

Soils and MicroClimate

- Obtaining Soils and climate data
- How much N in ecosystems, and
- How to calculate how much N is there

Microclimate and SOILS

Characterizing the Physical Environment

Focus is LOCAL, not global or regional

What are the site properties?

What site properties might constrain management activities?

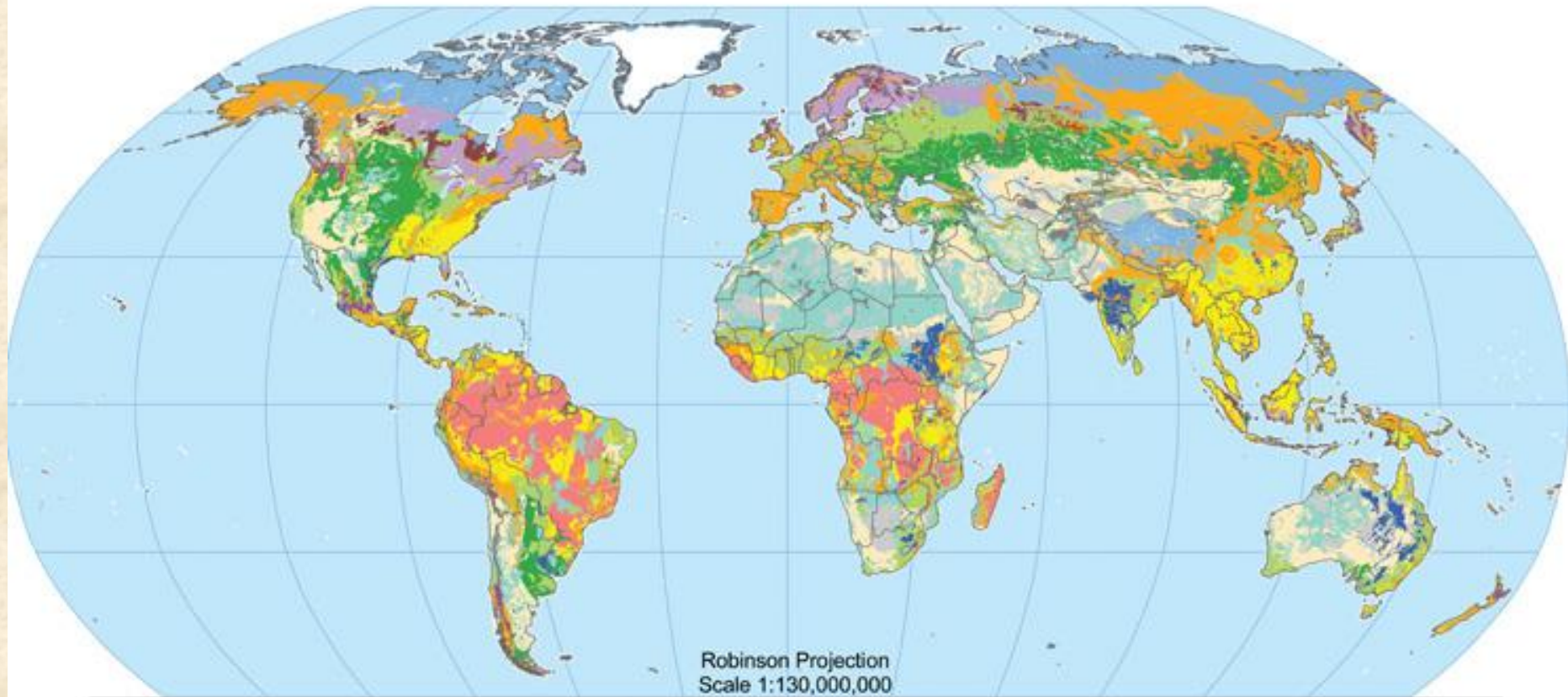
Are there sensitive areas that might be changed by management?

How can you obtain and use this info??

