Overviews from Canada - The Soil Landscapes of Canada Project

Walter R. Fraser

Agriculture and Agri-Food Canada, Research Branch

North Central Cooperative Soil Survey Conference

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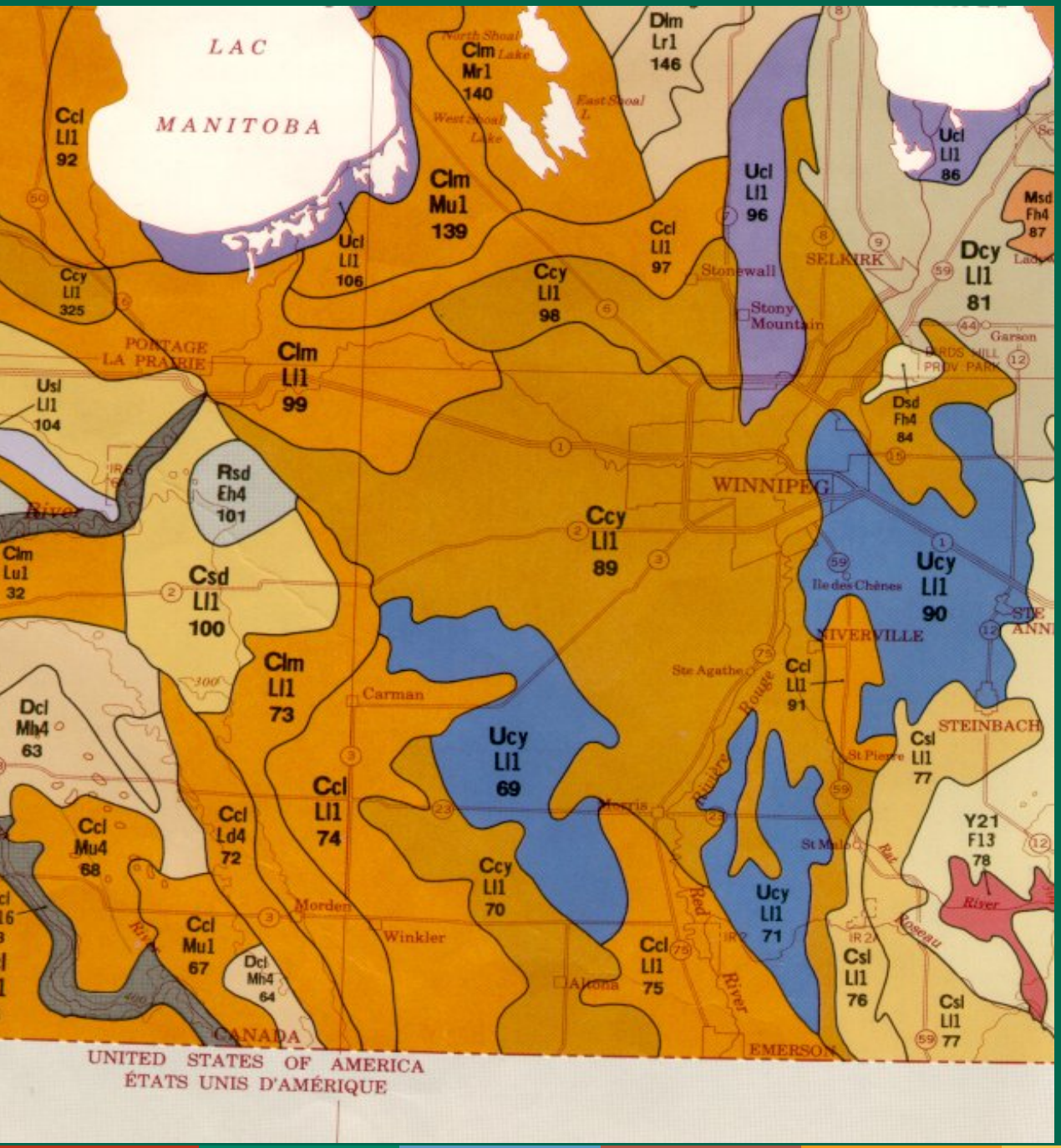
Medora, North Dakota

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
Canada

Soil Landscapes of Canada (SLC)

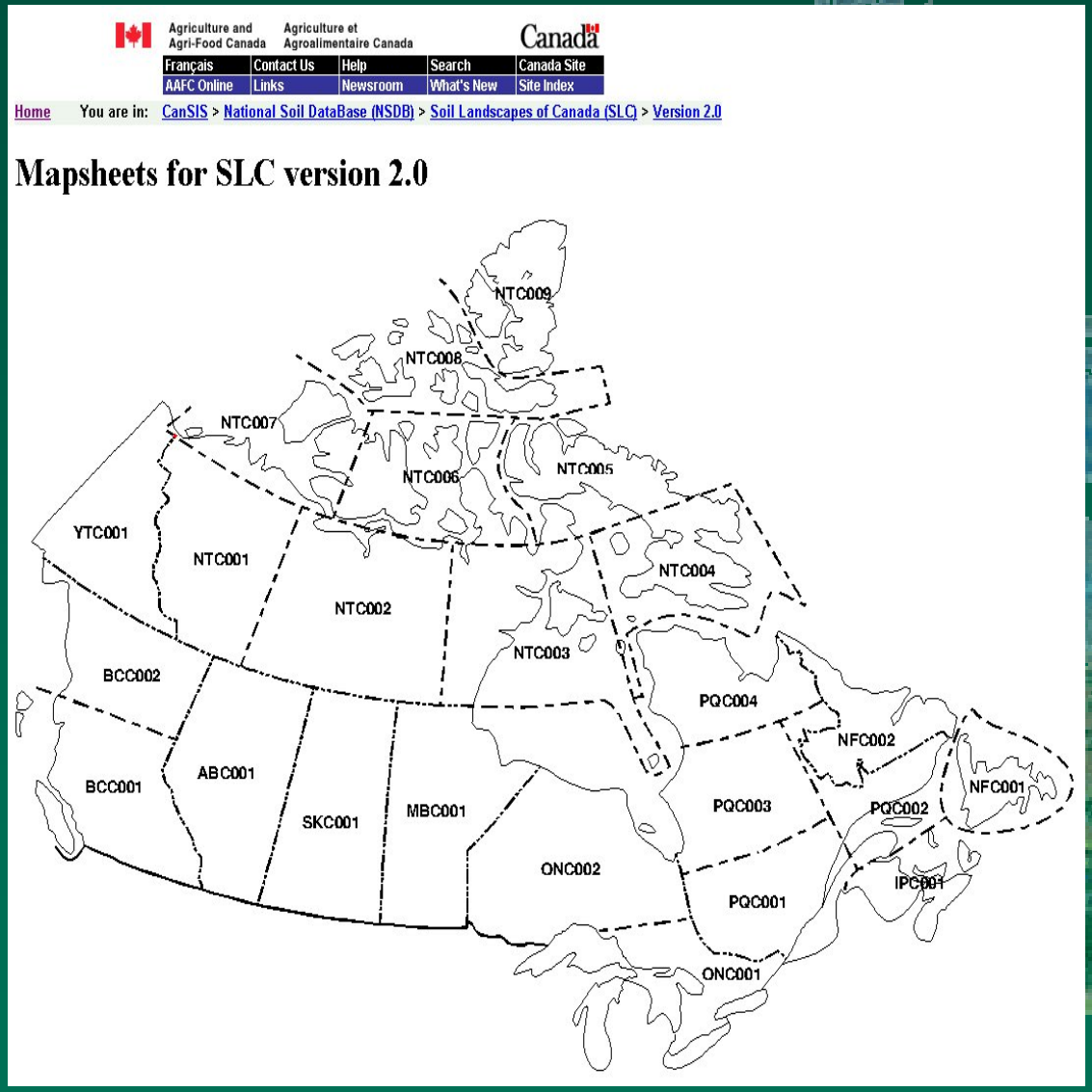
- Brief overview of SLC maps
- New features of SLC Version3
- Related data sets (land form, Ag census, climate)
- New web map applications



