

# Greenprint: How we can stop the sprawl

by Helena Rusak

## Beyond the Greenbelt, urban hotspots expand and highways multiply. Is there a cure for sprawl? Ontario Nature's strategy for a livable landscape

Picture this: You are being taken on a fantastic aerial tour of southern Ontario. As if you were sitting in an IMAX theatre, you are surrounded by sounds and images of unsurpassed size, clarity and impact. You feel yourself soaring over the landscape. This virtual experience is highly realistic, except that the narrator tells you the year is 2025: the near future.

What does southern Ontario look like 20 years from now? From your vantage point in the sky, you can see rolling hills of farmland and some smaller woodlots, many of them set off in perfect squares and rectangles below. A dense network of roads and highways stretches across the landscape. The river valleys retain a slim buffer of trees and vegetation. Ironically, the sprawling cities and towns, with their irregular boundaries, have taken on a more organic form than nature has. Urban areas are the new closed canopy of southern Ontario. In the Greater Golden Horseshoe area, this is particularly evident: since 2005, 3 million more people are living and working in the region, 9 million more cars are on its roads and as much as 1,070 more square kilometres have been swallowed up by urban centres - a staggering 45 percent increase in urbanized land.

Today we are at a crossroads in our planning for the future of southern Ontario. Provincial decisions made now regarding land use and urban growth will determine what kind of landscape you might fly over in 20 or 30 years. The new Greenbelt Act, which is intended to protect natural areas and agricultural lands from urban development in the Golden Horseshoe area, is a major step forward in land-use legislation.

But we can do better than this - arguably, we must do better. Southern Ontario does not end with the Greater Golden Horseshoe area (bordered by Midland in the north, Fort Erie in the south, Waterloo in the west and Peterborough in the east). A bold vision for nature protection and land-use planning should allow for a system of protected natural spaces in the shape of core areas and connecting corridors throughout the southern part of the province. These green spaces should be integrated with farmlands and urban centres.

Ontario Nature is pushing for a "Greenway," or greenprint, for all of southern Ontario. We cannot overstate the benefits of retaining our natural spaces. Air pollution kills 16,000 Canadians each year. In Ontario alone, smog is estimated to cost taxpayers more than \$1 billion a year in increased hospital admissions, emergency department visits and lost workdays due to respiratory illnesses. A Greenway means cleaner air, clean sources of water, more wildlife habitat, better soil conservation, new recreational opportunities and a better connection to nature for Ontarians.

A Greenway strategy could entail linking existing parks and natural corridors with conservation areas, significant wetlands and woodlands, and protected features such as the Niagara Escarpment, the Oak Ridges Moraine and the Great Lakes shoreline.

CONSIDER: According to the Pembina Institute, \$33 billion in new investments will be made over the next 25 years in water and wastewater treatment infrastructure in the Greater Golden Horseshoe. Compare this to a similar situation in neighbouring New York State. New York City once received naturally pure drinking water from the Catskill Mountains. As population and development pressures grew, forests in the watershed were logged to make room for farms, housing and resorts. Gradually, sewage and agricultural runoff contaminated the water until it fell below the standards set by the Environmental Protection Agency for drinking water. Officials in New York City had a choice. They could build a filtration plant for \$6 to \$8 billion (U.S.) in capital costs, plus \$300 million in annual maintenance costs, or, for \$1 billion, they could restore the Catskills watershed to somewhere near its original purification capacity, with subsequently very low maintenance costs. The decision was easy. In 1997, the city purchased forested lands in the watershed to resume the task of natural water filtration. This was but one of the many benefits provided by preserving an important green space. On the next few pages, let us explore the possibilities for a greener landscape.

This article is continued in the [Summer 2005 Issue](#) of *ON NATURE*.

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### Over the next 25 years:

In the Greater Golden Horseshoe region, 1,070 square kilometres of land will be urbanized. This is almost double the area of the City of Toronto and represents a 45 percent increase in the amount of urbanized land in the region.

