The GSDNR Communicator

Newsletter of the Geomatics for the Sustainable Development of Natural Resources Program (GSDNR)

The Geomatics for the Sustainable Development of Natural Resources (GSDNR) Program, established after Earth Sciences Sector (ESS) activities were reorganized to respond more effectively to government issues and priorities, has been in operation for a year, and the time has come to take stock of its success. Developed to respond to needs expressed by the user community, this program provides basic geospatial data required for the responsible management of Canada's natural resources. To this end, special attention is paid to the quality of information and data, the establishment of uniform standards, and the value of the data produced.

This first year of operation was one of transition and adaptation to the new Earth Sciences Sector organizational structure, and of familiarization with new program objectives. Nevertheless, progress has been significant and achievements were substantial. Certain data layers are currently being completed (Landsat 7 ortho-image coverage, national road network), while others already contain a critical mass of relevant information (digital elevation models, national framework data, and geographical names). As a result, a number of new activities can be initiated including the establishment of a national hydrographic network, an information layer identified as essential by many stakeholders and partners.

For a country as vast as Canada, the development of relevant, high-quality geospatial data is an enormous task. But based on the work accomplished to date, the future looks bright. I am proud of the progress made in this first year of operation and I would like to thank not only the members of the different project teams, but also the various partners, collaborators and private, public and academic stakeholders.

Éric Loubier, *Program Manager*
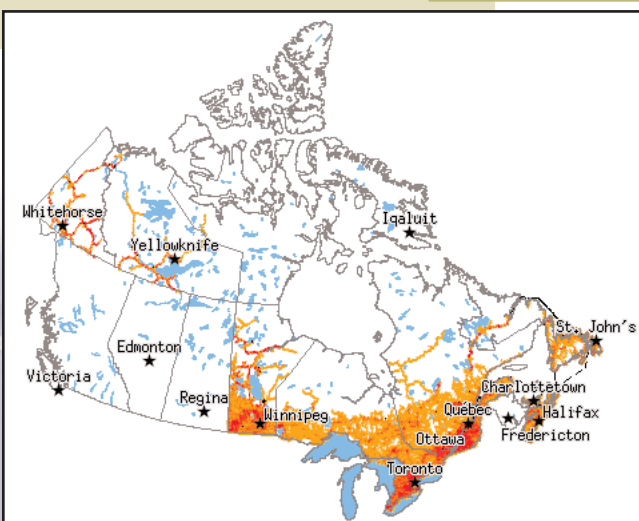
National Road Network, Canada - status as of November 2003

National Road Network Essential Framework Data for Information Display

The National Road Network (NRN) focuses on providing a quality geometric description and a set of basic attributes of the Canadian road phenomena. GSDNR works in collaboration with federal (Statistics Canada, Elections Canada, Canada Post) and many provincial stakeholders to define and maintain the road network model and data that serve as a foundation to which geographic features can be linked and displayed. In the United States, ESRI is working on a case study with GSDNR that will have international implications. The use of a common NRN model will ensure uniformity and cost efficiency in producing, maintaining and sharing digital road data throughout Canada.

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Drainage Areas Dataset and Agricultural Policy

*T*he Integrated National Thematic Frameworks Project, a component of GSDNR, provides national-scale digital base maps at a 1:1M scale that combine integrated geospatial dataset layers associated with people (census, transportation, populated places) and the environment (watersheds, protected areas, land cover). These frameworks feature the correct relative positioning of features rather than absolute accuracy. Given the national scope of this project, amalgamation of other framework themes will also be undertaken with national-scale mapping program partners from Mexico and the United States with the goal of producing a set of North American frameworks with seamless geometry and consistent classification systems. All framework data developed under GSDNR is based on international standards to ensure consistency and compatibility.

