The Story of Soil Science in Alberta: A Guided Tour of Soil Resources at the University of Alberta

2009

The Soil Maps of Alberta – Then and Now

RENEWABLE RESOURCES . UNIVERSITY OF ALBERTA

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The soil monoliths and artifacts are organized by clusters on the second, third and fourth floors of the Earth Sciences Building. Here is a list of materials which would aid interested individuals to see the Soil Science Collections:

Cluster No. 1 located at NE entrance in the middle block of the fourth floor, ESB

1.1 A time line of Soil survey from 1800-2006 developed by USDA-NRCS which shows major activities that were happening in USA, Europe and Russia. The University of Alberta was involved in arranging a soil monolith display for a field trip in 1927 (see item 1.3) and for hosting the 11th World Congress of Soil Science in 1978.

1.2 A collection of Soil Science books, used by the Soil Science pioneers, Drs. F. A. Wyatt and J. D. Newton, and prominent professors such Drs. C. F. Bentley and J. A. Toogood, is located in a lighted cabinet across the Soil Survey timeline poster.

Dr. F. A. Wyatt

1.3 A special collection of four Alberta profiles forms a focal point on the fourth floor along the wall which is adjacent to the northeast entrance. These monoliths were collected by the Soil Science pioneers, Drs. F. A. Wyatt and J. D. Newton, for the First International Congress of Soil Science in 1927. Unlike all other profiles, these four are contained in large wooden cases with glass fronts and have not been preserved with any of the usual impregnating compounds.

Dr. J. D. Newton

1.4 A map of Soils of Canada produced by the Canadian Soil Information System (CanSIS) under the auspices of Agriculture and Agri-Food Canada (AAFC), links the Canadian System of Soil Classification to the system used by the soil pioneers.

Cluster No. 2 located in 4-42 ESB Auxiliary Office Complex

2.1 Room 4-42B was designated as the J. D. Newton Conference Room by the Board of Governors in 2001. A brief biography of Dr. J. D. Newton is mounted on a pillar in this room. This conference room has internet connections and equipment for meetings. The pictures of Heads/Chairs of Soil Science, Forest Science and Renewable Resources are mounted on the wall.

2.2 The J. D. Newton Soil Science Collection (1921-1998) consisting of extension articles, other articles, proceedings, project reports, refereed chapters, refereed publications and refereed reports. Reprints of these items are housed in this room. Click here to download a PDF file which has the list of available documents.

2.3 The conference room has a thesis collection and a scientific journal collection.

2.4 A picture of the Breton Plots is also mounted at the entrance of the Conference room.

Cluster No. 3 located in Fourth Floor Hallway, ESB

3.1 Four plant root displays, prepared in 1937 by Professor Pavlychenko of the University of Saskatchewan, depicting development and competition between species, are encased in glass and mounted on the north wall. Donated to the Department of Soil Science by Searle Grain Company Ltd.

3.2 'Topography of Alberta' poster is located across from root display and 'Terrestrial Ecozones, Ecoregions and Ecodistricts (of AB, SK and MB)' poster is located further down the hall. Donated by Alberta Agriculture, Food and Rural Development, Edmonton.

3.3 Role of soil in biogeochemical cycling (posters of energy, water, carbon and nitrogen cycle). These are located on the south wall facing the common room and show the importance of soils in Agriculture, Forestry, Ecology, Environmental Sciences, and Earth Systems Sciences.

Cluster No. 4 located on the East Wall of the Fourth Floor, ESB

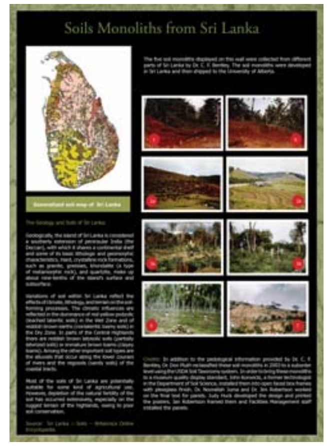
4.1 Three Indonesian soil monoliths, collected by Dr. J. D. Newton in 1958 and 1962, are displayed on the wall which is at the east end of the fourth floor corridor in the Earth Sciences Building.

