

# THE NEED CANADA WET INVENTORY

Canada has an estimated 1.5 million square kilometres of remaining wetlands – roughly 23 to 28 per cent of the earth's total. Yet, Canada remains far behind many nations in terms of wetland inventory and monitoring.

by KARLI REIMER

**IN** SOME AREAS OF CANADA, ESTIMATES OF wetland loss are available only for a few locations and for a few time periods. No standardized wetland inventory or monitoring program is available that could provide a complete and accurate picture for Canada.

These days, federal, provincial and municipal governments are stressing the significance of promoting cleaner air and water, reducing greenhouse gases, combatting climate change and conserving and protecting the natural environment. Protecting and restoring wetlands aids all these things. This is why a comprehensive and consistent wetland inventory using geographic information systems (GIS) – specialized computer systems for dealing with geographic information – is required to assess the status and trends of these vital ecosystems.

“Although wetland inventories have been completed for some areas of the country, large gaps still persist,”



pinball: © Denis Faucher



# D FOR A CANADIAN WETLAND INVENTORY

says Brian Kazmerik, national GIS manager for Ducks Unlimited Canada (DUC). “The wide variation in scale, time periods, methodology and classification hinders the achievement of a comprehensive and consistent national wetland perspective.”

Wetlands are among the most threatened and most socio-economically valuable life-support systems in the world. Studies suggest wetland loss may be 80 to 98 per cent in urbanized regions, 80 per cent in southern Ontario and St. Lawrence hardwood and shoreline swamps, 70 per cent in prairie potholes and 65 per cent in Atlantic salt marshes. Since 1800, it is estimated that 20 million hectares have been lost, which is 15 per cent of Canada’s total projected wetland base.

This loss is startling as wetlands provide productive ecosystems and exceptional biodiversity, flood control, natural water filters, groundwater recharge, vast quantities of carbon storage and other benefits including commercial and recreational hunting and fishing, agriculture, birdwatching, outdoor recreation, ecotourism and education.

Wetlands perform essential ecological services upon which people depend. Wetlands also provide habitat for more than 600 species, and one-third of Canada’s species at risk depend on wetlands for all or part of their life cycle.

“The Canadian Wetland Inventory (CWI) will be an invaluable tool by helping... *(continued on page 41)*



# Conservation Across Canada



## DUC'S 70TH ANNIVERSARY MAP SELECTED FOR ESRI CANADA MAP COMPETITION

**D**ucks Unlimited Canada has been selected from among 35 applicants to be included in the 10th annual Map Gallery competition held by ESRI Canada, a world leader in GIS modelling and mapping software and technology. The map appears in ESRI Canada's 2009 Map Gallery calendar for December.

