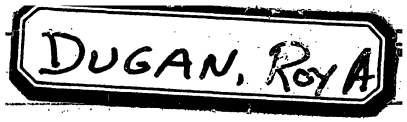
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SOIL ANNALYS OF DOUGLAS LAKE SAMPLES

by

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Soil Analysis of Douglas Lake Samples

Introduction

The soil samples used in this analysis were taken from the University property at Douglas Lake, Michigan. The samples were taken from different horizons, lettered a,b,c, etc, of sample plots established by Professor Young of the School of Forestry and Conservation. The following analysis was made of sixteen samples.

1. Determination of Nitrogen Content (Kjeldahl method).
2. Determination of Ammonium Soluble Humus.
3. Determination of Organic Material by Heating.
4. Mechanical Analysis.
5. Determination of Moisture Content.
6. Determination of Acidity.
7. Description of Soil.

Nitrogen Content (Modified Kjeldahl Method)

All organic nitrogenous substances when digested with strong sulfuric acid are converted into ammonium sulphate $(NH_4)_2SO_4$. In order to determine the amount of ammonium sulphate thus formed, the ammonia is driven off by the addition of an excess of a strong alkali solution. The ammonia thus driven off is caught in a known amount of a standard

acid solution, i.e. an acid of known strength; such as N/10 sulfuric acid. The amount of this latter solution that has been neutralized by the ammonia is determined by titration with a standard alkali such as sodium hydroxide (NaOH). The formula is -- $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$).

Table I shows the results for each of the samples used.

Table I. Total Nitrogen In Douglas Lake Samples

Soil number	Nitrogen per cent	Ammonium * soluble humus	Organic material
1a	.096	.650%	3.730%
1c	.092	.375	1.030
2a	.160	1.470	8.000
2b	.106	.350	0.800
2c	.025	.350	1.420
2d	none	.325	0.364
3a	.023	1.420	5.120
3b	none	none	0.740
3c	none	none	1.435
4a	.614	.225	18.195
4b	.031	.350	1.118
4c	.036	2.100	3.550
4d	.034	none	3.118
4e	none	none	0.779
5a	.406	3.100	12.425
5b	.037	.400	1.473

Determination of Ammonium Soluble Humus

Another way to express the nitrogenous material or humus in soil is to determine how much will dissolve in an ammonia solution. To do this the calcium in a 5 gram sample of the soil was washed out with 1% hydrochloric acid and any remains of the acid with H_2O then the sample was placed in a stoppered graduate which was filled to the 250 cc mark with a 4 per cent ammonia solution.

These figures should be divided by 2.

The solution was well mixed and allowed to stand 24 hours, after which a 50 cubic centimeter sample representing 1gm of soil was drawn off and evaporated to dryness. The residue was weighed, ignited and weighed again. From the difference in the two weights the percentage of organic material was determined. (See Table I.)

Determination of Organic Material by Heating

The equivalent of 5 grams of oven dry soil is placed in a porcelain dish (in duplo) and the dishes are placed in an furnace ~~oven~~ and heated to approximately 600 degrees centigrade to constant weight for a half hour. The loss of weight is determined and the percentage is calculated. (See Table I)

Mechanical Annalysis

The mechanical annalysis separates the soil into grades and determines the % by weight of each grade. ~~which determines the percent of various grades of soil~~ particles in the soil. Once the % of the different grades has been determined the soil can be assigned a class name. On the basis of the mechanical analysis, we can classify the soil into its proper textural class. (Mechanical composition)

The three main grades of soil are sand, silt, and clay, and are based on the size of the particles as follows --[1]

Sand - from 2 mm. to .05 mm

Silt - from .05 mm to .005mm

Clay - less than .005 mm.

Depending on the per cent of sand, silt or clay in the soil it is given a textural class name. The ten classes of soils are as follows -

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1 Davis and Bennett. Classification of Soils on the Basis of Mechanical Analysis. U.S.D.A. Cir. 419, July 1925.

1. Clay
2. Sandy clay
3. Silty clay
4. Sandy clay loam
5. Clay loam
6. Silty clay loam
7. Loam
8. Sandy loam
9. Silty loam
10. Sand

The soil samples that were used in this alalysis were all sand and so were divided into the secondary grades of sand which are: Fine gravel ------- 2 mm. to 1 mm. in size.

