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Canada

The National Land and Water Information Service

Soil Information in Canada: Upgrade and Delivery

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Agriculture and Agri-Food Canada

Presentation to the NRCS National Cooperative Soil Survey Conference, Madison WI June 7, 2007

www.agr.gc.ca/nlwis-snite

Outline

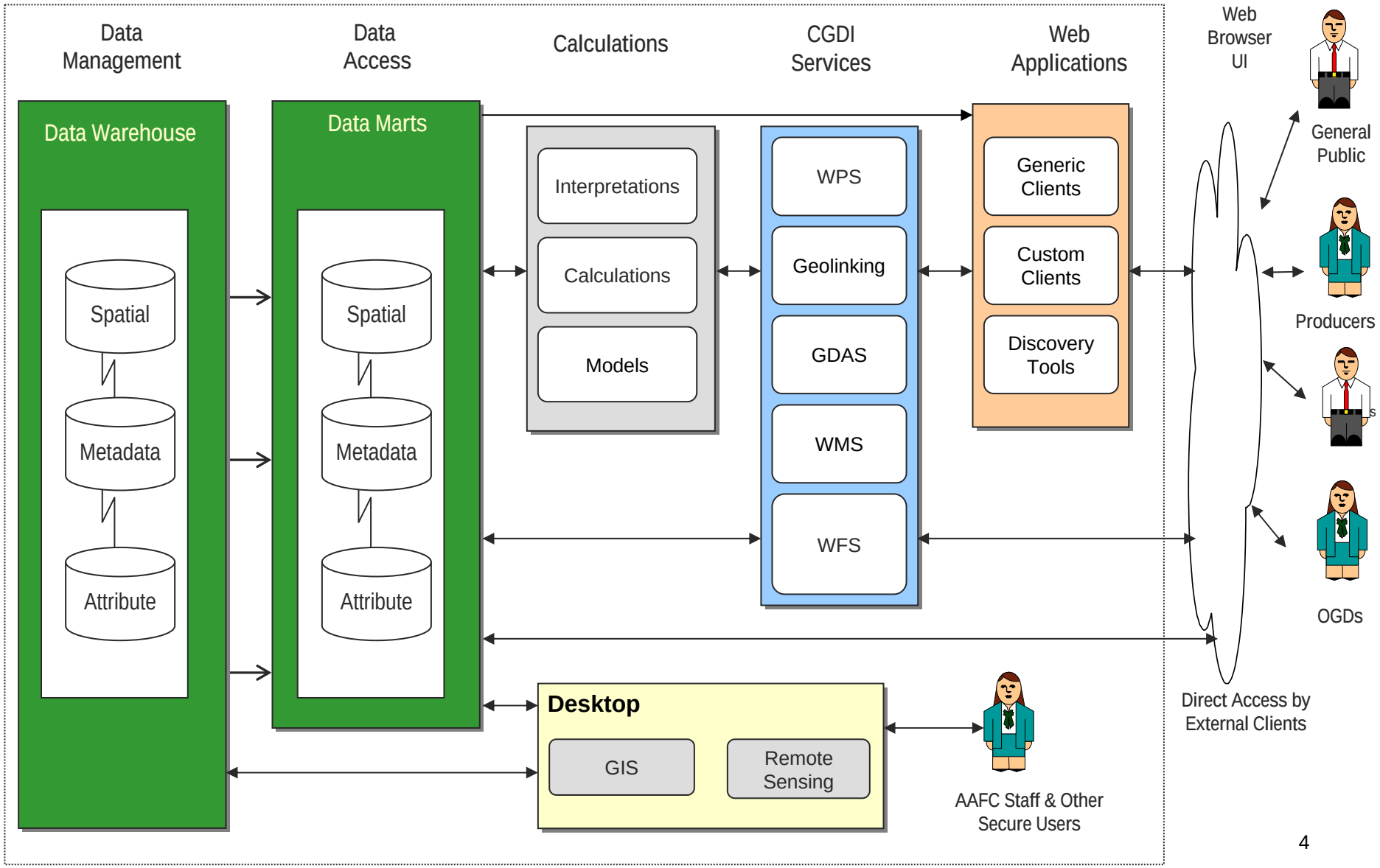
- Brief overview of new information National Land and Water Information Service initiative
- Composition of the federal soil resource group (federal soil survey)
- View of the Canadian Soil Information System
- Strategic planning for the group
- Overview of the current activities in detailed mapping, broad-scale mapping, interpretations, development of the national pedon database

What is the National Land and Water Information Service?

Agriculture and Agri-Food Canada's on-line, agricultural information service to:

- provide access to a range of spatial data through a public Internet portal,
- Utilize recognized standards for interoperability, metadata and web services,
- enhance the quality of, and access to, agri-environmental geographic data (soil, water, climate and biodiversity) on a national basis,
- develop agricultural decision support tools (interactive applications), and
- make available land and water expertise (user support).

