INDICATOR: Ontario's Ecological Footpring and Biocapacity

Strategic Direction: Reduce Threats

Target: 9. By 2020, the growth of Ontario's per-capita resource consumption and waste generation is halted and reversed.

Theme: Pressures on Ontario's Biodiversity — Consumption

Previous version: http://sobr.ca/_biosite/wp-content/uploads/Indicator-Ontarios-Ecological-Footprint-and-Biocapacity_May-19-2015.pdf

Background Information

Human activities affect biodiversity directly through habitat loss, introduction of invasive species, pollution, unsustainable use, and climate change. A growing population combined with increasing levels of consumption drive these threats and often compromise the ability of ecosystems to provide ecosystem goods and services, such as timber and the sequestration of carbon. A necessary condition to sustain humanity's use of biological resources is to harvest renewable resources at rates that can be regenerated, and to emit wastes at rates that can be metabolized. These necessary conditions can be evaluated by measuring Ecological Footprint and biocapacity.

Since the 1970s, humanity has been in ecological overshoot, meaning that annual demand on resources exceeds what Earth can regenerate. Recent analyses show that the Ecological Footprint of humanity has exceeded biocapacity in each year since 1970, with 70% overshoot in 2015 (Miller et al. 2021). Global ecological overshoot has major environmental implications, including degradation of ecological assets, depletion of natural reserves, biodiversity loss, and ecosystem collapse. While discrete threats to biodiversity can be identified (e.g. the loss of forest habitat to urban development), the overall unsustainable use of biological resources — driven by human consumption patterns, technology and population levels — represents a suite of cumulative stresses on biodiversity and is a major factor driving biodiversity loss.

The Ecological Footprint measures humanity's demand for renewable natural resources and identifies whether our collective consumption levels are approaching or exceeding the Earth's ecological limits. The Ecological Footprint is widely recognized as a strong measure of environmental sustainability and is used by governments and institutes worldwide. The Ecological Footprint has been used as an indicator at the global level to assess progress on the Aichi Biodiversity Targets (Secretariat of the Convention on Biological Diversity 2014). While the Footprint does not measure biodiversity loss directly, it tracks global pressures on biodiversity and can be used to complement other measures of ecosystem-specific impacts on biodiversity (Galli et al. 2014). The strength of the Ecological Footprint is that it makes a direct comparison between resource availability and resource consumption and looks at total human demand on global ecosystems rather than giving a limited view of the sustainable use of a single commodity or industry.

This metric is composed of two parts: Ecological Footprint and biocapacity. The Ecological

Footprint of consumption measures the area of the planet needed to supply humans with food and fiber crops, forest products, lands for settlements and infrastructure, and the sequestration of anthropogenic carbon emissions. This can be compared to Biocapacity, which measures the potential for specific lands and waters to sustain an Ecological Footprint. This comparison is human-centered because both measures only relate to human uses of ecosystems. Yet this comparison also infers human pressures on ecosystems and biodiversity that are not used by humans.

This indicator examines trends in Ontario's Ecological Footprint and Biocapacity for the years 2005, 2010, and 2015 based on analysis completed by the York University Ecological Footprint Initiative in partnership with the Global Footprint Network. See the full report here.

Data Analysis

The Ecological Footprint is measured in global hectares, or actual hectares weighted according to the biological productivity of each hectare relative to its global average. An Ecological Footprint of 5 global hectares per person means that it takes 5 hectares of world average productive land and water to support human consumption and waste assimilation. This provides a holistic picture of all resource demand regardless of where it takes place or what type of land is utilized.

The Ecological Footprint is calculated by taking the total mass of each product consumed (e.g. tonnes of wood), dividing by yield for that product (in tonnes per hectare), then multiplying by the yield factor and equivalence factor. The yield factor accounts for differences between provincial and world yields for the land-use type in question. The equivalence factor takes into account differences in world average productivity between the various land-use types (e.g. cropland, forest land, fishing grounds). Biocapacity is calculated by multiplying the area of each land-use type (e.g. forest land) by the respective yield and equivalence factors for that land-use type.