Recently, the National Agri-Environmental Health Analysis and Reporting Program (NAHARP), a national initiative under the Agricultural Policy Framework of Agriculture and Agri-Food Canada, decided to incorporate the 1:1M National Scale Frameworks Hydrology - Drainage Areas dataset, in addition to the National Ecological Stratification Hierarchy, as a geographic standard. NAHARP will utilize watershed boundaries to report on the effect of various agricultural practices such as nutrient management and pesticides on water quality to policy-makers and the public. Scientists participating in this program over the next five years will develop a series of models or agri-environmental indicators for reporting on the interaction of agriculture and the environment for soil, air, water quality, biodiversity and eco-efficiency

Agri-environmental indicators are science-based measures of key environmental conditions, risks, and changes resulting from agriculture, and of management practices used by producers. They are designed to

13 distinct Drainage Processing Units of the National-Scale Hydrology Framework V.5

- inform agricultural and other decision makers about environmental performance in agriculture;

- demonstrate progress in adoption of stewardship principles and use of environmentally sound practices;

- support development of strategies and actions targeted at areas and resources that remain at environmental risk; and

- facilitate the environmental analysis of policies and programs in agriculture and the monitoring of their performance.

NAHARP will provide science-based agri-environmental information that can play a critical role in guiding policies and program design and help determine which options will be most effective. As policies and programs are implemented, information will help in analyzing and understanding the results actually achieved. The information generated will also be used to provide a general report card that can help track the environmental performance of Canadian agriculture. GSDNR is committed to enhancing NAHARP through improved access to relevant geospatial data on behalf of the Earth Sciences Sector, Natural Resources Canada.

See the GSDNR web site for more information regarding the 1:1M National Scale Frameworks Hydrology data collection and NAHARP.

Ontario Land Cover Database 2000+

The National Imagery Coverage (Landsat 7) project, a part of GSDNR, is tasked with producing a national coverage of orthorectified Landsat 7 satellite images and delivering the geometric correction of non-precise digital files of the National Topographic Data Base (NTDB) to ensure the accurate overlaying of geospatial information. Co-funded by GeoConnections, this project is being undertaken in partnership with more than twenty federal and provincial organizations and is a unique initiative because of its goal of achieving complete Canadian coverage, and the extensive collaboration necessary to achieve this national coverage.

An important partner in this effort is the Ontario Ministry of Natural Resources (OMNR) Inventory, Monitoring and Assessment Unit, which is using orthorectified Landsat 7 data to produce a revised provincial land cover database. The availability of an almost complete set of cloud-free (less than 10%) orthorectified (processed to remove image displacements caused by terrain relief or sensor tilt) imagery using Landsat 7 Enhanced Thematic Mapper (ETM+) data of the entire Ontario landmass represents a valuable source of Earth observation data to support Ontario's land cover mapping needs for the strategic management of its natural resources.

Originally produced in nine segments ("tiles") under three separate programs of the OMNR between 1991 and 1998, the Ontario Land Cover Database was the first land cover classification in Canada to be completed for an entire province wholly from Earth observation data. Initially developed to serve specific information needs, the Ontario Land Cover Database provides a basic thematic layer for a wide range of applications, and is a foundation layer for a developing provincial information system for managing natural resources and the environment.

Updating to orthorectified Landsat 7 data represents a significant improvement in positional accuracy over the original land cover database that was derived from digital, multi-spectral Landsat 5 Thematic Mapper data acquired between 1986 and 1997, with the majority of the satellite data frames imaged in the early to mid 1990s. In the original land cover database, the best Landsat 5 resolution was 30m; by producing the new database using orthorectified Landsat 7 data accuracy is approximately doubled. This accurate positioning is especially important in Northern Ontario, where traditional mapping approaches cannot meet current accuracy and content requirements for land cover mapping.

However production of the new Land Cover 2000 commenced well before Landsat 7 orthorectified images were available for the entire province, the initial two grid zones (15 & 16) are presently not registered to the Landsat 7 orthorectified images. This registration is in process.

Access to the Ontario Land Cover Database is provided for internal government uses including ecological mapping, transportation planning, as well as wildlife, conservation and forestry studies. For example, Land Classification Ecologists, working for the OMNR Provincial Terrestrial Assessment Program, use information from the database to develop methodologies for mapping and inventorying ecosystems at a variety of spatial scales.

Presently, regular clients outside of the OMNR who use the Ontario Land Cover database include: Conservation Authorities, Agriculture and Agri-Foods Canada, the Ontario Ministry of the Environment, the Ontario Ministry of Transportation, the Ontario Ministry of Health and Long-Term Care, and Hydro One for corridor studies. In the summer of 2003, the Muskoka and Perry Sound Health Unit accessed the Ontario Land Cover database to identify wetlands that could be of concern due to the West Nile virus.