4.2 These soil monoliths are classified to a Sub-Order level according to Soil Taxonomy, a USA Soil Classification System. A panel describing the 12 Orders of Soil Taxonomy is also mounted adjacent to soil monolith display.

4.3 An acknowledgement panel for Soil Science Collections is located in between the Indonesian Soil Monoliths. This is a cumulative recognition of a large number of people who have contributed time and knowledge, and material resources over a period of almost 90 years.

Cluster No. 5 located at NE entrance in the middle block of the third floor, ESB

5.1 Five Sri Lankan soil monoliths, collected by Dr. C. F. Bentley in 1954, are located on the third floor along the wall which is adjacent to the northeast entrance.



5.2 These soil monoliths are classified to a Sub-Order level according to Soil Taxonomy, a USA Soil Classification System. A panel describing the 12 Orders of Soil Taxonomy is also mounted adjacent to soil monolith display.

5.3 Also, there is a new display entitled "Pedosphere Supports Life" in a lighted glass cabinet adjacent to the Sri Lankan soil monolith display on the third floor of the Earth Sciences Building. This display also has samples of soil maps for the Edmonton Region, several soil profile pictures, and some information on the Breton Plots.

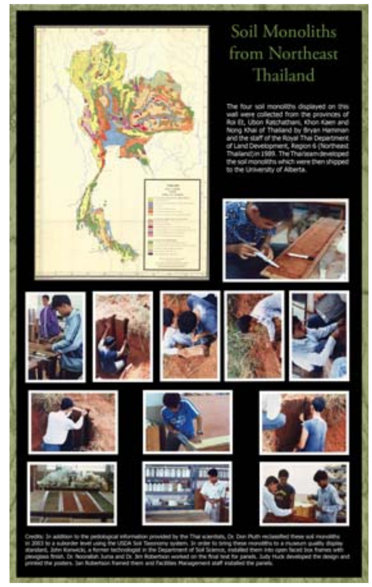
5.4 Across from the above display, the 'Soils of the World' poster by FAO UNESCO shows pictures of soil profiles. The pedosphere, i.e., the skin of the Earth, is diverse and colorful.

5.5 There are two large posters for the Breton Plots on the north and south walls in the third floor hallway. This recognizes the work of Drs. Wyatt and Newton, with follow up by Drs. Toogood and Bentley, Drs. McGill and Robertson, and as well as current scientists in the Department, Alberta Agriculture, Food and Rural Development (AAFRD) and Agriculture and Agri-Food Canada (AAFC).

5.6 Six panels produced by Agriculture and Agri-Food Canada showing Soil Landscape Illustrations from different regions of Canada are mounted along the north wall of the third floor corridor.

5.7 Dr. Nyborg's discovery of S deficiency in barley and canola. The display shows the responses of barley and canola to NPKS, NPK and PKS. The late Helene Nyborg actualized the work of her husband by mounting plant samples from different soil fertility treatments in a display case. A remarkable artistic achievement indeed!

Cluster No. 6 located at NE entrance in the middle block of the second floor, ESB