Data from the National Ecological Footprint and Biocapacity Accounts were combined with Ontario-specific data to derive Ontario's Ecological Footprint and biocapacity. The current indicator for the years 2005, 2010, and 2015 were derived from the most recent (2021) edition of the National Accounts, which use updated Canadian and global statistics for all years. Results differ from previous assessments of Ontario's Ecological Footprint and biocapacity, which used earlier editions of the National Accounts. The State of Ontario's Biodiversity reported in 2015 (OBC 2015) used results from Zokai et al. (2015) based on the 2014 edition of the National Accounts. The State of Ontario's Biodiversity reported in 2010 (OBC 2010) used results from Stechbart and Wilson (2010) that were based on the 2008 edition of the National Accounts. The current report provides a more comprehensive and updated measure of Ontario biocapacity from updated land-use inventories and by including wetlands, which were not included in prior Ontario assessments and which are not included in the National Accounts (Miller et al. 2021).

Data for Ontario's Ecological Footprint and biocapacity were sourced from several organizations, including the United Nations Food and Agriculture Organization, the International Energy Agency, Statistics Canada, the Ontario Ministry of Agriculture, Food and Rural Affairs, and the Ontario Ministry of Natural Resources and Forestry. Ontario's Ecological Footprint and biocapacity in 2015 were compared to values from 2010 and 2005 to assess trends (Figure 1). Ontario's Ecological Footprint was compared to Canada and the World in global hectares per capita over this period based on consumption category (Figure 2).

The information presented in this indicator represents a summary of the technical report: Ontario's

Ecological Footprint and Biocapacity: Measures and trends from 2005 to 2015 prepared by the York University Ecological Footprint Initiative (Miller et al. 2021). This report builds on prior Ontario assessments from Zokai et al. (2015) and Stechbart and Wilson (2010).

- View full report: Ontario's Ecological Footprint and Biocapacity: Measures and Trends from 2005 to 2015
- View Ecological Footprint and Biocapacity trends for individual nations

