Ministry of Natural Resources

Ontario

Natural. Valued. Protected.

Leading Edge

Innovations in MNR science, research, and geographic information

September 2009

Contents

There are great things happening in the science world at Ontario's Ministry of Natural Resources

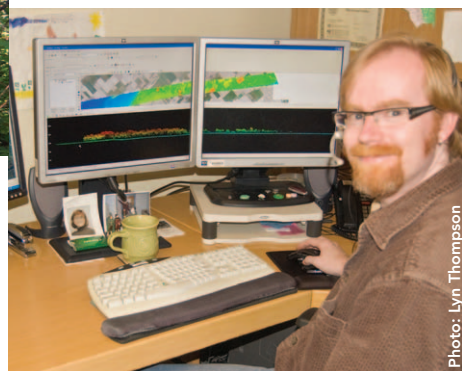
Welcome to the first issue of *Leading Edge*, MNR's science and geographic information magazine. From Kenora to Timmins to Peterborough and all points between, our staff are leading the development and implementation of natural resources science and geographic information, and we want to tell you about it.

Our work focus is broad, and our results are recognized internationally. We provide science and geographic information for forest management, climate change, species at risk, land use planning, fisheries and wildlife management and protection, water resources, and you, the public.

This document highlights some of our success stories such as bringing southern Ontario's blowsand areas back to healthy forests—or Land Information Ontario's *Make-a-Map* website, where you can make your own map for your next hunting or back country adventure.

We're proud of the work we do, and we hope you enjoy reading about it. If you'd like more information on these topics or want to know more about what we do, contact us at 1-800-667-1940 or mnr.nric.mnr@ontario.ca. We'd like to hear from you.

A researcher collects data on habitat.



Specialist mapping bird habitat using imagery and LiDAR.

After being processed and collared, a moose calf is returned to the cow.

A researcher banding a Canada goose.

Blowsand area in the1900s.

A former blowsand area that is a healthy forest today.

The amazing journey of Ontario's former blowsand areas

A tree planting success story: yesterday's blowsand areas are today's healthy, biologically diverse red pine plantations, providing ecological, economic, recreational and other values to the people of southern Ontario.

If you could go back in time a hundred years and tour southern Ontario, you might be shocked to see expanses of desert along the way. Where did they come from? And why aren't they there anymore?

The transformation of these deserts or *blowsand areas* is one of Ontario's most interesting ecological restoration stories. Bill Parker, a researcher with MNR's Ontario Forest Research Institute (OFRI) in Sault Ste. Marie, begins the tale.

"The Europeans who began arriving in southern Ontario in the early 1800s were very efficient at clearing the forests for farming as well as timber harvesting," he explains. "They not only used the timber for construction but also shipped it back to England. Ontario's white pines, for example, were coveted for ship's masts and other naval uses. The settlers also burned many of the original forests to clear the land for farming."

By about 1880, 75 to 80 per cent of southern Ontario`s forests were gone. In areas where glaciers had deposited sand and gravel, deforestation led to ecological disaster.

"After the trees were removed and the land plowed, the thin topsoil eroded and blew away," Parker says. "Remaining were barren wastelands covering up to 300 hectares, and the farms had to be abandoned."

Tree planting to the rescue

"In the early 1900s, the Ontario government began working with counties to draw up laws and agreements to encourage tree planting in the blowsand areas," says Ken Elliott, a forestry specialist at MNR's Southern Science and Information office in London.

Conifers were chosen as they could tolerate the conditions of the dry, infertile blowsands. Red pine was seen as the species that could best stabilize these sites and would have future value.

Over the 20th century, these mostly publicly owned plantations grew well. They allowed for soil enrichment and shelter under which plants and wildlife could thrive. Degraded waterways were restored, and erosion, sedimentation, and flash flooding returned to natural levels. Millions of people have enjoyed hiking, skiing, cycling, and other activities in these plantations without realizing their historic nature. County governments and other owners have reaped as much as $1 million per year through careful management, including harvesting mature pines for utility poles and other uses while fostering natural regeneration of native tree species.

"Some people criticize tree plantations as being unnatural," Elliott says. "But no one can dispute that they have transformed the blowsand areas back into healthy, diverse forests. It's a remarkable success story and was the beginning of ecological restoration in Ontario."

John McLaughlin, another OFRI research scientist working in these plantations, likes to tell how John Wilson, a former MNR employee in Kemptville, often hosted tours of the Larose Forest, a former blowsand area. "He would show pictures of the blowsands and talk about how forest management had converted desert into orchid habitat. He would then point out the pink lady's slippers growing at their feet. It was always a moment of awe for the audience."

What does the future hold for Ontario's former deserts?

One concern for researchers and forest managers is a puzzling increase in the death of *pockets* (large patches) of red pines in some plantations, which has resulted in lost revenue for counties and fears that less desirable species such as raspberry and Manitoba maple will take over. McLaughlin has been investigating a range of factors that might be contributing to this decline.

Even so, the former blowsand areas are slowly returning to what they were before European settlement: healthy forests teeming with a diversity of tree, plant, and wildlife species.

Old pine stump in a thriving red pine plantation in southern Ontario.

Introducing... Bill Parker

How can forest managers ensure their practices encourage *natural regeneration* and get the next generation of trees to sprout and grow naturally?

This question is one that research scientist Bill Parker of MNR`s Ontario Forest Research Institute (OFRI) has been working on since he came to OFRI 17 years ago. As an ecophysiologist, he investigates how different tree species respond to variations in water, light, temperature, and soil nutrients. This research has helped him and his colleagues to determine what conditions are needed for natural regeneration—and when seedlings should be planted to achieve the desired future forest. Also important is understanding how human activities such as harvesting methods, fire suppression, and prescribed burns affect growing conditions and thus seed germination and seedling survival/growth.