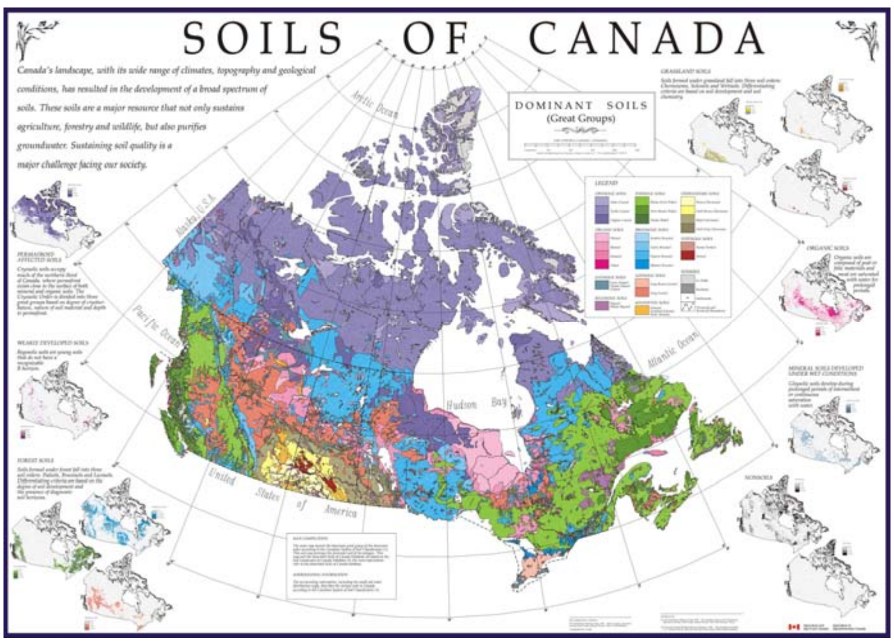


6.1 Four monoliths collected by Bryan Hamman from Thailand in 1989 are located on the second floor along the wall which is adjacent to the northeast entrance of the Earth Sciences Building.

6.2 These soil monoliths are classified to a Sub-Order level according to Soil Taxonomy, a USA Soil Classification System. A panel describing the 12 Orders of Soil Taxonomy is also mounted adjacent to soil monolith display.

6.3 Soil Profiles of Canada (ISSS Collection), entitled ‘Soils of Canada’, is a comprehensive collection of soil profiles representing the major soils in Canada. Augmented by representative landscape photographs and analytical data, this collection was assembled in conjunction with the 11th International Congress of Soil Science (Edmonton 1978). The collection, which is unique in Canada, was given to the Department of Soil Science by Canadian Society of Soil Science in 1978.

6.4 A map of Soils of Canada produced by the Canadian Soil Information System (CanSIS) under the auspices of Agriculture and Agri-Food Canada (AAFC), ties the Canadian System of Soil Classification into the ISSS soil monolith collection.



Cluster No. 7 located at the Wyatt Lecture Room, 2-36 ESB

7.1 Room 2-36 ESB was designated as the Wyatt Lecture Room by the Board of Governors in 2001. Wyatt Alberta Soil Monolith Collection, a comprehensive collection of soil profiles representing the major and prominent soils of Alberta, resides in Earth Sciences Room 2-36. This reference set collection is used extensively for teaching and extension at the undergraduate and graduate level. This collection spans a eriod of collection in excess of 60 years. Many profiles are unique in that they represent soils before cultivation occurred. This reference set is used for display, while stored duplicate/similar profiles are used in class and made available to select groups, outside the Department of Renewable resources, for teaching and extension activities. These monoliths were collected almost exclusively by the Alberta

Soil Survey.

Collection of the profiles was done by Agriculture Canada and Alberta Research Council Soil Survey staffs which for decades were housed with the Department of Soils of the University of Alberta. The collection was inventoried and reclassified to adhere to the current classification system in 1984. This collection consists of approximately 220 profiles.