N-GIS High Level Architecture



Service Components

The National Land & Water Information Service will provide:

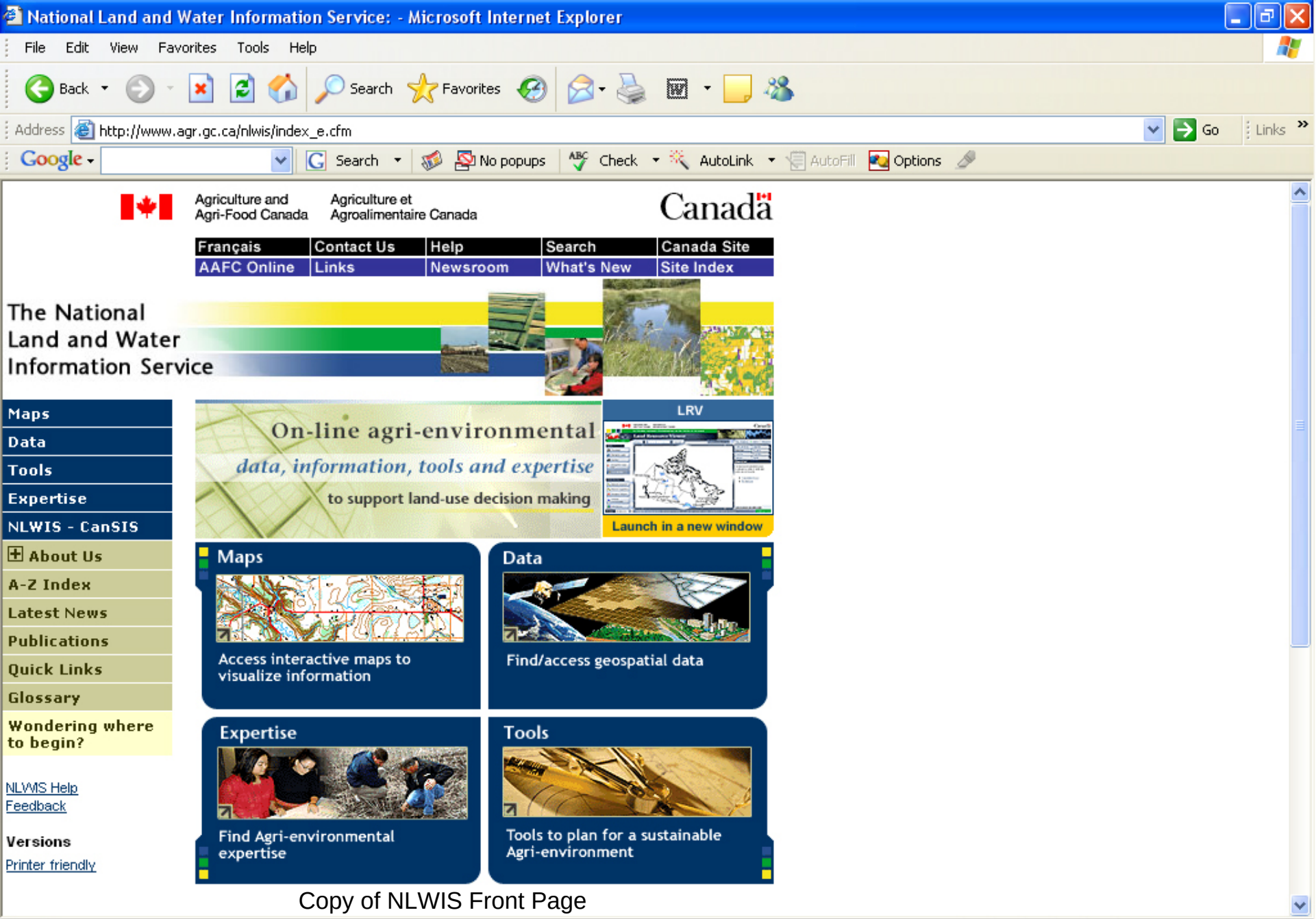
- **Applications** that meet user needs to support decisions.
- **Data** that is current, accurate and at an appropriate scale.
- **Partnerships and Collaboration** with other governments, agencies both federal and provincial to develop, or share access to existing, soil, water, climate and bio-diversity information.
- **IM/IT infrastructure** built on GeoConnections principles. This will be a network of independent servers and databases accessible through the Internet which are housed at AAFC and its many partner agencies.
- **Expertise/Outreach** that includes knowledge management, the capacity to interpret the information and to collect and maintain the Service.

Data Development Activities

- Maintenance of Current Data Sets
  - NLWIS through its maintenance of the Canada Soil Information System (CanSIS) is the authoritative source for Soils data in Canada
  - Soils data are collected, maintained and accessed in CanSIS as part of the overall NLWIS service.

- New Data Development
  - Undertaken to support the core business of AAFC/NLWIS and reflect the detailed business requirements
  - Expertise resides within AAFC
  - Most data development activities will continue post NLWIS

- Data Acquisition
  - Occurs when AAFC is not source of primary data (e.g. water, climate) Work in collaboration with data owner
  - Partnership Office negotiates agreement to acquire required data from partners



Copy of NLWIS Front Page

Canadian Soil Information System (CanSIS)

Frequently Asked Questions (FAQ)

MAPS

DATA

Find data

Ecozones, Ecoregions, and Ecodistricts

Soil Landscapes

Soil Surveys

TOOLS

PUBLICATIONS

Environmental Sustainability of Canadian Agriculture

National Ecological Framework

Health of our Soils

Soil Surveys

Manuals

Classification System

Glossary

Canadian Soil Information System

New SLC Version 3.1 Released!