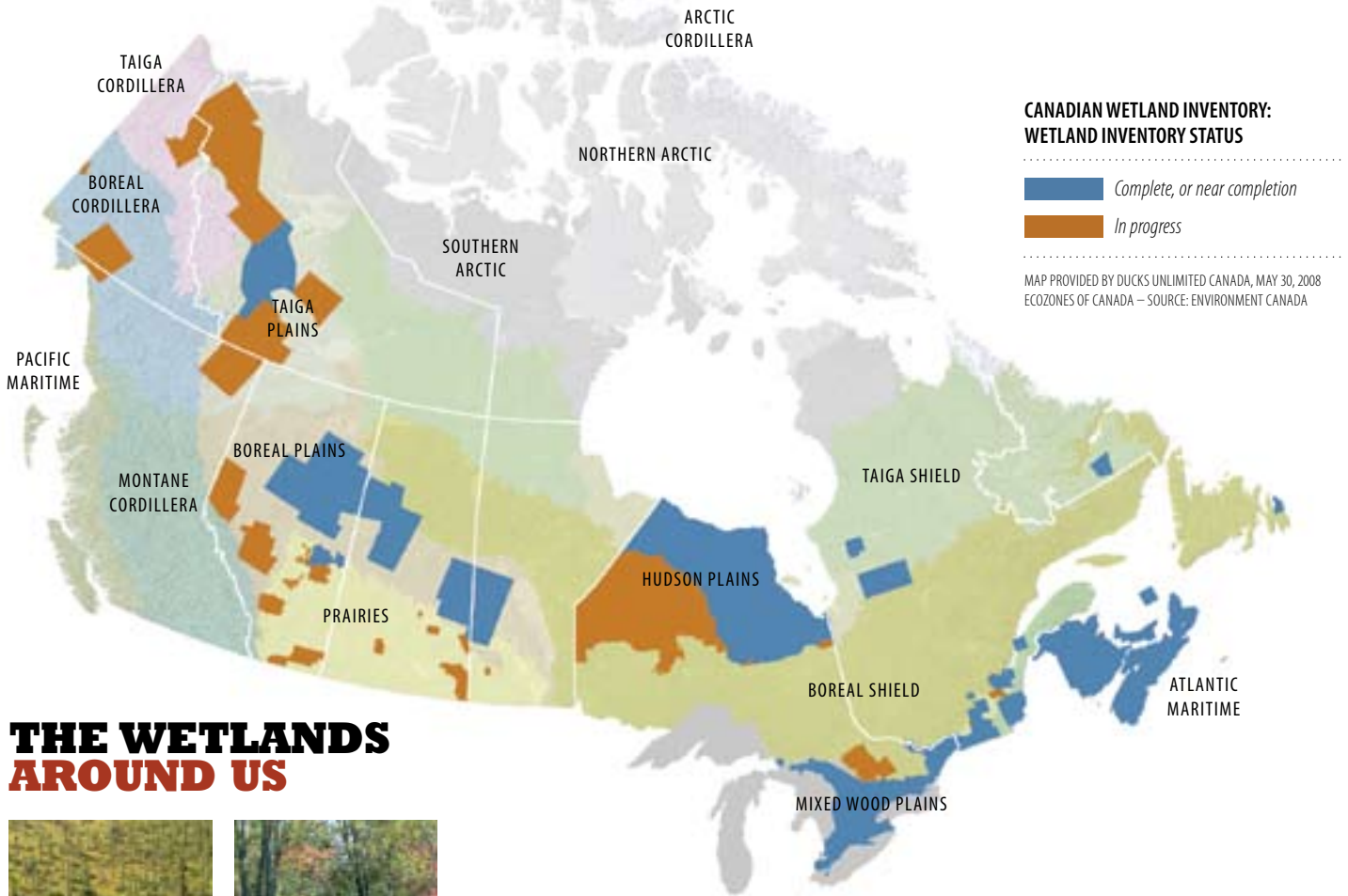
To celebrate 70 years of wetlands and waterfowl conservation in Canada, DUC GIS specialists Tatjana Radulovic and James Kellough developed a comprehensive map to showcase the scope of DUC's on-the-ground work. Designed by DUC's GIS department, the map pinpoints the locations of nearly 8,100 projects and uses photographic image pullouts to highlight the first DUC projects developed in each province and territory.

"This includes DUC's first-ever conservation project in North America, Big Grass Marsh in Manitoba. Built in 1938, the project is still in operation and provides important habitat for waterfowl and other wildlife," says Brian Kazmerik, national GIS manager for DUC. "This is also the first time we are displaying areas that we have helped protect through our initiatives in the western boreal forest and B.C. Besides the ESRI Canada calendar, DUC staff are presenting this map to different audiences to depict our nationwide activities in an understandable way."

The Map Gallery contest was started to display the GIS community's best cartographic work to an audience of thousands across Canada. The 11th annual ESRI Canada Map Gallery competition is now underway.

"We greatly value our long-standing partnership with Ducks Unlimited and would like to congratulate them on 70 years of dedication to wetland and waterfowl conservation," says Alex Miller, president, ESRI Canada. "We selected this map for inclusion in our 2009 Map Gallery because it beautifully illustrates the amazing extent of Ducks Unlimited's work across Canada to restore and preserve our natural environment."