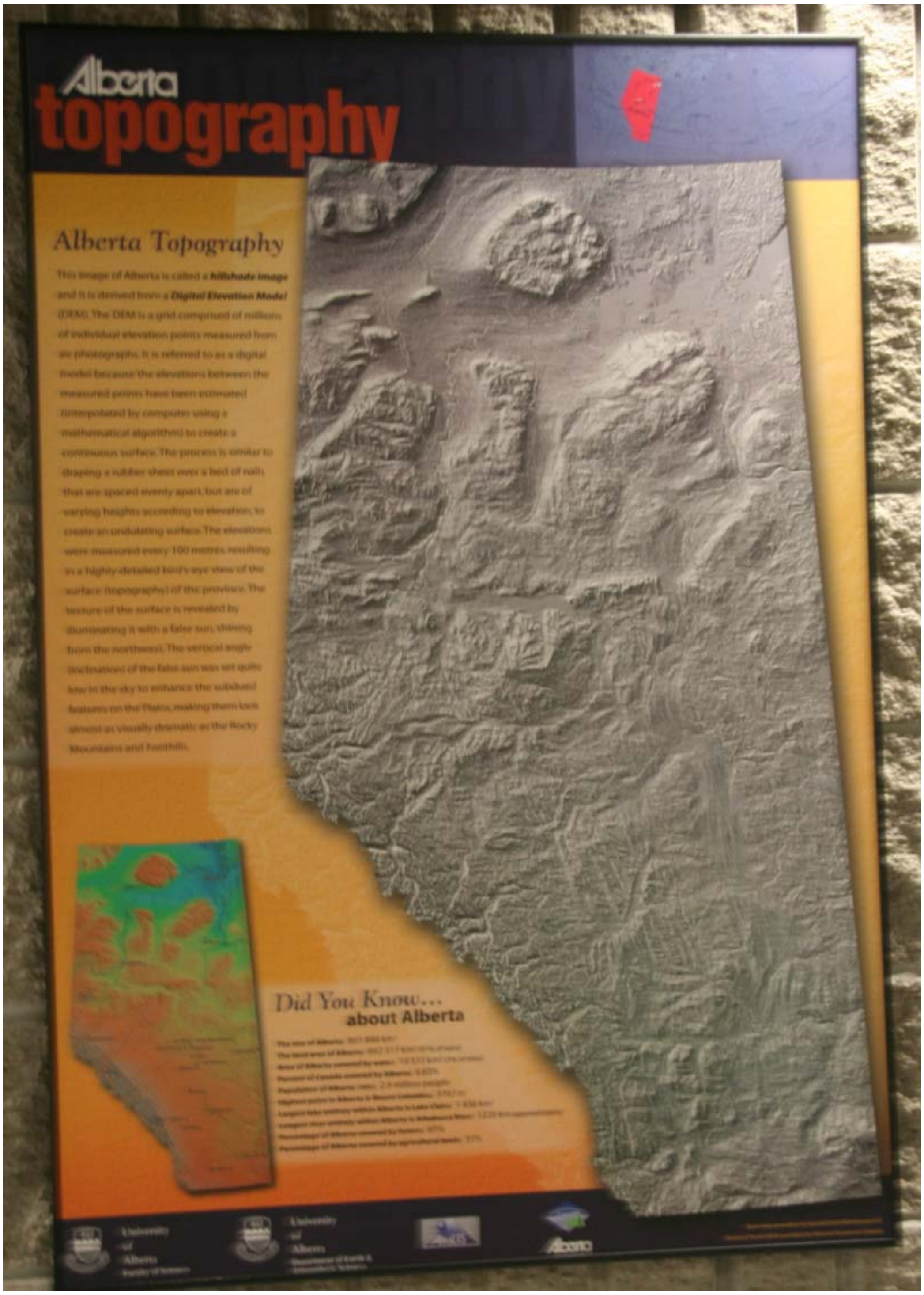
7.2 The Wyatt Lecture Room poster cluster: This cluster consists of two hallway signs and two Wyatt biography panels (one at each entrance of 2-36), five posters on the south wall of 2-36 (Soils of the World monolith poster by FAO UNESCO [same as 5.4], original Soil Zones map, current Soil Great Group map, a map of Ecoregions and Ecodistricts of Alberta, and Soil - a Vital Natural Resource).

Compiled by:

Noorallah Juma, Ph.D., P.Ag. & Jim Robertson Ph.D., P.Ag. (Past Soil Monolith Collections Curators and Professor Emeriti), Department of Renewable Resources, University of Alberta

May 4, 2009

Large sized images from this brochure are appended to this 14-page brochure to permit readers to see details of some artifacts.



SOIL SCIENCE COLLECTIONS
Acknowledgements

The Soil Monolith Collections are a part of the University of Alberta Museums, a network of 35 interdisciplinary museums and collections across campus, ranging from art to zoology. The collections are used on a daily basis to fuel discovery and advance knowledge through teaching, research, and community outreach. To learn more about our collections and programs, please visit our website at www.museums.ualberta.ca.

