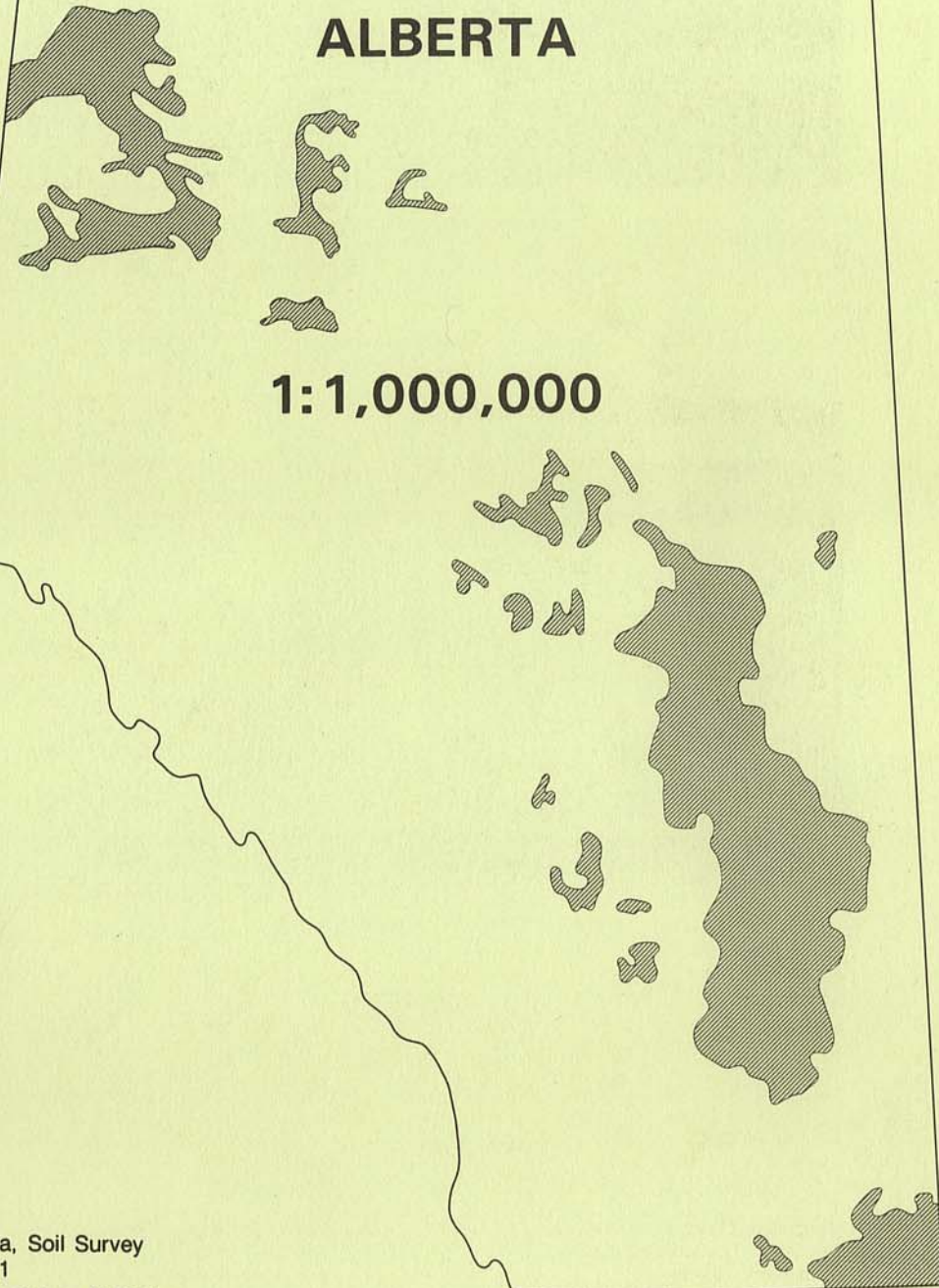




Agriculture
Canada



SOLONETZIC SOILS OF ALBERTA



1:1,000,000

Agriculture Canada, Soil Survey
1981

Alberta Institute of Pedology M-80-4

SOLONETZIC SOILS OF ALBERTA



solonchized solonetz soil profile

photo J. Day



wavy crop pattern on solonchized soils

photo W.W. Pettapiece

AVAILABLE FROM

Agriculture Canada - Soil Survey
6th Floor, Terrace Plaza
Edmonton, Alberta
T6H 5R7

or

Alberta Institute of Pedology
Agriculture Bldg.
University of Alberta
Edmonton, Alberta
T6G 2E3