Soil Landscapes of Canada - Version 1

- Paper maps and legends at 1:1 Million scale
- Manually compiled for each province
- General soil attributes only
- Digitized with water polygons (no separate base)

Soil Landscapes of Canada (SLC)



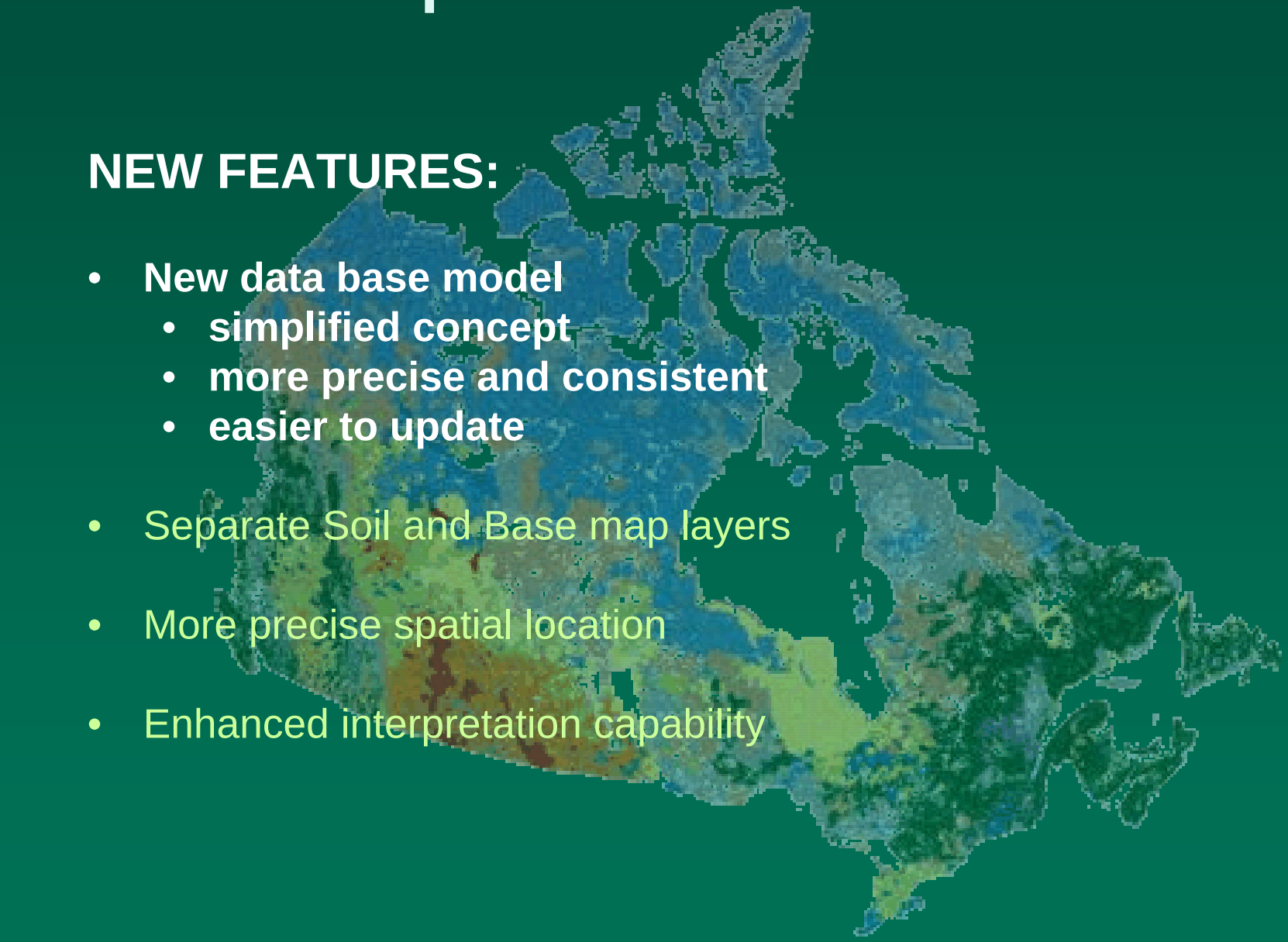
Version 2.0 (1994)

- National coverage in 24 map sheets
- Dominant and Subdominant soil attribute files

Version 2.2 (1996)