Parker and his colleagues have added much to what we know about natural regeneration, especially that of eastern white pine, Ontario's provincial tree, which has declined greatly over the past century. He is also now studying climate change, investigating how far seeds should be planted from their geographic origin to ensure they are genetically suited to expected future temperatures, rain/snowfall, and other conditions.

Can forest biomass play a key role as a renewable energy source?

Roadside slash is typically piled and burned to increase the amount of area available for regeneration. These materials could represent an important source of biofuel.

Photo: OMNR

Generating energy from forest biomass is making a comeback due to rising fuel prices and environmental problems associated with burning fossil fuels.

Possible sources of forest biomass include roadside slash, undersized trees, and tree species that are not useful for paper or wood products. As the market demand for timber and pulp declines, even standing trees may become economically viable as a fuel source. These materials can be turned into pellets and burned for energy or distilled into a liquid fuel.

However, removing biomass from forests could affect the ecosystem. Some questions that researchers are pondering: How could harvesting biomass for fuel affect biodiversity in the forest? Could it affect how carbon cycles through the forest, in turn affecting the rate of climate change? And what will the effect be on the amount of nutrients available to maintain forest productivity? Working with Canadian Forest Service researchers, Dave Morris of MNR's Centre for Northern Forest Ecosystem Research is looking at how removing biomass in black spruce and jack pine forest ecosystems could affect long-term productivity (forest growth). These efforts are part of the North American-wide Long-Term Soil Productivity (LTSP) research program that includes a network of nearly 100 experimental sites.

"Our research project aims to discover the effects of forest biomass removal on soil carbon, nutrients, and associated processes," Morris explains. "We want to know whether or not removing these woody materials—how much and what kind—will result in a less-productive forest over the long term."

Some countries are already using substantial amounts of biomass for fuel. "In Sweden, for example, 24 per cent of the national energy demand is supplied by biomass, most of which comes from harvesting residues following clearcut operations in boreal forests," Morris says.

Researchers will complete the 15th year measurements on Ontario's 18 LTSP experimental sites in fall 2009, with preliminary results and recommendations expected by as early as 2010. Depending on the results of this research, biomass may one day play a key role in Ontario's bioeconomy and become an important source of renewable energy.

Photo: OMNR

First year vegetation regrowth in test plot following a full-tree harvest clearcutting operation.

Did you know...?

Situated on Lakehead University campus in Thunder Bay, the Centre for Northern Forest Ecosystem Research (CNFER) conducts long-term research on the effects and effectiveness of Ontario's resource management guidelines. CNFER staff are currently undertaking research in the areas of moose, caribou, songbird, and other wildlife habitat, fish habitat, silviculture, renewable energy, and tourism values in Northern Ontario.

Visit *ontario.ca/mnr* and click on *Programs & Services - Centre for Northern Forest Ecosystem Research*, or call (807) 343-4000.

Two hundred thousand hunters help to set harvest quotas

Have you ever wondered how wildlife harvest quotas are set in Ontario? They are set with help from hunters and trappers and the folks at the MNR's Wildlife Aging Laboratory in Bracebridge.

Since the 1980s, staff at the Wildlife Aging Lab have been managing harvest information on deer, moose, and bear. "Each year we mail out about 200,000 voluntary harvest survey questionnaires to hunters who buy deer or moose licenses in Ontario," says wildlife biologist Linda Dix-Gibson. "The survey asks questions about their hunting experience—did you shoot a deer or moose? In which wildlife management unit did you hunt? What firearm did you use? How many days did you hunt? How many live deer or moose did you see while hunting? We give similar mandatory surveys to hunters who buy black bear or wolf licenses in Ontario."

Dix-Gibson puts all this harvest information together and sends the results to wildlife biologists across the province. "The biologists determine the number of adult moose tags, antlerless deer tags, and additional deer seals that MNR can issue and still maintain healthy populations."

Staff at the lab also help Ontario wildlife managers by finding out the age of bear, moose, and marten from the teeth of harvested animals. "We cut a thin slice from the root of the tooth, stain it to give it color and then view it under a microscope. To figure out the age of the animal we count the rings around the outside of the root—just like you would count rings in a tree," Dix-Gibson explains.

Wildlife biologist Linda Dix-Gibson at microscope.

Sectioning black bear tooth.

Wildlife aging technician Rose Emerson sectioning black bear tooth.

Photos: Linda Dix-Gibson

Black bear tooth and section removed.

"We encourage bear hunters to submit two premolar teeth from harvested bears in exchange for a bear hunter crest and information on the age of their bear," Dix-Gibson says. "We get teeth from around 2,800 of the 6,200 bears harvested each year."

District biologists use this information to determine the sustainability of harvests and set marten quota levels for the following year.

Did you know...?

Our Aging Lab staff assist district biologists in setting marten harvest quotas. Trappers across northern Ontario send marten heads to the aging lab where staff remove the lower jaw, boil it, and extract a canine tooth. Technicians can tell the sex and age—juvenile or adult—of the marten from x-rays of the teeth.

Photo: Kate Zhang

Do slot-size fishing regulations help manage fish populations?

Photo: Chuck McCrudden

Slot-size fishing regulations are designed to allow enough fish of reproductive age to survive—providing angling opportunities and sustainable populations. These rules help anglers identify which size of fish they are allowed to harvest.