Soil Monolith Collectors:
Dr. Frank Wyatt
Dr. John Newton
Alberta Soil Survey
Soil Survey Units of Canada
Dr. Fred Bentley
Bryan Hamman
Peter Geib

Soil Monolith Curators:
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Michael Abley
Dr. Pawluk's graduate students and research associates

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Dr. John Newton
Dr. Fred Bentley
Dr. John Toogood
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Department of Soils
Department of Soil Science
Department of Renewable Resources
Faculty of Agricultural, Life & Environmental Sciences
Friends of Dr. Noorallah Juma

J. D. Newton Soil Science Collection (Earth Sciences Building 4-42B)
Reprints
Theses
Books
Soil Survey reports
Books

Poster Donors
USDA-NRCS
Alberta Agriculture, Food and Rural Development
Agriculture and Agri-Food Canada

In addition to all those mentioned above, we would also like to thank hundreds of people who have generously donated their time and knowledge as well as physical and material resources.

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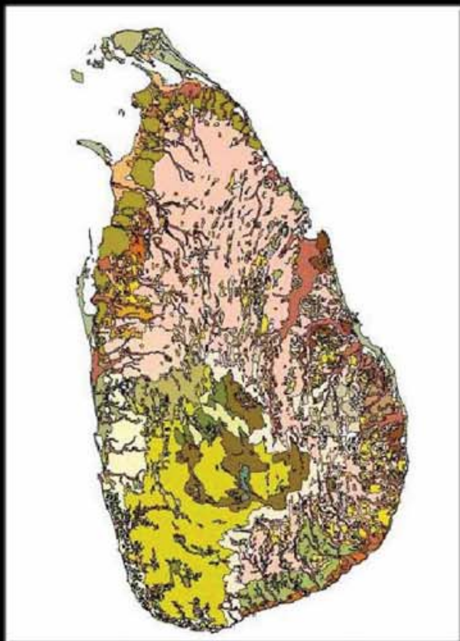
RENEWABLE RESOURCES

Soils Monoliths from Sri Lanka



Generalized soil map of Sri Lanka

The Geology and Soils of Sri Lanka:

Geologically, the island of Sri Lanka is considered a southerly extension of peninsular India (the Deccan), with which it shares a continental shelf and some of its basic lithologic and geomorphic characteristics. Hard, crystalline rock formations, such as granite, gneisses, khondalite (a type of metamorphic rock), and quartzite, make up about nine-tenths of the island's surface and subsurface.

Variations of soil within Sri Lanka reflect the effects of climate, lithology, and terrain on the soil-forming processes. The climatic influences are reflected in the dominance of red-yellow podzolic (leached lateritic soils) in the Wet Zone and of reddish brown earths (nonlateritic loamy soils) in the Dry Zone. In parts of the Central Highlands there are reddish brown latosolic soils (partially laterized soils) or immature brown loams (clayey loams). Among the other important soil types are the alluvials that occur along the lower courses of rivers and the regosols (sandy soils) of the coastal tracts.

Most of the soils of Sri Lanka are potentially suitable for some kind of agricultural use. However, depletion of the natural fertility of the soil has occurred extensively, especially on the rugged terrain of the highlands, owing to poor soil conservation.

Source: Sri Lanka :: Soils -- Britannica Online Encyclopedia

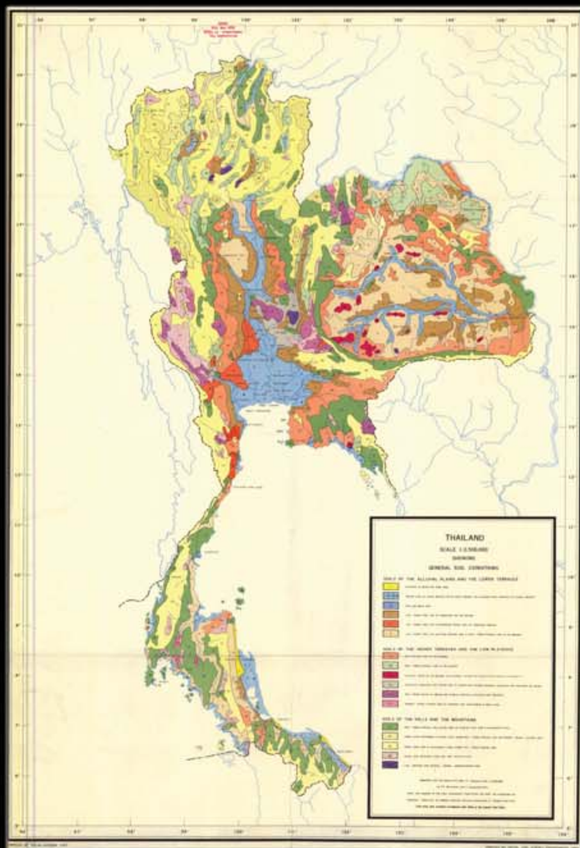
The five soil monoliths displayed on this wall were collected from different parts of Sri Lanka by Dr. C. F. Bentley. The soil monoliths were developed in Sri Lanka and then shipped to the University of Alberta.