Results

Trend: Mixed	**Data Confidence:** Medium	**Geographic Extent:** Provincial

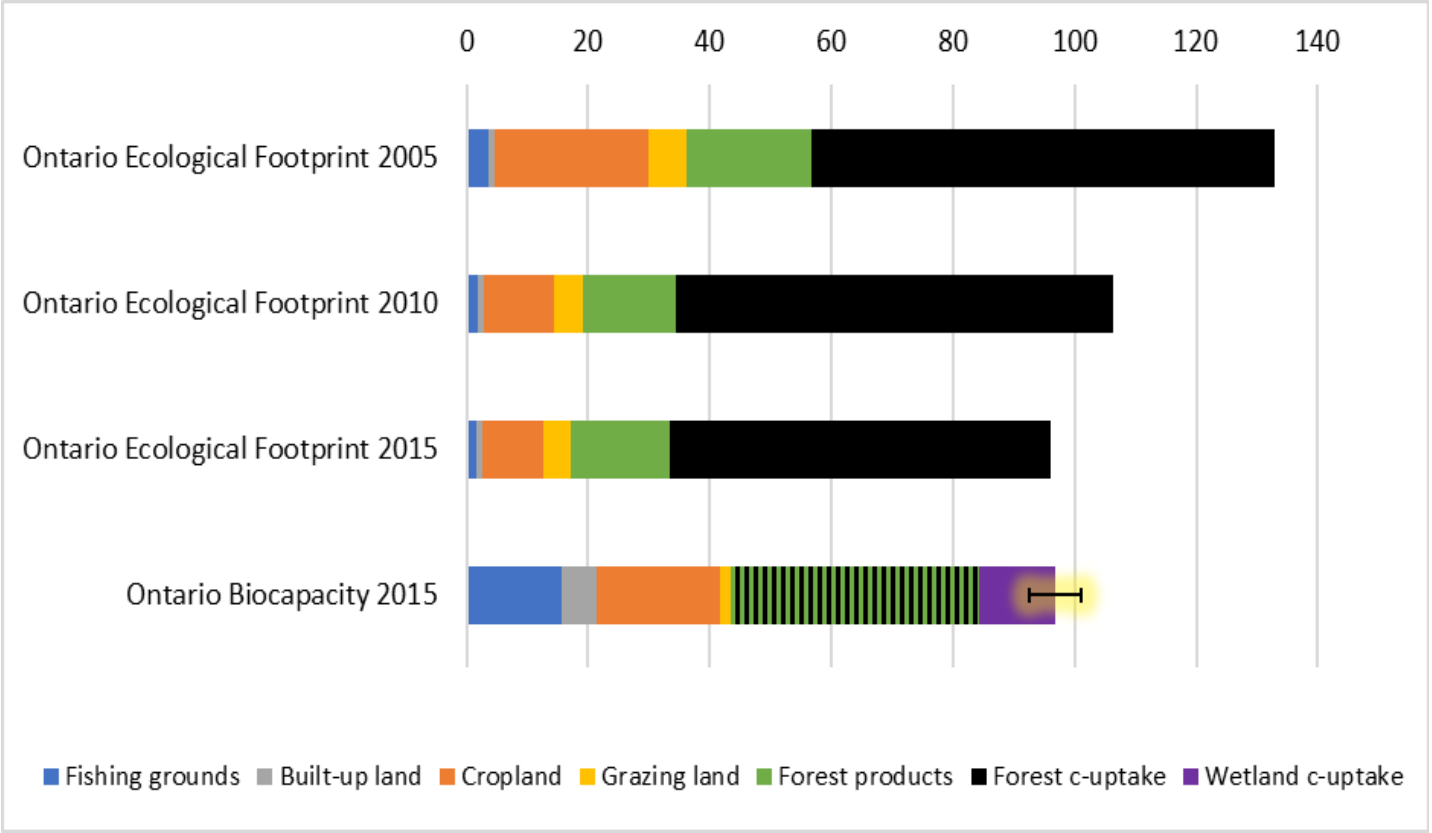

Figure 1: Ontario Ecological Footprint versus biocapacity, in millions of global hectares per year, 2005, 2010 and 2015.

Note: Between 2005 and 2015, there was a large reduction in the carbon intensity of electricity in Ontario, due to a phasing out of coal-fired electricity generation. By 2015, electricity in Ontario was produced with 80% less carbon emissions than were produced per unit of electricity in 2005 (Ontario Ministry of Energy, 2017). This change accounted for about a fifth of the reduction in the forest carbon

uptake component. Had this change not occurred, the forest carbon uptake component would have been about 5% greater in 2015 using the same emission parameters that existed in 2005. Conversely, if Ontario had phased out coal earlier, such that electricity-generated emissions in 2005 matched 2015 levels, the carbon component in 2005 would have been over 5% lower (Miller et al. 2021).

Also note: The Ecological Footprint of consumption is equal to the footprint of production plus the footprint of all imports minus the footprint of all exports. Since 1961, Canada's Ecological Footprint of production has been larger than its footprint of consumption because Canada's exports have been more footprint intensive than its imports. Most of this relates to the carbon intensity of exports, followed by the net export of forest products, followed by crops. In 2015, the footprint of production was 47% larger than the footprint of consumption in Canada. A similar pattern should be expected for Ontario during the period of 2005–2015 if not also before and after: Ecological Footprint of production in Ontario was likely much larger than Ontario biocapacity in each year. The Ecological Footprint of production in Ontario puts pressure upon biodiversity in Ontario, even though a portion of this pressure can be attributed to consumption in the rest of the world of the goods and services exported from Ontario.