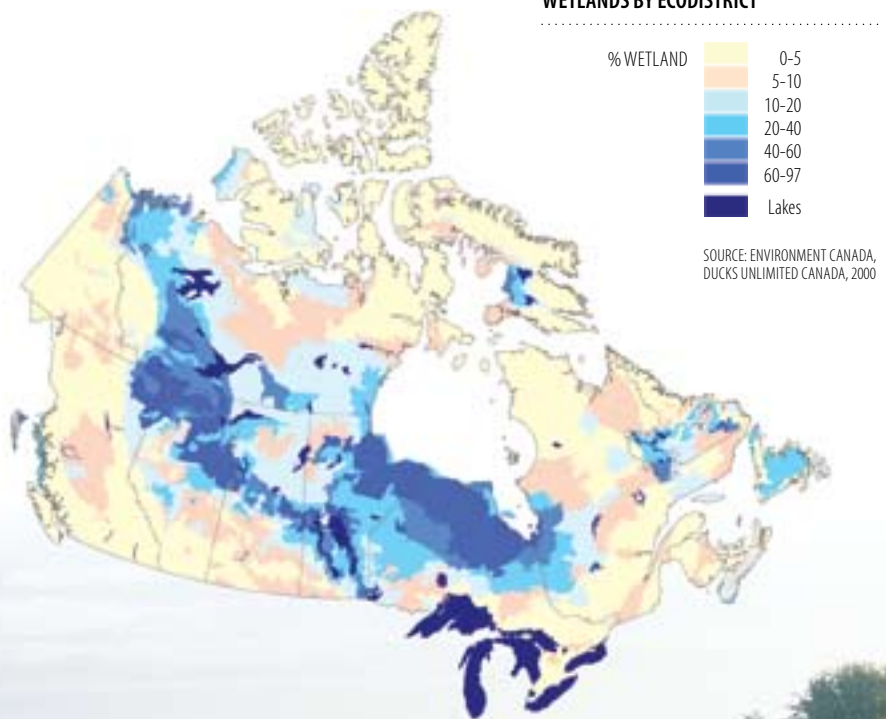
*If you would like a copy of the calendar, contact your local ESRI Canada office. To find an office visit [www.esricanada.com/contactus](http://www.esricanada.com/contactus).*



## THE WETLANDS AROUND US



The Canadian Wetland Inventory will map the five major classes of the Canadian Wetland Classification System: (above, clockwise from top left) bog, swamp, fen, shallow open water and marsh (below) – a system that best represents the range of wetlands found across Canada. Top: CWI-compatible inventories have been initiated or completed across representative regions of the country. Right: Canada has more than 1.5 million square kilometres of remaining wetlands – about one-quarter of the earth's total.



left: DU Canada (4)  
 below: Ian McCausland



to measure performance towards sustainability objectives and assess the effectiveness of conservation programs,” Kazmerik says. He adds the CWI will also help model climate change, develop policy based on science for all levels of government, manage wetlands to sustain their functions and values, support environmental assessment and sustainable development planning. It will also focus conservation, restoration and scientific research programs, provide a foundation for a national wetland monitoring program and maintain the well-being of Canadians.

“A national inventory of wetlands would answer basic questions crucial to their sound management: Where are the remaining wetlands? How much area do they cover? What type of wetlands are they? And are they still threatened?” he says.

### THE BIRTH OF THE CWI

THE CWI PARTNERSHIPS WERE ESTABLISHED IN 2002 between DUC, Environment Canada, Canadian Space Agency and North American Wetlands Conservation Council (Canada). It was built upon Southern Québec’s Wetland Atlas and regional inventories, the National Conference on Canadian Wetland Stewardship – where

a wetland inventory and monitoring emerged consistently as an important need – and the National Round Table on the Environment and the Economy.

“Ducks Unlimited Canada was invited to initial meetings of the CWI because of its long history of wetland inventory work in Canada, especially in the Prairie and western boreal regions. In fact, DUC pioneered the use of remote sensing techniques for detecting wetlands as early as 1979 – and has since mapped over 156 million hectares using both medium-resolution satellite imagery and high-resolution aerial photography,” Kazmerik says.

The main objectives of the CWI is to provide a national wetland inventory that can be used for the conservation and sustainable management of wetlands for environmental and societal benefits and to provide easy access to standardized digital wetland mapping products.

Over the last six years, CWI partners have completed inventories on 25 study sites across nine ecozones representing the diversity of wetland types in Canada. Ecozones are broad ecological units where organisms and their physical environment endure as a system. Ecozones are determined by factors such as landform, soils, water



Ducks Unlimited Canada national GIS manager Brian Kazmerik in the field. CWI partners have completed inventories on 25 study sites over the last six years.