Winfield, M. 2003. *Building Sustainable Urban Communities in Ontario: Overcoming the Barriers*. The Pembina Institute.

The population in the Greater Golden Horseshoe area will have increased to 10.5 million (a 43 percent increase since 2000).

Neptis Foundation, 2000.

Of the land on which this urban growth will occur, 92 percent will be on prime agricultural land.

Winfield, M. 2003. *Building Sustainable Urban Communities in Ontario: Overcoming the Barriers*. The Pembina Institute.

Greenhouse gas emissions in new suburban areas are projected to increase by 526 percent.

Winfield, M. 2003. *Building Sustainable Urban Communities in Ontario: Overcoming the Barriers*. The Pembina Institute.

The cost of delays due to traffic congestion, principally in the 905 region surrounding Toronto, will increase from about \$1 billion per year to \$3.8 billion per year.

Winfield, M. 2003. *Building Sustainable Urban Communities in Ontario: Overcoming the Barriers*. The Pembina Institute.

The Donut Effect: Statistics Canada reports that "in several census metropolitan areas, the population in the core municipality is growing more slowly than in the areas around it, forming a donut. The fastest growing municipalities are in the outlying areas. Six of the top 25 fastest growing

municipalities are in the Golden Horseshoe: Vaughan, Markham, Richmond Hill, Brampton, Barrie [and] Caledon."  
*Statistics Canada. A profile of the Canadian population: where we live. [http://geodepot.statscan.ca/Diss/Highlights/Index\\_e.cfm](http://geodepot.statscan.ca/Diss/Highlights/Index_e.cfm)*

## Water

Seventy-five percent of the water in our streams, rivers and lakes comes from the forest. Forests absorb rainwater and snowmelt and release water slowly, preventing erosion that can clog streams. Forests also filter pollutants out of water.

*Friesen, L.E. 1996. Forest birds in fragmented landscapes: The pressures from without. PhD Thesis, University of Waterloo, Ontario. 130 pp.*

A watershed is an area of land that drains into a particular body of water such as a river or lake. No matter where you live, you live in a watershed.  
*Federation of Ontario Naturalists. 2003. Water at risk: it's our source for life (brochure).*

More than 75 percent of southern Ontario's wetlands have been lost due to draining, filling or other habitat alteration. Eighty to 90 percent of Canada's urban wetlands have been destroyed.

*Friesen, L.E. 1996. Forest birds in fragmented landscapes: The pressures from without. PhD Thesis, University of Waterloo, Ontario. 130 pp.*

A projected \$33 billion in new investments will soon be needed in the water and wastewater treatment infrastructure in the Toronto-centred region (the area from Midland to Fort Erie, Waterloo to Peterborough).

*Winfield, M. 2003. Building Sustainable Urban Communities in Ontario: Overcoming the Barriers. The Pembina Institute.*

## Wildlife

More than 2,535 species of breeding birds, mammals, fish, reptiles, amphibians and flowering plants inhabited Ontario several hundred years ago. More than 50 of these are now locally extinct. Still other species persist at much-reduced population levels.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.13.*

There are more than 60 endangered species in southern Ontario.

*Royal Ontario Museum. Date unknown. Ontario's species at risk. [rom.on.ca/ontario/risk.php](http://rom.on.ca/ontario/risk.php). Accessed 2005 March 13.*

Forest birds and small mammals are more likely to travel via fencerows between woodlots than across open fields.

*Wegner, J.F., G. Merriam. 1979. Movements by birds and small mammals between a wood and adjoining farmland habitats. Journal of Applied Ecology 16: 349-357.*

Forest interior habitat species include: scarlet tanager, red bat, red squirrel, spring beauty and red trillium.

*Ministry of Natural Resources. 2000. Extension notes – Conserving the forest interior: a threatened wildlife habitat. Toronto: Queen's Printer for Ontario.*

Wildlife can use small patches of natural habitat and fencerows as stepping stones between larger forested areas.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.26.*

Habitat connectivity is in the eye of the beholder: the woodland vole forages within 15-30 metres of its nest; a red fox may travel up to 8 kilometres per night in search of food.