Research scientist David Evans of MNR's Aquatic Research and Development Section is studying the effectiveness of size-based fishing regulations for lake trout in Haliburton County (south-central Ontario). Evans' team is also investigating the effectiveness of fish stocking in combination with slot size regulations.

Lake trout grow very slowly and mature late in life, so their populations are especially sensitive to high fishing pressure. Slot-size regulations and stocking are two quite different management techniques designed to solve the problem of overexploitation of slow growing stocks of wild lake trout.

Evans' study examines different harvest and stocking scenarios over an extended period of time from 2000 to 2010 across four lakes in Haliburton County.

What we found out

- ***slot-size regulations***

By reducing fishing mortality, researchers saw that slot size regulations clearly protected lake trout of prime spawning ages (6 to10 years) by reducing fishing mortality. This shows that regulations are an effective management approach for ensuring the long-term sustainability of wild lake trout stocks.

- ***no slot-size regulations***

After slot regulations were removed in two lakes, the rate of people catching and keeping their fish increased dramatically during the first few years. The total harvest of fish then fell back to pre-slot amounts showing that high fishing pressure has depleted these populations.

- ***stocked and no size limits***

Stocking in the absence of a slot-size regulation provided some incentive for anglers but could not counteract the impacts of high fishing pressure and high mortality rates, placing the population at risk.

- ***stocked…but with size restrictions***

Stocking has not proved to be a "hook" for anglers when slot-size regulations are in place, because what anglers are allowed to keep (based on size) is restricted to provide protection for the highly vulnerable, mature adults.

What's the verdict?

A management strategy that combines slot-size protection with stocking of lakes with poorer habitat seems to be the best approach for providing both angling opportunities and ensuring the long-term future for Ontario's native lake trout.

Have you ever seen the American marten in the wild?


Photo: Daniel Gabcan

If you haven't, you are not alone! The American marten, which is similar to a mink, is definitely elusive, spending much of its time in trees. However, they are an important part of Ontario's boreal forest ecosystems, and they are considered during forestry planning. Martens also provide an important source of income for northern Ontario trappers due to their valuable fur.

These inquisitive creatures like to live in mature forests dominated by conifer trees such as spruce. Ensuring these forests are sustained helps not only marten populations but also northern Ontario's sawmills and pulp and paper mills, which provide jobs for thousands of people.

Learning more about what kind of forest martens need to live, hunt, and reproduce is one way to make sure martens thrive. Marten research has been done before in Ontario, but a recent long-term study by MNR, the University of Guelph, and the Canadian Forest Service focused on sustaining this species in the managed forest in northern Ontario.

"We were interested in learning how well *regenerating* forests—ones that were harvested 20 to 40 years ago and in which a new forest has been growing—can support marten populations," explains Jim Baker of MNR's Applied Research and Development Branch. "Guidelines for managing marten habitat were developed using the best available scientific information, but we wanted to test some of the critical assumptions underlining direction in the guidelines, so we could make changes if necessary."

Over the past eight years, field technicians have captured and placed radio collars on hundreds of martens at two sites in northern Ontario. Researchers have analyzed the electronic signals from these collars to find out what kind of forest martens prefer, how large an area they call home, and how successfully they hunt and capture prey such as red-backed voles. Among other things, researchers discovered that marten are more likely to be found in regenerating forests than was previously thought, especially if some dead trees were left on the forest floor after harvesting. Martens use fallen logs to travel along the forest floor, searching for small rodents to eat; rodents are often hiding beneath the dead wood.

Researchers have also looked at where martens like to give birth. In the early 2000s, field crews were able to track female martens to their birthing dens, but researchers with MNR's Northeast Science and Information Section (NESI) decided to find out exactly what martens prefer. "We followed radio-collared marten throughout the year, but really took things seriously in the spring when the babies are born," says Stephen Mills, NESI's forest wildlife habitat specialist. "We followed them until mid-summer when the young are less dependent on their mother and more likely to travel away from dens for days at a time."

He says that most of the dens were in hollow logs or other previously reported locations. However, he notes that they often found dens in areas with more trembling aspen than the surrounding forest, which was "somewhat surprising."

"We're now in a better position to protect marten habitat and populations," he concludes. "By understanding the importance of things like the amount of downed wood and tree age, we can help minimize the conflict between martens and human activity."

Did you know...?

As a member of the weasel family, martens eat mostly meat, hunting and killing rodents, birds, and snowshoe hares—they will also eat vegetable matter, particularly forest berries.

Martens are sought as a furbearing mammal, with moderate demand and reasonably high fur prices.

Taking a flying leap—where are flying squirrels headed?

Okay, "flying" is a little misleading, it's more of a glide. Nevertheless, recent studies are showing that flying squirrels are on the move—with some interesting outcomes.

Southern flying squirrel.

Photo: Jeff Bowman

Both the northern and southern flying squirrel are native to North America. Northern flying squirrels are typically found in coniferous forests throughout Ontario, while southern flying squirrels are limited by cold winters and mainly live in hardwood forests, south of Dorset, Ontario.

Jeff Bowman, research scientist with MNR's Wildlife Research and Development Section, has recently wrapped up a study with Trent University graduate students Colin Garroway and Andrea Coombs to look at flying squirrel distribution, genetics, and impacts of climate change.

The lowdown...

With a recent run of warm winters, southern flying squirrels are travelling much farther north than their historical northern range-limit. This expansion in range has brought them much closer to their related counterpart, the northern flying squirrel.

A bit of background...