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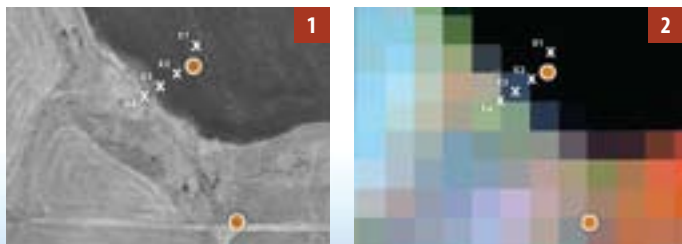
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## ON CLOSER INSPECTION

The mapping challenge for seven per cent of Canada requires identifying wetlands using high-resolution solutions. Wetland vegetation information is collected in the field (below) along a sample transect using GPS (Global Positioning) technology. Then for comparison, the information is displayed with high-resolution orthophotography (left, 1) and medium-resolution Landsat imagery (2).



“A national inventory of wetlands would answer basic questions crucial to their sound management.”

**Brian Kazmerik**  
National GIS manager,  
Ducks Unlimited Canada

features, vegetation and climate. Human activities are also considered.

“Cutting-edge remote sensing techniques have been developed and refined that take advantage of multiple data sources and object-based image processing. Many of these developments have been presented at national and international conferences and published in scientific journals,” Kazmerik says.

A current status map shows areas of the country where a CWI-compatible inventory is either in progress or complete. A business case has been drafted for completing the rest of the country according to federal government guidelines and is presently in the hands of the lead agency, Environment Canada. Kazmerik says it was recommended that the CWI should be completed by preparing a comprehensive map of Canada’s wetlands using both medium- and high-resolution mapping techniques, distributed freely to Canadians through Natural Resource Canada’s (NRCan) GeoBase and continuing to investigate emerging technologies that benefit time and cost.

“The CWI will provide the baseline for monitoring trends,” he says. “Monitoring should be sample-based by ecozone and can build upon the established monitoring programs of the Prairie Habitat Joint Venture, the Great Lakes, Canadian Forest Service and Agriculture and Agri-Food Canada.”

### INNOVATIVE DUC RESEARCH

DUC RECENTLY CONDUCTED A STUDY IN THE BROUGHTON’S Creek watershed in southwestern Manitoba to determine the impacts of wetland loss and associated drainage activity. The area was selected as a study water-

shed because the land use and wetland loss trends are representative of southwestern Manitoba.

The project confirmed that between 1968 and 2005, 5,921 wetland basins, or 70 per cent of the total number of wetlands in the Broughton’s Creek watershed, have been degraded or totally lost due to drainage activity.

This research determined that wetland loss since 1968 in the Broughton’s Creek watershed has also resulted in 30 per cent increase in water flow, 31 per cent increase in nitrogen and phosphorus loading, 41 per cent average annual increase in sediment loading, the release of 34,000 tonnes of carbon and 28 per cent decrease in the waterfowl production.

Scaling up the results in the Broughton’s Creek watershed to all of southwestern Manitoba has found an annual increase in phosphorus loading by 114 tonnes (equal to dumping 10 semi loads of commercial agricultural fertilizer into Lake Winnipeg every year) and the release of five million tonnes of carbon into the atmosphere (equal to emissions from 169,000 cars for 20 years).

And the study reports that if wetland loss is not stopped, the environmental problems only get worse.

Research from the Broughton’s Creek watershed is reason enough for the CWI. This inventory and monitoring system will help policy- and decision-makers protect important wetlands and all the ecological goods and services they provide.

### THE CARBON FACTOR

WETLANDS PLAY A CRUCIAL ROLE IN THE FUTURE OF climate change and the CWI would help reduce negative effects to the environment by highlighting the

## FIVE THINGS YOU DIDN'T KNOW ABOUT GIS

1 The first known maps are of the heavens, not the earth. Dots dating to 16,500 BC on the walls of caves in Lascaux, France, map out part of the night sky, including the three bright stars Vega, Deneb and Altair (the Summer Triangle asterism), as well as the Pleiades star cluster. (*Wikipedia*)

2 About 15,500 years ago, on the walls of caves near Lascaux, Cro-Magnon hunters drew pictures

of the animals they hunted. Associated with the animal drawings are track lines and tallies thought to depict migration routes. While simplistic in comparison to modern technologies, these early records mimic the two-element structure of modern geographic information systems, an image associated with attribute information. (*Wikipedia*)

3 Geographic information systems (GIS) is a term originated by Dr. Roger Tomlinson in the 1960s when he planned and directed the Canadian Geographic Information System, which also involved development of the Canada Land Inventory.