Coarse sand ------- 1 mm to .5 mm

Medium sand ------- .5 mm to .25 mm

Fine sand ------- .25 mm to .10 mm

Very fine sand ---- .10 mm to .05 mm

Table II shows about all of the soils to be either fine or medium sands.

Determination of Acidity

The acidity of the soil was determined by the Soiltex Soil Reaction Test, prepared by C. H. Spurway at the Michigan Agriculture Experiment Station. The results are given in table II which also shows the PH range for each soil...

Moisture Determination

To determine the moisture percent in air dry soil 50

in duplicate sets

grams of the sample was placed in an electric oven and heated to 100 degrees for 12 hours. This was done in order to determine what weight of soil should be used in other experiments to get the required amount of oven dry soil. (See Table II) In addition, the % of moisture in such air-dry soils gives an indication of the amount of organic matter in the soil.

Table II. Data On Douglas Lake Soil

Soil	Grade of soil	Acidity	PH range	Moisture content %
1a	Medium sand	Very strongly acid	4.9 down	0.490
1c	Medium sand	Very strongly acid	4.9 down	0.286
2a	Fine sand	Medium acid	5.7 - 6.1	1.060
2b	Fine sand	Medium acid	5.7 - 6.1	0.117
2c	Medium sand	Strongly acid	5.0 - 5.6	0.546
2d	Fine sand	Medium acid	5.7 - 6.1	0.162
3a	Coarse sand	Medium acid	5.7 - 6.1	0.844
3b	Medium sand	Strongly acid	5.0 - 5.6	0.134
3c	Medium sand	Strongly acid	5.0 - 5.6	0.476
4a	Fine sand	Strongly acid	5.0 - 5.6	3.444
4b	Fine sand	Very strongly acid	4.9 down	0.291
4c	Fine sand	Very strongly acid	4.9 down	0.965
4d	Fine sand	Strongly acid	5.0 - 5.6	0.883
4e	Fine sand	Medium acid	5.7 - 6.1	0.226
5a	Medium sand	Medium acid	5.7 - 6.1	1.811
5b	Medium sand	Strongly acid	5.0 - 5.6	0.219

Description of Soils

Soil 1a.

A dark grey soil, almost black because of the large amount of humus present. The soil is about half humus by volume and very light weight.

Soil 1c.

A light brown sand with very little humus and a few large

pebbles. Very heavy.

Soil 2a.

A dark grey sand containing a large amount of black humus. Apparently from a burned area since it contains considerable carbon. Light weight.

Soil 2b.

A light grey sand with only a small amount of humus.

Soil 2c.

A very light brown sand with a few large pebbles and very little organic material.

Soil 2d.

A fine sand with no particles over 2 millimeters. Very light brown mixed with white sand; no humus.

Soil 3a.

A grey sand containing a large amount of humus and considerable charcoal.

Soil 3b.

A light grey sand containing a small amount of humus (in the form of fibrous roots) and small stones.

Soil 3c.

A light brown sand containing a little gravel and a few small roots.

Soil 4a.

A black soil, mostly humus, and a little sand. About half of the sample is larger than 2 millimeters and consists of, charcoal, roots, and other organic material.

Soil 4b.

A dark grey sand with a few small pebbles and a small amount of humus.

Soil 4c.

A mixture of dark brown and grey sand containing a little gravel and very little humus.

Soil 4d.

A dark brown sand with a little gravel and no humus.

Soil 4e.

A light brown, fine sand with no humus on large material.

Soil 5a.