Bowman's research began in 2002 by tagging and taking DNA samples of both flying squirrel species from across the area where these two species overlap. The sampling area extended from Lake Erie to Temagami. Because southern flying squirrels were listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a species of special concern, the research team wanted to look at distribution and genetic structure of both species. They also looked at nesting differences between the species and range of movement.

What did they find?

By 2003, they realized that the southern species was about 200 kilometres north of where the 1988 COSEWIC status report listed their range. With southern flying squirrels moving into northerners' territory, the team soon came across hybrid flying squirrels. In fact, it was determined that at least four per cent of the animals were genetic hybrids.

The big picture...

- This is the first contemporary evidence of hybridization between species that is directly attributable to climate change.
- It shows that climate change can cause rapid shifts to species' ranges and can result in interbreeding of two closely related species.
- Hybridization can affect how well a population is going to do, since new genes are introduced to the species.
- Conservation implications are still unknown, but hybridization may play an important role in adaptation—especially in a rapidly changing climate.

Bowman and Garroway published *Climate Change Induced Hybridization in Flying Squirrels* in 2009. The southern flying squirrel was de-listed by COSEWIC in 2006, based in part on findings in Bowman's publication, *Northern Range Boundary Dynamics of Southern Flying Squirrels: Evidence of an Energetic Bottleneck* in 2005.

Did you know...?

Flying squirrels don't actually fly—they glide. In fact, they can't gain elevation; they glide from tree to tree and to the ground. A thin membrane, called the patagium, connects the flying squirrels' "arms and legs" and acts like a parachute. With outstretched limbs, and using the tail for stability, a flying squirrel can glide a distance of three times the height at which it takes off.

How Ontario's lakes get their names

Whether we use *Google Maps*, global positioning systems (GPS) or traditional paper maps, the names of places and features such as hills, valleys, rivers, islands, and lakes help us understand where we are and where we want to go. So, who decides if a body of water is named Crystal Lake or Muck Lake?

"In Ontario, the naming of geographic places and features is governed by *the Ontario Geographic Names Board Act*," says Jeff Ball, with MNR's Geographic Information Branch. "MNR administers *the act* on behalf of the province."

Ball points out that we have used geographic names for centuries to help us reference our place in the world, travel, and create maps. The naming of places and features allows us to understand and remember multiple locations as well as information about locations.

"Names can commemorate great persons and important events, providing valuable insight into the history and culture of an area," Ball says. "They can also tell us about the landscape and natural resources around us."

In the distant past, the naming of geographic features was fairly informal: A settler might notice that a nearby lake was shaped like a beaver tail and name it Beavertail Lake. Today, the Ontario Geographic Names Board works with local communities and governments, including First Nations, to determine what names are used in the local area and then recommends these names for approval.

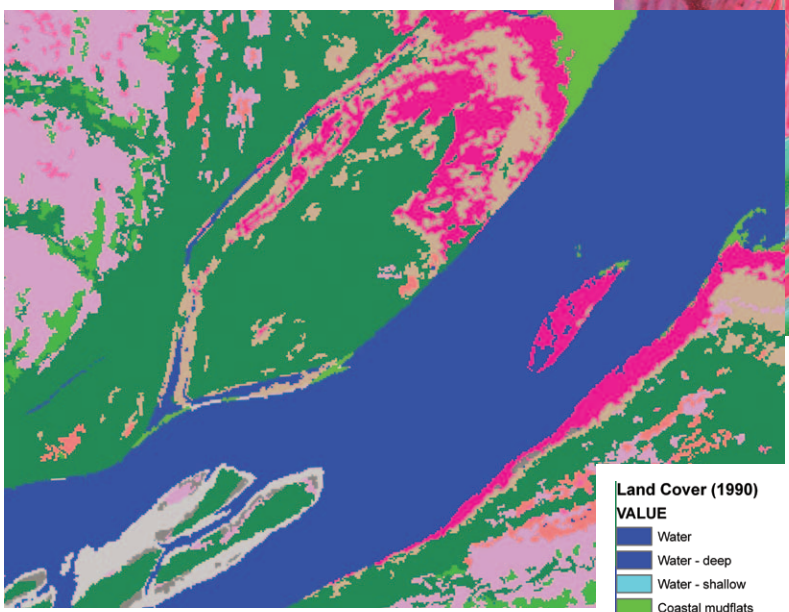
Did you know...?

Although often spelled *Temiskaming District*, the official spelling is actually *Timiskaming*. *Timiskaming* is a First Nation word meaning "place of deep, dry water," referring to the clay flats in the northeastern part of Lake Timiskaming, which are exposed and dry when the water in the lake is low.

In 2008, MNR approved an Ontario Geographic Names Board recommendation to name a creek in Bentinck Township in southwestern Ontario in memory of a local dairy farmer. Prior to his death in 1990, Dave Aljoe volunteered his services and time to various sporting and agricultural organizations within the community. The creek that runs through the family farm is now called *Aljoe Creek*.

Using satellites to map the Far North

Mapping land cover such as wetlands, water, and forests is possible using satellite imagery. Here is an example of a satellite image (right) and a land cover map (left) that will be created for the Far North.



The vast, sparsely populated northern portion of Ontario, referred to as the Far North, encompasses approximately 441,000 square kilometres, roughly 42 per cent of the area of the province. Due to its expansive size and the limited transportation infrastructure in some parts, this area has been challenging for scientists to gather information about the landscape.