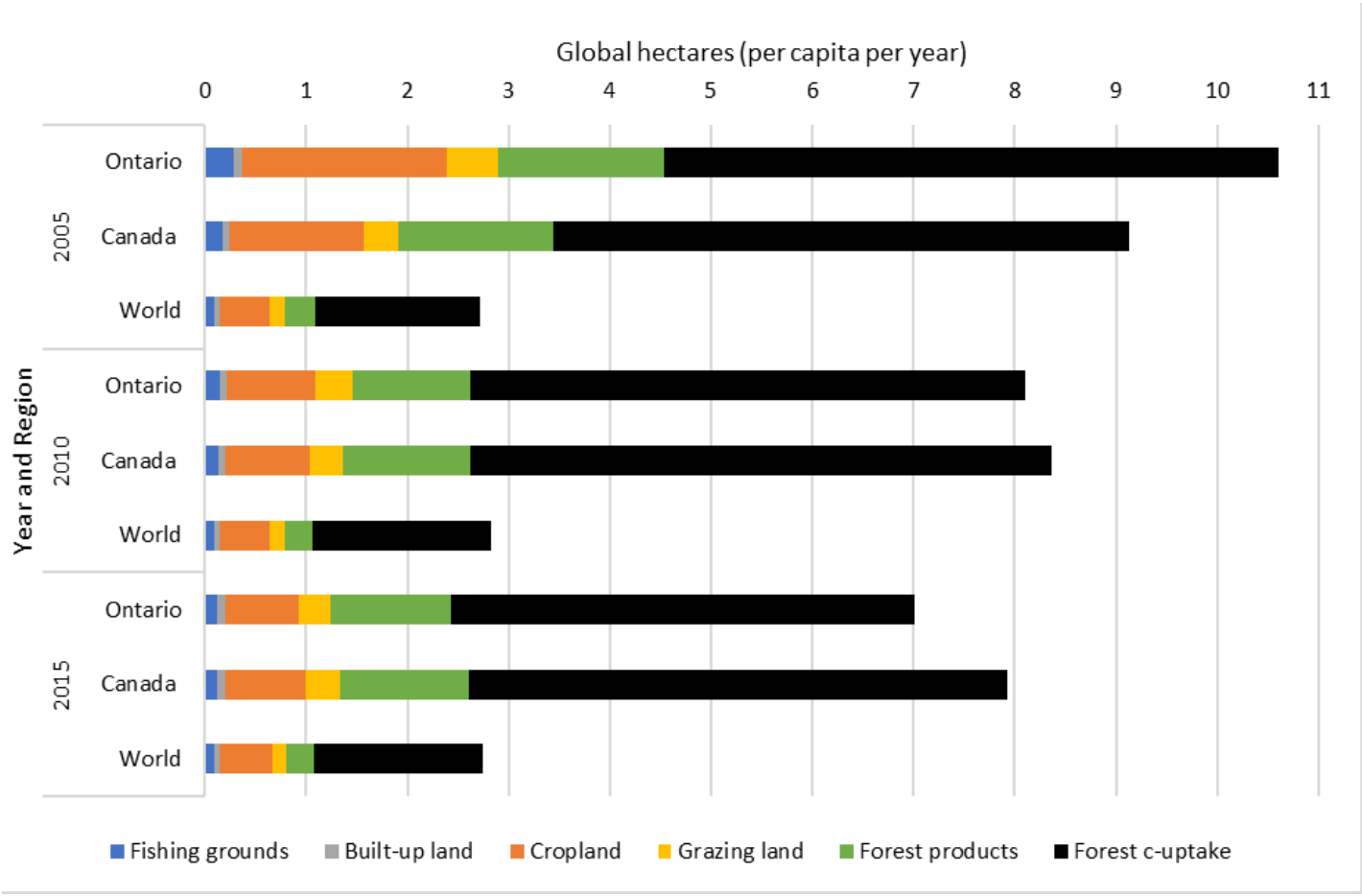

Figure 2. Ontario's Ecological footprint compared to Canada and the world, in global hectares per capita per year, 2005–2015.

When looking at the global context Ontario's per capita Ecological Footprint (of consumption) in 2015 ranked 12th highest in the world compared to other countries, with Canada in 6th place.

Table 8. Ontario's rank among countries with the largest Ecological Footprint per capita in 2015.

