CHAPTER 8 – FRAGMENTATION

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WHY ARE LARGE NATURAL AREAS IMPORTANT TO MUSKOKA?

Despite the high percentage of natural cover in the Muskoka watershed, development is resulting in a more fragmented landscape. How much disturbance (or development) is too much before habitat is lost is a particularly important, but difficult, question to answer.

Although an aerial view of Muskoka shows a mosaic of mostly green (forests) and blue (water), a grey colour scheme from urbanization is becoming more prominent in some quaternary watersheds. All development, small or large, can contribute to habitat loss, decreased biodiversity, and a fragmented landscape. Although development fulfills human needs and social well-being and generates economic growth, maintaining and conserving the ecological integrity of Muskoka should remain a priority to sustain the tourism-based economy closely tied to the natural features in the landscape. Minimizing fragmentation is an important way of conserving ecological integrity.

NATURAL AREAS AND FRAGMENTATION IN MUSKOKA

In Muskoka, the human population isn't growing as quickly as it is in southern Ontario and with this comes relatively less development pressure. Tourism in Muskoka has evolved over time resulting in Muskoka being recognized as one of the premier vacation destinations in Ontario. It is the proliferation of nature across the Muskoka River Watershed that drives the local tourism-based economy (MacDougall, 2014). People flock to Muskoka from across the globe to take in the scenic views and participate in water-based recreational activities.

Long-term preservation of the things that make Muskoka what it is today require that fragmentation of landscape (i.e., the breaking apart of large undeveloped areas into smaller and

smaller pieces) be minimized to allow large natural areas to be maintained in Muskoka. Considering these large patches of natural areas is key when planning for development.

In most of Ontario, conservation focus is primarily geared toward maintaining or expanding forest cover (Muskoka Watershed Council, 2018). Within Muskoka, forests are the most common land cover type; however, it is important to look beyond the simple total of forested land to ensure long-term conservation of the larger ecosystem. The way that different land cover types (e.g., wetlands, fields, rock barrens, etc.) are arranged across the landscape plays a primary role in the ability of an area to sustain diverse ecological systems that provide both habitat for wildlife as well as ecosystem services including carbon sequestration, clean air, and prime recreational opportunities.

As development proceeds, it tends to change the pattern of the landscape, initially by fragmenting large, contiguous patches of forest or other habitat type into numerous, smaller, separated patches. Such fragmentation, over time, can have major impacts on biodiversity as species which require large, contiguous areas of habitat, or deep, interior forest habitat, disappear. With enough fragmentation, the connectivity of the landscape is compromised, disrupting important ecological processes.

THE INFLUENCE OF FRAGMENTATION ON LARGE NATURAL AREAS AND WILDLIFE

Roads, which cover only a small portion of the landscape, can have profound negative effects on wildlife populations and water quality. For instance, in southern Ontario, no point in the landscape is greater than 1.5 km from a road (Crowley, 2006). Roads and other types of development dissect continuous areas of habitat, breaking them apart into smaller and smaller fragments. Movement between these fragments can be difficult for some species of wildlife leading to populations of the same species becoming increasingly small and isolated (Gibbs and Shriver, 2005). These isolated populations often have reduced genetic diversity (Lesbarrères et al., 2003) that can increase the chances that they will die off due to chance events (Bennett, 1991). In addition, during the winter months, most Muskoka roads are maintained with a combination of salt and sand, which typically washes into surrounding water bodies resulting in higher chloride and sediment concentrations. For additional details on chloride, refer to Chapter 4.

Large, relatively undisturbed areas are important for a healthy watershed and should remain in their natural state to continue to supply goods and services for the esthetic, social, cultural, and

economic needs of our communities. All types of development result in a fragmented landscape, threatening the state of large natural areas.

With development comes the need for supporting infrastructure (i.e., roads, hydro corridors, pipelines, etc.). In Muskoka this is best illustrated by the construction of new roads and the widening of existing roads (i.e., Highways 11, 117, and 118), the clearing of trees for the installation of hydro lines, and the installation of underground utilities. These types of development are major contributors to the fragmenting of habitat.

The recreational activities enjoyed by many seasonal residents can also lead to the degradation or fragmentation of the landscape. For instance, while hiking, boating, fishing, cross-country skiing, or snowmobiling may not have any widespread negative ecological effects individually, together these activities may result in habitat alteration, or simply by increasing the extent to which humans push into the more remote portions of the watershed. These access routes also create opportunities for garbage to be left behind while also providing mechanisms for the spread of invasive species.

