheet erosion down sparsely vegetated slopes. Category 4 properties can be found all over LCO, with notably few on Victory Heights or Little LCO.

Category 5- All but one property with zero vegetation in buffer zone. Most moderate to steep slopes, with erosion being found on the steeper sloped properties. One seawall. Various types of erosion noticed, mostly on sloping bare soils/sand. No apparent distribution pattern.

Recommended actions steps by category

There are a number of things land owners can do to mitigate the pollutant load from their properties. Obviously, changing your soil type or slope to reduce runoff is not very practical. The single most important thing shoreline residents can do to protect the lake is maintain a vegetated shoreline buffer. Below is a list of basic steps that shoreline property owners should take to move toward achieving optimal buffer conditions. Check with the Sawyer County Zoning and Conservation office to inquire about the appropriate plants for your area and soil type.

Category 1- Conservation and management: keep watch for erosion at Ordinary High Water Mark (OHWM) and on slopes

Category 2- Conservation and management: keep watch for erosion at OHWM and on slopes; allow existing woods to expand; address existing erosion by vegetating or installing erosion logs and vegetation; replace seawalls with engineered/biodegradable logs and deep-rooted, native vegetation.

Category 3- Stop mowing lawn at least 35 feet from the lake/land shoreline; add deep-rooted vegetation to shoreline and slopes to address erosion; replace backyard boat launches with vegetation, consider a hardy natural ground cover if you intend to use this area frequently, for launching and landing kayaks, for example.

Categories 4 & 5- Contact COLA about establishing a vegetated buffer and vegetating slopes to address erosion.

How to get started

Contact COLA to discuss funding assistance for a shoreline project. Some people have already completed shoreline projects to improve their properties, and it didn't cost them a penny. Of late, there has been a steady increase of shoreline properties donning tall grass at the edge, where LCO residents are proudly protecting the lake rather than mowing to the water. Again, most properties on LCO have nearly perfect shoreline conditions. Those property owners are a big reason that LCO is still so beautiful; hopefully others will follow their example and preserve the lake for generations to come.

References

Fitzpatrick, F.A., P.J. Garrison, S.A. Fitzgerald, & J.F. Elder. 2003. Nutrient, trace-element, and ecological history of Musky Bay, Lac Courte Oreilles, Wisconsin, as inferred from sediment cores. U.S. Geological Survey Water Investigations Report 02-4225.

Garrison, P.J. & R.S. Wakeman. 2000. Use of paleolimnology to document the effect of lake shoreland development on water quality. *Journal of Paleolimnology* 24: 369-393.

Garrison, P.J. & S.A. Fitzgerald. 2005. The role of shoreland development and commercial cranberry farming in a lake in Wisconsin, USA. *Journal of Paleolimnology* 33: 169-188.

Garrison, P.J. 2005. Paleoecological study of Round Lake, Sawyer County. Wisconsin Department of Natural Resources, Bureau of Integrated Science Services. PUBS-SS-1011 2005.

Garrison, P.J. 2006. Paleoecological study of Whitefish Lake, Douglas County. Wisconsin Department of Natural Resources, Bureau of Integrated Science Services. PUBS-SS-1028 2006.

Garrison, P.J. 2008. Paleoecological study of Grindstone Lake, Sawyer County. Wisconsin Department of Natural Resources, Bureau of Science Services. PUBS-SS-1042 2008.

Gibbs, J.P., J.M. Halstead, K.J. Boyle, & J. Huang. 2002. An hedonic analysis of the effects of lake water clarity on New Hampshire Lakefront Properties. *Agricultural and Resource Economics Review* 31(1): 39-46.

Graczyk, D.A., R.J. Hunt, S.R. Greb, C.A. Buchwald, & J.T. Krohelski. 2003. Hydrology, nutrient concentrations, and nutrient yields in nearshore areas of four lakes in northern Wisconsin, 1999-2001. U.S. Geological Survey Report 03-4144.

Poor, J.P., K.J. Boyle, L.O. Taylor, & R. Bouchard. 2001. Objective versus subjective measures of water clarity in hedonic property value models. *Land Economics* 77(4): 482-493.

Robertson, D.M., D.A. Saad, & D.M. Heisey. 2006. A regional classification scheme for estimating reference water quality in streams using land-use-adjusted spatial regression-tree analysis. *Environmental Management* 37: 209–229.

Wilson, C.B. 2010. Lac Courte Oreilles Economic Survey and assessment. < http://cola.adceval.com/media/LCO_Economic_Survey_and_Assessment.pdf>