Since 1972, the Canadian Soil Information System (CanSIS) has supported the research activities of Agriculture and Agri-Food Canada by building the

- National Soil DataBase,

and acting as a source of GIS products and expertise through its

Impacts on federal soil survey

- CanSIS no longer stand-alone entity within AAFC
- Loss of independence and flexibility
- Data updates no longer ad-hoc but part of a formal release schedule
- Centralized support for IT infrastructure licensing not available previously
- New information management technology
- System architect for new enterprize system (NLWIS) is former Head of CanSIS

AAFC Soil Resource Group (Federal Soil Survey)

- Headquartered in Ottawa with CanSIS staff and Ontario regional unit
- Regional units of 2 to 6 staff in each province
- Total staff of 60 pedologists, soil technicians and geomatics specialists
- Supported by IT staff, Applications, and Partnerships staff elsewhere within the National Land and Water Service
- Using contractors in northern territories and Newfoundland
- Size of the group has dimenished over last 10 years but is up over the last 2 years

Federal Soil Resource Group

Components and Functions

Regional Units

•65% of effort

Function: Field data collection, synthesis, validation and product development

Landscape and Pedological Research

•15% of effrot

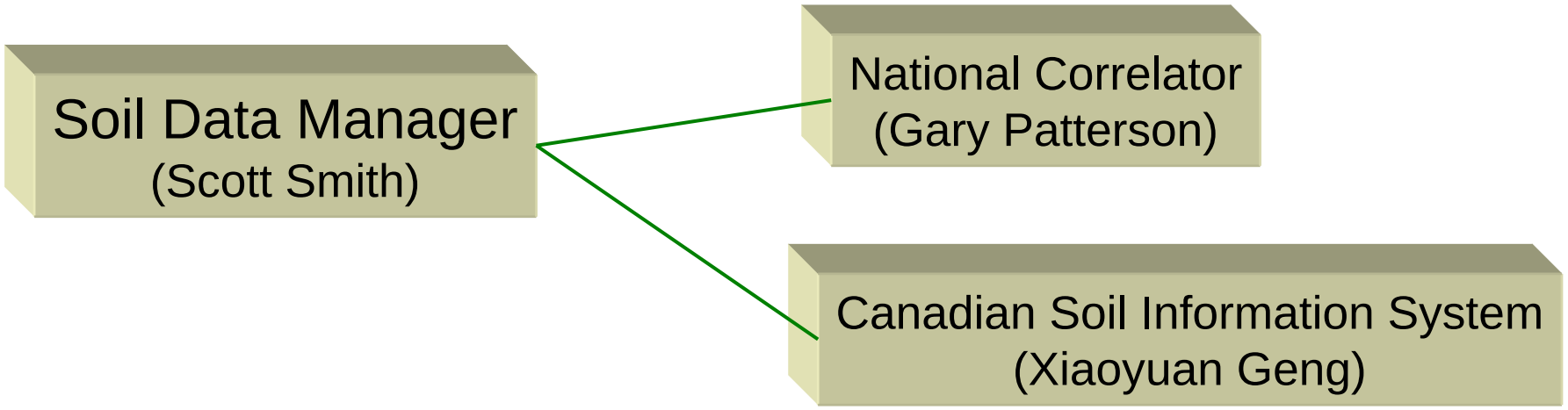
Function: Collaborative research in pedology, landscape modelling, technology development

CanSIS Unit (Ottawa)

20% of effort

Function: Data management QC/QA, geomatics, product development and web site, dissemination

Soil Resource Group: Management structure



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NSDB Detailed Soil Survey Status and Metadata - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address http://wms1.agr.gc.ca/cgi-bin/mapmeta?mode=browse Go Links

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AAFC Online | Links | Newsroom | What's New | Site Index

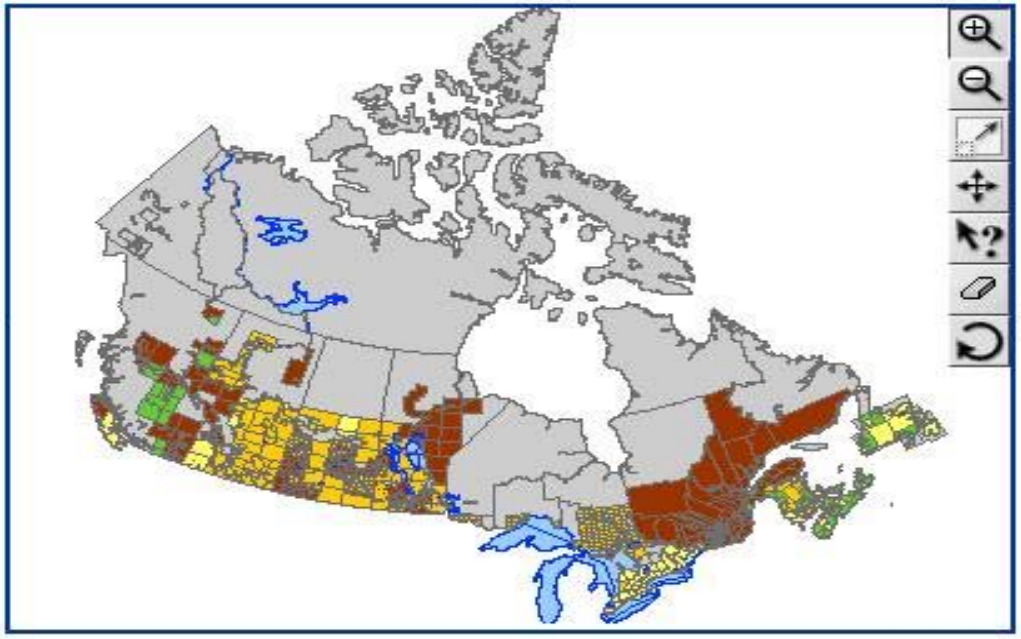
The National Land and Water Information Service

Home You are in: CanSIS > National Soils Database > Detailed Soil Surveys

NSDB Detailed Soil Survey

Status and Metadata

Map Size: -Small- Help!



0 610 1220 1830 2440 km

Getting Started

Zoom into an area on the map by drawing a rectangle using the tool.
To download data and examine metadata for a polygon, use the tool and click on the polygon.

Legend

- Civil Boundaries
- Hydrology
- Survey Status
  - Complete
  - Incomplete
  - Not Online
  - Not Digital
  - Not Surveyed
  - Water

More Information:

Soil Landscapes of Canada: A broad-scale map product and database for environmental assessments

Version 3.0 for Agriculture
http://sis.agr.gc.ca/cansis

Version 1 and version 2 cover all of Canada, version 3 covers agricultural region all at a scale of 1:1,000,000.