To maintain natural cover as development occurs, growth should be directed to existing urban areas, when possible, to concentrate environmental effects and reduce the potential for widespread impacts (i.e., sprawl). Muskoka's development along shorelines varies from low to high density, resulting in the potential for widespread impacts across the landscape. The largest lakes in Muskoka have significant levels of shoreline development, including roads, which increases the pressure on many species that rely on access to specific habitats to survive. For this reason, a sustainable and effective framework is important to support the maintenance of healthy natural ecosystems. This may be accomplished through municipal land use policy, private land stewardship initiatives, and land acquisition by local land trusts.

THE BENEFITS OF PROTECTING LARGE NATURAL AREAS

Maintaining large areas of contiguous natural areas is important to ensure that ecological processes, structure, and functionality are maintained. Large natural areas have been shown to help maintain wildlife populations and to ensure that adequate areas are available for use by many species (Fahrig, 2003; Obbard et al., 2010). Additionally, landscapes dominated by large unfragmented areas are known to have higher water quality, provide high quality wildlife habitat, and support diverse ecological communities (Desbonnet et al., 1994) compared to landscapes with limited natural areas. The benefits of maintaining large natural areas are numerous as these areas are typically associated with high biodiversity, multiple habitat types

(e.g., forests, wetlands, rock barrens, etc.), and ecosystem stability, resilience, and resistance (Riverstone Environmental Solutions, 2011).

Biodiversity is an essential part of our environment that helps local ecosystems to maintain productive soils, clean water, and fresh air. Biodiversity also confers ecosystem resilience, which can help our environment recover from future shocks and changes. Habitat loss because of development is the leading cause of biodiversity loss, followed closely by the establishment of invasive species.

Contiguous habitat refers to patches of similar habitat that are connected to each other (i.e., the opposite of fragmentation). These connected habitats allow species with large ranges to survive and allow opportunity for species to access key areas to perform critical parts of their life cycle including reproduction and maintaining healthy populations. When developments such as roads, utility corridors, and urbanized areas are constructed, they can functionally break apart these large natural systems resulting in loss of habitat as well as key habitat areas becoming isolated or inaccessible. The loss of connectivity within these natural systems can have considerable effects on wildlife and the health of the entire ecosystem. For additional information about ecological integrity, see Chapter 14. The benefits and services that large natural areas provide can become compromised or lost altogether because of habitat loss which is a common side effect of development.

HOW IS FRAGMENTATION MEASURED IN MUSKOKA?

A conservative approach has been taken in identifying the current extent of fragmentation of Muskoka's large natural areas.

Analysis of the fragmentation indicator was completed at a quaternary watershed level using GIS and layers obtained from the Province of Ontario and the District Municipality of Muskoka (DMM). The extent of natural area was determined for each quaternary watershed by subtracting altered landscapes (including roads, buildings, railways, utility lines, trails, hydro corridors, urban communities, quarries, and agricultural land) and the 17 largest lakes from the overall watershed area. A 100-metre buffer was applied around each feature to account for edge habitat between development features and the natural area habitat. The 17 largest lakes were removed from the calculation because they are so large that their presence acts as a boundary to other habitats.

The natural areas in the resulting layer were then categorized based on patch size, with larger patches better able to support environmental services. The five categories used were;

- Patches less than 200 hectares in size.
- Patches 200 to 499 hectares in size.
- Patches 500 to 4,999 hectares in size.
- Patches 5,000 to 9,999 hectares in size.
- Patches 10,000 hectares in size or greater.

The focus of this analysis has been directed towards measures of the extent of natural areas that are greater than 200 ha in area in an effort to capture those portions of the watershed that provide major biodiversity benefits. For each quaternary watershed, the amount of natural area in each of the remaining four categories were then calculated to form the basis of the grading.

It is important to note that natural area classes may span more than one quaternary watershed. Therefore, it is possible to have a patch within a class in a watershed that appears to have less than the required area. For example, in the Baysville Narrows-South Branch Muskoka River, there are only 2,360 hectares of land in the 10,000 and above hectare class size (Table 15). This would indicate that only a portion of the larger natural area is in the Baysville Narrows-South Branch Muskoka River Watershed and the remaining portion would be in an adjacent watershed.