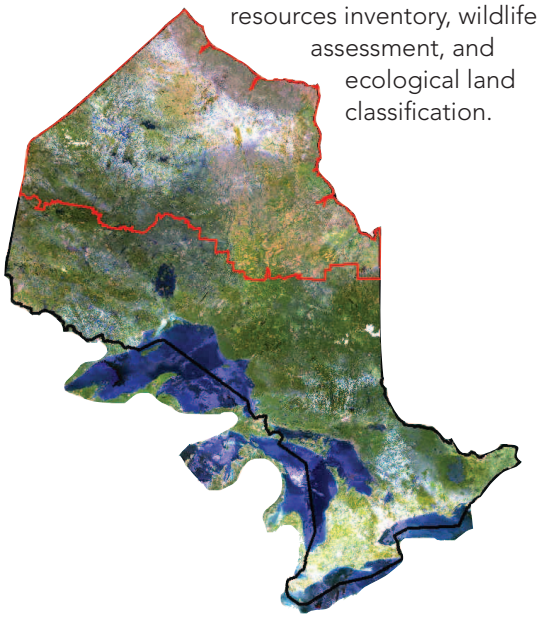
In an effort to learn more about the Far North, remote sensing specialists in MNR's Inventory, Monitoring and Assessment Section are using information from satellite imagery to supplement and update existing maps produced from earlier mapping campaigns.

With special tools and a well-trained eye, these specialists analyze satellite imagery to identify observable land cover features, such as water, forests, and wetlands. Combining this new

Islands in the Moose River.

information with existing maps and other data, such as geology and elevation, MNR staff are able to produce a series of land cover maps that will identify the extent and distribution of a variety of vegetation and landform types across the Far North. "Land cover is recognized as a fundamental information layer," says Richard Mussakowski, coordinator for MNR's Inventory, Monitoring and Assessment Services Unit. "It can be used for a range of applications: from the development of a basic inventory of landscape features, to identifying, analyzing and reporting on changes to the landscape over time from natural or other disturbances." This land cover information will be an important tool to support proposed land use planning and natural resource management in the Far North.

MNR's Inventory, Monitoring and Assessment Section provides leadership in remote sensing science and inventory, monitoring, and assessment activities in areas such as forest productivity, forest resources inventory, wildlife assessment, and ecological land classification.



Far North planning area outlined in red.

Customized map making at your fingertips

Have you ever needed a map to take with you on your fishing trip, create your own hiking or canoe route, find a cottage, or highlight a tourist attraction? Land Information Ontario (LIO) has created an online web mapping service called *Make-a-Map* that will do just that!

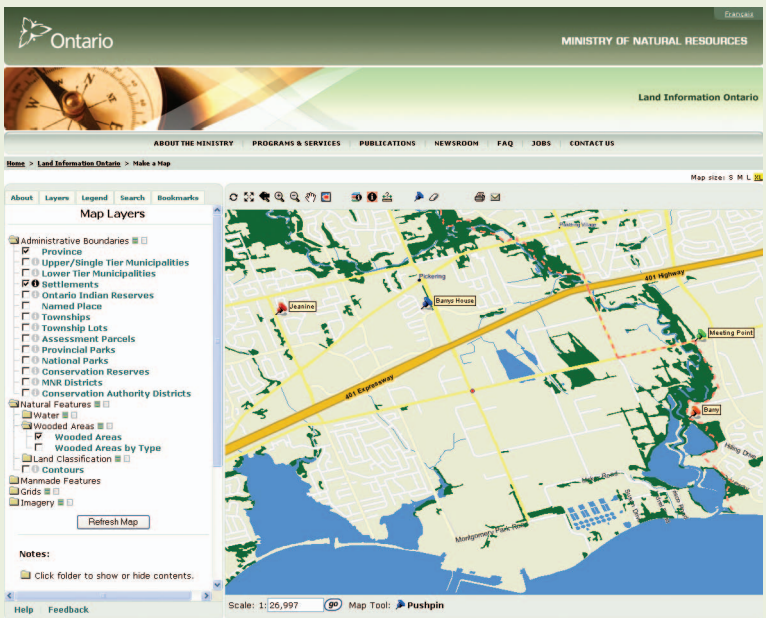
Make-a-Map has many uses because it allows you to choose which map features you wish to see on your map. These features, which are easily turned off and on as layers, can be things such as roads, municipal boundaries, parks, protected areas, trails, land parcels, wooded areas, lakes, rivers, and more. It even allows you to create a map with satellite imagery in the background.

