INDICATOR: AFFORESTATION AND DEFORESTATION

STRATEGIC DIRECTION: Reduce Threats

TARGET: 6. By 2015, plans for climate change mitigation are developed and implemented and contribute to Ontario's target to reduce greenhouse gas emissions by 6 per cent below 1990 levels.

THEME: Pressures on Biodiversity – Climate Change

Background Information:

Although climate change poses a serious threat to biodiversity, conservation of biodiversity can play an important role in mitigating climate change. For example, ecosystems such as forests and wetlands are important carbon sinks that help reduce greenhouse gas emissions. The forests and treed wetlands in Ontario's Crown forest management units (portion of the Ontario Shield Ecozone) are estimated to store 4.3 and 3.0 billion tonnes of carbon, respectively (OMNR 2012). It is estimated that non-treed peatlands in Ontario's Far North store 36 billion tonnes of carbon (McLaughlin and Webster 2013). The protection and sustainable management of forests and wetlands, effectively managing and expanding protected area networks, afforestation (planting trees on currently non-forested land) and wetland restoration can all play a role in climate change mitigation (SCBD 2009).

Climate change mitigation is the focus of *Go Green: Ontario's Action Plan on Climate* Change (Government of Ontario 2007). The action plan commits to reduced emissions associated with energy production, transportation and energy conservation, as well as planting 50 million trees on 25,000 ha of private and public lands by 2025. The 50 Million Tree Program was established in 2008 as a partnership between the Ontario Ministry of Natural Resources and Forestry and Forests Ontario. The program is implemented through partners such as conservation authorities, stewardship councils and municipalities. In addition to enhancing biodiversity and ecosystem services, it is estimated that the trees in each hectare of forest will help to mitigate climate change by storing more than 5.5 tonnes of carbon dioxide annually over their lifetime (Government of Ontario 2007).

While recognizing the importance of afforestation efforts to climate change mitigation through the sequestration of carbon, deforestation (conversion of forested land to other uses such as roads, urban development and agriculture) must also be accounted for on the balance sheet. Forest harvest is not considered deforestation as the forest is re-established post-harvest. Deforestation results in the release of carbon and diminishes the ability of ecosystems to remove carbon dioxide from the atmosphere and store carbon on the landscape. Article 3.3 of the Kyoto Protocol requires accounting for carbon sequestration due to afforestation and carbon emissions due to deforestation.

This indicator examines trends from 1990-2013 in the annual area of land in Ontario that has been afforested, compared with the area that has been deforested.

Data Analysis:

Afforestation

Afforestation was estimated as the area of land converted to forest by examining annual records of tree planting on previously un-forested lands. Only afforestation projects with a minimum area of 1 ha and 25% canopy cover of trees that have the potential to reach 5 m in height at maturity are included. Information from 1990-2007 are based on records maintained by the Ontario Ministry of Natural Resources and Forestry with input from partners. Since 2008, more detailed information on the species, area planted and planting locations has been maintained by Forests Ontario through the 50 Million Tree Program. The vast majority of planting projects have occurred in the Mixedwood Plains Ecozone (95% of area planted from 2008-2013), but there have also been afforestation efforts in ecodistricts on the southern edge of the Ontario Shield Ecozone. The analysis does not include abandoned lands that have gradually succeeded to forest condition or any tree planting that is not associated with the 50 Million Tree Program.

Deforestation

Data on deforestation were derived from several sources:

In the Mixedwood Plains Ecozone of southern Ontario (excluding Manitoulin Island), data from 1990-1999 were based on observed forest loss in a sample of National Forest Inventory plots followed by extrapolation to larger areas (see OMNR 2012). For the period 2000-2011, estimates of deforestation were made using land cover information from the Southern Ontario Land Resource Information System (SOLRIS; OMNR 2008). SOLRIS version 2.0 (2011 land cover) was developed using a LandSat based change detection analysis process applied to woodlands and wetlands identified in SOLRIS version 1.0 (2000-2002 land cover). Estimates of deforestation over two time periods (2000-2005 and 2006-2011) were averaged to produce annual estimates. There were no available data to reliably assess deforestation after 2011 which is the year for the latest SOLRIS land cover.