Overall quaternary watershed grades were assigned based on the guidelines provided by *How much disturbance is too much?* prepared by Beacon Environmental (2012). This report outlines habitat conservation guidance for the southern Canadian shield. Watersheds were graded as follows (McIntyre and Hobbs, 1999):

- Not stressed: at least 90% of the watershed is covered in natural areas greater than 200 hectares in size. These watersheds are characterized by intact landscapes with little to no habitat destruction. Connectivity of the remaining habitat is high and the degree of modification of the remaining habitat is low.
- Vulnerable: 60% to 90% of the watershed is covered in natural areas greater than 200 hectares in size. These watersheds have a landscape that is variegated with a moderate degree of habitat destruction. Connectivity of the remaining habitat is generally high; however, connectivity may be reduced for species that are sensitive to habitat modification. The degree of modification of the remaining habitat is low to moderate.
- Stressed: 10-60% of the watershed is covered in natural areas greater than 200 hectares in size. These watersheds have a highly fragmented landscape and may have experienced a high degree of habitat destruction. Connectivity of the remaining habitat is generally low and the degree of modification of the remaining habitat is moderate to high.

Finally, the distribution of each fragmentation class was compared across quaternary watersheds to review the extent of fragmentation in each area. As the size of quaternary watersheds vary across Muskoka, the relative proportion of each watershed covered by a given fragmentation class was calculated to allow for comparison.

RESULTS

Table 15. Provides the class size and area for each quaternary watershed, as well as the total percentage of natural area and its resultant grade.

Quaternary Watershed and Area (ha)	Class Size (ha)	Class Area (ha)	Area by Class (%)	# of Patches	Proportion of Quaternary Watershed Covered by Natural Areas (%)	Grade
Baysville Narrows - South Branch Muskoka River	200-499	822	2.55	5	63.93	Vulnerable
32,297	500-4,999	11,380	35.23	13		
	5,000-9,999	6,084	18.84	2		
	10,000+	2,360	7.31	3		
Blackstone Harbour	200-499	540	3.09	3		
17,446	500-4,999	5,436	31.16	4	65.47	Vulnerable
	5,000-9,999	5,447	31.22	1		
	10,000+	0	0	0		

Quaternary Watershed and Area (ha)	Class Size (ha)	Class Area (ha)	Area by Class (%)	# of Patches	Proportion of Quaternary Watershed Covered by Natural Areas (%)	Grade
Cache Creek - Black River	200-499	595	1.78	2	84.24	Vulnerable
33,519	500-4,999	9,129	27.24	6		
	5,000-9,999	11,847	35.34	2		
	10,000+	6,664	19.88	2		
Distress Pond - Big East River	200-499	1,536	3.31	6	83.96	Vulnerable
46,465	500-4,999	12,127	26.1	13		
	5,000-9,999	0	0	0		
	10,000+	25,350	54.56	1		
Hollow River	200-499	1649	4.37	5	79.02	Vulnerable
37,766	500-4,999	5,854	15.5	7		
	5,000-9,999	5,724	15.16	2		
	10,000+	16,685	44.18	1		
Kahshe River	200-499	819	3.45	6	66.79	Vulnerable
23,758	500-4,999	8,625	36.3	6		
	5,000-9,999	0	0	0		
	10,000+	6,423	27.04	2		

Quaternary Watershed and Area (ha)	Class Size (ha)	Class Area (ha)	Area by Class (%)	# of Patches	Proportion of Quaternary Watershed Covered by Natural Areas (%)	Grade
Lake Muskoka - Muskoka River	200-499	4290	10.63	15	45.13	Stressed
40,356	500-4,999	9,666	23.95	15		
	5,000-9,999	4,259	10.55	2		
	10,000+	0	0	0		
Lake Rosseau	200-499	3,508	5.38	10	55.84	Stressed
65,186	500-4,999	19,351	29.69	17		
	5,000-9,999	2,107	3.23	1		
	10,000+	11,432	17.54	1		
Lake St. John - Black River	200-499	604	1.6	3	69.7	Vulnerable
37,633	500-4,999	8,854	23.53	8		
	5,000-9,999	0	0	0		
	10,000+	16,773	44.57	2		
Lake Vernon	200-499	1,093	3.09	4	72.53	Vulnerable
35,375	500-4,999	16,938	47.88	11		
	5,000-9,999	172	0.49	1		
	10,000+	7,454	21.07	1		