*Reading: Anderson and Ingram, Tropical Soil Biology and Fertility:
A Handbook of Methods, Chap. 2: Site Description
available as electronic reserve on the web page*
















*Also on Library Reserve: Brady and Weil, Elements of the Nature
and Properties of Soils*

Global Soil Regions

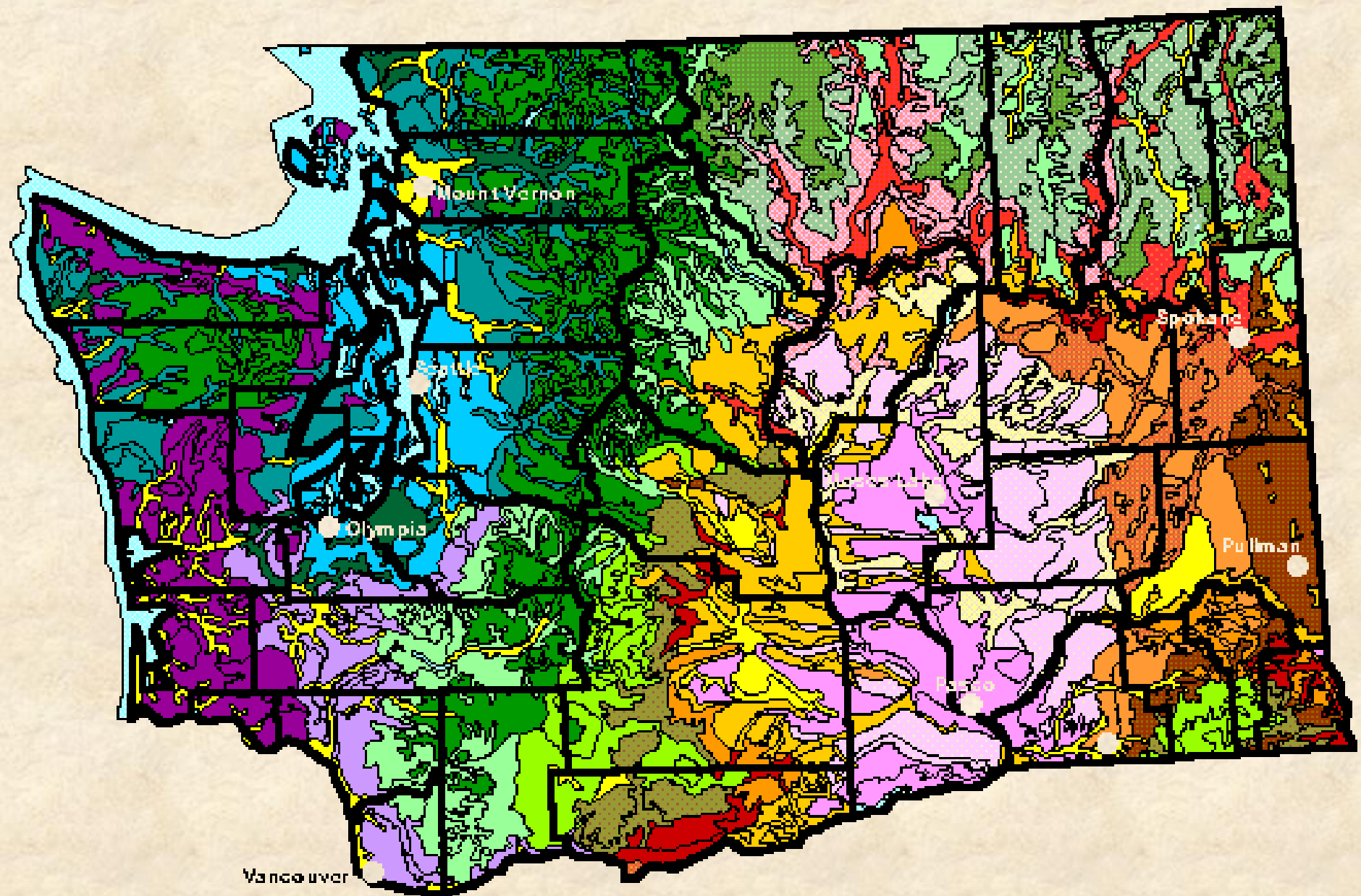


Robinson Projection
Scale 1:130,000,000

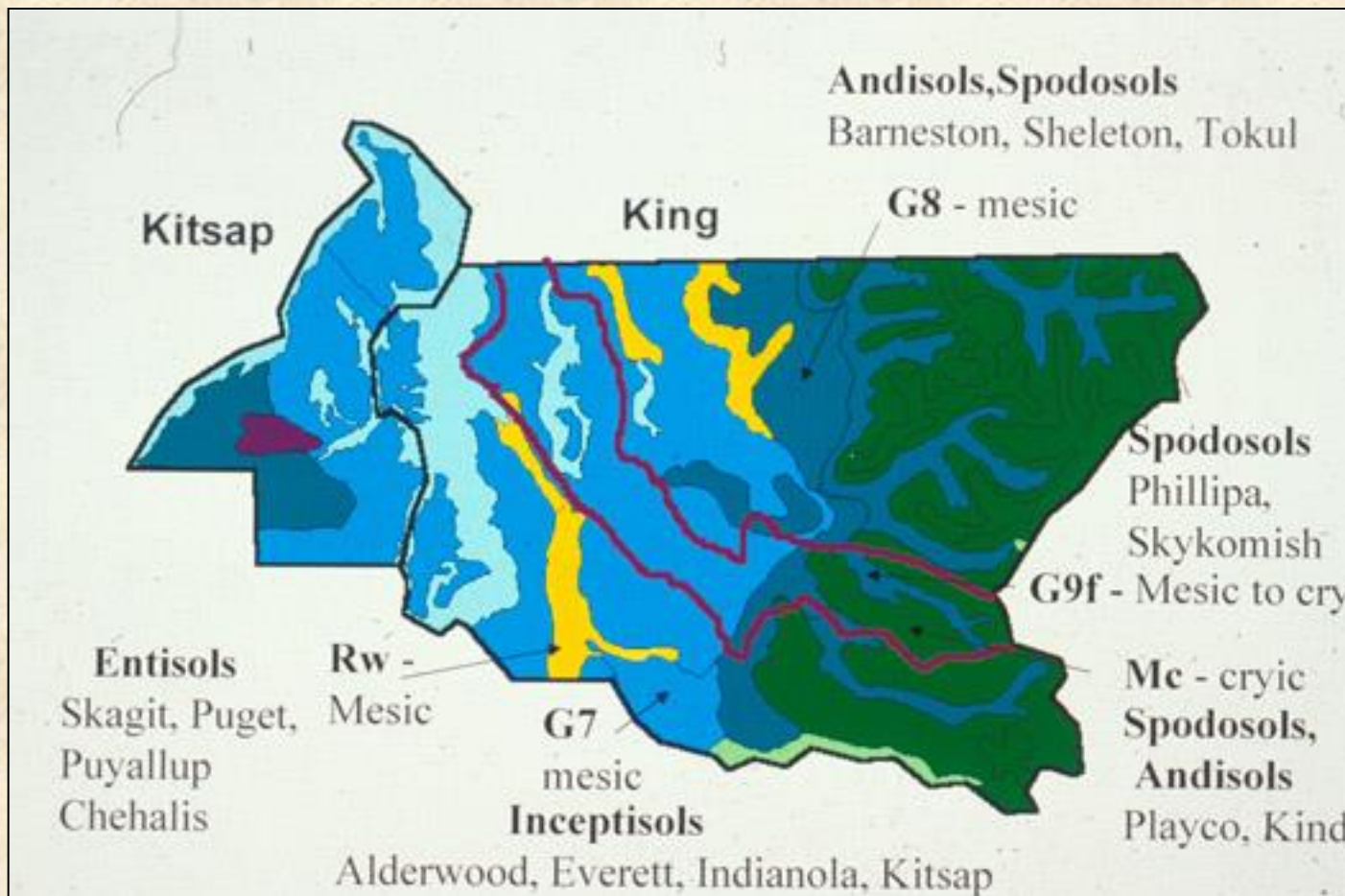
Soil Orders

| | | | | |
|---|---|---|---|---|
|  Alfisols |  Entisols |  Inceptisols |  Spodosols |  Rocky Land |
|  Andisols |  Gelisols |  Mollisols |  Ultisols |  Shifting Sand |
|  Aridisols |  Histosols |  Oxisols |  Vertisols |  Ice/Glacier |

Washington Soil Series



Pierce County





United States
Department of
Agriculture

Soil
Conservation
Service

In Cooperation with
Washington State
Department of
Natural Resources and
Washington State
University Agriculture
Research Center