OMNR also responds to requests for land cover data from academia, communities, and the private sector on a regular basis. Sixteen provincial university libraries have access to the database. Faculty and students use this information source for enhanced curriculum content, student projects, and research theses.

The new Landsat 7 based Ontario Land Cover Database will enable OMNR to continue to provide reliable, up-to-date information on land cover for over 90% of the province. In addition, this new geospatial dataset will become an indispensable source for detecting change in land cover and by inference in land use, an important indicator in sustainable development.

See the GSDNR Web site for more information regarding orthorectified Landsat 7 imagery and the Ontario Land Cover Database.

New Watershed Lookup Service Incorporates National Scale Frameworks Data

Environment Canada recently launched their new **Watershed Lookup Service** (ec-watershed), which provides a powerful mapping, analysis, and display tool using geospatial data supplied by GSDNR. Originally developed for the Pockwock-Bowater Watershed study, this service incorporates the 1:1M National Scale Frameworks Hydrology - Drainage Areas dataset as its basis. The service enables a user to determine boundary geometry for watersheds in Canada. This thematic layer can then be incorporated with other feature information within a GIS environment.

GSDNR Program Highlights

NRCan is committed to the Government of Canada's priority of integrating sustainable development as a key consideration in federal programs towards "Building a 21st Century Economy". GSDNR has important responsibilities to provide reliable geospatial information for supporting the Earth Sciences Sector's leadership role in sustainable development.

GSDNR Influences Geographical Standards for Sustainable Development Indicators

A partnership is underway between the Atlas programs of Canada, Mexico, and the USA, under the auspices of the environmental monitoring agency CEC (Commission for Environmental Co-operation), to develop a harmonized set of North American framework data (hydrology, transportation, population), which will be used as an environmental reporting framework. A tri-country Memorandum of Understanding is being developed, and the first version of the harmonized North American frameworks should be unveiled in map and electronic form at the annual meeting of the CEC and signed by the Ministers of the Environment from the three countries in Mexico, June 2004. Canada's contribution will be conducted through the GSDNR program.

National Hydrographic Network Contributes to Sustainable Development Reporting

GSDNR will produce and deliver a dataset on the National Hydrographic Network (NHN) as a contribution to the Canadian Information System for the Environment (CISE), which will rely on this framework dataset that is based on Earth observation data, to build the Extent of Wetland Indicator. CISE, an Environment Canada project that falls under the federal government's Environment and Sustainable Development Indicators Initiative (ESDI), has a key role to play in expanding the collection, management, integration, assessment, and communication of environmental data and knowledge at the national level. Over time CISE will help set national priorities for sustainable development indicator programs.

GSDNR , in collaboration with Environment Canada is currently conducting a pilot study using the NHN in the Maritimes. A partnership involving several departments from the federal and Nova Scotian governments has been established to produce a hydrographic model for the Pockwock Lake watershed, a drainage basin that supplies water to the Halifax Regional Municipality. With data supplied by the Nova Scotia Geomatics Centre, the model will be used to test the NHN through CISE as input for the development of a comprehensive watershed management tool. The Pockwock Bowater Watershed Study is a research study being conducted by the Nova Forest Alliance, a partnership of landowners, researchers, industry, First Nations communities, environmentalists, academia and government committed to finding sustainable forest management solutions.

GSDNR Supports "green" Hydro-electric Power Supply

GSDNR is in the process of providing digital elevation model (DEM) data for evaluating the hydro-electric potential and environmental acceptability of a hydro project in the Northwest Territories. This project will deliver "green" energy to support short and long term economic benefits to local Aboriginal and non-Aboriginal communities, as well as various levels of government (First Nations, Territorial and Federal).

## Geographical Names Fundamental to Canada's Geospatial Datasets
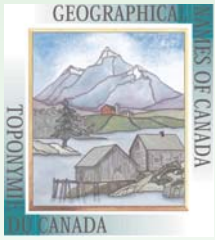
The Canadian Geographical Names Service (CGNS), launched on June 25, 2003 uses the latest web technology to distribute Canada's geographical names data via the Internet (**http://geonames.nrcan.gc.ca/)**. Geographical names are considered an intuitive spatial reference and a fundamental layer of this country's framework data. This national framework makes it possible to provide the geographical data sets of Canada based upon a common reference system and will enable the development of related applications and value-added services available on-line.

