



NOTE ON ECO-CLASSIFICATION SYSTEMS FOR CANADA

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A Spatial Basis for Reporting on Geochemical Background

Earth Sciences Sector

- A spatial foundation for interpreting and reporting on geochemical background concentration is needed.
- Eco-classifications systems provide a basis for the expression of background values.
- Other starting points are bedrock geology, surficial geology, etc.



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Key Points in Ecological Classification

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Source: Marshall and Schut (1999)

- Ecological Land Classification incorporates all major components of ecosystems: air, water, geology, soil, and biota, including humans.
- It is based on a hierarchy with ecosystems nested within ecosystems.
- It involves integration of knowledge and is not simply an overlay process.
- It recognizes that map lines generally depict the location of zones of transition.



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- Source: Marshall et al., (1996) and Marshall and Schut (1999), A national ecological framework for Canada – overview; On-line at <http://sis.agr.gc.ca/cansis/nsdb/ecostrat/intro.html>
- Late 1960s - Recognition of the need for an nation-wide ecological framework to provide standardized, multi-scale geographical reporting and monitoring units.
- 1976 - The Canada Committee on Ecological Land Classification was created to develop (1) a uniform national ecological approach to terrestrial ecosystem classification and mapping and (2) to encourage use of the ecological approach to sustainable resource management and planning. First version - 7 levels of generalization and also spatial units that needed revisions.



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- 1991 - a collaborative project was undertaken after the first State of Environment report for Canada published in 1986 by some federal, provincial and territorial governments to revise the previous work and establish a common ecological framework for Canada.
- 1996 - Working group focused on 3 levels - ecozones, ecoregions, and ecodistricts and resulted in the national report "A National Ecological Framework for Canada" released by the Ecological Stratification Working Group
- Report described the methodology used to construct the ecological framework maps, the concepts of the hierarchical levels of generalization, narrative descriptions of each ecozone and ecoregion and their linkages to various data sources.



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A NATIONAL ECOLOGICAL FRAMEWORK FOR CANADA



Centre for Land
and Biological Resources Research
Centre de recherches sur
les terres et les ressources biologiques



State of the Environment
Directorate
Direction générale de l'état
de l'environnement

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The revised ecozones and ecoregions were used for the State of Environment Report 1996.



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SINCE 1996:

- Provincial: More in-depth descriptions for BC (1996), SK (1998), MB (1998), NS (1999).
- Federal : A Perspective on Canada's Ecosystems (1996) by the Canadian Council on Ecological Areas (CCEA) - provides a country wide, in-depth description of Canada's terrestrial ecozones.
- International: 1997 - Ecological Regions of North America - Towards a Common Perspective - by the NAFTA Commission for Environmental Cooperation (CEC), provides the integrated, continental perspective.



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SINCE 1996:

- Federal: 1998 - As the North America perspective (last slide) was being developed, an ecoprovince level of generalization, between ecozone and ecoregion, was compiled for the Canadian framework (Marshall et. al. 1998).
- 1999 - a revised and expanded attribute database (Marshall et. al. 1999), replaced the earlier version (Selby and Santry, 1996). It includes attribute data for the ecoprovince level of generalization.



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State of the Environment Reporting spatial framework maintained by the CANSIS group at Agriculture and Agri-Food Canada (referred to hereafter as the CanSIS system)

- Ecozones – 15; Ecoprovinces – 53; Ecoregions - 194; Ecodistricts - 1021.

Commission for Environmental Cooperation (CEC) for North America

- Level 1 – 15; Level 2 – 52; Level 3 – 182; Level 4 - ?