- Basic units for Ecological Stratification of Canada

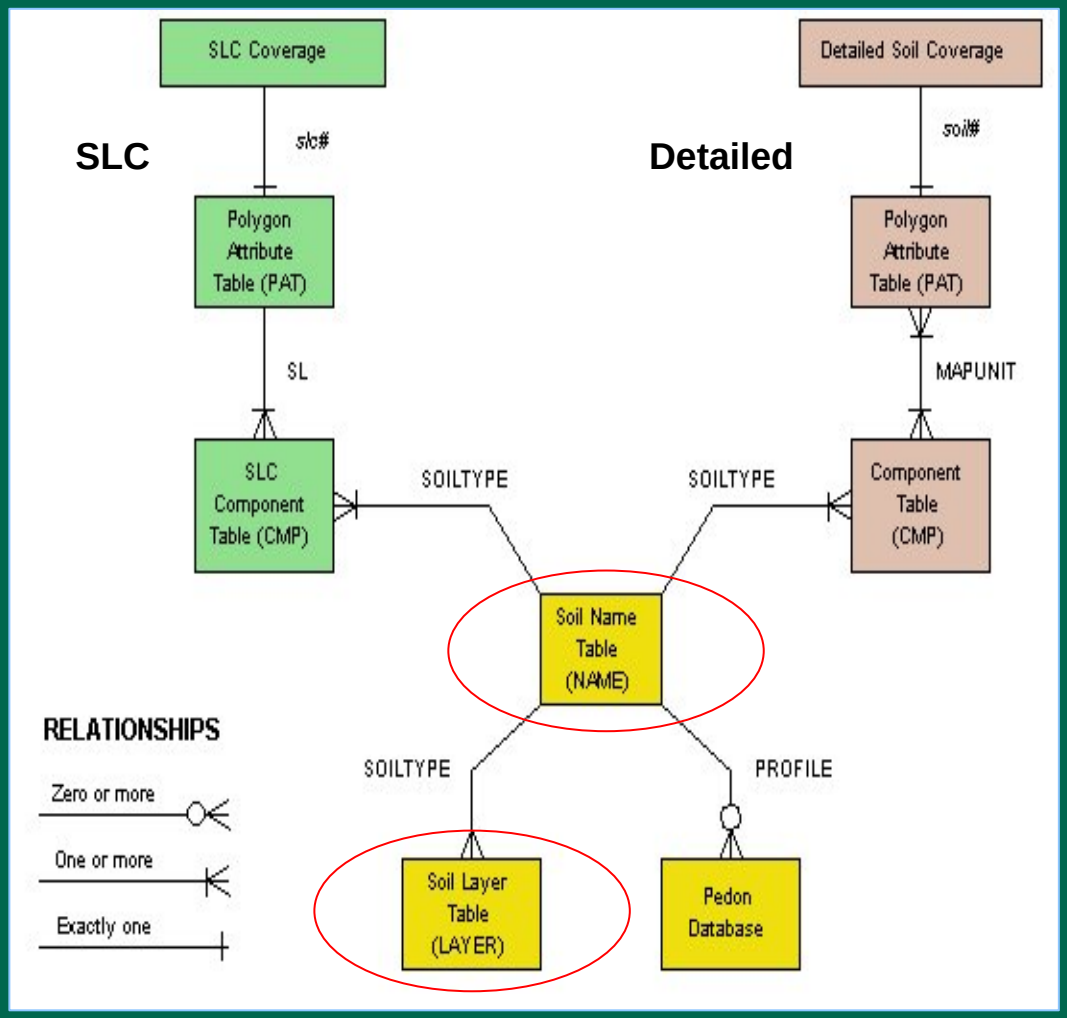
Soil Landscapes of Canada Version 3.0



NEW FEATURES:

- **New data base model**
  - **simplified concept**
  - **more precise and consistent**
  - **easier to update**
- Separate Soil and Base map layers
- More precise spatial location
- Enhanced interpretation capability

SLC Version 3.0 – Data Base Model



Common Relational Data Base Model for SLC and detailed maps

- Shared Soil Name (SNF) and Soil Layer (SLF) attribute files
- Simple to understand
- Easier to update
- More powerful

SLCv3 Component Table (CMP)

Polygon number (SL)	Ecodistrict + number
Component number	1 to 99
Province + Soil Code + Modifier codes (= SOILKEY)	link to SN and SL Tables
Percent	0 to 100 %
Slope class	A,B,C,D,E,F
Stone class	**N**one, **S**light, **V**ery stony
Local Surface Form	L, U, H, R, etc.
Drainage, Taxonomy, PM1,2 Mode of Deposition, Texture	from Soil Names Table
AWHC, C. Frag, Rooting depth	Calculated from SL Table

CanSIS Soil Layer Table

- A data base model of each soil series
- Maintained by Pedologists in each province
- Updated based on best available information
- Data source for GIS soil interpretations

SOIL CODE: GOL MODIFIER: LU: A FILE: MBSLFMAS RECORDS: 3244/4 PROVINCE: MB UPDATED: 1993.06.25

#	HORIZON	UP	LO	CF%	CF#	DS	VFS%	VFS#	S%	S#	Si%	Si#	C%	C#	OC%	OC#	PHCA	PHCA#	PH2	PH2#
1	A p	0	25	0	0	F	0	0	24	1	45	1	31	1	3.4	1	6.7	1	7.2	0
2	B tgj	25	40	0	0	F	0	0	10	1	43	1	47	1	1.7	1	7.6	1	7.9	0
3	BC	40	60	0	0	F	0	0	12	1	43	1	45	1	0.9	1	8.3	1	8.6	0
4	C kgs	60	100	0	0	F	0	0	10	1	56	1	34	1	0.0	0	8.5	1	8.8	0

#	BASES	BASES#	CEC	CEC#	KSAT	KSAT#	KP0	KP0#	KP10	KP10#	KP33	KP33#	KP1500	KP1500#	BD	BD#	EC	EC#	CACO3	CACO3#	VP	VP#	WOOD	WOOD#
1	100	1	27	1	3.000	0	49	0	41	0	33	0	16	0	1.30	0	1	1	0	0	-9	0	-9	0
2	100	1	27	1	3.000	0	48	0	39	0	31	0	15	0	1.35	0	1	1	0	0	-9	0	-9	0
3	100	1	28	1	3.000	0	44	0	38	0	30	0	14	0	1.45	0	3	1	8	1	-9	0	-9	0
4	100	1	19	1	3.000	0	43	0	38	0	30	0	14	0	1.51	0	8	1	26	1	-9	0	-9	0

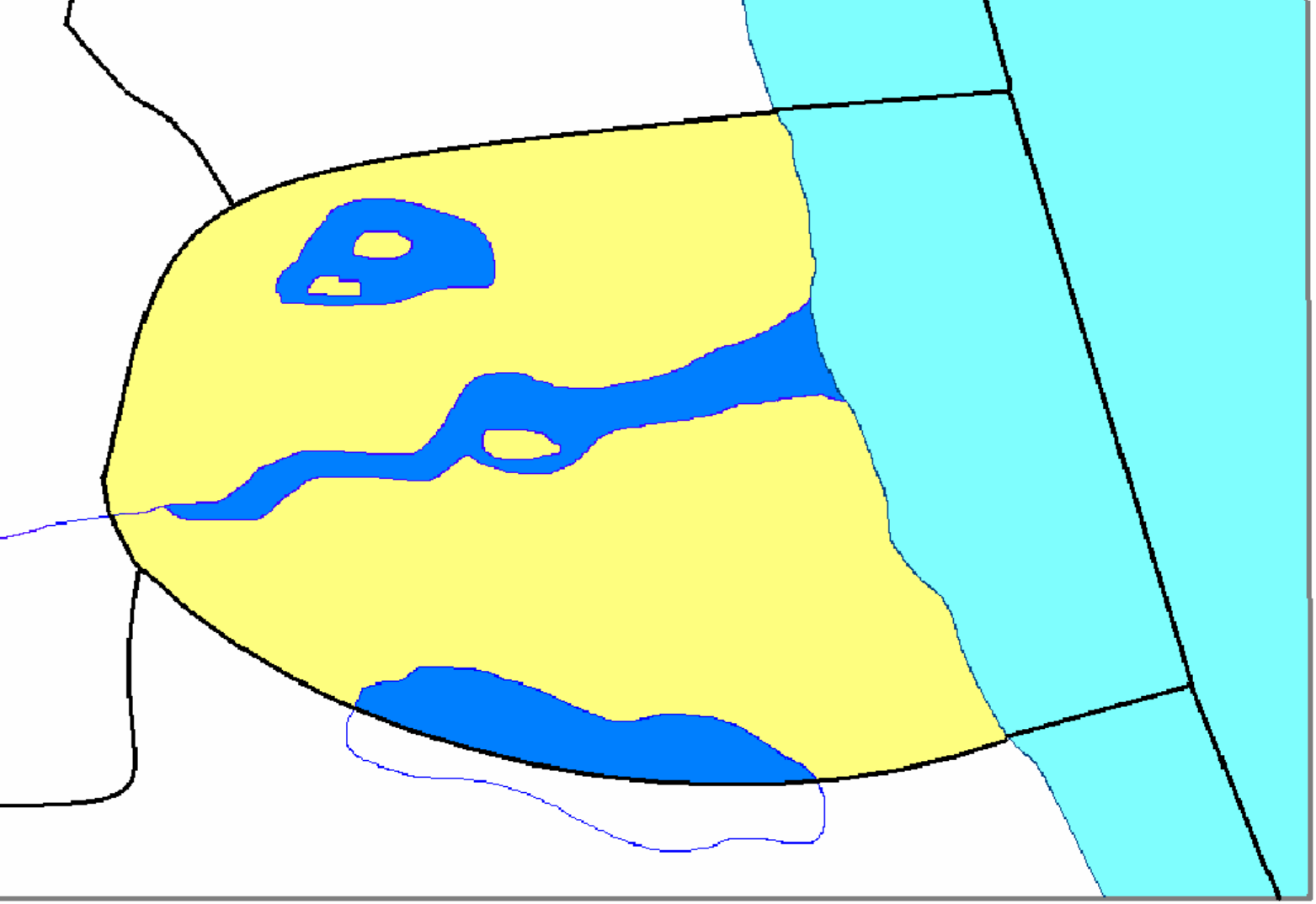
Notes:

YR	ID
69	04

Soil Landscapes of Canada Version 3.0

NEW FEATURES:

- New data base model
- Separate Soil and Base layers
  - Soils layer maintained by CanSIS
  - Base layers from GeoGratis
- More precise spatial data
- Enhanced interpretation capability



Soil Landscapes of Canada - Polygon Overlay Concept

SLC boundary
Base map hydrography
LAND_AREA
HYDRO_FRESH
HYDRO_OCEAN

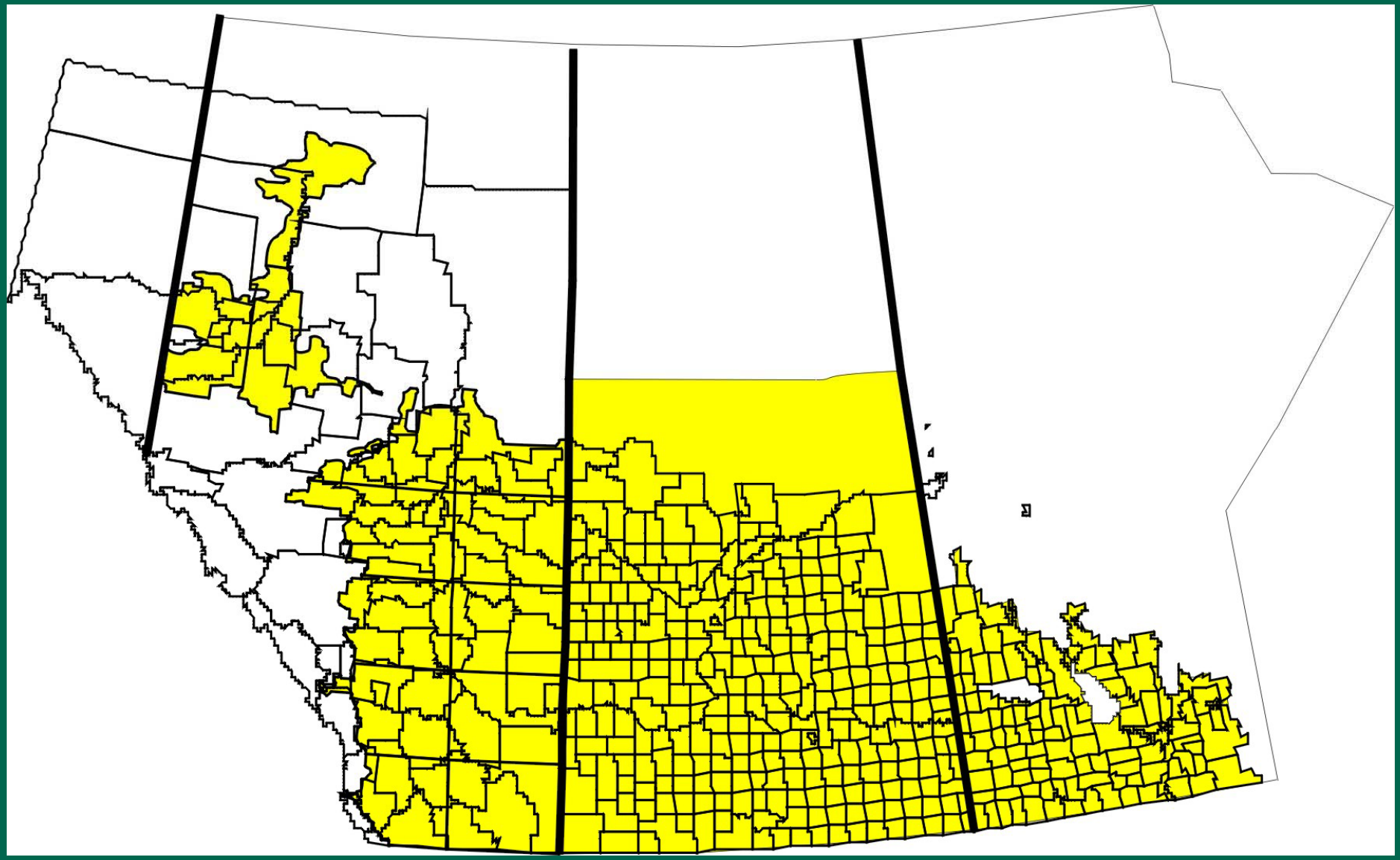
SLC v3 Overlay Concept
- separate Soil and Base map layers

Soil Landscapes of Canada Version 3.0

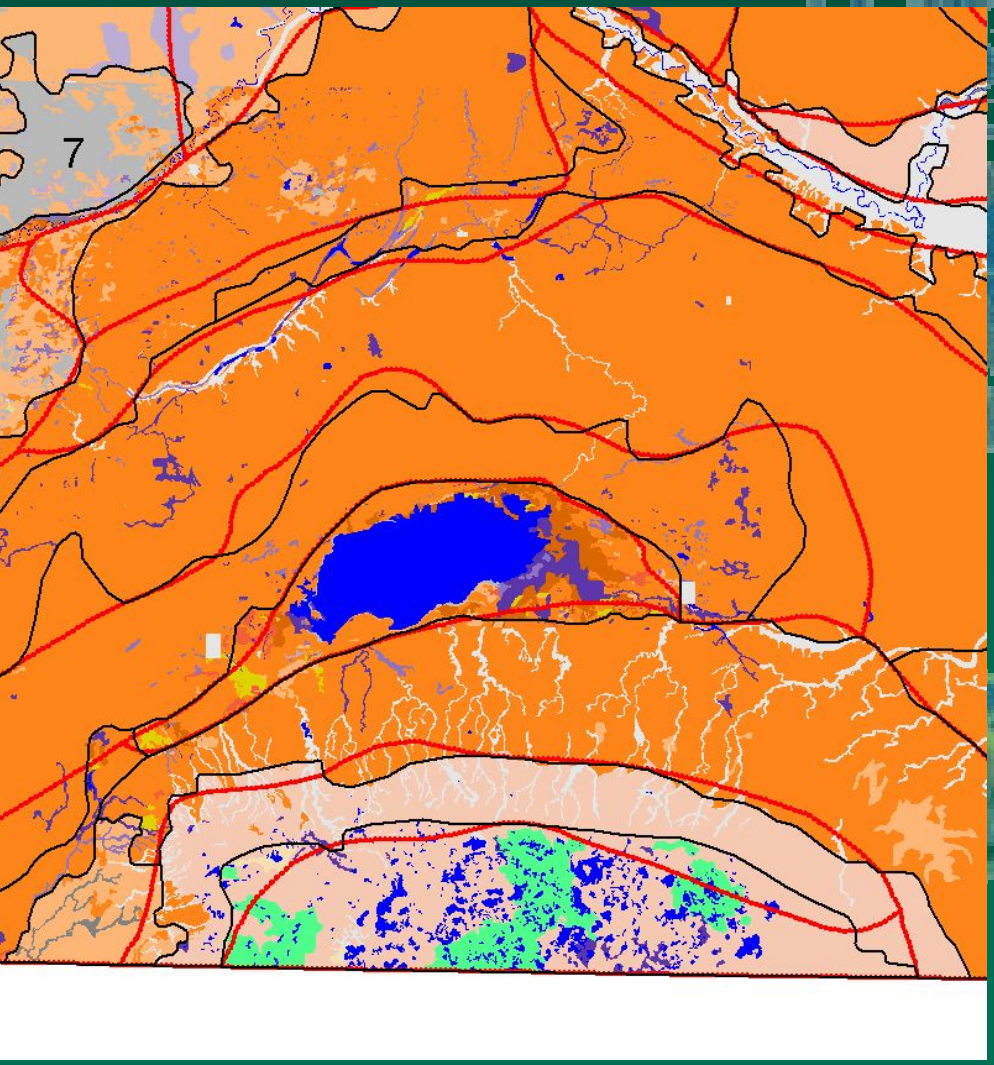
NEW FEATURES:

- New data base model
- Separate Soil and Base layers
- **More precise spatial data**
  - **SLCv3 polygons and soil components defined by GIS overlay from detailed soil map coverages**
  - **Soil Attributes derived from Soil Names and Layer Files**
- Enhanced interpretation capability

Detailed soil map coverage for Alberta, Saskatchewan and Manitoba.



Soil Landscapes of Canada (SLC)



Turtle Mountain Manitoba

Detailed soil map coverage colour themed as a GIS base map layer

SLCv3 polygon lines adjusted to improve spatial accuracy

SLCv3 lines (black)

SLCv2 lines (red)

Soil Landscapes of Canada Version 3.0

NEW FEATURES:

- New data base model
- Separate Soil and Base layers
- More precise spatial data
- Enhanced interpretation capability
  - Common data base structure allows easier integration of interpretation programs and models
  - Provincial and national SLCv3 maps available
  - nested within national Ecological hierarchy

SLC Land Use and Management Data

- Statistics Canada Census of Agriculture Information collected from all farms every 5 years (1991, 1996, 2001, 2006).
- recompiled for SLCv3 polygons.
- land use, management and extent of ag crops in each polygon.
- SLC polygons with >5% farmland are “Ag” polygons.

SLCv3 is the Spatial Data Framework for the National Agri-Environmental Indicators Program

All indicators use the same data sources:

- **SLC soil attribute data.**
- **Landscape Segmentation data.**
  relates SLC soil components to landscape characteristics.
- **Land Use and Management data.**
  Census of Agriculture data recompiled by SLC polygon
- **Climatic data.** AAFC Ecodistrict 1961-90 Climate Normals database (linked to SLCv3 via Ecodistrict number).

SLC is used for “scaling up”

Models are run on individual soil + landform components with land use, management and climatic data from related data sets.

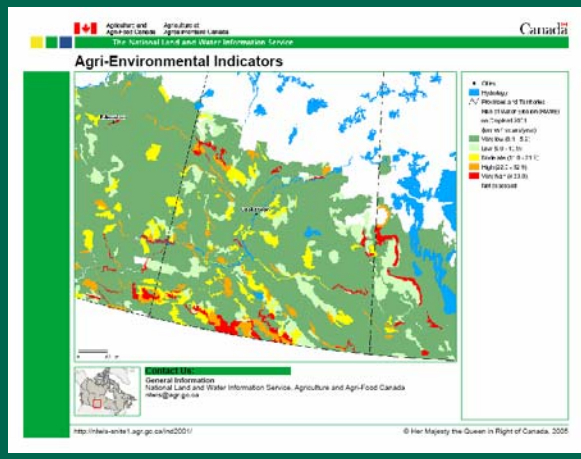
Results summarized for the SLC polygon and regional and national maps.

Soil Component Data

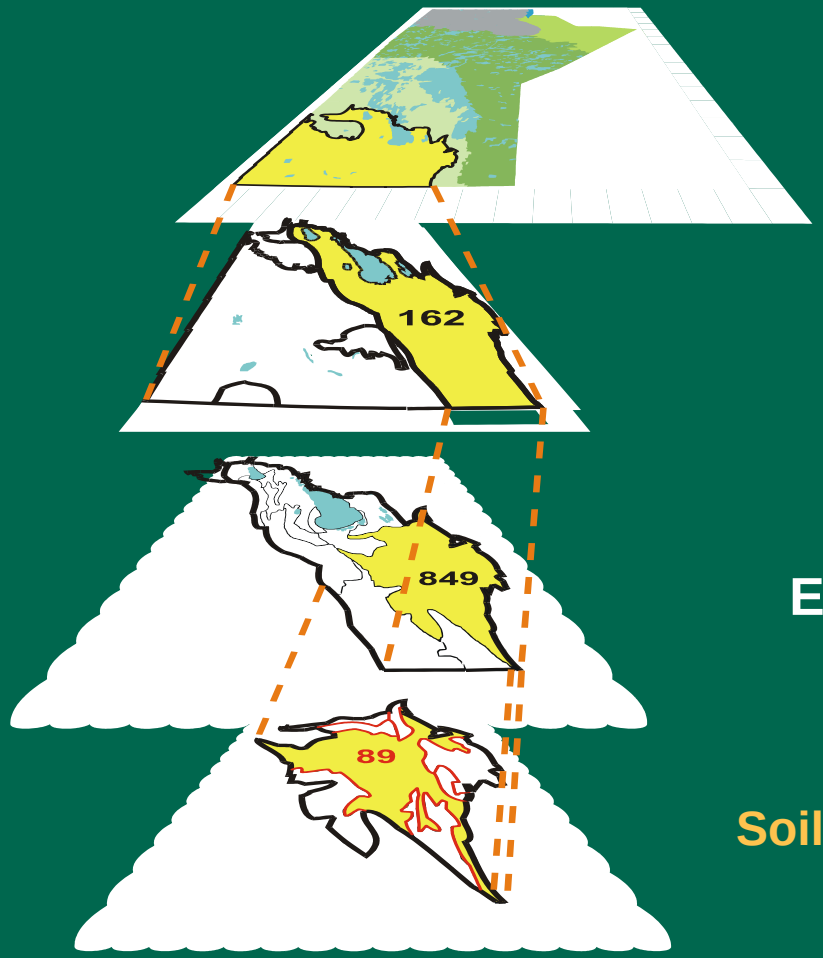
(SN and SL Tables)