Earth Observation Enables Sustainable Development Indicator Reporting

GSDNR delivers geo-referenced Landsat 7 satellite imagery coverage of Canada to the Canadian Forest Service in support of its contribution to Kyoto reporting through the National Forest Carbon Monitoring, Accounting and Reporting System. This system includes the National Forestry Inventory (NFI), one of six indicators identified by the National Round Table on the Environment and Economy to track the impact of economic practices on Canada's natural and human assets.

Production Status for the Ortho7 Project - January 2004
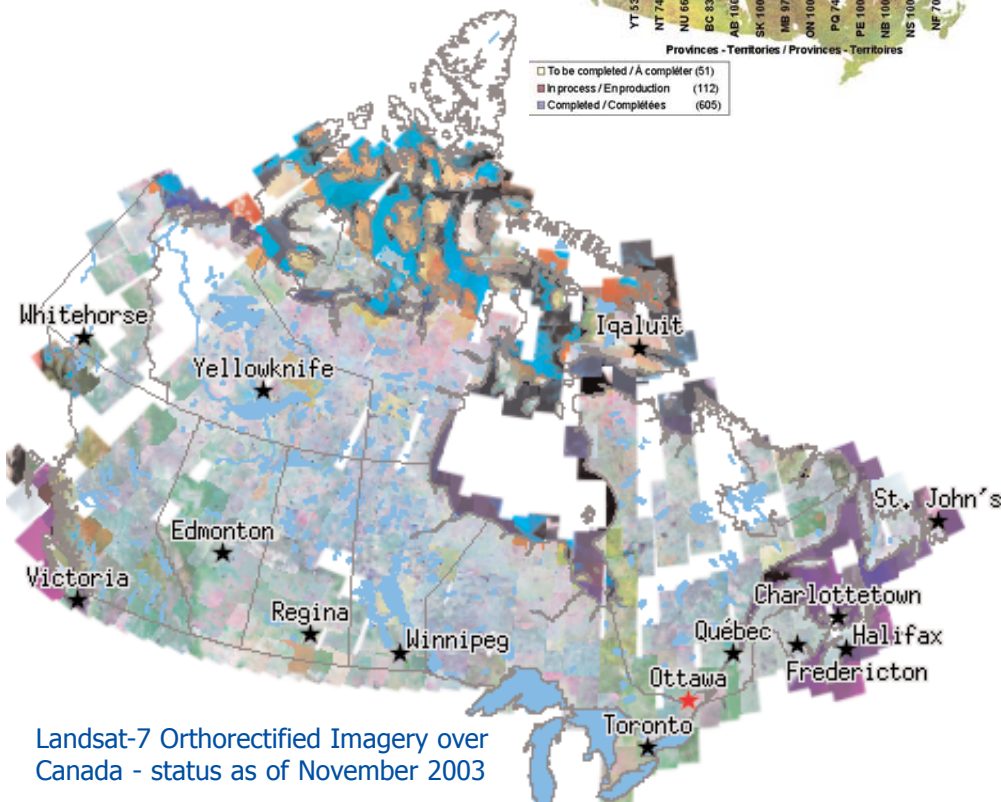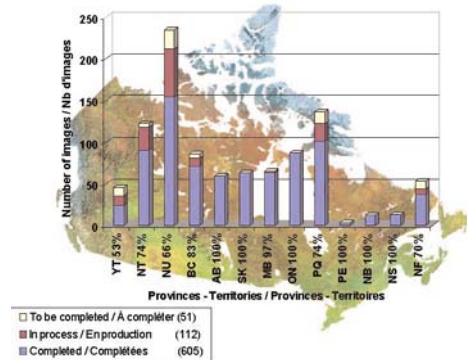
Landsat-7 Orthorectified Imagery over Canada - status as of November 2003
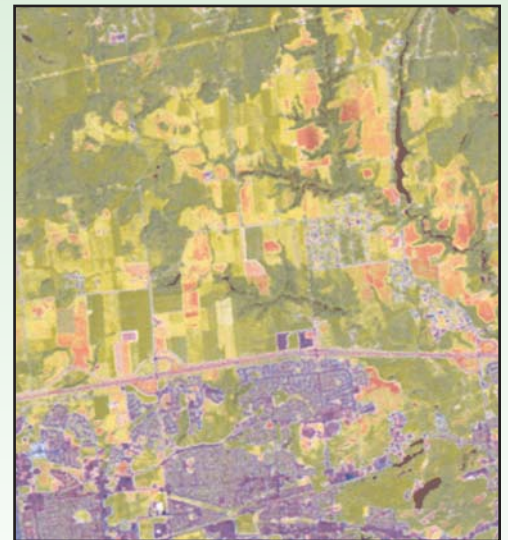
Example of *Spatiocarte*, second generation. Buckingham, Québec