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CanSIS Ecozones and CEC Level 1

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CanSIS system – 15 terrestrial ecozones for Canada



CEC Level 1 – fewer Level I regions for Canada



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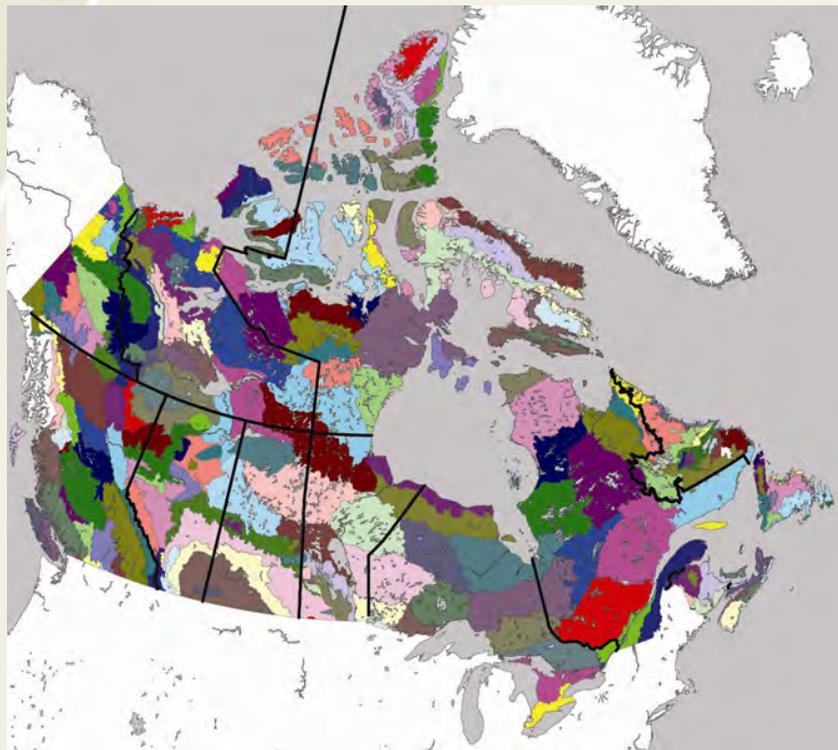




CanSIS Ecoregions and CEC Level III

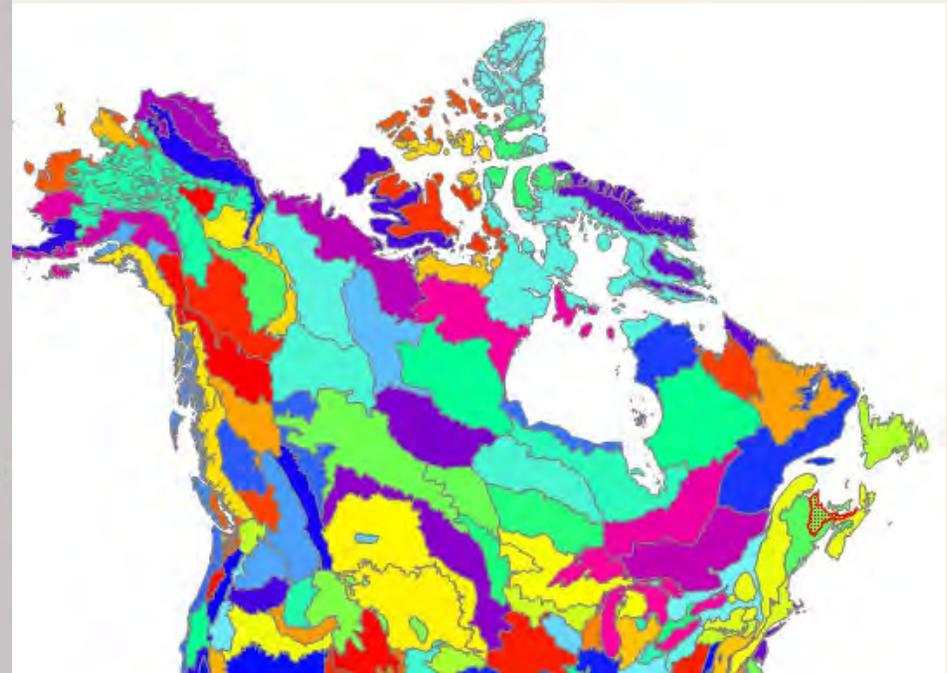
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CANSIS Ecoregions