Rank	Country	Ecological Footprint gha per capita
1	Qatar	14.58
2	Luxembourg	12.76
3	United Arab Emirates	9.54
4	Kuwait	8.44
5	United States of America	8.07
6	Canada	7.92
7	Bermuda	7.91
8	Mongolia	7.32
9	Denmark	7.15
10	Trinidad and Tobago	7.11
11	Estonia	7.03
12	Ontario	7.02

Globally, humanity's Ecological Footprint has exceeded biocapacity in each year since 1970, with an overshoot of 70% in 2015.

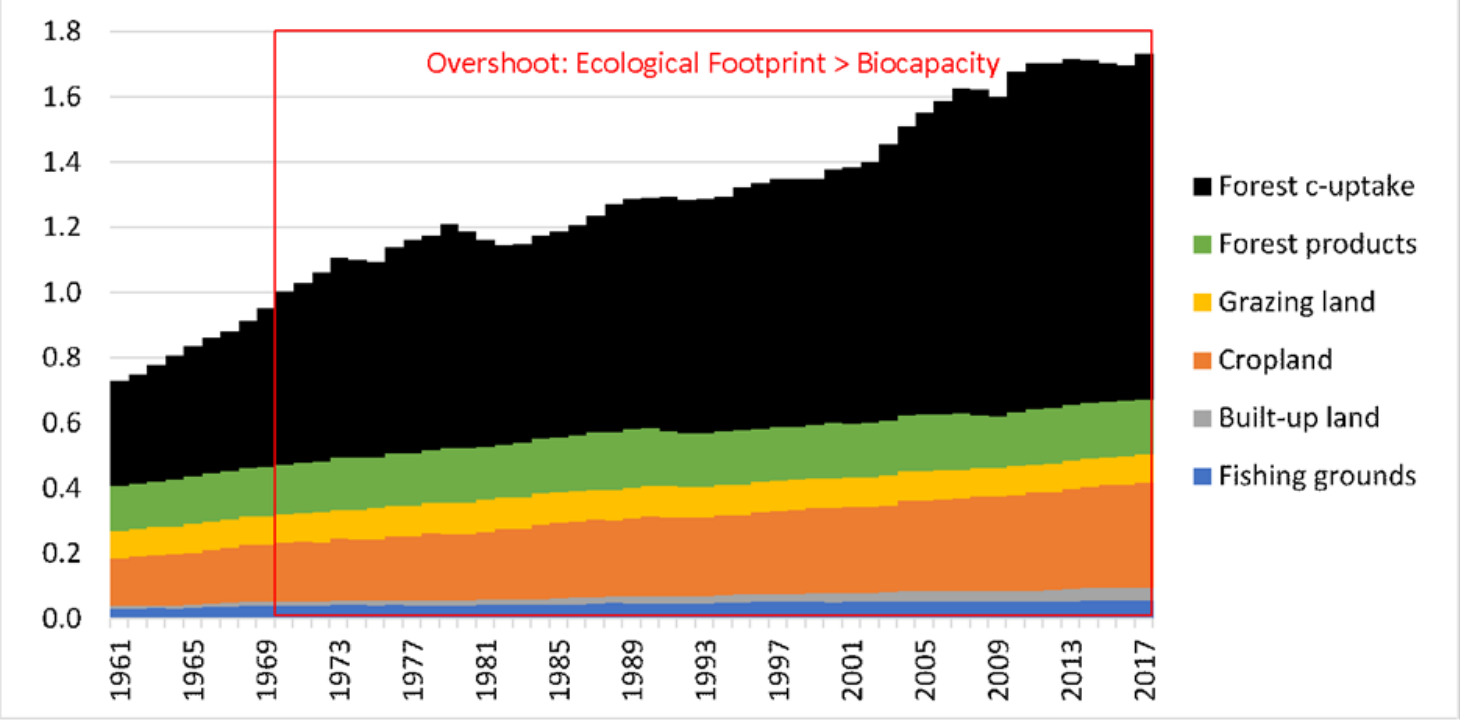

Figure 3. Global Ecological Footprint divided by global biocapacity per year, showing overshoot. A value above 1 means that footprint overshot biocapacity in that year. Since 1970 the Ecological Footprint of humanity has exceeded biocapacity in each year (Miller et al. 2021).