Canadian Soil Information System (CanSIS) – Current activities

- Migration and loading of existing data and web pages to new enterprize GIS system
- Metadata creation, alignment with new digital base map
- Scanning of historical reports and maps
- Edit and update >5000 web pages of information
- Implementation of interoperable standards of OGC

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Soil Survey Data Access and Visualization Using Interoperable Web Services

Xiaoyuan Geng, Dave Rewlins, Jean Melnichuk, Kelly Sonkiny, Gary Patterson, National Land and Water Information Service, Agriculture and Agri-Food Canada

Introduction

Traditional two-tier or three-tier client-server application architecture has been used in the USA and Canadian soil information systems for data management and distribution. These client-server architectures are often characterized by a focus on business functional requirements only. For example, a specific function such as download soil survey data is realized using proprietary formats; a soil web mapping application is designed and implemented using hard-coded data source locations and a highly customized client user interface. As a result of this type of function-specific design, many soil-related applications are isolated, monolithic and complex in nature. These implementations have a tendency to produce systems with high maintenance costs – they are unsustainable, non-interoperable and fragile.

To meet the needs of clients today, an application architecture should reflect the complete range of business requirements such as agility, interoperability, continuity etc. Thus, many architects and developers are now working to support the shift toward a service oriented architecture (SOA) or system model. This means moving from a sprawling mass of client-server applications to a set of organized, distributed systems based on Web services and other standards-based technologies. The SOA model has several key features that may be beneficial to soil related information system migration or construction (Figure 1).

Figure 1. Key features of SOA model and benefits

In the context of the SOA model, and given the geospatial nature of soil survey data, how to best serve up soil data using a suite of interoperable Web services needs to be communicated. In addition to mainstream Web service solutions, the Open Geospatial Consortium (OGC), an international geospatial standard organization, has officially released several well accepted Web service implementation specifications (eg. WMS, WFS, WPS and some newly proposed GDAS and GLS etc.). Web services as reusable software components on the network can be built once and used many times; also web services are often built according to well accepted specifications and interoperable. For example, a WMS based Soil Landscapes of Canada web service can be plugged into the Google EarthE interface for visualization, query and analysis.

The objectives of this presentation are to identify the commonalities of the soil survey data structure used in the USA and Canada, while discussing and demonstrating the use of some of the OGC services for serving up and accessing soil survey data in the context of the SOA model.

Common Data Structure of Soil Survey Data in the US and Canada

In the USA and Canada, digital soil survey data are often captured, managed and distributed with similar data models (Figure 2). For example, the Map Unit concept is often used. A map unit is a collection of areas defined and named according to their soil components or miscellaneous areas or both. Each map unit differs in some respect from all others in a survey area and is uniquely identified on a soil map. Each individual area on the map is a delineation. Map units consist of one or more components. In Canada, each map unit can have many components but commonly consists of three in the digital content for detailed maps and is commonly uncontrolled for the Soil Landscapes of Canada. In the USA, each map unit can have up to 21 components.

As Figure 2 illustrates, the relationship between the Map Unit Table and the Soil Component Table is "one to many". The relationship can be "one or many to many" between the Soil Component Table and other soil property tables such as the Soil Name Table and the Soil Layer Table in Canada.

In both the USA and Canada, soil survey data (including the spatial and geo-linkable attribute data) are delivered using proprietary formats. This often requires end users to have specific Geographic Information System (GIS) software as well as a certain level of relational database handling skills to use the data. There are some pre-processed or interpreted data that can be served through some web mapping applications or download links. However, there remains a significant amount of room for us to improve the usability of soil survey data by leveraging the latest SOA architecture and Web service technologies.

Figure 2. Shared Common Structure of Soil Survey Data between US and Canada

Common Use Cases of Soil Survey Data in the US and Canada

Soils are an important component of the earth system. A wide range of natural science and ecosystem management disciplines require soil information resources. Thus it is important to make the soil survey data easily accessible and usable via the Internet as the data is widely required by various levels of users such as scientists, modelers and managers, producers etc. However many of the soil data users have formulated generic use cases (Figure 3).

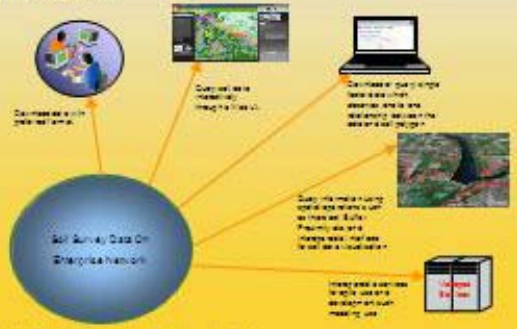

Figure 3. Illustrated soil survey data use cases

How can interoperable Web services help?

To support Web based interactive query, visualization and analysis, soil survey data needs to be served up using various Web services. WMS can be used for polygon data rendering and cartographic mapping over the Internet; a soil survey data WPS will provide flexible attribute access without using proprietary software; to support various data transformation and dynamic computational needs, WPS can be implemented and used. For example, through a WPS a GML-based WPS response can be transformed into a user-preferred format such as ESRI Shape or WKT format. The major benefit of Web service based soil data access is that we can make our subject matter specific data easy to access and use. Figure 4 demonstrates some of possible data flow scenarios based on prototyping work in Canada.