Credits: In addition to the pedological information provided by Dr. C. F. Bentley, Dr. Don Pluth reclassified these soil monoliths in 2003 to a suborder level using the USDA Soil Taxonomy system. In order to bring these monoliths to a museum quality display standard, John Konwicki, a former technologist in the Department of Soil Science, installed them into open faced box frames with plexiglass finish. Dr. Noorallah Juma and Dr. Jim Robertson worked on the final text for panels. Judy Huck developed the design and printed the posters. Ian Robertson framed them and Facilities Management staff installed the panels.


UNIVERSITY OF ALBERTA
Soil Monolith Collections : : Soils of the World
Renewable Resources
FAO UNESCO
SOILS OF THE WORLD
ELSEVIER ISRIC

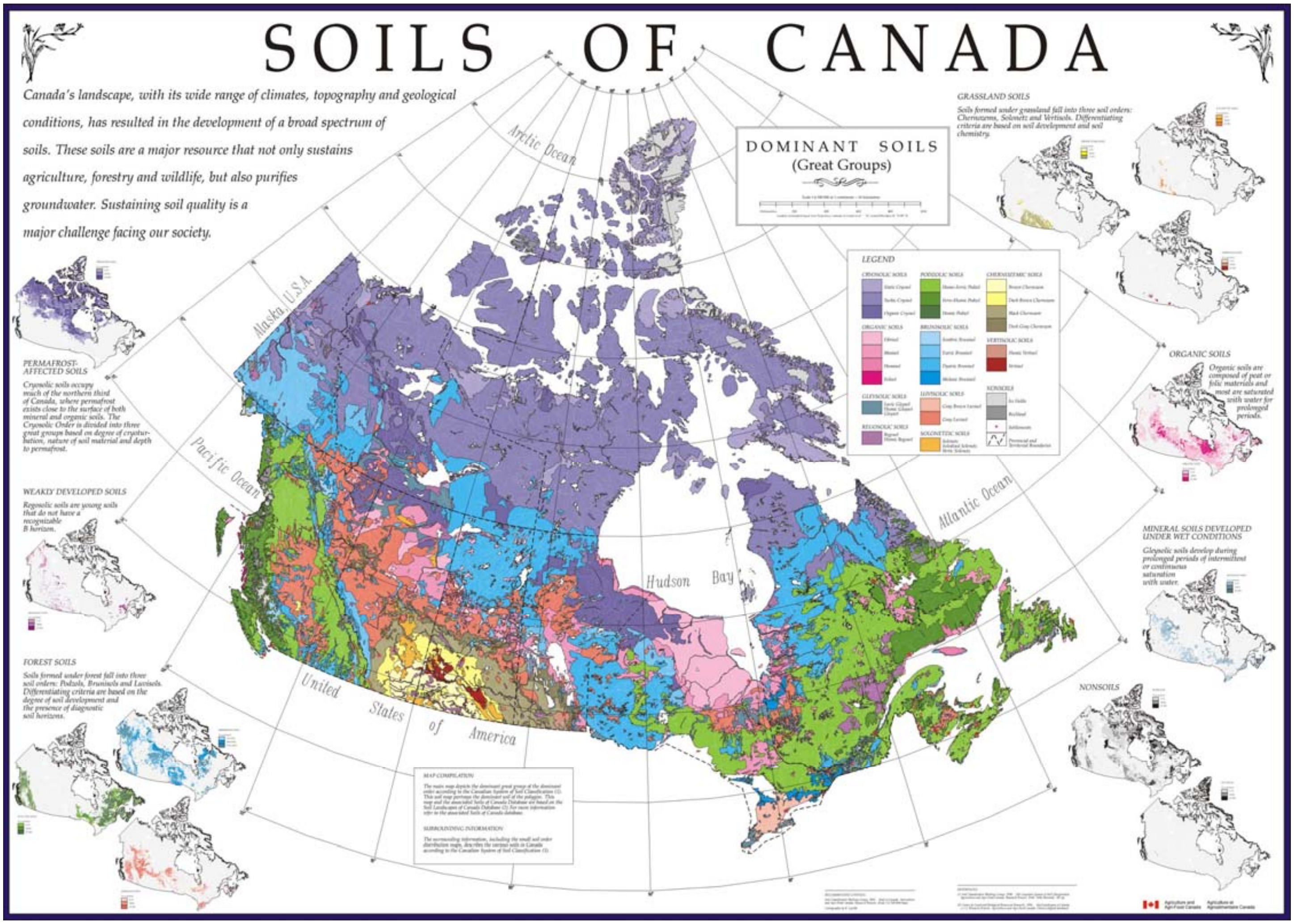

Discovery of Sulphur as a Plant Nutrient
UNIVERSITY OF ALBERTA
HISTORIC DISCOVERIES
Plants must have at least 16 different nutrient elements to grow and reproduce. Carbon, hydrogen and oxygen are obtained from the air and water while the others usually come from the soil. In addition some plants - especially legumes - can obtain their nitrogen from the air. Further, many plants can absorb atmospheric sulphur where it is present.
In agricultural practice it was thought for a long time that the only nutrient deficiencies in most soils were nitrogen, phosphorus and potassium. Thus fertilizers were made to contain these three nutrients, and fertilizer bags were labelled with their nitrogen (N), phosphate (P2O5) and potash (K2O) contents.
In the 1920s fertilizers were hardly known in western Canada. When settlers moved into the forested area west of Highway 2, they found that they could not grow satisfactory crops on the Gray Luvisol soils found there. They tried unsuccessfully to improve the soil by growing legumes. Some preliminary observations in Alberta in the late 1920s hinted at the need for sulphur by legumes but these observations were not documented. In 1932 Dr. J.D. Newton of the Department of Soils at the University of Alberta demonstrated clearly that the Gray Luvisols at the Breton Plots were lacking sulphur. Thereafter sulphur-containing fertilizers such as 21-0-0 and 16-20-0 were recommended and used successfully.
