pH of Saskatchewan Soils

by
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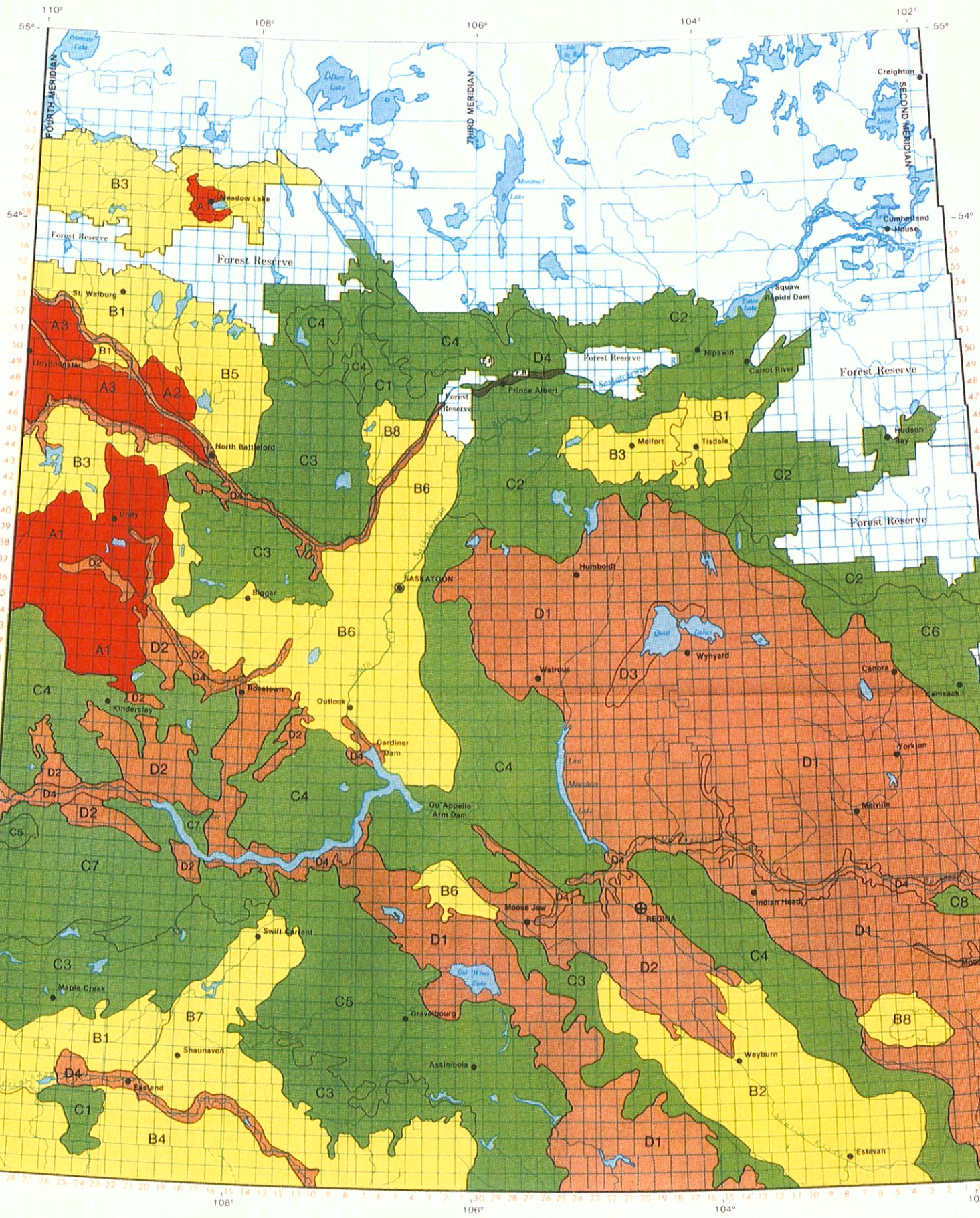


MAP UNITS AND pH FREQUENCY DISTRIBUTION

A1	$A^4B^4X^2$	B1	$B^5A^3C^2$	C1	C^6B^4	D1	D^6C^4
A2	$A^5B^3C^2$	B2	$B^6C^2A^2$	C2	C^7B^3	D2	D^7C^3
A3	$A^4B^4C^2$	B3	$B^5C^3A^2$	C3	$C^5B^3D^2$	D3	D^9C^1
		B4	$B^4C^4A^2$	C4	$C^6B^2D^2$	D4	Variable River Valleys
		B5	$B^6C^3A^1$	C5	$C^5B^2D^3$		
		B6	B^6C^4	C6	C^6D^2		
		B7	B^5C^5	C7	C^6D^4		
		B8	$B^5C^3D^2$	C8	C^5D^5		