CanSIS system – 194 ecoregions
for Canada

CEC Level III



Fewer Level III regions for Canada



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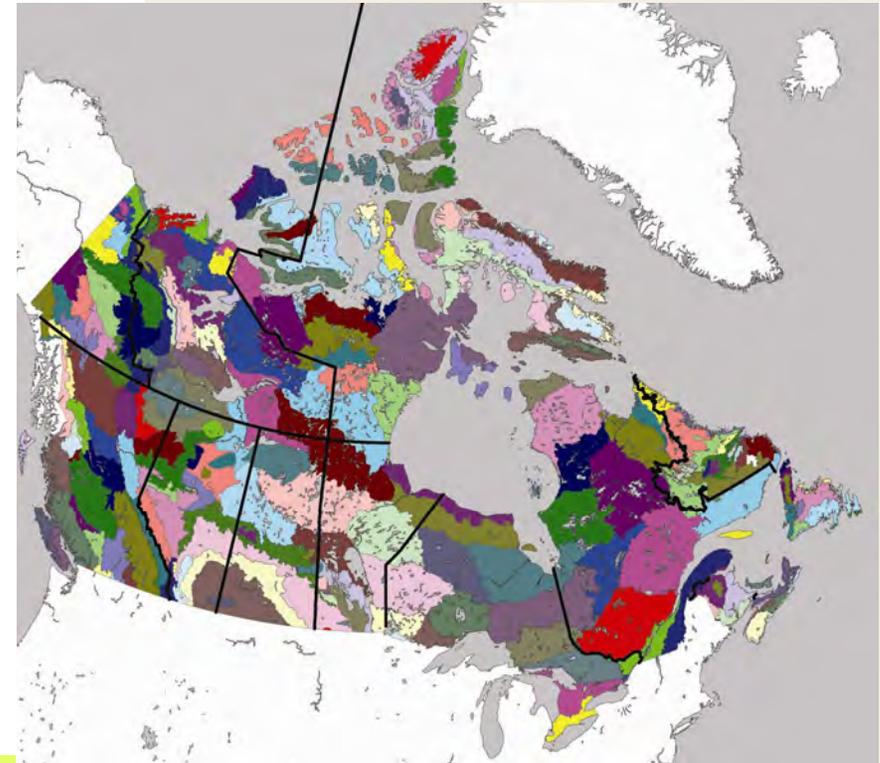
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Comparison of Bedrock Map and CanSIS Ecoregions

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Source: Ecoregions:: CanSIS database
Source: Bedrock: GSC Map 1860A (1: 5 000 000)



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CanSis Ecodistricts for the Maritimes