SLC polygon

Provincial and National Maps



SLC polygons are the building blocks for National Ecological Stratification



Eco-Zones

Eco-Regions

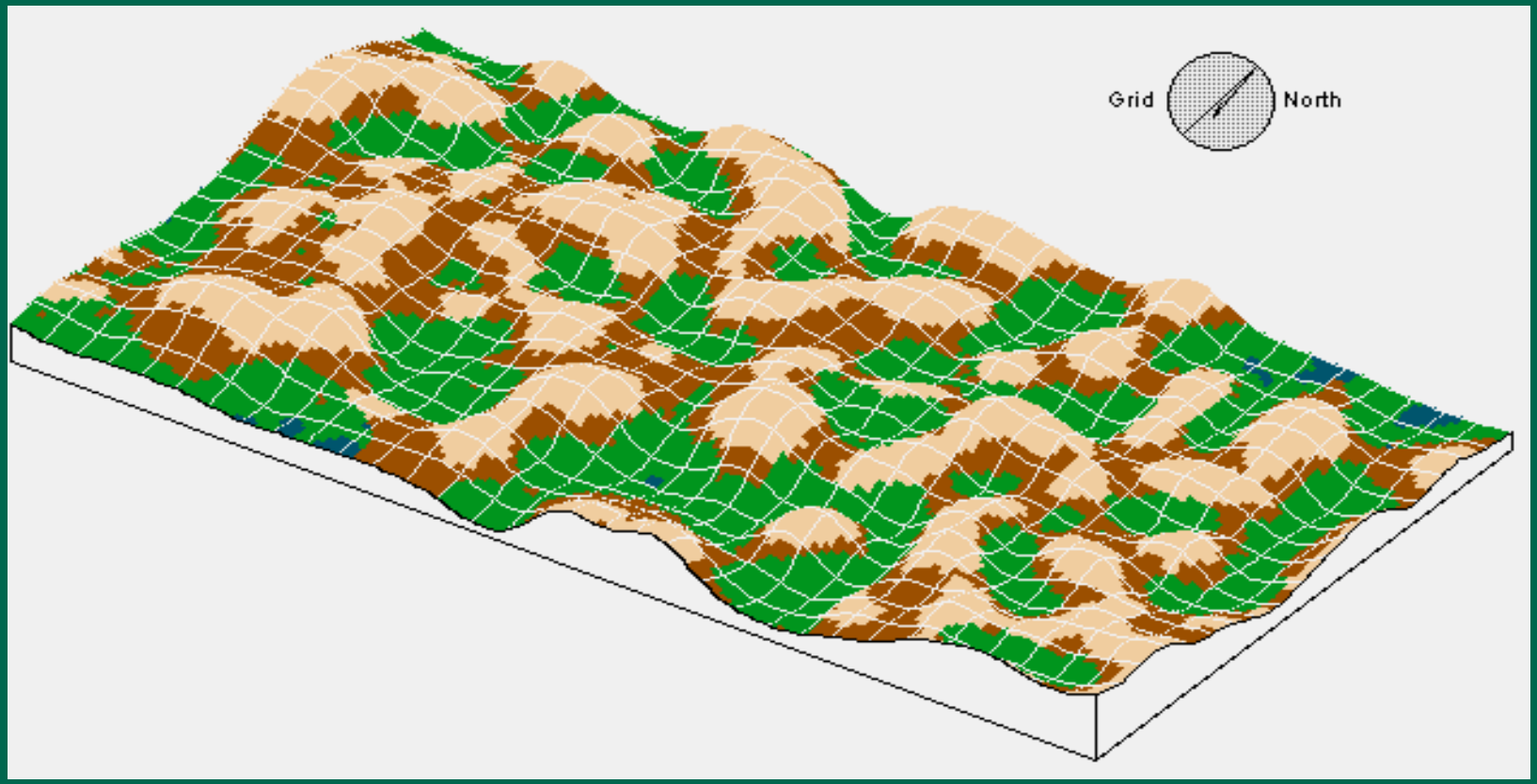
Eco-Districts

Soil Landscapes

Problem: SLCv3 Component File has limited landform information

Solution: Add a Landform Segmentation Table (NCGAVS)

Example: Hummocky "C" landscape (9 to 15% slopes)



Landscape Segmentation Characteristics

SEGMENTATION VALUES FOR SOIL LANDSCAPES OF CANADA LANDFORMS (Proposed) *

SLC Landform Descriptor		Alberta	Total		UPPER			MID			LOWER			DEP	
Surface Form	Slope Class	source	length	Prop	Slope	S_L	Prop	Slope	S_L	Prop	Slope	S_L	Prop	Slope	S_L
Inclined (i)	A or 1	I1l	1000	20	1	200	60	2	600	20	1	200	0	n/a	n/a
and	B or 4	I3l	300	20	4	50	60	5	200	20	4	50	0	n/a	n/a
Dissected (d)	C or 10	I3m	500	15	10	75	70	12	350	15	8	75	0	n/a	n/a
	D or 16	I3h	800	10	17	80	80	20	640	10	16	80	0	n/a	n/a
	E or 31	I3h	1000	10	35	100	80	45	800	10	30	100	0	n/a	n/a
Steep (s)	F or 61	I3h	1000	0	n/a	n/a	90	70	900	10	50	100	0	n/a	n/a
Hummocky (h)	A or 1	H1l	150	30	1	45	35	2	50	25	1	40	10	0.5	15
and	B or 4	H1l	125	30	4	40	35	6	40	25	3	30	10	1	15
Knoll and Kettle (k)	C or 10	H1m	125	30	9	40	35	12	40	25	7	30	10	1	15
	D or 16	H1h	175	35	14	60	30	20	50	25	10	45	10	2	20
Level (l)	A or 1	Ll	1000	0	n/a	n/a	45	1	450	45	1	450	10	1	100
Rolling (m)	B or 4	M1l	500	25	3	125	45	5	225	25	3	125	5	1	25
	C or 10	M1h	600	20	8	120	55	11	330	20	6	120	5	1	30
	D or 16	M1h	800	20	13	160	55	18	440	20	9	160	5	2	40
Ridged (r)	A or 1	R2l	200	20	1	40	55	2	110	20	1	40	5	0.5	10
	B or 4	R2m	300	20	4	60	60	6	180	15	3	45	5	1	15
	C or 10	R2h	400	15	9	60	65	12	260	15	7	60	5	2	20
	D or 16	R2h	500	15	15	75	65	20	325	15	10	75	5	3	25
Terraced (t)	A or 1	FP1	500	10	2	50	60	1	300	20	1	100	10	0.5	50
Undulating (u)	A or 1	U1l	250	20	1	50	50	2	120	15	1	40	15	0.5	40
	B or 4	U1h	200	25	3	50	45	5	90	20	2	40	10	1	20

* Landscape Segmentation values based upon the descriptions in the document Alberta Landforms - MacMillan and Pettapiece, 2000