For several decades two misconceptions were held in Alberta regarding the need for sulphur in fertilizers. The first was that sulphur-containing fertilizer was required only by legume crops. This notion arose because the addition of low rates of sulphur-containing fertilizers increased dramatically the yields of legume but not cereal crops. Of course, legumes could obtain their nitrogen from the air while cereal crops could not. Also, since the fertilizer rates tested added insufficient nitrogen for the cereal crops to benefit from the added sulphur, it was wrongly concluded that sulphur-containing fertilizer was not needed by cereal crops. The second misconception was that sulphur-containing fertilizer was required only on Gray Luvisols in central Alberta and not in the Peace River area nor on other soils.
Dr. Marvin Nyborg of the Beaverlodge Research Station, ever the skeptic, did not accept these two ideas and designed experiments using suitable rates of nitrogen and sulphur, alone and in combination, with barley and canola as test crops. His work showed clearly that on many soils adding either nitrogen or sulphur alone had little, if any, beneficial effects but when both were added (when other nutrients were adequate) the crop yields were increased dramatically as shown in this demonstration.
Reference:
Nyborg, M. 1971. Sulphur deficiency in cereal grains. Can. J. Soil Sci. 48: 37-41.
Credits:
- The display on the right was produced by (the late) Helene Nyborg. She took the bold step of visualizing the research discoveries of her husband, Professor Marvin Nyborg.
- This historical note was written by Dr. Jim Robertson (Professor Emeritus) with suggestions from Dr. Keith Smillie and Dr. Noorallah Juma.
- Financial support for this display from the Department of Museums and Collections Services, University of Alberta, and the Friends of the University of Alberta Museums is gratefully acknowledged.
NPKS
PKS
NPK
Braeburn L. Series, Webster, Alberta, 1970

