INDICATOR: TERRESTRIAL LANDSCAPE FRAGMENTATION

STRATEGIC DIRECTION: Reduce Threats

TARGET: N/A

THEME: Pressures on Ontario's Biodiversity – Habitat Loss

Background Information:

Landscape fragmentation is the process by which habitat loss results in the division of large, continuous habitats into smaller, more isolated remnants. Recent scientific evidence shows that landscape fragmentation has negative effects on biodiversity (Fahrig 2003), largely resulting from the loss of the original habitat, reduction in habitat patch size and increasing isolation of habitat patches (Andrén 1994). More specifically, landscape fragmentation causes a reduction in habitat area, with associated declines in population density and species richness, and significant alterations to community composition, species interactions and ecosystem functioning (Fahrig 2003). Species occupying fragmented landscapes are also less able to shift their distributions to compensate for altered habitat quality resulting from changing climatic conditions. Thus, there is an important synergy between climate change and landscape fragmentation that may lead to increased loss of biodiversity (Varrin et al. 2008).

Landscape fragmentation not only deprives plants and animals of habitat, but also has indirect impacts, generating noise, light and air pollution or changing microclimates. Some species avoid human structures, which reduces their potential habitats even more. As a result, areas in which animals feel undisturbed become ever more scarce due to landscape fragmentation (Jaeger 2000). Further, landscape fragmentation results in an abundance of edge habitat, where edge-sensitive species or those that require large, undisturbed habitat are excluded (Fahrig 2003).

Landscape fragmentation is most evident in intensively used regions, where the habitat is divided by urbanization, agriculture, roads or other human developments (Fahrig 2003). Fragmentation has been rapidly increasing in Ontario, particularly in the south where human development is greatest (OBC 2010). This trend is likely to continue as Ontario's population is projected to grow by 31% over the next 28 years, from an estimated 13.5 million in 2013 to almost 17.8 million by 2041, resulting in greater fragmentation of the remaining ecological network (Ontario Ministry of Finance 2014).

This indicator assesses terrestrial landscape fragmentation in Ontario using effective mesh size, an unbiased measure of the sizes of habitat patches within regions.

Data Analysis:

Terrestrial landscape fragmentation in southern Ontario was assessed based on natural and anthropogenic land cover types in 2011 aggregated from the Southern Ontario Land Resource and Information System (SOLRIS v 2.0; OMNRF 2015). Landscape fragmentation was measured using effective mesh size (Jaeger 2000). Effective mesh size (m_{eff}) is a method to quantify fragmentation based on the probability that two points chosen at random in a region will be connected (i.e., found in the same habitat patch; Jaeger 2000). It is measured in units of area (i.e., ha or km^2)

Effective mesh size was assessed for each ecodistrict in the Mixedwood Plains Ecozone in Ontario, with the exception of Manitoulin Island (Figure 1). Roads and other infrastructure, urban areas, agricultural lands and extraction areas were considered barriers. It is important to note that as a measuring unit, effective mesh size assigns equal weight to all barriers. In reality, it may make a big difference whether an animal is confronted with a small country road or a highway. While it is possible that for some species, all barriers might constitute insurmountable obstacles, for most species, it will be the nature of the barrier placed in their path (volume of traffic, width, animal-tight fences, etc.) that carries the most weight (Jaeger 2000).

Patch-based landscape metrics can be biased by the boundaries and the extent of a reporting unit if the reporting unit boundaries fragment patches. To overcome this limitation the cross-boundary connections procedure was used, where provincial and/or ecozone borders were considered to be barriers and regional boundaries were not (Moser and Jaeger 2007). As such, m_{eff} was calculated using the following formula:

$$m_{eff} = \frac{1}{A_{total}} \sum_{i=1}^{n} A_i \cdot A_i^{cmpl}$$

where n = the number of patches, A_i = size of patch i inside the boundaries of the reporting unit (i = 1,2,3,…, n), A_i^{cmpl} = the area of the complete patch that A_i is a part of, and A_{total} = the total area of the reporting unit. A high effective mesh size value indicates low fragmentation of the landscape. More detailed information of the analysis of landscape fragmentation in southern Ontario is provided in McIntosh et al. (2015).

- Download m_{eff} data

Results:

Trend:	Baseline	**Data Confidence:** Medium	**Geographic Extent:** Mixedwood Plains

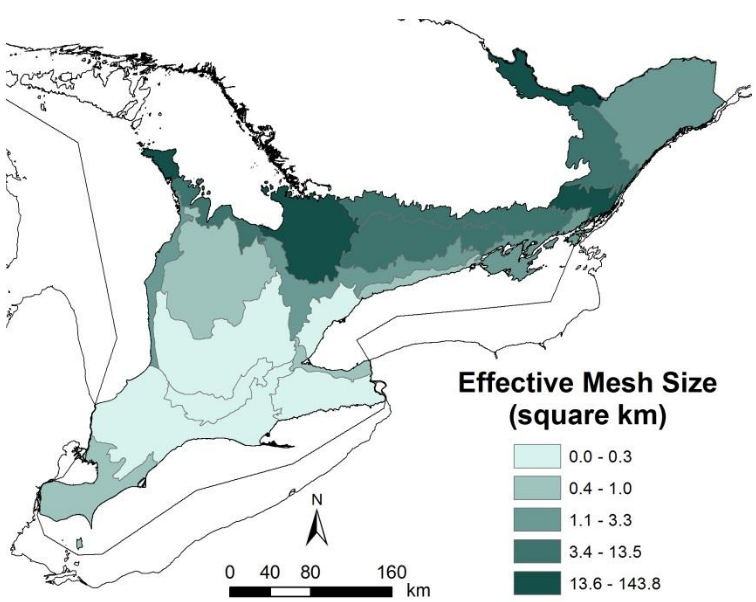

Figure 1. Effective Mesh Size for ecodistricts in southern Ontario (2011).

Status:

- In 2011, the effective mesh size in southern Ontario ranged from a low of 0.03 km^2 in the Toronto Ecodistrict to a high of 144 km^2 in the Charleston Lake Ecodistrict.
- Median effective mesh size for ecodistricts in the Mixedwood Plains Ecozone was 1.3 km^2. The effective mesh size for all seven ecodistricts in the southwestern portion of the ecozone was less than the median value.
- Analysis of effective mesh size in Ontario is ongoing (Ontario Shield and Hudson Bay Lowlands ecozones as well as an examination of trends in the Mixedwood Plains Ecozone).

Links:

Related Targets: N/A

Related Themes: N/A

References:

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Citation
Ontario Biodiversity Council. 2015. State of Ontario's Biodiversity [web application]. Ontario Biodiversity Council, Peterborough, Ontario. [Available at: **http://ontariobiodiversitycouncil.ca/sobr** (Date Accessed: May 19, 2015)].