Prop = areal extent of landscape segment within SLC landform

Slope = median slope % associated with each landscape segment

S_L = slope length in meters, for each landscape segment

SLCv3 Landscape Segmentation Table

Soil Polygon 0753012
"Undulating B" landform

NDL Newdale Series

Orthic Black Chernozem

Loamy glacial till

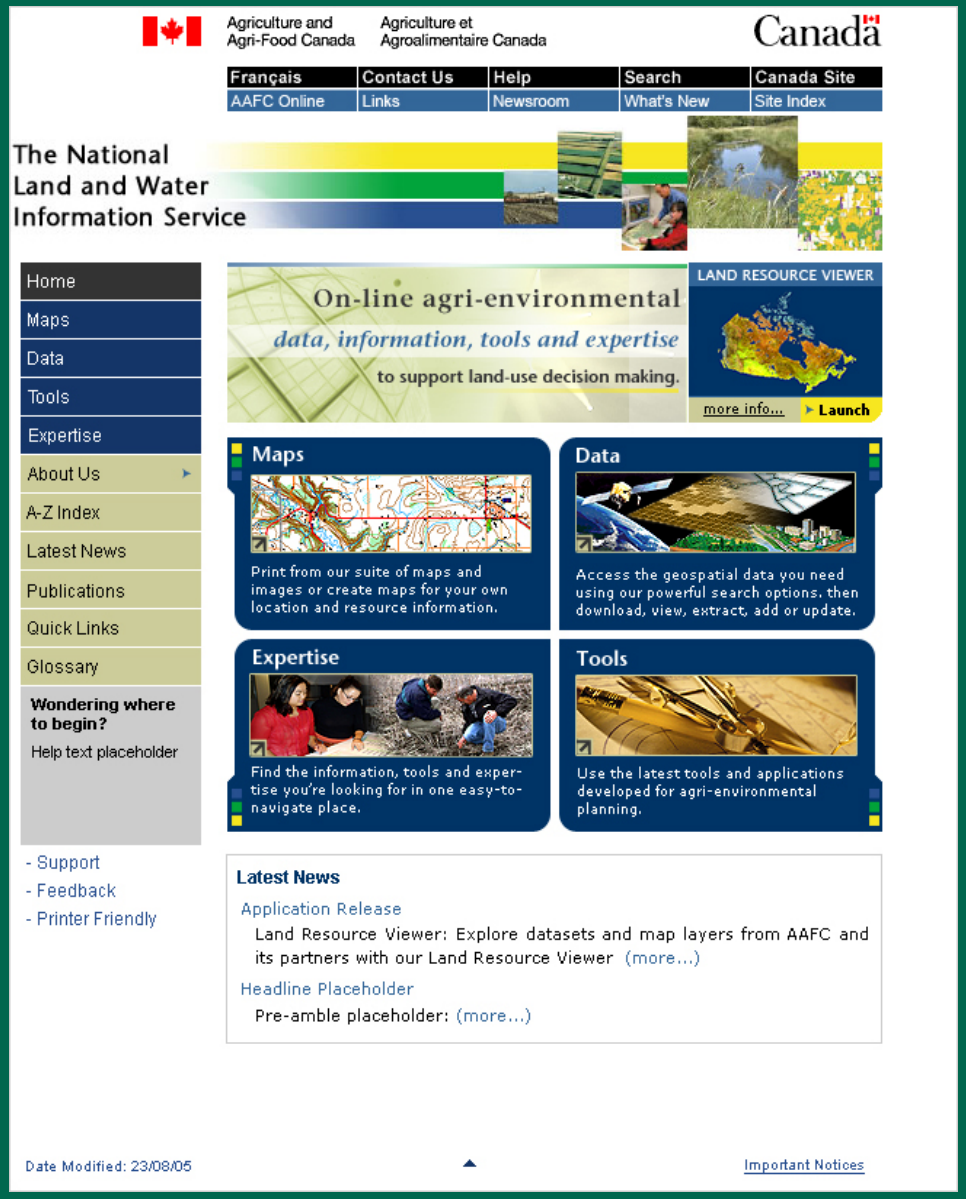
Soil Components

| NDL 25% | NDL 45% | VRC 20% | DRO 10%

| **Upper** 25% | **Mid Slope** 45% | **Lower** 20% | **Depression** 10%

| 3% 50m | 5% 90m | 2% 40m | 1% 20m

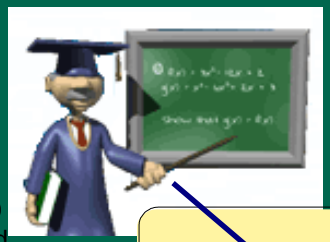
National Land and Water Information System (NLWIS)



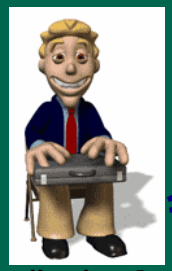
- A Major Crown Project
- $100 Million over 4 years (2005 to 2009)
- standardize system architecture and web based delivery of GIS information within Agriculture and Agri-Food Canada.
- all existing Canadian Soil Information System (CanSIS) data sets will be reloaded and delivered through the new NLWIS web interface.

www.agr.gc.ca/nlwis

NLWIS Architecture Overview

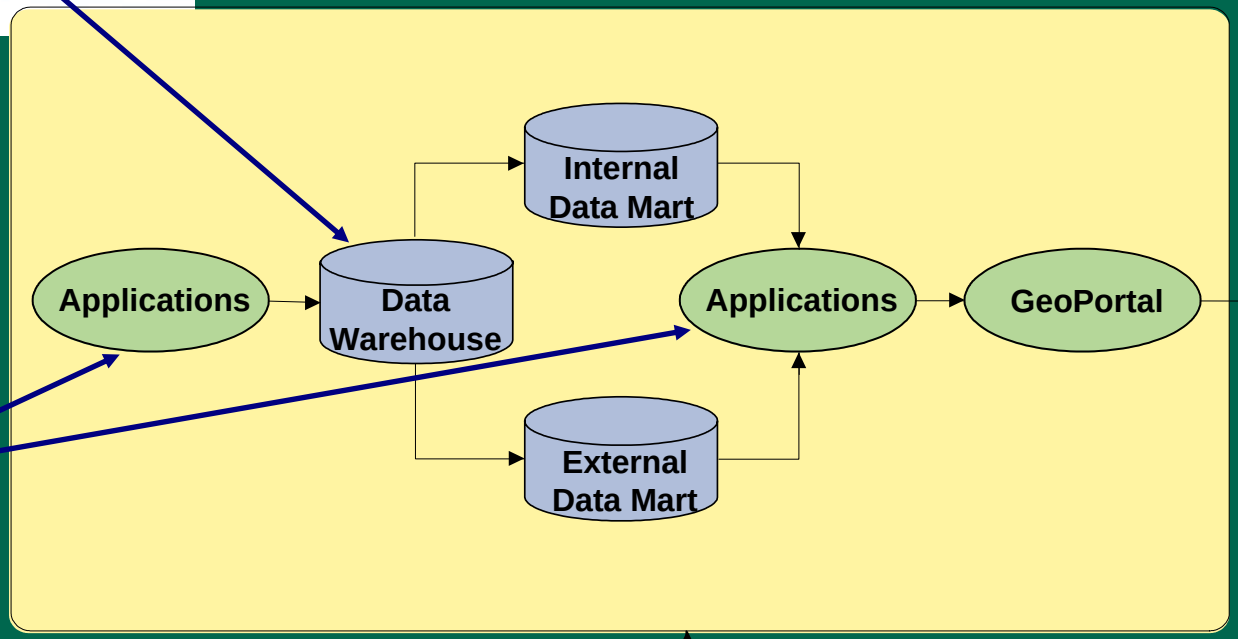


Data Group
develops and maintains geospatial data and interpretations (service content)