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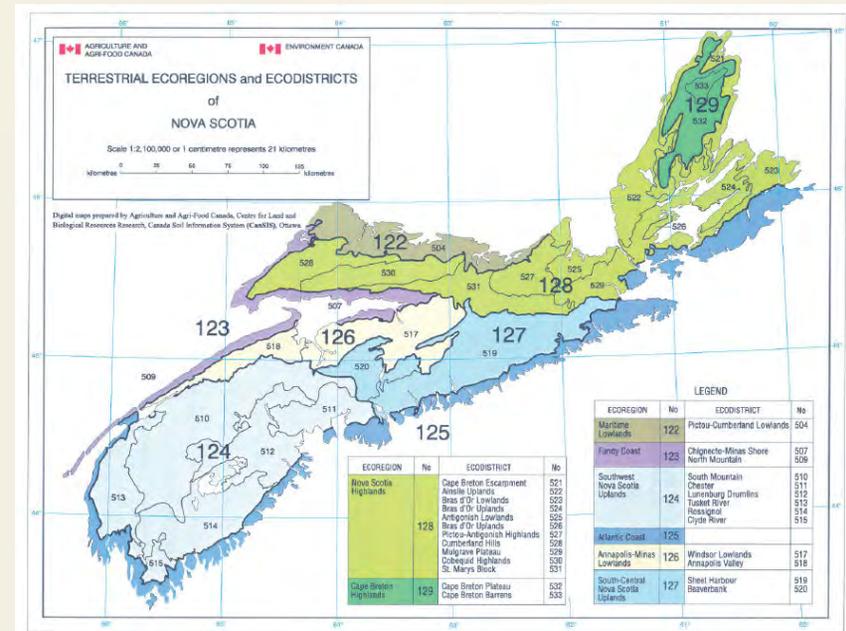
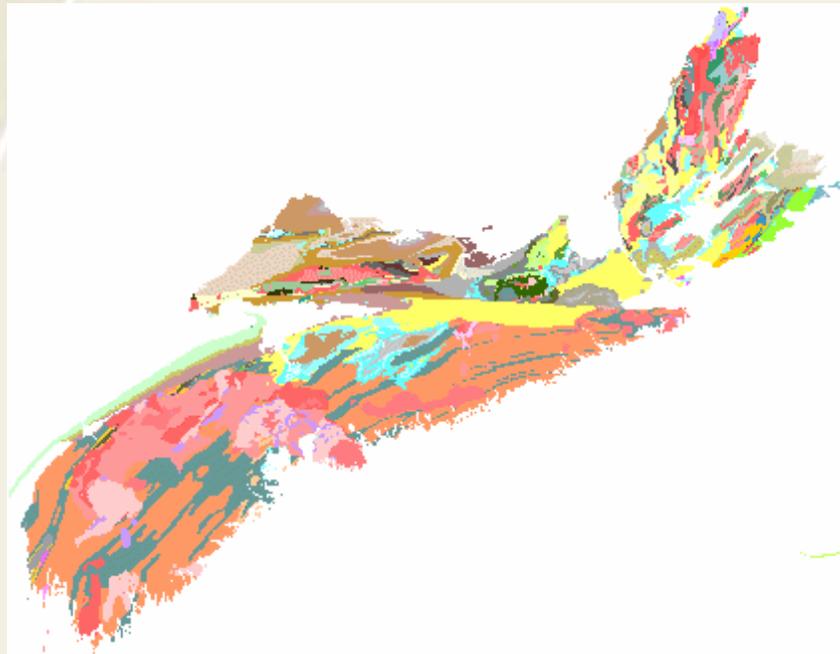
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Nova Scotia Geology and Ecoregions/Ecodistricts

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DP ME 43, Version 2, 2006, Digital Version of NSDNR Map ME 2000-1, Geological Map of the Province of Nova Scotia, scale 1:500 000, compiled by J. D. Keppie, 2000.



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Recommendations

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- Geochemical data sets that are geo-referenced can be “cookie cut” using any eco-classification system and GIS.
- Numerous systems, somewhat similar but not identical. Clearly state the system you are using.
- The scale used depends on the project purpose and the amount of data available
- The CanSIS system is widely used in Canada for national and regional reporting.
- CEC system is used for international reporting.
- If using the more detailed scales of eco-classification information, it is necessary to have sufficient data points within the individual ecosystem polygons to ensure the validity of statistical comparisons.