Quaternary Watershed and Area (ha)	Class Size (ha)	Class Area (ha)	Area by Class (%)	# of Patches	Proportion of Quaternary Watershed Covered by Natural Areas (%)	Grade
Little East River - Big East River	200-499	266	0.97	1	70.47	Vulnerable
27,558	500-4,999	3,589	13.02	7		
	5,000-9,999	812	2.95	1		
	10,000+	14,753	53.53	1		
Little Lake - Severn River	200-499	3,488	10.48	12	59.61	Stressed
33,272	500-4,999	13,223	39.74	11		
	5,000-9,999	3,122	9.38	3		
	10,000+	0	0	0		
Moon River Bay	200-499	1120	4.67	4	77.31	Vulnerable
23,997	500-4,999	7,817	32.57	8		
	5,000-9,999	117	0.49	1		
	10,000+	9,499	39.58	1		
Musquash River	200-499	930	2.93	6	78.33	Vulnerable
31,747	500-4,999	8,297	26.13	10		
	5,000-9,999	12,228	38.52	3		
	10,000+	3,411	10.74	2		

Quaternary Watershed and Area (ha)	Class Size (ha)	Class Area (ha)	Area by Class (%)	# of Patches	Proportion of Quaternary Watershed Covered by Natural Areas (%)	Grade
North Branch Muskoka River	200-499	3306	7.24	13	54.92	Stressed
45,664	500-4,999	5,700	12.48	9		
	5,000-9,999	3,877	8.49	2		
	10,000+	12,193	26.7	4		
Oxtongue River Outlet	200-499	525	1.94	4	78.48	Vulnerable
27,015	500-4,999	7,652	28.32	7		
	5,000-9,999	4,059	15.02	2		
	10,000+	8,966	33.19	2		
South Branch Muskoka River Outlet	200-499	827	2.3	6	72.24	Vulnerable
36,003	500-4,999	9,091	25.25	10		
	5,000-9,999	843	2.34	1		
	10,000+	15,246	42.35	3		

Quaternary Watershed and Area (ha)	Class Size (ha)	Class Area (ha)	Area by Class (%)	# of Patches	Proportion of Quaternary Watershed Covered by Natural Areas (%)	Grade
South Georgian Bay Shoreline	200-499	1,640	5.39	7	66.15	Vulnerable
30,415	500-4,999	2,612	8.59	5		
	5,000-9,999	1,278	4.2	2		
	10,000+	15,246	47.97	2		
Sparrow Lake - Severn River	200-499	1183	5.59	5	32.11	Stressed
21,173	500-4,999	5,616	26.52	7		
	5,000-9,999	0	0	0		
	10,000+	0	0	0		
Tea Lake - Oxtongue River	200-499	3,259	9.48	12	80.52	Vulnerable
34,369	500-4,999	20,630	60.02	17		
	5,000-9,999	0	0	0		
	10,000+	3787	11.02	1		