*Cooper JL. 2000. Special animal abstract for *Microtus pinetorum* (woodland vole). Michigan Natural Features Inventory, Lansing MI. 2 pp. Available from [http://web4.msue.msu.edu/mnfi/abstracts/zoology/Microtus\\_pinetorum.pdf#search=woodland%20vole%20foraging%20orange](http://web4.msue.msu.edu/mnfi/abstracts/zoology/Microtus_pinetorum.pdf#search=woodland%20vole%20foraging%20orange). Accessed 2005 Feb. 27. [natureserve.org](http://natureserve.org) for red fox. Accessed 2005 Feb. 27.*

Trade in peregrine falcon and eastern prairie fringed-orchid – both Ontario species at risk - is controlled under the Convention on International Trade in Endangered Species.

*<http://www.cites.org/eng/append/appendices.shtml>. Accessed 2005 Feb. 26.*

Fragmentation generally leads to colonization by non-native, invasive species.

*Meffe GK, Carroll CR. 1997. Principles of conservation biology. 2nd ed. Sunderland MA: Sinauer Associates Inc. 729 p. See p. 291-294*

Wide-ranging species such as large carnivores are usually the most threatened by habitat fragmentation. This is due to shrinking habitat and prey availability, and increased human-induced mortality as animals travel through the fragmented landscape.

*Harris LD, Gallagher PB. 1989. New initiatives for wildlife conservation: the need for movement in corridors. In G. MacKintosh (ed.), Preserving communities and corridors, pages 11-34. Washington: Defenders of Wildlife. As cited in Meffe GK, Carroll CR. 1997. Principles of conservation biology. 2nd ed. Sunderland MA: Sinauer Associates Inc.*

## Forests and Plants

Across southern Ontario, woodland losses have exceeded losses of almost any other major ecosystem.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.27.*

The impacts of development on woodland biodiversity are striking: a 1996 study found that four-hectare woodlots without any nearby housing had on average a richer, more abundant neotropical community than 25-hectare urban woodlots. Conclusion: the future of forest-dwelling neotropical migrants in settled landscapes depends on the availability of rural woodlands.

*Friesen, L.E. 1996. Forest birds in fragmented landscapes: The pressures from without. PhD Thesis, University of Waterloo, Ontario. 130 pp.*

Toronto's urban forest traps or absorbs 614 tonnes of ozone per year, 117 tonnes of sulphur dioxide per year, 306 tonnes of nitrogen oxide per year and 452 tonnes of particulates per year.

*Friesen, L.E. 1996. Forest birds in fragmented landscapes: The pressures from without. PhD Thesis, University of Waterloo, Ontario. 130 pp.*

Almost no old-growth forest remains in southern Ontario. Less than 0.07 percent of the land base is in vital old-growth habitats.  
*Neptis Foundation, 2000*

Since 2003, more than 16,000 trees have been cut down in North York, Etobicoke and Vaughan as a result of Asian long-horned beetle infestation.  
*The Toronto Star: April 20, 2005*

Trillium seeds are dispersed by ants and do not survive well in edge habitats or small forest patches; nor will they disperse between habitat fragments.  
*Ness JH. 2004. Forest edges and fire ants alter the seed shadow of ant-dispersed plants. Oecologia 138(3): 448-454.*

Square or circular forest patches provide the greatest amount of interior habitat; irregularly-shaped patches may provide none.  
*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-forest-e.html. Accessed 2005 Feb. 22*

Edge habitat tends to favour generalist species, whereas specialist species tend to require interior habitat.  
*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-forest-e.html. Accessed 2005 Feb. 22*

Forest interiors are more likely to be sheltered from the harmful effects of wind and sun if they are surrounded by a dense stand of trees around their edges; especially on their southwest-facing side.  
*Friesen L and Stabb M. 2001. Conserve Ontario's Carolinian Forests – Preserve Endangered Songbirds. Acadian Flycatchers and Hooded Warblers. Port Rowan: Bird Studies Canada.*