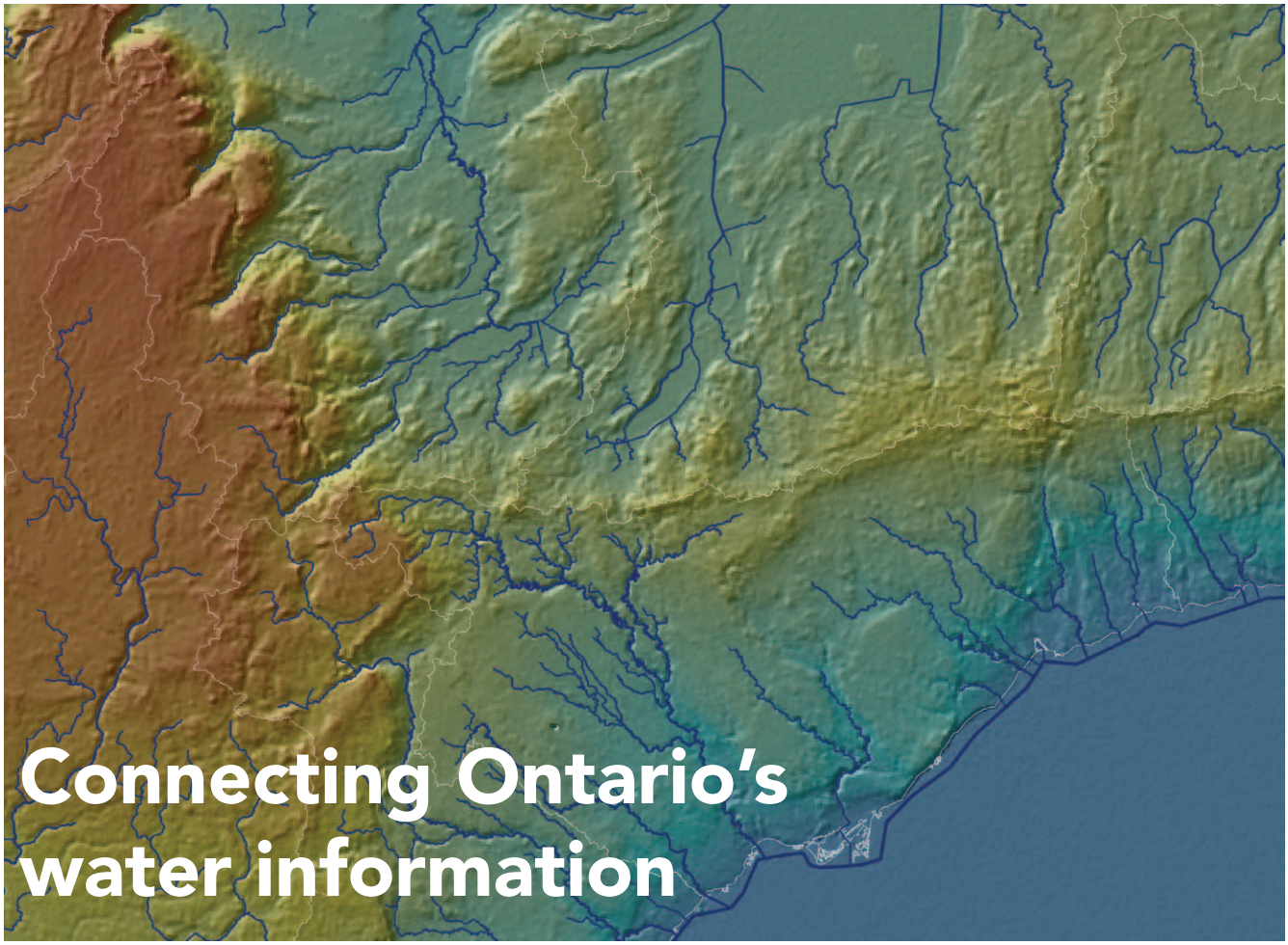
With *Make-a-Map* you can search for an address or place, bookmark locations for later use, measure distances, put labels on your map, and email or print your customized map. You can also click on points on the map to find out information about that feature, such as the name of a lake, the type of trail or the coordinates of the feature, so you can find it on your GPS or your car's navigation system.

"*Make-a-Map*'s local Ontario data and easy customization capability make it a great alternative to standard systems like Google Maps," says Raphael Sussman, coordinator of Land Information Ontario within the MNR's Geographic Information Branch.

Make-a-Map uses data from the Ontario and Canadian governments as well as other sources. You can view descriptions of each data layer by clicking on the name of the layer in the *Make-a-Map* application.

To access this application, go to ontario.ca/lio and select *Make a Map*.





Connecting Ontario's water information

Digitally reproduced hills shaded to appear in three dimensions with blue lines representing streams and rivers.

Water: Ontario's big blessing

Most people understand how water is critical to life. Our bodies are mostly water. We can live without food much longer than we can live without water. Unlike much of the world, including many parts of Europe and North America, Ontario is very lucky to be blessed with an abundance of fresh water. Because we have so much fresh water, it is understandable that we take it for granted.

Water information is everywhere

Information about water is like water itself: it's everywhere. While water information may seem very straight forward, in reality it's very complex. Ontario has thousands of lakes, rivers and streams. How do these all connect? Where does water go once it falls from the sky and lands on the earth? When we talk about water information what do we mean? Do we mean measurements about water depth, water temperature, water quantity, water quality…the list goes on.

Information about Ontario's water is collected and managed by many departments in the Ontario government. From MNR which maps our rivers and streams, to the Ministry of Health which collects data about well water quality, water information is everywhere across government. Like many large organizations, the Ontario government faces a difficult task in keeping track of who collects what information about water and how to link this data together.

"MNR's Water Resource Information Program (WRIP) was established to improve the way the Ontario

government collects and manages water information and to improve the quality of water information," says James Britton, manager for WRIP. "WRIP works with departments across the Ontario government and beyond to build a better understanding of Ontario's water resources through better information."

WRIP promotes information standards, improves the quality of data and ensures that water information collected by any one department is compatible with information from other departments.

WRIP also produces key datasets used for water analysis in the province. Other MNR departments use this data for a variety of tasks including low water monitoring and estimating what areas might be flooded by a particular rainstorm.

Source water protection—a water information challenge

Source water protection is an example of how WRIP works with different groups to improve the quality of Ontario's water information. The province works with conservation authorities to protect water sources through an intensive process of mapping and evaluating risks and threats to water quality. Many datasets from different organizations are required to carry out this protection process. WRIP is working with the Ministry of the Environment, conservation authorities, municipalities, and private consultants to ensure that all the required data is included in this process and that the analysis process can accurately link the many data layers together. WRIP is working to improve the quality of this information to better identify future threats to drinking water.