Estimates of deforestation in Ontario's Crown forest management units (portion of the Ontario Shield Ecozone) from 1990-2013 are based on the area of forest lost to the construction of forest access roads. Data on the length of various classes of forest access roads (primary, branch and operational) constructed annually are maintained by the Ontario Ministry of Natural Resources and Forestry based on information provided by the forest industry. To convert road lengths to deforested area, buffered widths were assigned to each road based on its class (total width: primary = 19.2 m, branch = 14.2 m and operational = 12.2 m). Industry reporting of data has not always been timely and complete and in some cases, the amount of road construction was estimated based on known harvest areas. Operational roads are normally not maintained after they are no longer required for forest management purposes, and are often site prepared and regenerated. Operational roads are more difficult to regenerate than surrounding harvest areas due to soil compaction. As a result, regeneration can be delayed (10-20 years) and is affected by a variety of factors like the substrate, the amount of gravel, the season of construction, and amount and duration of vehicle traffic. Some operational roads may not completely regenerate if they continue to be used for other purposes (non-forest management). Work is ongoing to determine how operational roads regenerate over time. Deforestation data were not available for pits, quarries, electrical generation facilities or expanding urban areas. A preliminary analysis of deforestation associated with the development of mines in this area of northern Ontario showed a total loss of 3.1 km^2 of forest over the period 1999-2013 (0.22 km^2/yr).

It is important to note that information on deforestation for the two regions used different data sources. The assessment of forest loss in the Mixedwood Plains used remote sensing and could miss

small losses (e.g., less than 0.5 ha over 5 years). In the Ontario Shield Ecozone, forest losses were based on the known or estimated length of new forest access roads, but did not include new land uses that would be detected by the remote sensing methods used in the south (e.g., expanding urban areas).

Annual data on deforestation in southern and northern Ontario and data on afforestation were combined into a single graph to compare forest gains and losses over the period 1990-2013 (Figure 1). Areas of afforestation were also subtracted from areas of deforestation to determine the annual net area of deforestation (Figure 2). Because of the uncertainty around forest regeneration on operational roads, the area of deforestation attributed to operational roads has been highlighted in Figure 1. Annual net deforestation in Figure 2 includes scenarios where all operational roads are considered deforested and where no operational roads are considered deforested – the real situation is somewhere between these scenarios and will be reflected in future updates to this indicator.

- download afforestation and deforestation data

Results:

Trend: Improvement **Data Confidence:** Medium **Geographic Extent:** Mixedwood Plains/Ontario Shield

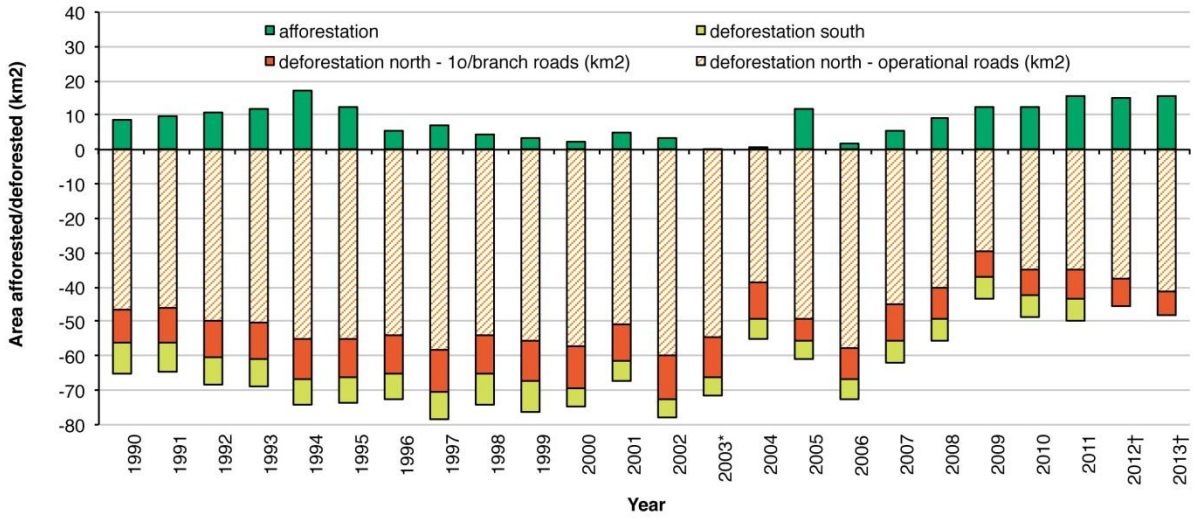

Figure 1. Trends in areas of afforestation (positive values) and deforestation (negative values) 1990-2013 (*afforestation area not available for 2003, † area of deforestation not available for southern Ontario 2012-2013).