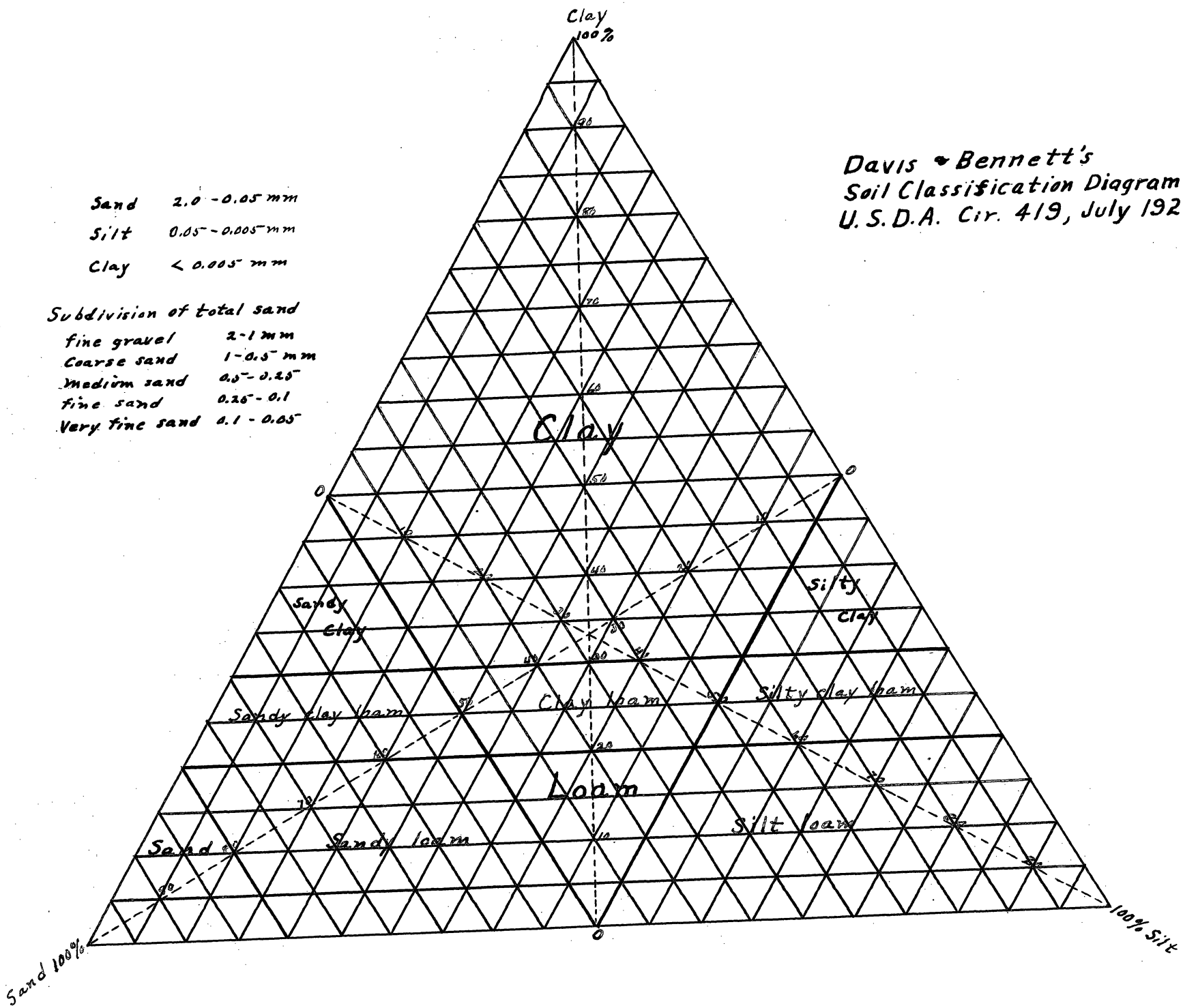
Mostly black humus with a little white sand and charcoal.

Soil 5b.

A very light grey sand with a little humus and some gravel.

Note

I wish to acknowledge my appreciation of the help I received from Professor M. W. Senstius of the Geology Department under whom this work was carried out.


Clay
100%
Sand 100%
100% Silt
Clay
Sandy Clay
Silty Clay
Clay loam
Sandy clay loam
Silty clay loam
Loam
Sandy loam
Silt loam
Sand
Sand 2.0 - 0.05 mm
Silt 0.05 - 0.005 mm
Clay < 0.005 mm
Subdivision of total sand
fine gravel 2 - 1 mm
Coarse sand 1 - 0.5 mm
Medium sand 0.5 - 0.25
fine sand 0.25 - 0.1
Very fine sand 0.1 - 0.05
Davis & Bennett's
Soil Classification Diagram
U.S.D.A. Cir. 419, July 1927.