SOLONETZIC SOILS OF ALBERTA

1:1,000,000

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 Kilometers
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 Miles

- Main highway
- Secondary highway
- Railway
- Boundary, provincial
- Boundary, park or reserve
- Township boundary
- Provincial capital
- International airport
- Other airports
- Elevation (in metres)

Author T.W. Peters

SOLONETZIC SOILS

Solonchetsic soils have developed on saline parent materials mainly under a grass or grass-forest vegetative cover in semiarid to subhumid climates. These soils have a prominent darkly colored subsurface layer which is hard to very hard when dry and which swells to a dark colored mass of very low permeability when wet. They occur in association with Chernozemic soils and to a lesser extent Luvisols and Oxisols.

Solonchetsic soils are divided into three Great Groups depending upon the hardness of the subsurface layer (Bt) and the presence of a measurable elevated layer (Ae) above the subsurface layer.

These separations are:
 a) Solonchets - hard subsurface layer, little or no elevated layer.
 b) Solonchets Solonchets - hard to very hard subsurface layer, well developed light colored elevated layer.
 c) Solonchets - well developed elevated layer, upper portion of subsurface layer breaks readily to blocky aggregates when dry or moist.

Solonchetsic soils owe their origin to the accumulation of soluble salts (salinization) in the landscape. Initially, the soils are well flocculated and show little evidence of pedogenic development. They would be called Regosols-Glezes phase (formerly Solonchets). Salt accumulations generally originate from groundwater discharge and are mainly magnesium, sodium and calcium sulphates.

Once groundwater ceases to concentrate salts at the surface, for whatever reason, natural precipitation can leach the salts and an entirely new process is initiated. The salts in the pore water are washed downwards and become concentrated at depth, at a salt content of about 0.1% to 0.15% exchangeable sodium causes dispersion of soil colloids. The dispersed clay particles fill soil voids and reduce permeability whereas dispersed organic matter stains the material a dark brown to black colour.

These compounds combine to form a very sticky plastic mass when wet and a very hard columnar structure when dry. This is a Bt horizon. Surface water logging is common and hydrotypes of sodium can result in very high pH values. This process has been called solonchetsion and the soil at this stage is an Alkali Solonchets.

As the leaching process continues the surface becomes impoverished in colloids and the remainder is a highly siliceous, platy horizon which, when the sodium has been removed, becomes acidic in reaction. This is the Ae horizon. Surface water logging is common and the Ae horizon in the Peace River region. Solonchetsic soils are a mixed component in both areas. The Solonchetsic soils may be further separated on the basis of parent material and the color of the surface layer.

At the stage when the columnar structure of the Bt begins to break down into blocky aggregates a significant amount of sodium and salts are present in the C horizon. However, the upper portion is much more suitable for plant growth although it may be somewhat acidic. If roots can lead into calcium and cross it, further mellowing of the horizons can take place and the soil may approach the zonal type.

The rate and indeed the path of evolution depends on many factors including the initial salt content, hydraulic conductivity of the parent material, groundwater conditions, and climate.

The relative proportions of the three kinds of Solonchetsic soils varies across the province. In central and southern Alberta Solonchetsic soils dominate while Solonchets are the most common in the Peace River region. Solonchetsic soils are a mixed component in both areas. The Solonchetsic soils may be further separated on the basis of parent material and the color of the surface layer.

Very few of the Solonchetsic soils in the Brown soil zone are cultivated, most being left in native pasture. However, in the Dark Brown Black soil zones the majority of the Solonchetsic soils are cropped. Low moisture storage, poor root penetration, crop variability and soil workability all contribute to the agronomic problems associated with these soils. Experimental work with deep plowing is being carried out quite extensively on Solonchetsic soils to improve crop growth. In most cases significant improvements have been realized.

For more information refer to: Solonchetsic Soil Technology and Management in Alberta. Edited by J.A. Topogon and R.L. Cairns. Distributed by Faculty of Extension, The University of Alberta, Edmonton, Alberta.