The use of Landsat 7 ortho-images in Québec

The *Ministère des Ressources naturelles, de la Faune et des Parcs* is responsible for the sustainable development of Québec's land, energy, forest, and mineral resources. They use the Landsat 7 orthoimages for a variety of purposes including:
• providing up-to-date information on fire mapping and regeneration inventory;
• classifying ecological districts;
• identifying landslide prone areas; and
• conducting municipal planning.

Additionally, the ministry produces the *Spatiocarte du Québec*, a product derived from the Landsat-7 orthoimages, refined and produced as a series at a scale of 1:100 000. Keen users of *Spatiocarte* include provincial park managers who use it for conservation and shoreline restoration, the identification of geological features, and landuse managers for mapping wetlands and vacation sites. Other users include, the *Ministère de la Sécurité publique*, the *Ministère de l'Environnement*, Hydro-Québec, forest companies and academia.

Product of the Altimetry and Hydrography Project

Legend
- Single Line Water Flow
- Coastline
- Man-Made Hydrographic_1
- Obstacle Hydrographic_1
- Man-Made Hydrographic_2
- Island
- Water Region
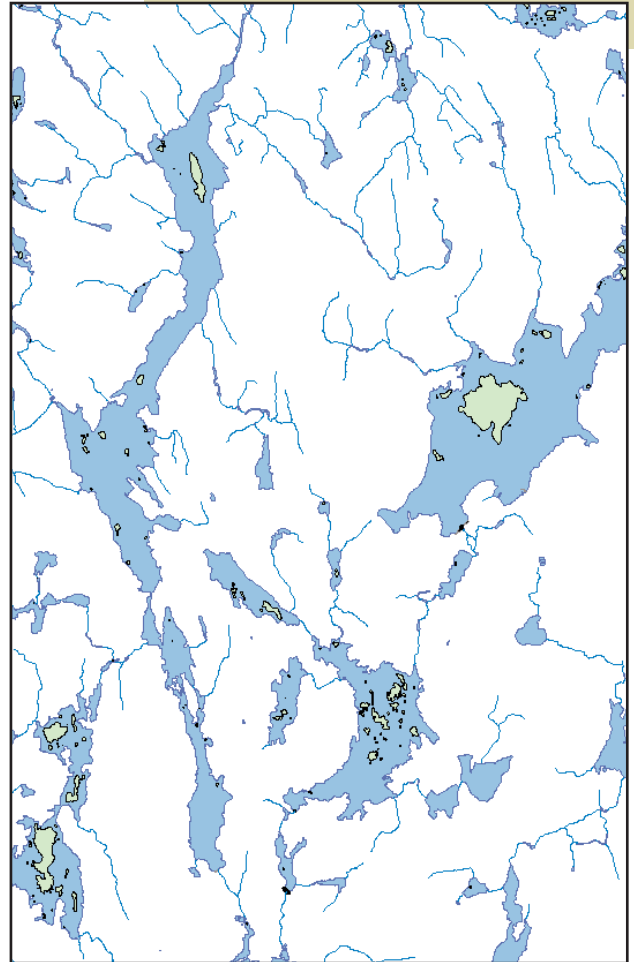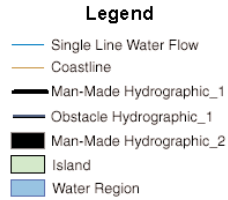
Traditional cartographic representation, depicting all boundaries of various water bodies in the Pockwock watershed.

Product of Canada Digital Elevation Model Project

Spray Lakes reservoir in Banff National Park - mix of shaded relief, grid meshes, contours, and drainage.