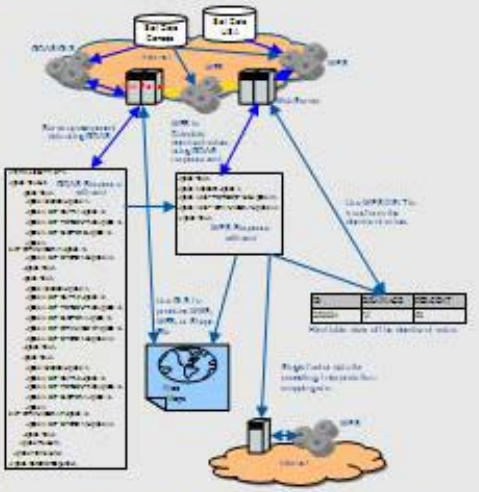

Figure 4. Enabling soil data use and sharing using interoperable Web services

References and Acronym

So where do we go from here?

- Organizational change triggered a call for a strategic plan for the future of the soil resource group within AAFC
- Opportunity to inform senior departmental executive of the challenges and opportunities ahead
- Opportunity to make recommendations for future strategic directions
- Expected outcome is that when decisions are made about the soil program they will be informed decisions


The National
Land and Water
Information Service

The National Land and Water Information Service

Strategic Plan for the Delivery of Soil Resource Information within AAFC

Document Version 1.1

May, 2007

Prepared for:

Environmental Health Science Program
National Land and Water Information Service

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

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Strategic Plan

- Current supply of and demand for soil data
- Outlines HR trends and needs, options and implications
- Strategic future directions

Soil Resource Group – Strategic Directions

1. Maintain national network of regional offices with centralized correlation, data management and geomatics functions.

2. Focus on three product lines:
   - -Soil Landscapes of Canada (1:1M scale)
   - -Update to create seamless provincial coverages at common scale
   - -National Pedon Database
   - Interpretive products relating to agriculture and the environment.

Soil Resource Group – Strategic Directions

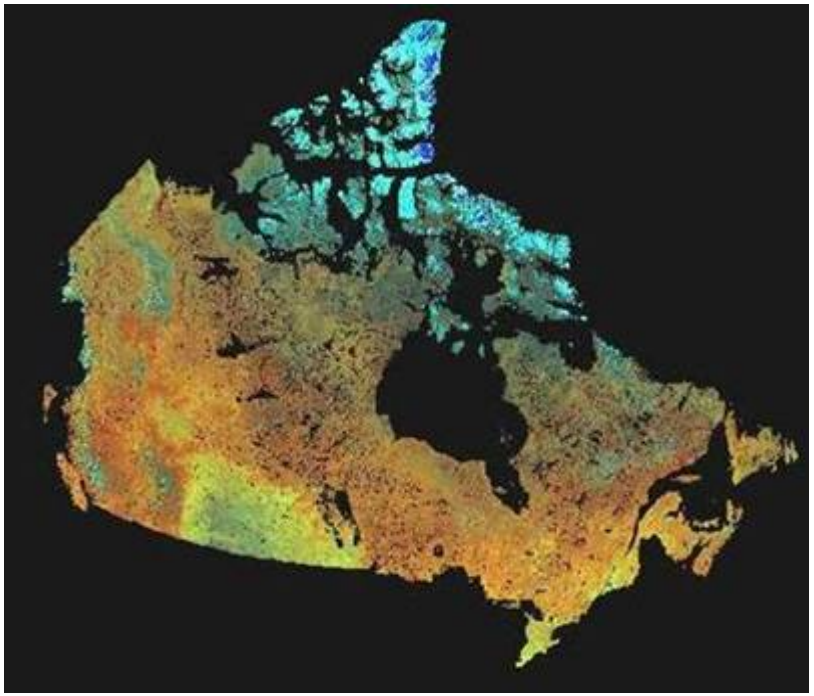
3. Actively seek to utilize new technologies to update soil map products wherever possible
   -LandMappR, SoLiM, Imagery, DEM
4. Achieve effeciencies through partnerships and collaborations
   -Multi-agency product development
   -Seek external funding wherever possible

5. Utilize the National Land and Water Information Service to make CanSIS products publicly available over the internet via the best and most current geomatics technologies available.

Overview of Work Plans

- Soil Landscapes of Canada
- Provincial coverages
- Detailed mapping- range of activities at regional and provincial scales
- National Pedon Database
- Scanned maps and reports
- Interpretations

Soil Landscapes of Canada (Wally Fraser)



Version 1 and version 2 cover all of Canada, version 3 covers agricultural region.
Scale of 1:1,000,000

- SLC is used for scaling up: models run on soil-landform components with land use, management and climate data from other sources.

-SLC supports agri-environmental indicators, environmental farm scans, greenhouse gas emissions accounting.

-SLC is the basis of the Ecological Framework for Canada.