Soil Monoliths from Northeast Thailand



The four soil monoliths displayed on this wall were collected from the provinces of Roi Et, Ubon Ratchathani, Khon Kaen and Nong Khai of Thailand by Bryan Hamman and the staff of the Royal Thai Department of Land Development, Region 6 (Northeast Thailand) in 1989. The Thai team developed the soil monoliths which were then shipped to the University of Alberta.

Credits: In addition to the pedological information provided by the Thai scientists, Dr. Don Pluth reclassified these soil monoliths in 2003 to a suborder level using the USDA Soil Taxonomy system. In order to bring these monoliths to a museum quality display standard, John Konwicki, a former technologist in the Department of Soil Science, installed them into open faced box frames with plexiglass finish. Dr. Noorallah Juma and Dr. Jim Robertson worked on the final text for panels. Judy Huck developed the design and printed the posters. Ian Robertson framed them and Facilities Management staff installed the panels.


SOILS OF CANADA
Canada's landscape, with its wide range of climates, topography and geological conditions, has resulted in the development of a broad spectrum of soils. These soils are a major resource that not only sustains agriculture, forestry and wildlife, but also purifies groundwater. Sustaining soil quality is a major challenge facing our society.
DOMINANT SOILS
(Great Groups)
LEGEND
Arctic Ocean
Alaska, U.S.A.
Pacific Ocean
Hudson Bay
Atlantic Ocean
United States of America
PERMAFROST-AFFECTED SOILS
Cryosolic soils occupy much of the northern third of Canada, where permafrost exists close to the surface of both mineral and organic soils. The Cryosolic Order is divided into three great groups based on degree of cryoturbation, nature of soil material and depth to permafrost.
WEAKLY DEVELOPED SOILS
Regosolic soils are young soils that do not have a recognizable B horizon.
FOREST SOILS
Soils formed under forest fall into three soil orders: Podzols, Brunisols and Luvisols. Differentiating criteria are based on the degree of soil development and the presence of diagnostic soil horizons.
GRASSLAND SOILS
Soils formed under grassland fall into three soil orders: Chernozems, Solonetz and Vertisols. Differentiating criteria are based on soil development and soil chemistry.
ORGANIC SOILS
Organic soils are composed of peat or folic materials and most are saturated with water for prolonged periods.
MINERAL SOILS DEVELOPED UNDER WET CONDITIONS
Gleysolic soils develop during prolonged periods of intermittent or continuous saturation with water.
NONSOILS


Soil Group Map of Alberta
N
0
100
200 km
Soil Groups*
Natural Subregions**
Brown Chernozemics
Dry Mixedgrass
Dark Brown Chernozemics
Mixedgrass, Northern Fescue
Black Chernozemics
Foothills Fescue, Foothills Parkland, Central Parkland
Dark Gray Chernozemics, Dark Gray - Luvisols
Dry Mixedwood, Peace River Parkland
Brunisols, Gray Luvisols
Montane, Sub-alpine, Alpine
Gray Luvisols
Upper and Lower Foothills
Gray Luvisols, Organics
Peace River Lowlands, Boreal Highlands, Wetland Mixedwood
Organic Cryosols, Gray Luvisols
Sub-arctic
Brunisols
Athabasca Plain, Kazan Upland
*Alberta Soil Survey information.
**Natural Regions and Subregions of Alberta, 1994, Alberta Environmental Protection.
Map compiled by Alberta Land Resource Unit, Research Branch, Agriculture and Agri-Food Canada, 1995.
Produced by Conservation and Development Branch, Alberta Agriculture, Food and Rural Development
Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
Cartographic design by:
Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT
Conservation and Development Branch
Fort McMurray
Peace River
Grande Prairie
Edmonton
Lloydminster
Red Deer
Drumheller
Calgary
Medicine Hat
Lethbridge