Vegetation improves water quality by absorbing excess nutrients, fertilizers and even some toxins. Forests, wetlands, grasslands and other habitat types act as huge sponges, soaking up surplus water after rain and snowfall and releasing it slowly back into streams and groundwater reservoirs.  
*Federation of Ontario Naturalists. 2003. Water at risk: it's our source for life (brochure).*

A recent study of bloodroot, whose seeds are dispersed by ants, revealed that seed-bearing ants avoid forest edges and instead carry bloodroot seeds toward the interior of the forest. This may explain why bloodroot and other ant-dispersed plants (for example, trillium) don't survive well in edge habitat or small forest patches, and why they don't disperse well between habitat fragments.  
*Ness JH. 2004. Forest edges and fire ants alter the seed shadow of ant-dispersed plants. Oecologia 138(3): 448-454.*

## Corridors and Biodiversity

The concept of wildlife corridors was first proposed in 1936 by G.G. Simpson.  
*Voller J and Harrison S. 1998. Connectivity. Page 78 in: Voller J and Harrison S (eds.). Conservation biology principles for forested landscapes. Vancouver: UBC Press.*

Preserving urban green spaces is only part of maintaining urban biodiversity. Without connections between green spaces such as corridors, plant and animal habitats become isolated and more vulnerable to disease and extinction.  
*Rudd H, Vala J, Schaefer V. 2002. Importance of Backyard Habitat in a Comprehensive Biodiversity Strategy Study: A connectivity analysis of Urban Green Spaces. Restoration Ecology 10(2): 368-375.*

Natural corridors, which are more or less elongated, link or border natural areas in the countryside and exist at different scales. Hedgerows, old fields and rights-of-way act as corridors. Larger corridors can serve as passageways for plant and animal species and communities and as protective buffer zones for conservation lands and waters.  
*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.41.*

Corridors:

- Enhance the movement of plants, animals and other organisms;
- Minimize the effects of water and nutrient runoff, and wind damage (e.g., soil erosion);
- Provide habitat for some species;
- Provide ecological services (e.g., moisture and temperature moderation through shade, dispersal points for wildlife);

*Forman RTT. 1983. Corridors in a landscape: their ecological structure and function. Ekologia 2(4): 375-387. As cited in Voller J and Harrison S. 1998. Connectivity. Pages 93-94 in: Voller J and Harrison S (eds.). Conservation biology principles for forested landscapes. Vancouver: UBC Press.*

Early successional natural forest ecosystems and plantations, including smaller sites, should be retained because they serve as corridors and connecting links, as viable habitats for diverse non-mobile species and as part of the woodland mosaic.  
*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.24.*

When an area first becomes isolated due to fragmentation, mobile animal species may initially become more abundant as they are displaced from their former homes. This phenomenon has been called "crowding on the ark" and is usually followed by population collapse.  
*Meffe GK, Carroll CR. Principles of conservation biology. 2nd ed. Sunderland MA: Sinauer Associates Inc. 729 p. - see p. 290*

The Quebec City - Windsor corridor contains almost half of Canada's threatened or endangered species, as well as almost half of Canada's human population. Although cities and towns account for only a small portion of Canada's land area, most of them are in the richest of Canada's ecosystems in terms of species. For this reason, the abundance and arrangement of green spaces in cities, and their connections with each other and the surrounding countryside, are critical to maintaining biodiversity.  
*Environment Canada, 1994. Biodiversity in Canada: A Science Assessment for Environment Canada – Chapter 6: Effects of Urbanization on Biodiversity in Canada.*

The common buckeye and variegated fritillary butterflies move more frequently between habitat patches connected by corridors, than between habitat patches not connected.  
*Haddad NM. 1999. Corridor and distance effects on interpatch movements: a landscape experiment with butterflies. Ecol. Appl. 9(2) 612-622.*

## Woodland Size

A 1996 study found that migrating birds consistently increase in number and abundance as forest size increases.