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References

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- Acton, D.F., Padbury, G. A. and C. T. Stushnoff. 1998. The Ecoregions of Saskatchewan. Saskatchewan Environment and Resource Management and Canadian Plains Research Center, University of Regina, Regina, Sask. pp. 205.
- Commission for Environmental Cooperation. 1997. Ecological Regions of North America: Towards a Common Perspective. Montreal, Quebec. 71pp. Map at scale 1: 12.5 million.
http://www.cec.org/pubs_info_resources/publications/enviro_conserv/ecomap.cfm?varlan=english
- Demarchi, Dennis A. 1996 (revised,4th ed.) An Introduction to the ecoregions of British Columbia. Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria, 47pp. and map. <http://www.elp.gov.bc.ca/rib/wis/eco/bcecode.html>
- Ecological Stratification Working Group. 1996. A National Ecological Framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of Environment Directorate, Ottawa/Hull. 125pp. And Map at scale 1:7.5 million. <http://www.ec.gc.ca/soer-ree/English/Framework/framework.cfm>. Pdf copy available from [/cansis/publications/ecostrat/intro.html](http://cansis/publications/ecostrat/intro.html)
- Environmental Conservation Task Force. 1981. Ecological land survey guidelines for environmental impact analysis. Ecological Land Classification Series No. 13. Federal Environmental Assessment and Review Process, Lands Directorate, Environment Canada and Federal Environmental Assessment Review Office (FERRO) Ottawa, Ont. 42 pp.
- Ironside, G.R. 1991. Ecological land survey: Background and general approach. In H.A. Stelfox, G.R. Ironside, and J.L. Kansas (eds.) Guidelines for the integration of wildlife and habitat evaluations with ecological land survey. Wildlife Habitat Canada and Canadian Wildlife Service, Environment Canada, Ottawa, Ont. 107 pp.
- Marshall, I.B., C.A. Smith, and C. Selby. 1996. A national ecological framework for monitoring and reporting on the environmental sustainability in Canada. In R. Sims (ed.) Global to local: Ecological land classification. Kluwer Academic Publishers, Netherlands.pp 25-38.
- Marshall, I.B., E.B. Wiken and H. Hirvonen (Compilers). 1998. Terrestrial Ecoprovinces of Canada. Ecosystem Sciences Directorate, Environment Canada and Research Branch, Agriculture and Agri-Food Canada, Ottawa/Hull. Draft Map at 1:7 500 000 scale.
- Marshall, I.B. and Schut, P.H., 1999. A national ecological framework for Canada – overview.Ecosystems Science Directorate, Environment Canada and Research Branch, Agriculture and Agri-Food Canada. <http://sis.agr.gc.ca/cansis/nsdb/ecostrat/intro.html>



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References

Earth Sciences Sector

- Olson, D.M., Dinerstein, E. Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P., and Kassem, K.R., 2001. Terrestrial ecoregions of the world: a new map of life on Earth; *Bioscience*, v. 51, p. 933-938. <http://www.worldwildlife.org/science/ecoregions/WWFBinaryitem6498.pdf> [accessed March 8, 2010]
- Selby, C.J., and M.J. Santry. 1996. A national ecological framework for Canada: Data model, database and programs. Centre for Land and Biological Resources Research, Research Branch, Agriculture and Agri-Food Canada and State of the Environment Directorate, Environment Canada Ottawa, Ont.
- Smith, R. E., H. Veldhuis, G. F. Mills, R.G. Eilers, W. R. Fraser, and G. W. Lelyk 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba: An Ecological Stratification Of Manitobas Natural Landscapes. Technical Bulletin 1998-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba. Report and map at 1:1 500 000 scale.
- Webb, K.T. and I. B. Marshall. 1999. Ecoregions and Ecodistricts of Nova Scotia. Crops and Livestock Research Centre, Research Branch, Agriculture and Agri-Food Canada, Truro, Nova Scotia and Environmental Quality Branch, Ecosystems Science Directorate, Environment Canada, Hull, Quebec. 39pp. And map.
- Wiken, E.B. (compiler). 1986. Terrestrial Ecozones of Canada. Ecological Land Classification Series No. 19. Environment Canada, Hull, Que. 26 pp. and map.
- Wiken, Ed.B., David Gauthier, Ian B. Marshall, Ken Lawton and Harry Hirvonen. 1996. A perspective on Canada's Ecosystems: An overview of the Terrestrial and Marine Ecozones. Occasional paper N.

Bedrock Maps

- DP ME 43, Version 2, 2006, Digital Version of Nova Scotia Department of Natural Resources Map ME 2000-1, Geological Map of the Province of Nova Scotia, scale 1:500 000, compiled by J. D. Keppie, 2000. Digital product compiled by B. E. Fisher and J. C. Poole.
- Wheeler, J O; Hoffman, P F; Card, K D; Davidson, A; Sanford, B V; Okulitch, A V; Roest, W R , 1996. Geological Map of Canada Map 1860A. Scale 1:5 000 000.



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