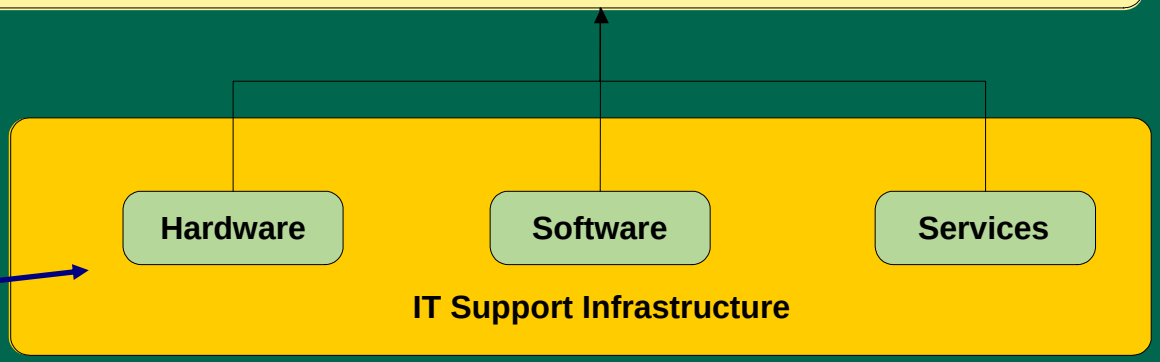


Application Group
develops and maintains geospatial applications and manages geospatial data in data warehouse

IT Group
develops and maintains IT infrastructure, applications and services



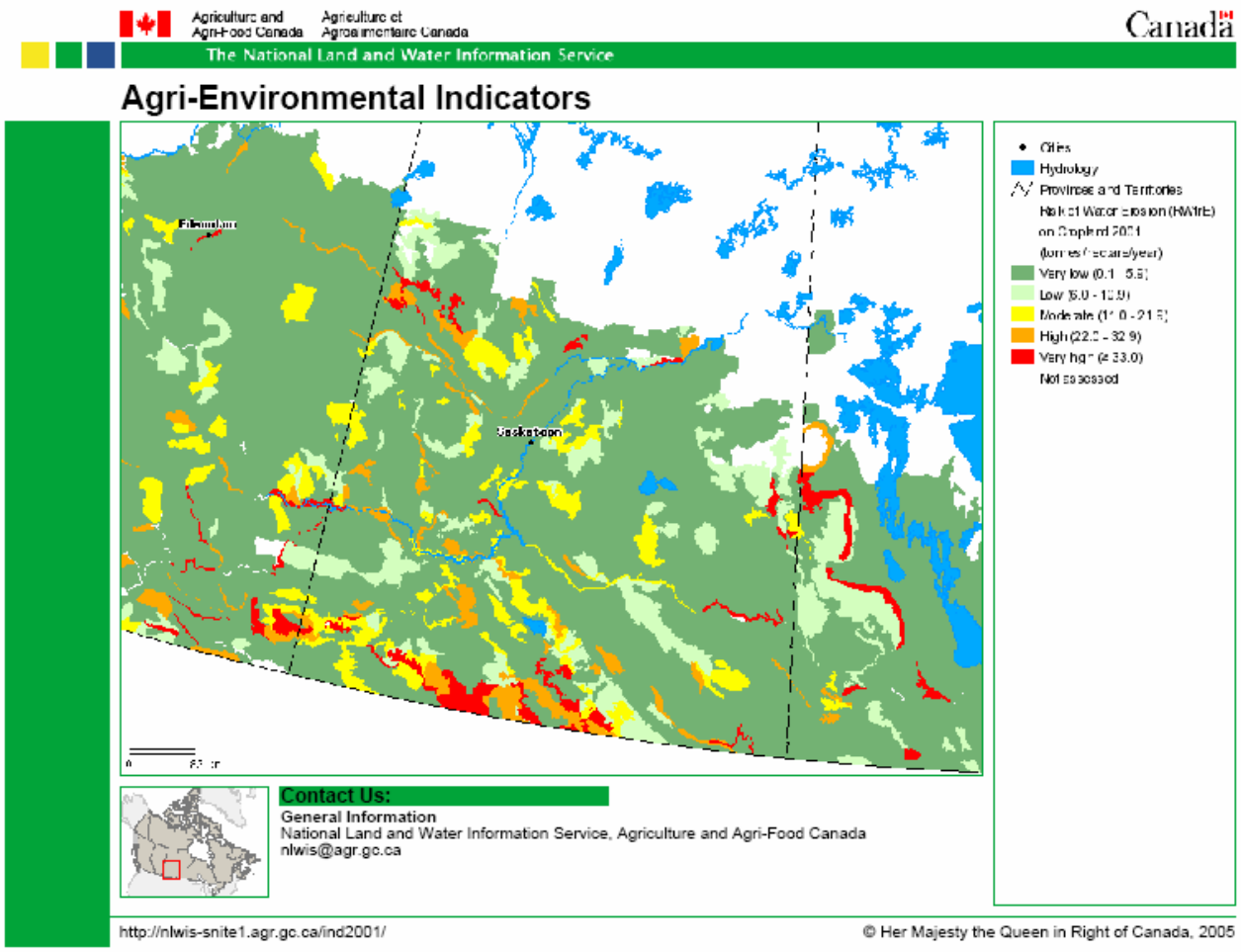
User Group
Authorised and Non-Authorised Users internal and external access N-GIS through the GeoPortal



NLWIS "LRV"
Land Resource Viewer

- The LRV will replace current Ag Canada/PFRA web map viewers
- Map information from many sources, including the SLC, will be available as different GIS layers within the LRV
- Based on Arc IMS
- Similar to US Web Soil Survey?

National Agri- Environmental Indicators



- National Agri-Environmental Indicator maps will also be available through the NLWIS LRV
- Water Erosion Risk Map, based on the SLCv3 using 2001 Census of Agriculture information.

SLCv3 Web Maps Using Google Earth

- Google Earth allows import and overlay of third party GIS coverages
- The Canadian SLCv3.0 coverage and NTS contours at 1:250,000 and 1:50,000 scale were loaded and evaluated.
- Turtle Mountain area of southern Manitoba, with SLCv3.0 polygon lines and numbers (in red)

SLCv3 Web Maps Using Google Earth

- Lake of the Prairies reservoir in western Manitoba, with SLCv3.0 polygons (in red).
- All standard Google Earth features are available
- Useful to show relationships between SLC polygons, landforms and land use

SLCv3 Web Maps Using Google Earth

- Lake of the Prairies reservoir in western Manitoba, with SLCv3.0 polygons (in red).

- All Google Earth features are available, including the ability to zoom in and “fly” through any area.

Future SLC Development

SLCv3.1, 3.2 etc.

- Update agricultural polygon CMP, SN, SL data.
- Review landscape component tables.
- Revise data base editing procedures.
- Develop NLWIS web based map display capabilities.

SLCv4.0

- Complete non ag polygon coverage for Canada.
- Complete CMP, SN, SL tables for non ag polygons.
- Complete revised Ecological Stratification for Canada (v2).

National SLC Version 3 Working Group

British Columbia – Elizabeth Kenney

Alberta – Tony Brierley

Saskatchewan – Glen Padbury

Manitoba – Walter Fraser

Ontario – Brian Monette, David Kroetsch

Quebec – Luc Lamontagne

New Brunswick – Herb Rees

Nova Scotia – Ken Webb

Prince Edward Island – Delmar Holmstrom

Canada