National Map

SLC polygon

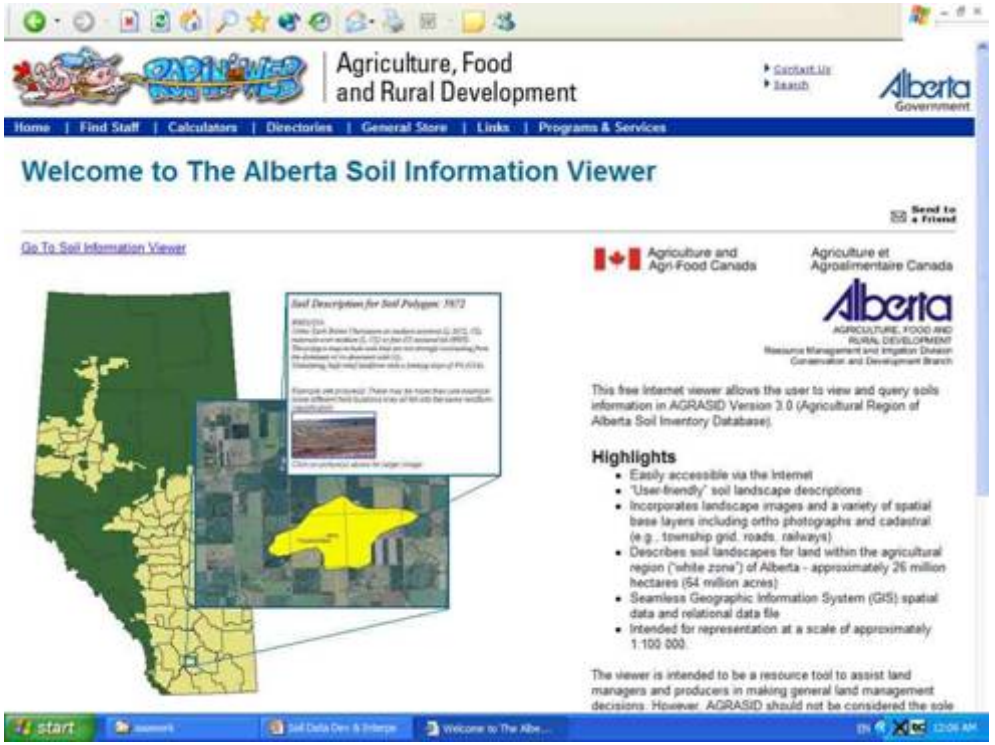
Soil Component Data

(SN and SL Tables)

Detailed Soil Maps (Jean-Marc Cossette and David Howlett)

Provincial soil map compilations

- 1:100K for AB SK MB
- 1:50,000 for ON, NB
- 1:20K PE
- One legend, seamless coverage, modern base for each province



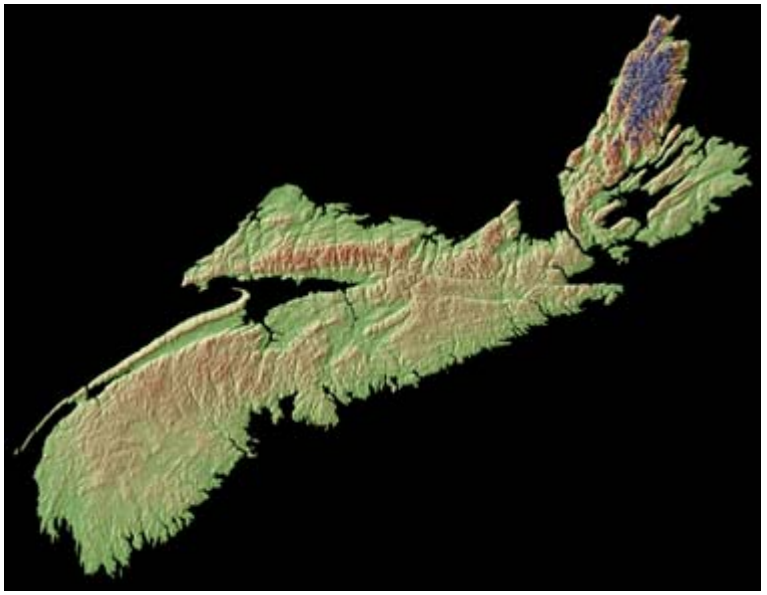
Regional assessments are possible with seamless provincial coverages as in Alberta

Detailed Soil Maps (Jean-Marc Cossette and David Howlett)

County and project area maps

Standard file structure and content

- Different scales, different legends (eg. BC and QC)
- Often organized by County to produce patch-work quilt of coverage
- Some value-added, e.g. digitized tile drainage, drape on DTM as is done in parts of Nova Scotia
- Some provinces thinking about a single coverage
- Mapping upgrades to some areas; fitting to modern base in others



National Pedon Database (Barb Lacelle and Luc Lamontagne)