Status

- The Ecological Footprint of consumption in Ontario declined by 28% from 2005 to 2015. The Ecological Footprint of consumption in 2005 was 132.8 million global hectares, 106.4 million global hectares in 2010, and 96 million global hectares in 2015. Canada's Ecological Footprint of consumption declined by 13% during this period, but the Ecological Footprint of humanity's consumption increased by 14%.
- Canada's Ecological Footprint of production has been larger than its footprint of consumption because Canada's exports have been more footprint intensive than its imports. A similar pattern should be expected for Ontario during the period of 2005–2015 if not also before and after, Ecological Footprint was likely much larger than Ontario's biocapacity in each year.
- On a per capita basis, Ontario's Ecological Footprint in 2015 was 7 global hectares per person, (7.71 per person in 2005 and 6.21 per person in 2010), which was smaller than the 2015 Canadian value of 7.9 global hectares per person.
- Between 2005–2015 Ontario's Ecological Footprint declined even as its population increased. Nevertheless, Ontario's per capita Ecological Footprint (of consumption) in 2015 remained relatively high by global standards, ranking 12th highest in the world compared to other Countries, while Canada ranked 6th. In 2005, only five nations ranked higher than Ontario and in 2010, 10 nations had a higher per capita Ecological Footprint.
- In 2015, Ontario's Ecological Footprint of carbon uptake lands was greater than the area needed to provide Ontarians with food and fiber crops, forest products, and lands for settlements and infrastructure. Personal transportation demanded more carbon uptake lands than any other component of consumption, including all food consumed in Ontario.
- Ontario's 107 million hectares of lands and waters provided 96.8 million global hectares of biocapacity in 2015. Per hectare, this capacity in Ontario tended to be above the Canadian average and below the global average. Ontario's Ecological Footprint of consumption was almost equal to this biocapacity when 12.5 million gha of wetland carbon uptake is included.
- The capacity of the province's biological resources to support these demands is limited. Ontario's per capita biocapacity in 2015 was 6.15 global hectares, which is less than half of the per capita measure for Canada of 15.16 global hectares, while also being almost four times the global per capita value of 1.61 global hectares.
- Although Ontario's footprint related to carbon emissions declined since 2005, it was still too large to be sustained by carbon-uptake biocapacity in Ontario.

Links

Related Targets: N/A

Related Themes: N/A

Web Links:

National Ecological Footprint and Biocapacity Accounts data https://data.footprintwork.org

York University Ecological Footprint Initiative https://footprint.info.yorku.ca

Global Footprint Network http://www.footprintnetwork.org/

References

Galli, A., M. Wackernagel, K. Iha, and E. Lazarus. 2014. Ecological Footprint: implications for biodiversity.

Biological Conservation 173:121–132.

Miller, E., R. Robinson, M.-L. McMaster, E. Holloway and A. Kapoor. 2021. Ontario's Ecological Footprint and Biocapacity: Measures and trends from 2005 to 2015. Report submitted to the Ontario Ministry of Natural Resources and Forestry.

Ontario Biodiversity Council (OBC). 2010. State of Ontario's biodiversity 2010. A report of the Ontario Biodiversity Council, Peterborough, ON. [Available at: http://sobr.ca/report/]

Ontario Biodiversity Council (OBC). 2015. State of Ontario's biodiversity 2015. A report of the Ontario Biodiversity Council, Peterborough, ON. [Available at: http://sobr.ca/report/]

Secretariat of the Convention on Biological Diversity. 2014. Global biodiversity outlook 4. Montréal, QC.

Stechbart, M., and J. Wilson. 2010. Province of Ontario Ecological Footprint and biocapacity analysis. Copyright by Global Footprint Network, Oakland, CA.

Zokai, G., J. Ortego, D. Zimmerman, and M. Wackernagel. 2015. The Footprint and Biocapacity of Ontario, Canada: comparing results for 2005 and 2010. Global Footprint Network, Oakland, CA

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