EXPLANATION OF SYMBOLS

- X Soil pH less than 5.5
- A Soil pH 5.5-6.0
- B Soil pH 6.1-6.7
- C Soil pH 6.8-7.5
- D Soil pH greater than 7.5

(pH measured in 1:1 Soil-Water)

Map Unit Symbol — B4 — $B^4C^4A^2$ — 20% of surface area has a pH in the "A" range (5.5-6.0)

40% of surface area has a pH in the "B" range (6.1-6.7)

40% of surface area has a pH in the "C" range (6.8-7.5)

40 0 40 80 120 160 kilometers

20 0 20 40 60 80 100 miles

Acidification of Soils

Natural processes such as microbial activity and leaching by rainwater are lowering the pH of most soils very slowly. Some of man's activities can also add to the acidification process. Additions of ammonium and/or certain sulfur fertilizers will add small amounts of acid to the topsoil. Atmospheric emissions of sulfur and nitrogen from the burning of fossil fuels also add small amounts of acid in the form of acid precipitation. Most agricultural soils in Saskatchewan are able to absorb sizeable amounts of an acid without showing any change in pH. Alkaline soils with high clay and/or organic matter are very resistant to acidification. Soils which are slightly acid, low in organic matter and/or clay are most sensitive to additions of acid.

Variation of Soil pH

Soil pH will vary from field to field and within fields; but in the short term, very little change will occur from year to year.

The soils in the Eastern portion of Saskatchewan have a higher average pH than those in Western Saskatchewan. The main reason for this difference is because soils in Eastern Saskatchewan were formed in parent materials with a higher carbonate content.

pH Variability East and West of the Third Meridian

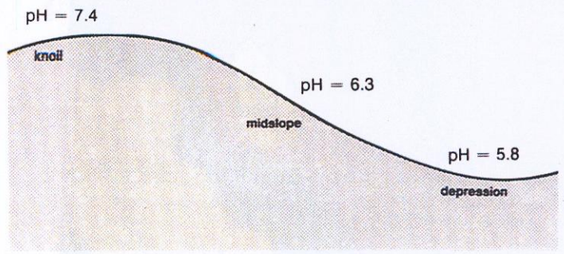
	East of 3rd meridian		West of 3rd meridian	
Soil Series	mean pH	number of samples	mean pH	number of samples
Oxbow Orthic	7.3	369	6.6	254
Blaine Lake Orthic	6.9	87	6.4	383
Weyburn Orthic	7.2	221	6.5	951
Weyburn Calcareous	7.6	69	7.3	205
Waitville Gray Wooded	7.1	25	6.6	95
Estevan Solonetzic	6.5	46		
Trossachs Solonetzic	6.6	22		
Echo Solonetzic			6.1	68
Hanley Solonetzic			6.0	32

In all cases, soils sampled east of the 3rd meridian have higher pH values than similar soils in the west. For example, the Oxbow Orthic soils in the east have an average pH of 7.3 while the Oxbow Orthic soils of the west average 6.6.

There are also pH differences between Soil Orders. Solonetzic soils, for example, generally have a lower average pH than associated Chernozemic soils. This trend is independent of whether the soils are located in the east or the west.

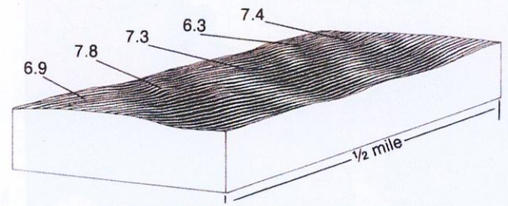
Variation of Soil pH within a Field

Variability of pH within a field is affected by the type of landscape. pH values tend to be the highest (most alkaline) on knolls and upper slopes. These soils have a high pH due to incorporation of alkaline subsoil with the thin surface soil. The soils on the lower slopes will usually have lower pH levels as surface soils are much thicker and subsoil is not incorporated.