Data from field sampling sites

Important as model input and to populate soil map databases

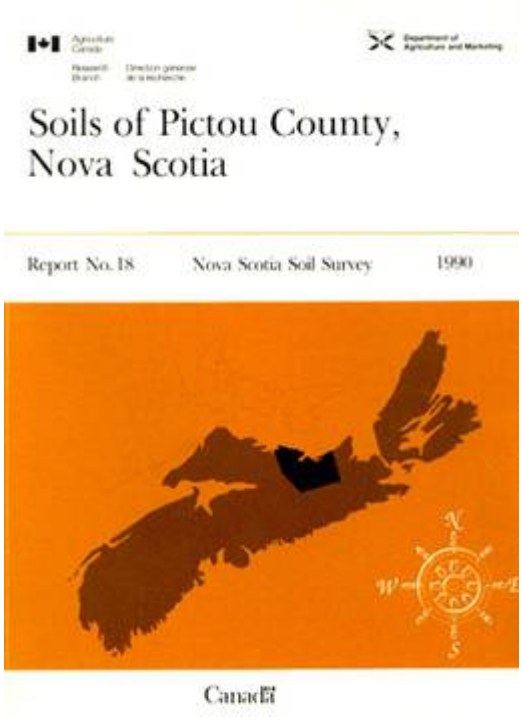
NDL Newdale Series

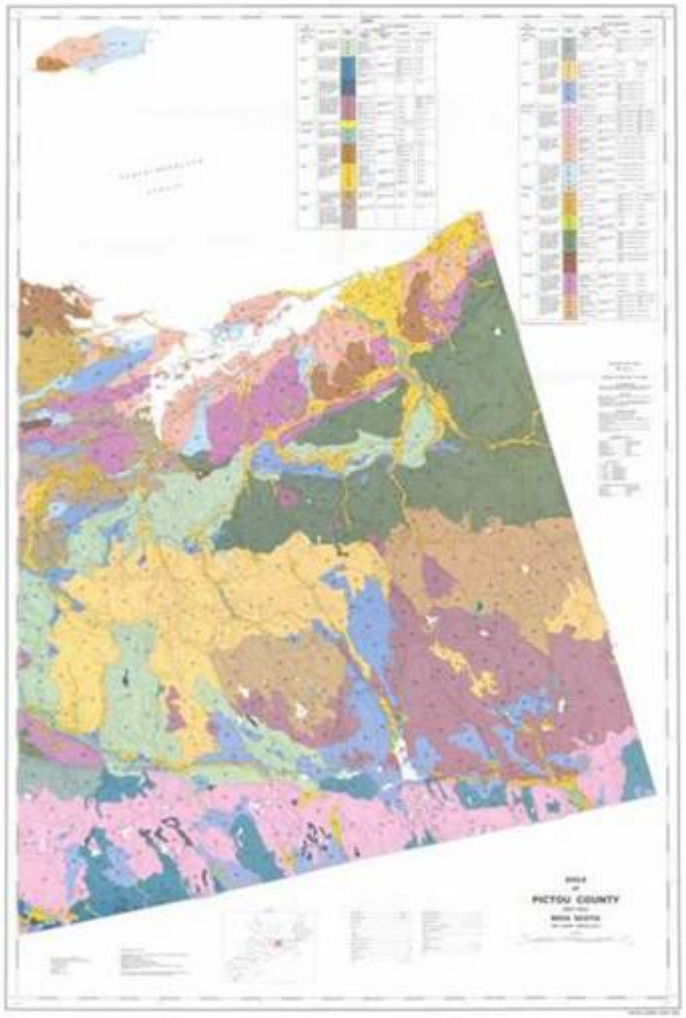
Orthic Black Chernozem

Loamy glacial till

Scanned maps and reports (Peter Brimacombe)

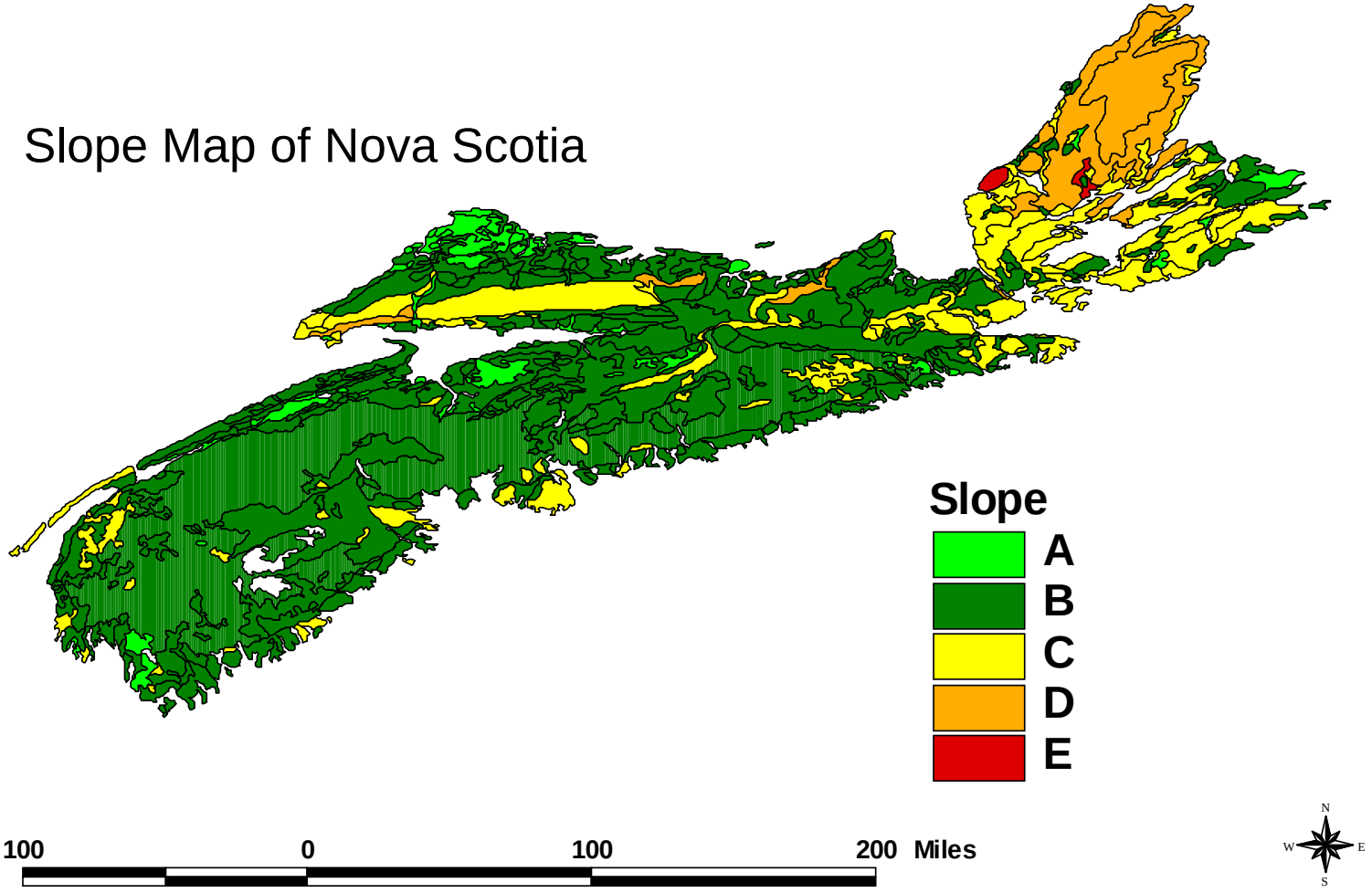
- For paper world clients
- For archival purposes