Did you know...?

Ontario has over a quarter of a million lakes and countless rivers and streams. The rivers of southern Ontario and the area between Thunder Bay, Sault Ste. Marie and North Bay drain southwards through the Great Lakes and Saint Lawrence River system. Rivers in Ontario's northwest and northeast drain towards James Bay and Hudson Bay.

The Great Lakes are one of the most important ecological systems in the world with over 95 per cent of Ontario's population living in and taking water from the Great Lakes Basin. The Great Lakes are huge: Lake Superior alone is larger than the provinces of Prince Edward Island, Nova Scotia, or New Brunswick, and it beats out 10 American states in size.

In 2000, Ontario used 766 billion litres per day from its lakes, rivers and streams. Of this total:

- Ninety-four per cent was for hydroelectric usage.
- Five per cent was for nuclear plant usage (used in cooling processes).
- One per cent was for municipal and domestic usage, irrigation and agriculture.

While Ontario stores one third of the world's fresh water supply, only a tiny fraction of this gets replaced each year by rain and snow. If we use more water than gets replenished, we can run out of water just like anyone else in the world. In 2004, Canadians were ranked one of the largest users of water in the world, using 343 litres of water per person, per day. That's over two bathtubs full of water per person every day of the year!

Introducing... Frank Kenny

Project manager, Water Resources Information Program

Looking at a question "through different eyes" can lead to better answers, especially if those "different eyes" can see things that our eyes can't. This is the main idea behind remote sensing—using sensors in aircraft and satellites to gather information about the surface of Earth.

Besides identifying things we can see, like rivers, buildings and forested areas, remote sensing can detect things we cannot see, including plants that are under stress from drought, urban sprawl, farming changes, and loss of natural habitats.

Using remote sensing for scientific work requires a high level of skill and accuracy. Frank Kenny, with his background in engineering, geosciences, and natural resources, has what it takes to make sense of remote sensing images. Frank and his colleagues use remote sensing to define drainage patterns to protect drinking water sources, determine potential flood areas to support emergency management decisions or even describe land use patterns to monitor climate change.

Frank has worked with organizations such as Natural Resources Canada, the United Nations Food and Agricultural Organization, and Sir Sandford Fleming College.

To understand our environment, we must ask tough questions. Frank's work, and seeing the world through "different eyes" can lead us to better answers.

Everything you wanted to know about climate change and Ontario's forests

These days everyone has heard of climate change. But many people still have questions about the science behind the headlines. MNR scientists are involved in research on climate change and forests. Here are some of the most common questions answered.

1 What is *carbon*, and what is the *carbon cycle*?

Carbon is a chemical element that is the key building block for life. On Earth, carbon is in everything from rocks, to trees, to microorganisms, to people.

The *carbon cycle* is the process of how carbon moves through land, water, plants and animals, into the atmosphere and back again. Carbon in the atmosphere is in carbon dioxide and other greenhouse gases.

2 How has the carbon cycle been changing?

Over the past 150 years, people have burned more and more fossil fuels such as gasoline, coal, and natural gas, causing an imbalance in the Earth's carbon cycle. More carbon is going into the atmosphere than is being removed.

This excess of carbon dioxide and other greenhouse gases in the atmosphere has caused an increase in the greenhouse effect over the Earth, which has caused Earth's climate to become generally warmer and more variable.

3 Is the climate truly warming? It seems like winters in Canada are getting colder.

It's important to understand the difference between weather and climate: Weather is what happens in your area over the short term on a daily or yearly basis; climate is how the atmosphere behaves on average over relatively long periods of time, from decades to centuries. One or even several cold winters does not mean that overall the climate is not warming. No matter where the mercury is on your thermometer today, over the past 150 years the average temperature has been heading steadily up.

4 How much do experts think Ontario's climate will change?

By the end of the century, average temperatures in Ontario could increase by up to 6 degrees Celsius. The Far North is expected to experience the greatest changes in temperatures. In addition to rising temperatures, the province may see an increase in extreme weather events such as rain, snow, flooding, drought, storms and heat waves.

How can you help balance the carbon cycle?

- Plant trees around your business or home to keep it cool in the summer (hardwood shade trees) and break the wind in the winter (conifers) and to store carbon.
- Take good care of your existing trees—be careful not to injure them with your mower or string trimmer and make sure that young trees get plenty of water.
- Walk, ride a bike, carpool, or take public transportation rather than drive.
- Keep your vehicle tires properly inflated.
- Set your thermostat a few degrees higher in summer and lower in winter, and use fans rather than air conditioning.
- Replace incandescent light bulbs with energy-efficient compact fluorescent bulbs.
- Turn computer monitors and other appliances off when not in use—use power bars for devices with remote controls since they draw energy even when off.

5 What role do forests play in climate change?

Forests store huge amounts of carbon for long periods of time, helping to balance the carbon cycle. The more trees grow, the more carbon they store. Forest soil stores even more carbon than trees—accumulating it from decaying leaves, logs, and animals.

6 What happens to the carbon in trees when they get old and die?

Eventually, aging trees will begin to decay, burn in a forest fire, or be attacked by insects, causing them to release their carbon into the atmosphere. That's why it makes sense to harvest some older trees for use in wood products and to make room for young forests, which can store more carbon over time.

7 How does forest harvesting affect forest carbon storage?

When trees are harvested, their wood goes into wood products, such as furniture or house trusses, locking up their carbon for many years. If we didn't use wood for many of these products, we would have to replace them with materials such as steel, aluminum, and concrete, which take more energy to produce and cause more greenhouse gases to be released.