*Friesen, L.E. 1996. Forest birds in fragmented landscapes: The pressures from without. PhD Thesis, University of Waterloo, Ontario. 130 pp.*

"Area-sensitive" songbird species will only settle in habitat patches many times the size of their territories.

*Meffe GK, Carroll CR. 1997. Principles of conservation biology, 2nd ed. Sunderland MA: Sinauer Associates Inc.*

Small woodlands (less than four hectares) play a critical role in local diversity. Woodland retention may be the only means of conserving some species-at-risk, and non-mobile animals, plants, insects, and soil flora and fauna.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.24.*

Several smaller sites normally contain more plant species than one large one, even if their combined areas are equivalent to the larger site's area. If species are protected at several small sites, they will be more likely to survive.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.26.*

In southern Ontario, many significant natural areas, such as prairies, bogs and fens, maintain their composition at sizes of two hectares or less.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.26.*

Small tracts of natural habitat can increase a species's ability to travel through highly fragmented landscapes. The smaller islands and fencerows serve as stepping stones between larger forested areas.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.26.*

For some species it is essential that larger tracts of forest also be present regionally in addition to smaller areas. For example, spring warblers experience a net energy (fat) loss while foraging in isolated woodlots compared to large forest tracts.

*Riley, J., P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A review of conservation and restoration ecology for land-use and landscape planning. OMNR, Aurora. p.26.*

Where there is low forest cover, forest patches must be large enough to support several breeding bird pairs, to prevent local extinction (extirpation).

*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-forest-e.html. Accessed 2005 Feb. 22.*

## Wetlands and Marshes

The Ramsar Convention on Wetlands (1971), recognizes eight wetlands of international importance in Ontario: Polar Bear Provincial Park, Southern James Bay, Matchedash Bay Provincial Wildlife Area, Long Point, Mer Bleue Conservation Area, Minesing Swamp, Point Pelee, St. Clair National Wildlife Area. All but two are in southern Ontario.

*http://www.ramsar.org/profiles\_canada.htm. Accessed 2005 Feb. 26.*

Marshes constitute only 10 percent of southern Ontario's wetland area, and several species at risk, such as the spotted gar (Threatened), king rail (Endangered), least bittern (Threatened), and northern map turtle (Special Concern), require them for their survival.

*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-guide-e.html. Accessed 2005 Feb. 22.*

Almost 64 percent of Lake Ontario fish species use coastal marshes for spawning, and 86 percent use marshes as nursery habitat.

*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-guide-e.html. Accessed 2005 Feb. 22] – Jude, D.J. and J. Pappas. 1992. Fish utilization of Great Lakes coastal wetlands. J. Great Lakes Res. 18: 651-672.*

Short-eared owls will only use marshes larger than 100 hectares in size.

*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-guide-e.html. Accessed 2005 Feb. 22.*

## Air Quality

Each year, 1,900 premature deaths are attributed to poor air quality in Ontario. This deterioration in air quality is largely due to motor vehicle use resulting from urban sprawl.

*Friesen, L.E. 1996. Forest birds in fragmented landscapes: The pressures from without. PhD Thesis, University of Waterloo, Ontario. 130 pp.*

Air pollution is linked to the premature deaths of up to 16,000 Canadians each year.

*(Environment Canada)*

Non-commercial vehicles are responsible for more than 50 percent of smog-causing nitrogen oxides and 30 percent of smog-causing volatile organic compounds in the air.

In Ontario alone, smog is estimated to cost taxpayers more than \$1 billion a year in increased hospital admissions, emergency department visits and lost workdays due to respiratory-related illnesses.

*Ontario Medical Association. 2000. The illness costs of air pollution: A summary of findings. oma.org/phealth/cap.htm. Accessed 2005 Mar. 10.*

Forests can absorb carbon dioxide and some air pollutants, and "breathe" out much needed oxygen. Toronto's urban forest traps or absorbs pollutants in great quantities. For example: 614 tonnes of ozone per year, 117 tonnes of sulphur dioxide per year, 306 tonnes of nitrogen oxide per year, and 452 tonnes of particulates per year.