National Scope Interpretations – Single Factor Maps

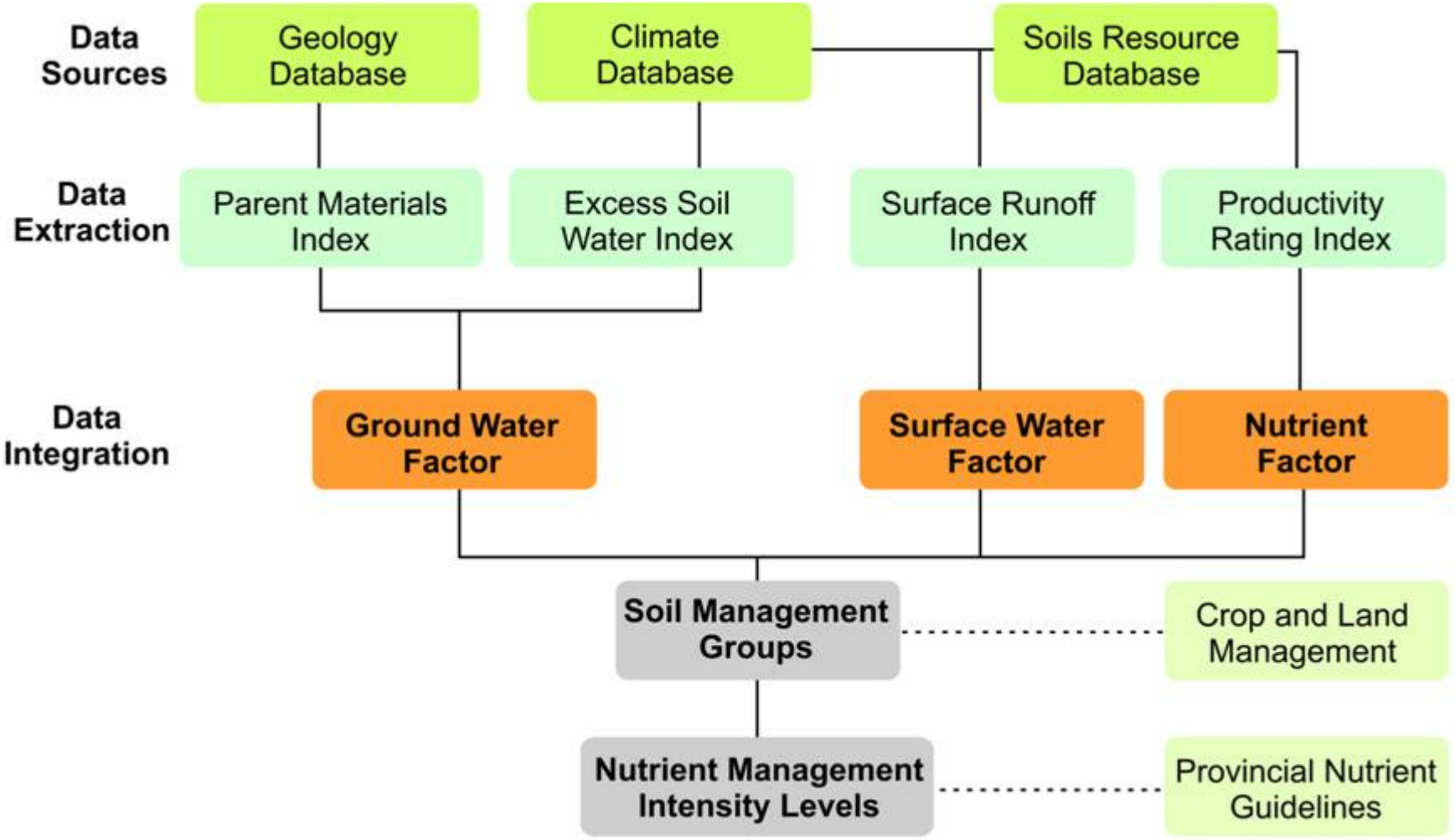
(Tony Brierley and Glenn Lelyk)



National Scope Interpretations – Nutrient Management Planner
(Tony Brierley and Glenn Lelyk)

Combines soil data with climate, surficial geology and well-log data

Summary of Data Integration



National Scope Interpretations - Land Suitability Rating System (Tony Brierley and Glenn Lelyk)

Combines soil, climate, and landscape data

LSRS - background

- Agronomic Interpretations Working Group established in 1988

- Guidelines:
  - Retain 7 class CLI concept
  - Be crop specific
  - Be national in scope
  - Expert system using existing data
  - Automate

- Crops
  - Spring seeded small grains (wheat, barley & oats)
  - Corn
  - Canola
  - Soybean
  - Forage (alfalfa, brome grass)

LSRS – Factors

Factor	Relationship	Data
Climate	Crop flexibility	Gridded 10km^2 1961-90 climate normals (P-PE & EGDD), rolled up to SLC
Soil	Productivity	NSDB – soil attributes
Landscape	Sustainability	NSDB – slope and slope length

Special interpretations

- Wide range of crop and engineering suitabilities in different regions of the country
- Prioritization of list required based on user requirements

Summary - The New Reality

- Future size of the federal soil survey group is probably going to include about 45 to 50 permanent employees.
- Our pressure is to maintain national/regional map data products using latest GIS and web service technologies
- Focus on agri-enviromental interpretations
- Benefit from National Land and Water Information Service – will provide access to developers, IT, partnerships etc


Canada