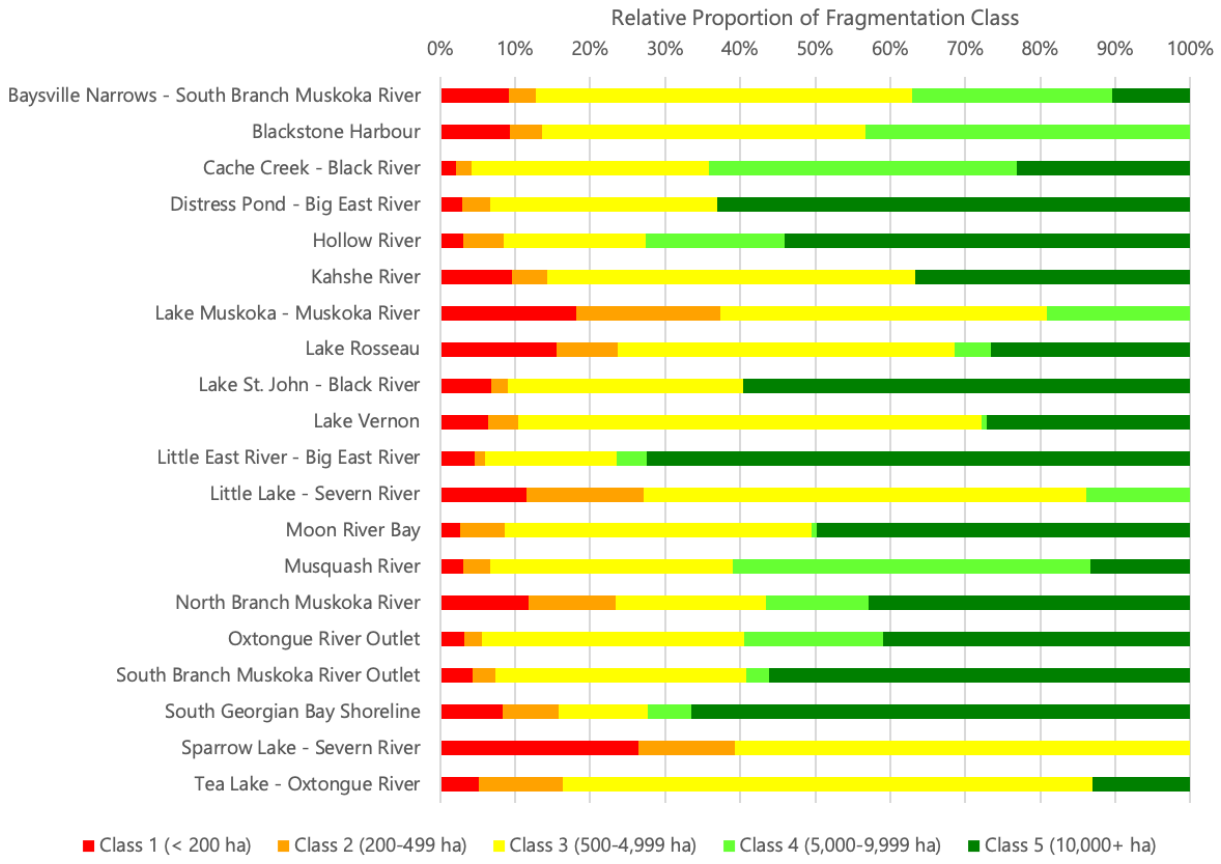

Figure 17. Relative proportion of each fragmentation class across quaternary sub-watersheds in Muskoka. Sub-watersheds with large proportions of Fragmentation Class 1 and 2 represent landscapes that have a high degree of fragmentation while areas dominated by Fragmentation Class 4 and 5 represent largely intact natural areas.

WHAT DOES IT ALL MEAN?

Across Muskoka, the majority of the quaternary watersheds have a *vulnerable* status indicating that the landscape within these areas has begun to be broken apart into smaller and smaller patches of contiguous habitat. Generally, the habitat loss is moderate and for the time being, connectivity of the remaining habitat patches is considered to be high. For some species that do not move great distances or rely on key habitat types within close proximity to each other, the existing level of fragmentation may be starting to have negative impacts. The good news is that for these areas that are *vulnerable* the degree of modification of the remaining habitat is considered to be low to moderate.

As was the case in the 2018 Report Card, both the Lake Muskoka and the Lake Rosseau quaternary watersheds continue to be *stressed* (Table 15). In 2023, three additional quaternary watersheds were identified as *stressed;* Little Lake-Severn River, Sparrow Lake-Severn River, and North Branch Muskoka River. Between 15% and almost 25% of these quaternary watersheds are comprised of patches of natural landcover types that are less than 200 ha in size (Figure 17). These areas are in the southern portion of Muskoka, as well as along a primary portion of the Muskoka River. Seasonal and year-round residential buildings and associated amenities dominate the landscape in the *stressed* portions of Muskoka. In this way, fragmentation also provides a measure of the extent of human impact on the larger landscape, pointing to portions of Muskoka where human development and encroachment are likely to be having the greatest impact on biodiversity and ecosystem health. This is in stark contrast to areas like the South Georgian Bay Shoreline, Little East River-Big East River, and the Hollow River which are dominated by large patches (i.e., > 5,000 ha, see Figure 17). As development often occurs incrementally, making loss of habitat difficult to detect until it has occurred on such a scale that the impacts are often irreversible, ongoing monitoring of areas with large components of contiguous natural landcover is important to the long-term viability of Muskoka's ecological communities.

WHAT CAN YOU DO?

- If you have a woodlot, carry out good stewardship practices using resources available from the Ontario Woodlot Association and enroll in the Managed Forest Tax Incentive Plan (MFTIP).
- If you are a landowner with forest property then investigate long term protection strategies such as Nature Reserves and Conservation Easement programs of the Muskoka Conservancy. https://www.muskokaconservancy.org/nature-conservation
- Limit the extent of development and clearing of natural vegetation on your property.
- Place development on your property close to existing roads thereby limiting the need for long driveways and extensive vegetation clearing.
- If you own large parcels of land, consider donating portions to conservation organizations rather than severing it into multiple smaller development lots.
- Support landscape level initiatives like Integrated Watershed Management to help bring broad scale planning and governance to the Muskoka River Watershed.
- Get more great stewardship ideas in Muskoka Watershed Council's *Living in cottage country: what you need to know* handbook.