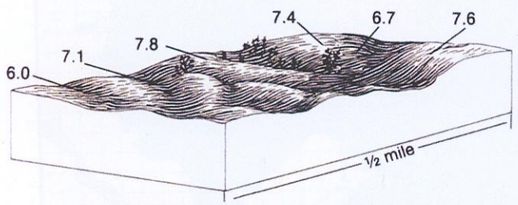


Variation in soil pH

Soil pH can vary greatly on level as well as on rougher landscapes. On level landscapes, pH values are not easily associated with visible topographic features. Fields which are considered flat or uniform may often have highly variable pH values.



pH variability on a nearly level landscape



pH variability on a nonlevel landscape

Soil pH values are often reported in soil test results. These values, however, represent the average pH of the fields tested and do not indicate the range of pH values which may occur in that field.

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Soil pH

The pH scale, ranging from 0 to 14, is used to indicate the relative acidity or alkalinity of a solution. pH is determined by the concentration of hydrogen ions in the soil solution. A soil with a pH of 7.0 is said to be neutral, while a value less than 7.0 acid, and a value greater than 7.0 alkaline in reaction.

The pH values, indicated on this map, are for the surface layer of soil which ranges in thickness from 10 to 20 cm (4-8 in.). Most subsoils in Saskatchewan are more alkaline (higher pH) than the surface soils.

Collection and Analysis of Data

During 1982, 8000 surface samples were collected using a modified grid system. On average, sampling sites were approximately 10 km apart. At each site, 3 samples were taken to represent various slope positions in the landscape. From 1983 to 1986, another 15,000 soils were sampled during routine soil survey activities. The pH of all samples are reported as equivalent to pH measured in water. The soil association, series, slope position, and pH of each soil sample was entered in a database for statistical analysis. The average pH and frequency distribution were calculated for each soil series and rural municipality to aid in the preparation of the map.

Areal Extent of pH Classes

Class	pH Range	Hectares
X	less than 5.5	710,000
A	5.5 to 6.0	2,040,000
B	6.1 to 6.7	5,222,000
C	6.8 to 7.5	9,878,000
D	greater than 7.5	10,507,000

Effect of pH on Crop Production

A soil with a pH between 6.5 and 7.5 provides the best environment for crop growth. Yields of sweet clover and alfalfa are reduced when the soil pH is below 6.0. If the pH is below 5.5 the yield may be reduced by one-half. A pH less than 5.5 may reduce the yields of wheat, barley and canola.

Soil pH determines the availability of many plant nutrients to crop root systems. The possibility of copper, iron, zinc, and manganese deficiencies is much greater in soils with an alkaline pH. Phosphorus availability may be greatly reduced at both low (less than 5.5) and high (greater than 7.0) pH due to phosphate fixation.

Acid Soils

Acid soils have a pH value less than 7.0. Soil acidity can be corrected by addition of liming materials that will neutralize the acidic ions in the soil. The most common liming materials are ground limestone or calcium carbonate. Depending on how acid a soil is, it may require from 2 to 10 tonnes per hectare to raise the soil pH to an acceptable level (pH 6.5). An application of lime will probably last 20 years or more under Saskatchewan climatic conditions.

Areas on the map such as A1, A2 and A3 may require liming if sensitive crops such as alfalfa or sweet clover are to be grown. The A1 soils have limited areas that also require liming for maximum yields of barley, wheat, or canola. Detailed soil testing is necessary to determine the amount of lime required to raise the soil pH to an acceptable level.

Alkaline Soils

Alkaline soils have a pH greater than 7.0. These are not the same as soils commonly referred to as 'Alkali' soils. Many of the alkaline soils (D1 and D2) are among the most productive soils in Saskatchewan. They generally occur in the more humid portion of the province and have a high organic matter content. Less productive alkaline soils occur on eroded knolls, where erosion has removed fertile topsoil and exposed the underlying alkaline subsoil.

High pH (greater than 7.5) can cause some herbicides to remain active in the soil for longer periods. This can create problems with rotations which include sensitive crops. The few herbicides which are sensitive to pH have the appropriate cropping restrictions described on their label.

Alkaline soils may have a detrimental affect on urea fertilizer efficiency and plant growth if the urea has not been properly applied. High soil pH increases the rate of nitrogen loss through volatilization if fertilizers such as urea (46-0-0) or ammonium sulfate (21-0-0) are broadcast on the soil surface without being immediately incorporated. Restrictions for seed placing nitrogen in the urea form should be strictly adhered to, as the toxic effect of urea is increased at higher pH levels.

Canada Saskatchewan

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