The latest from MNR researchers about forests, peatlands and climate change

Staff throughout the MNR are working to help Ontarians understand, adapt to, and mitigate the effects of a changing climate. The following are just a few examples of climate change research underway at the MNR.

Forest management can help forests store more carbon:

Steve Colombo, Michael Ter-Mikaelian, and Jiaxin Chen of MNR's Ontario Forest Research Institute (OFRI) have been investigating how much carbon Ontario's forests store. Through computer modelling they've learned that forests store massive amounts of carbon and will take in much more carbon over the next century, helping to slow the effects of climate change.

They also found that wood products such as lumber are important for storing carbon.

Sustainable forest management has a valuable role to play in helping Ontario adapt to and mitigate the impacts of climate change.

Colombo and OFRI's Bill Parker have found that certain forest management activities (such as planting trees, controlling forest fire, and managing insect pests) can help Ontario's forests store more carbon by improving overall forest condition.

The more trees we plant, the more carbon that can be stored:

The Ontario government wants 50 million trees to be planted across Ontario by 2020, and it is encouraging landowners to get planting! The more trees that are planted in open areas (a process known as *afforestation*), the more carbon can be removed from the atmosphere and stored on Earth.

Gary Nielsen, climate change coordinator for MNR's Southern Region, and partners such as Trees Ontario have organized workshops for private landowners to help them learn about how planting trees can benefit not only the environment but also their pocketbooks.

Unlocking the secrets of Far North peatlands:

Over 31 million hectares of the Far North are wetlands, most of which are covered in *peat* (organic material made up of the partially decayed remains of plants). These are known as *peatlands*. OFRI researchers led by Jim McLaughlin are studying peatlands in the Far North to help estimate how much carbon is stored there and how human activities and future climate could affect the carbon balance in the Far North.

Did you know...?

Every year, wood products made from trees harvested in Ontario store an amount of carbon that is equal to almost 75 per cent of the carbon dioxide that Ontario cars emit. These products are an important carbon storage *pool*.

A shout out for our websites!

Have we got you hooked? If you're anxious to learn more about the role of science and research at MNR—what we are doing, and the products we have available—go to *ontario.ca/mnr* and click on *Science & Research* on the menu on the left of your screen. Here you will find all sorts of science and research information about rabies in Ontario, monitoring and reporting on Ontario's forests, fish and wildlife research and development.

If it's maps and geographic information that grabs your interest, go to *ontario.ca/mnr* and click on *Maps & Geographic Information* on the menu on the left. Here you'll find maps for sale, wildlife research project details and lots of other geographic information about Ontario.

Do we have your trail?

Whether you prefer hiking, biking, paddling, snowmobiling, or just a leisurely walk, thousands of kilometres of trails and routes have been established across Ontario. But where are these trails located, what activities are permitted on them, and where can we access them?

To help promote the use of trails and healthier, active lifestyles, MNR's Land Information Ontario (LIO) program is working with trail users and managers to collect trail information in a geographic database called the *Ontario Trail Network* (OTN). The OTN contains information on over 15,000 kilometres of trails across Ontario, including bicycle routes, walkways, boardwalks and sidewalks, all-terrain vehicle and snowmobile trails, and canoe routes and portages.

"Having Ontario's recreational trails information in one authoritative database will make it much easier for government and trail organizations to promote trails in maps and websites," says Carol-Anne Albertson, project manager for base data in MNR's Geographic Information Branch.

LIO has developed an online map called *Do We Have Your Trail*? that shows trail locations across Ontario. Users can also find out the length and difficulty level of trails. The maps can be viewed with traditional map or satellite imagery backgrounds and are easy to print and email. To access the trail map, please go to ontario.ca/lio and click on *Ontario Trail Network*.

Using GPS to capture trail information

MNR's Northwest Science and Information Section developed a tool to help LIO and trail organizations collect and digitize trail information. The tool is a hand-held computer with special geographic positioning software (GPS) that records geographic information along the trail. This data, plus any other information or maps, will be entered in the OTN. MNR provides training to trail organizations interested in capturing their trail information with GPS.

From muskies to models, from toads to trees... just ask!

The Natural Resources Information Centre (NRIC) is your source for information about Ontario's natural resources. The NRIC answers phone and e-mail questions about all of MNR's different programs and initiatives.

Last year, NRIC staff received over 73,000 telephone enquiries and handled more than 7,300 emails in both English and French from Canada, the United States, and even Europe.

"Enquiries tend to be seasonally driven," says Steve Coombes, group leader of the NRIC. "Questions about fishing, hunting, and Ontario Parks are very common."

Some of the other more popular questions are about bears, nuisance animals, aggregates, forestry, Crown land, and species at risk. "The NRIC also fields some unusual questions, such as whether you can fish with a remote-controlled boat," according to Coombes.

If the NRIC can't answer your question, they will put you in contact with someone who can. "We maintain a list of MNR subject area experts to provide answers to technical or in-depth questions," Coombes says.

The next time you have a natural resources question, call the NRIC at 1-800-667-1940 (TTY: 1-866-686-6072) or email: mnr.nric.mnr@ontario.ca

Photo: John Butterill

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Photo: OMNR


Photo: Rick Stankiewicz

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Science and Information Resources Division
Ontario Ministry of Natural Resources

To contact the Science and Information Resources Division, call our toll-free line at 1-800-667-1940 (TTY for Hearing Impaired - 1-866-686-6072) between 8:30 am and 5:00 pm, Monday to Friday.

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