4 A GIS is a computer system designed to store, manage, analyze, model, query and visualize geographic information. Related technologies include Remote Sensing, Global Positioning Systems, Database Management Systems, Computer Assisted Design and Mapping Software and Spatial Statistics.

5 Ducks Unlimited, Inc. began mapping wetlands with satellite imagery in 1979 with the help of Purdue University in Lafayette, Indiana. During their Habitat Inventory and Evaluation Program in the 1980s and 1990s, DU was one of the world's largest consumers of Landsat satellite imagery.



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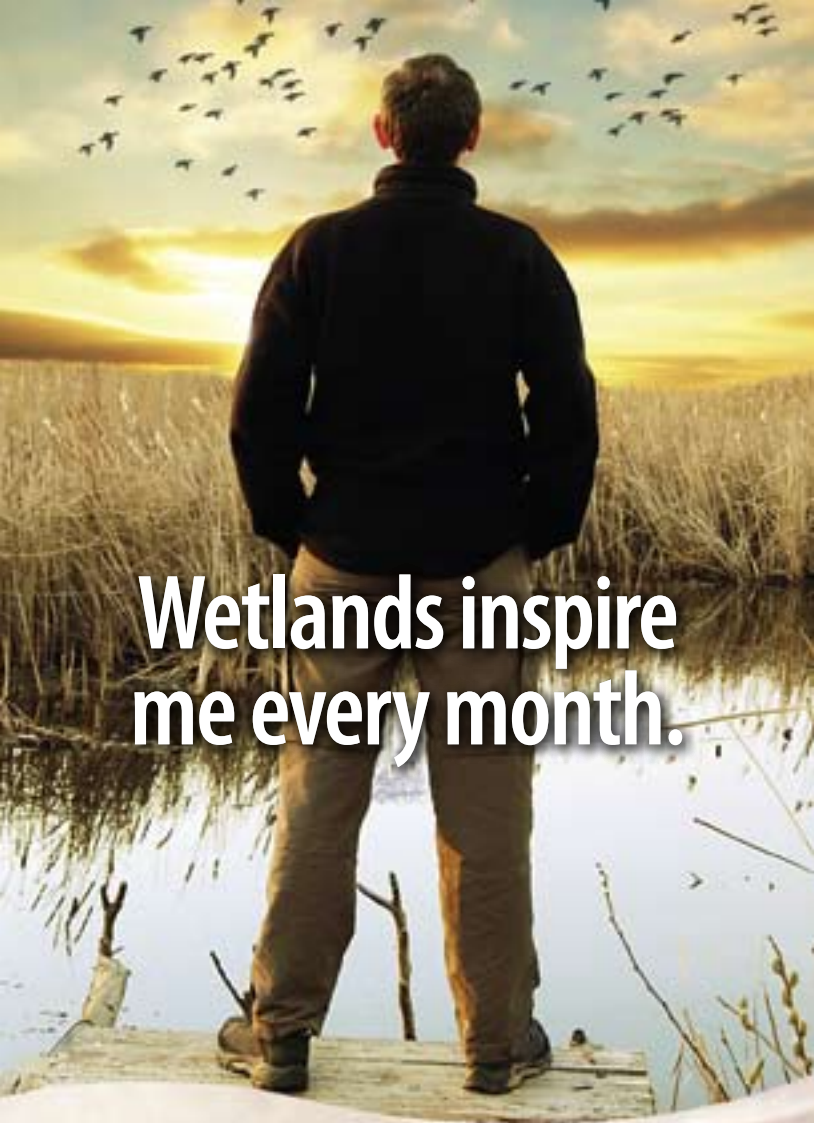
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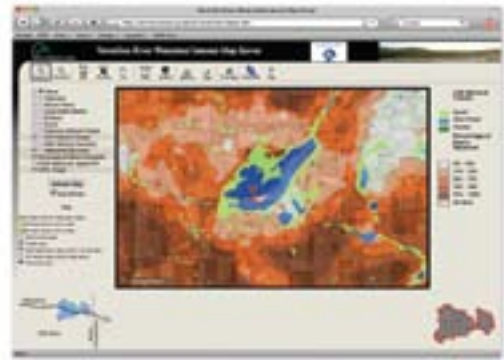
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Above: DUC's online GIS server is available to the public. CWI examples in the boreal forest region (Utikuma Lake), prairie region (Vermilion) and Québec (Montréal) can be viewed at [maps.ducks.ca/ims.html](http://maps.ducks.ca/ims.html)