*Ontario Nature. 2003. Urban forests: An important part of our natural heritage (fact sheet).*

## Human Impact

During the European settlement of Ontario in the nineteenth century, over 90 percent of southern Ontario was covered by forests. Since then, 80 percent of the upland woodlands south and east of the Canadian Shield have disappeared.

*Wood, D.J. 2000. Making Ontario. McGill Queen's University Press, Montreal & Kingston.*

The Ontario Home Builders' Association reports that in 1994, there were 46,645 housing starts. In 2004, there were 85,114.

*Ontario Home Builders' Association. Date unknown. Total housing starts, Ontario, 1994 – 2004. homesontario.com/ohba/starts/starts1993-2002.shtml. Accessed 2005 Mar. 13*

The establishment of rural subdivisions or "estate homes" in natural areas bring with them not only increased population density, but a host of other related problems such as an increase in household pets, automobiles and road-killed wildlife, encounters with "nuisance" wildlife, landscaping with exotic plants, increased light and noise. Studies suggest that this in turn results in an increase in human-adapted, generalist species at the expense of more sensitive, specialist species.

*Knight RL. 1997. Subdividing the west. Pages 272-274 in Meffe GK, Carroll CR. Principles of conservation biology. 2nd ed. Sunderland MA: Sinauer Associates Inc.*

The proximity of housing developments to woodlands can negatively impact a woodlot's suitability for neotropical migrants.

*Friesen, L.E. 1996. Forest birds in fragmented landscapes: The pressures from without. PhD Thesis, University of Waterloo, Ontario. 130 pp.*

Eighty percent of Essex County's forest interior bird species have disappeared; forest cover accounts for only three percent of the county.

*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-forest-e.html. Accessed 2005 Feb. 22.*

Ottawa-Carleton, with over 29 percent forest cover, is estimated to house all of the 94 bird species expected for that area. The same study found only 61 percent of expected bird species were found in Essex County (with 3 percent forest cover). Roughly 81 percent of expected bird species were found in Middlesex County, which a forest cover of 13.5 percent.

*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-forest-e.html. Accessed 2005 Feb. 22*

Riley, J.L. and P. Mohr. 1994. The Natural Heritage of Southern Ontario's Settled Landscapes: A Review of Conservation and Restoration Ecology for Land-Use and Landscape Planning. Ontario Ministry of Natural Resources, Southern Region, Aurora, Ontario. 78pp. ALSO Cadman, M.D., P.F.J. Eagles and F.M. Helleiner. 1987.

*Atlas of the Breeding Birds of Ontario. University of Waterloo Press. Waterloo.*

Essex County and the former Kent County (now part of the Municipality of Chatham-Kent) were originally between 60 and 80 percent wetland.

*CWS Ontario Region: on.ec.gc.ca/wildlife/docs/frame-guide-e.html. Accessed 2005 Feb. 22.*

There are approximately 9.7 million registered vehicles in Ontario.

*Ontario Ministry of Transportation. 2004. About the ministry: Quick facts. mto.gov.on.ca/english/about/quickfacts.htm. Accessed 2005 Mar. 14.*

There are 16,520 kilometres of highway in the provincial network.

*Ontario Ministry of Transportation. 2004. About the ministry: Quick facts. mto.gov.on.ca/english/about/quickfacts.htm. Accessed 2005 Mar. 14*

There are approximately 230,600 kilometres of roads (2-lane equivalent) in Ontario.

*Transport Canada. 2003. Transportation in Canada 2003 annual report: Addendum. Ottawa: Minister of Public Works and Government Services Canada. 106 pages. Available from tc.gc.ca/pol/en/anre/Transportation\_Annual\_Report.htm. Accessed 2005 Mar. 13.*

At an average lane width of 3.5 metres, this amounts to 807 square kilometres of road surface.

*Transport Canada. 2000. Technical standards document No. 500 – low-speed vehicles. Available from tc.gc.ca/roadsafety/mvstm\_tsd/tsd/500\_e.htm. Accessed 2005 Mar. 13.*