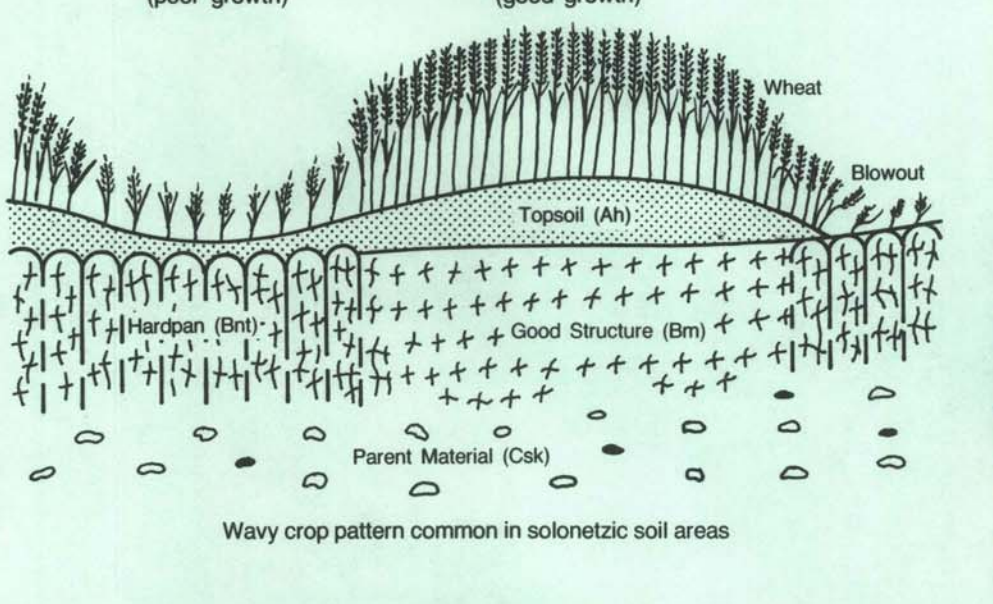
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Compiled from information collected by the Alberta Soil Survey. Cartography by the Land Resource Research Institute, Edmonton, Alberta, Canada, 1982.
 Some information previously supplied by the Map Reproduction and Distribution Division, Government of Alberta, Edmonton and Regina.

LAND USE

Solonchetsic soils are characterized by a hard, impermeable sodic hardpan from 5 to 30 cm (2 to 12 inches) below the surface which severely restricts root and water penetration below the topsoil. They are often associated in a complex manner with normal soils. Therefore, within a given field, normal crop growth on good soil is contrasted by the stunted growth on the solonchetsic patches and the crops tend to develop an uneven or wavy appearance (note Figure 1). Their productivity, which depends to a large extent on the depth of the topsoil and toughness of the hardpan, ranges from very low to near that of the associated normal soil. Crop yields vary considerably from year to year depending on the distribution of rainfall.

FIGURE 1



Very few of the Solonchetsic soils in the Brown soil zone are cultivated, most being left in native pasture. However, in the Dark Brown Black soil zones the majority of the Solonchetsic soils are cropped. Low moisture storage, poor root penetration, crop variability and soil workability all contribute to the agronomic problems associated with these soils. Experimental work with deep plowing is being carried out quite extensively on Solonchetsic soils to improve crop growth. In most cases significant improvements have been realized.

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PARENT MATERIAL	SOIL ZONE				TOTAL
	BROWN	DARK BROWN	BLACK	GRAY	
CENTRAL AND SOUTHERN ALBERTA					
Residual (or soft bedrock) (medium-textured)	36 000	124 000	142 000	11 000	313 000
Till (medium-textured)	1 159 000	264 000	814 000	71 000	2 308 000
Lacustrine (fine-textured)	33 000	32 000	170 000	37 000	272 000
Lacustrine (medium-textured)	199 000	29 000	29 000	-	257 000
Eolian or fluvial (coarse-textured)	79 000	30 000	18 000	11 000	138 000
Total	1 506 000	479 000	1 173 000	130 000	3 288 000
PEACE RIVER REGION					
Residual (or soft bedrock) (medium-textured)	-	45 000	12 000	-	57 000
Till (medium-textured)	-	-	174 000	-	174 000
Lacustrine (lacustrine-H) (fine-textured)	-	-	295 000	118 000	413 000
Lacustrine (medium-textured)	-	-	378 000	-	378 000
Eolian or fluvial (coarse-textured)	-	-	-	-	-
Total	-	728 000	304 000	1 022 000	2 054 000
Grand Total	-	-	-	-	4 310 000

LEGEND

- Dominantly medium-textured ill material (often thin, <3 m, over soft bedrock)
- Dominantly fine-textured lacustrine material
- Dominantly fine-textured lacustrine-ill material
- Dominantly medium-textured fluvial or eolian material
- Dominantly coarse-textured fluvial or eolian material
- Dominantly moderately fine-textured residual material (or soft bedrock)
- 30 to 50% Solonchetsic soil
- Boundary of Reconnaissance Soil Surveys

UNITED STATES OF AMERICA