need for wetland protection and restoration. The vast majority of wetlands in Canada are peatlands. Canadian peatlands store 147 gigatonnes of carbon, which is about 56 per cent of Canadian soil organic carbon, Kazmerik says.

“It is estimated that 60 per cent of Canada’s peatlands will be severely affected by climate change. If just 0.1 per cent of carbon stored in Canada’s peatlands was lost to the atmosphere, the offset costs would be \$8.1 billion,” he says, adding the numbers are from NRCan 2007 and DUC’s research scientist, Pascal Badiou.

Globally, peatlands account for approximately 20 per cent of carbon stores – about half of the carbon contained in the earth’s atmosphere. Peatlands cover about 12 per cent of the land base in Canada.

## **CWI WETLAND CLASSES AND MAPPING METHODS**

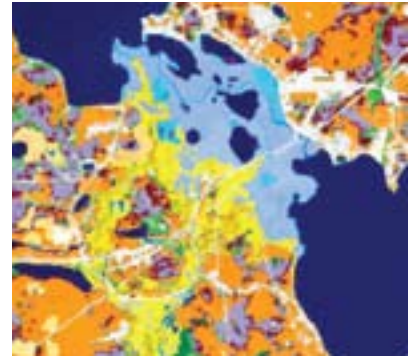
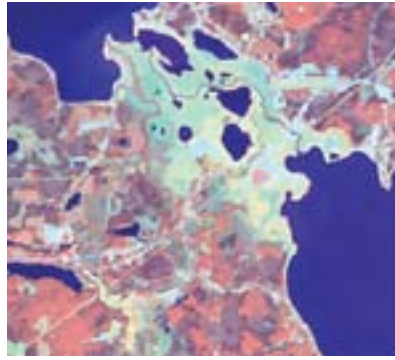
THE CWI WILL MAP THE FIVE MAJOR CLASSES OF THE Canadian Wetland Classification System: bog, fen, marsh, swamp and shallow open water. This classification system best represents the range of wetlands found throughout Canada.

Wetland densities, distribution and human-induced impacts vary across Canada, says Kazmerik. Certain regions such as the Prairie ecozone, the Maritime provinces and portions of B.C.’s Lower Mainland and Interior have high wetland densities and many small wetlands, and have been extensively impacted. The CWI partners in these regions have identified the need to use high-resolution wetland inventories. This accounts for approximately seven per cent of Canada and will use aerial photography that can accurately identify wetlands down to 0.2 hectares. This level of accuracy is important because over 80 per cent of the wetlands

in the prairie ecozone are less than one hectare in size.

Ninety-three per cent of Canada will be mapped at medium resolution. Medium resolution uses satellite imagery such as Landsat and RADARSAT and will map wetlands down to one hectare in size. The combination of medium- and high-resolution methods is the most cost-effective approach, with the highest benefits for dollars invested at the least investment risk. This is consistent with the needs of a number of partners and communities of interest, and take advantage of well-established connections and existing wetland mapping activities. It will provide a comprehensive national baseline for future mapping and monitoring within an "environmental monitoring network" building on existing programs within Environment Canada, Agriculture and Agri-Food Canada and the Canadian Forest Service.

"This approach will produce a standardized CWI that will provide consistent, efficient and user-friendly environmental information to support extensive and diverse local, regional and national initiatives and decisions affecting wetland conservation, management and land use planning," Kazmerik says, adding the CWI will



Under the CWI, large tracts of Canada will be mapped using medium-resolution satellite imagery – including the vast boreal forests (left) – then classified (right) according to five major wetland types.

be fundamental to sustainable development, especially in the vast northern region.

"National consistent knowledge of the exact location of wetlands will increasingly play a crucial role in decisions that affect the quality and quantity of Canada's water resources," he says. ✖



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