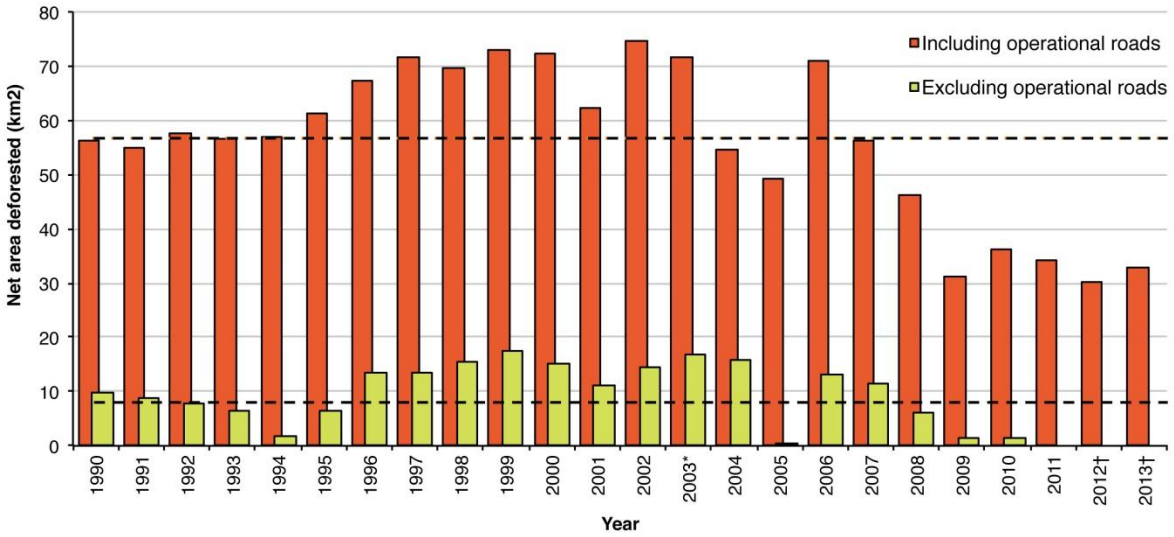

Figure 2. Trends in net area of deforestation in Ontario 1990-2013 under scenarios that include and exclude deforestation associated with operational forest access roads (dashed lines represents net annual average area deforested under each scenario; *afforestation area not available for 2003; †area of deforestation not available for southern Ontario 2012-2013).

Status:

- More than 99 km^2 (9,910 ha) of land have been afforested in Ontario over the last decade (2004-2013; average of 9.9 km^2 per year). Annual levels of afforestation were high in the early 1990s, declined in the late 1990s and early 2000s and have increased since 2008 with the establishment of the 50 Million Tree Program. The highest rates of afforestation are in areas of ecodistricts of southern Ontario that already have relatively high levels of forest cover.
- When operational forest access roads are included, annual deforestation associated with forest access road construction in the area of Crown forest management averaged 63.2 km^2 between 1990 and 2006, but has decreased since (average of 45.9 km^2 From 2007-2013; 0.01% of forested area); at the same time there has been a downturn in the forest industry and forest harvest.
- Most of the area deforested due to forest access road construction was associated with operational roads that provide direct access to harvest areas (83%). If operational roads are excluded from deforestation estimates, annual deforestation in the area of Crown forest management averaged 10.7 km^2 between 1990 and 2006, and 8. 3 km^2 from 2007-2013 (0.002% of forested area).
- In southern Ontario, 71 km^2 (7,115 ha) of forested land were deforested from 2000-2011 (average of 5.9 km^2 per year; 0.05% of forested area). Although this is slightly less than the estimated 82 km^2 over the previous decade, the methods used to calculate deforestation for these two periods were different. About one half of the recent deforestation was converted to agriculture while about one third was related to urban development.
- The annual rate of deforestation has been consistently greater than the rate of afforestation resulting in a net loss of forest cover. The annual net rate of deforestation has decreased substantially over the last decade and represents less than 0.01% of the forested land in Ontario. If operational roads are excluded from deforestation estimates, there has been no net loss of forest over the latest 3-year period (2011-2013).

Links:

Related Targets: N/A

Related Themes: Pressures on Biodiversity – Habitat Loss

Web Links:

Ontario Ministry of Natural Resources – Forestry https://www.ontario.ca/rural-and-north/forestry

Forests Ontario – 50 Million Tree Program http://www.forestsontario.ca/index.php/50mtp

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Ontario Ministry of Natural Resources (OMNR). 2008. Southern Ontario Land Resource Information System (SOLRIS) Phase 2 – Data Specifications Version 1.2. Ontario Ministry of Natural Resources, Peterborough, ON.

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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)].