Soil Survey of Snohomish County Area Washington



Many *counties* in the
U.S. have a Soil Survey
produced by
Natural Resources
Conservation Service
(NRCS)

Collecting Soil Information

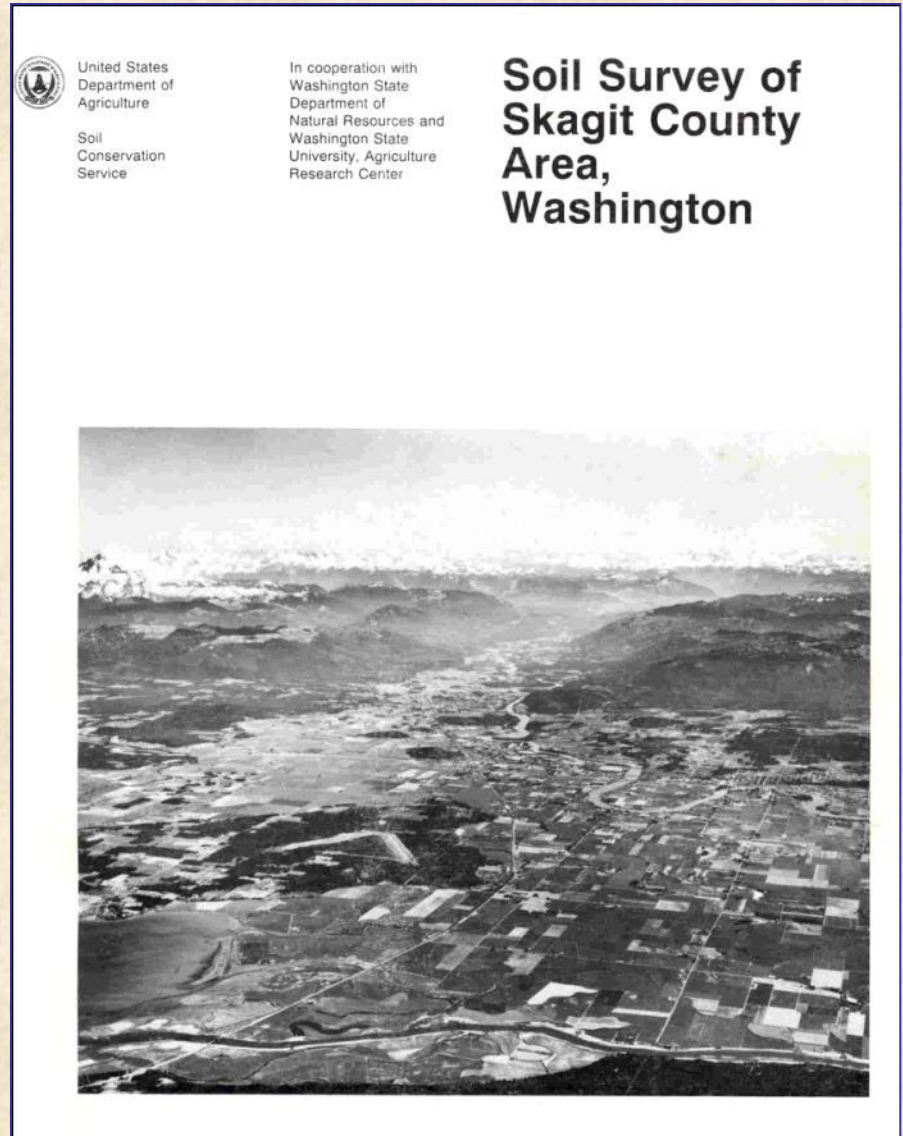
Soil Surveys

Maps

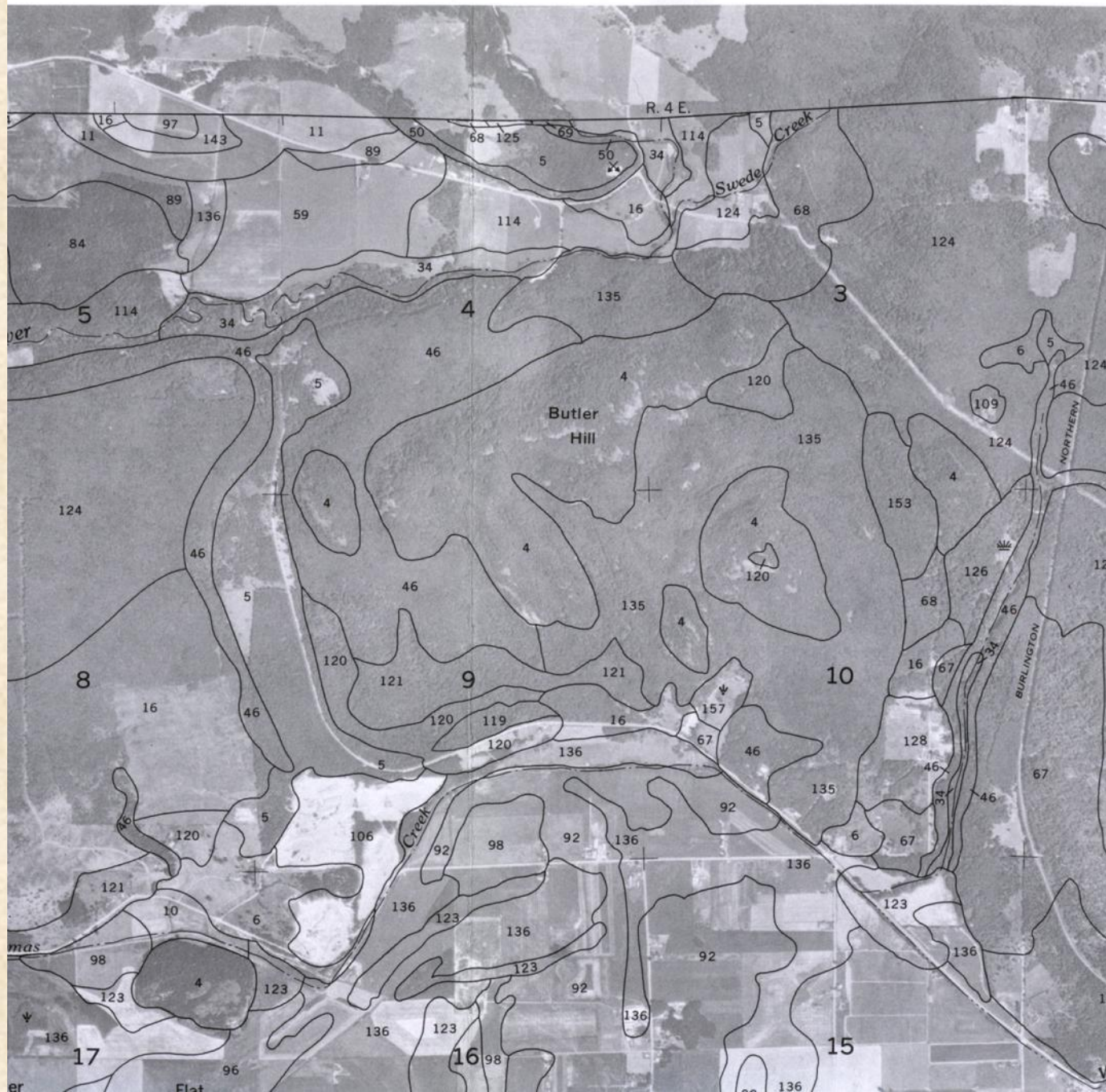
Profile descriptions

Tables on soil properties:

physical,
chemical,
engineering,
land capabilities,
plant growth



Soil Survey Map



ALDERWOOD SERIES

The **Alderwood series** consists of moderately deep to a cemented pan, moderately well drained soils formed in glacial till. Alderwood soils are on glacially modified foothills and valleys and have **slopes** of 0 to 65 percent. The average annual precipitation is about 40 inches, and the mean annual temperature is about 50 degrees F.

TYPICAL PEDON:

Ap--0 to 7 inches; **very dark grayish brown**; **gravelly ashy sandy loam**; moderate fine granular **structure**; slightly acid (**pH 6.2**). (3 to 7 inches thick). **Roots?**

Bs1--7 to 21 inches; dark yellowish brown; very gravelly ashy sandy loam; weak medium subangular blocky structure; slightly acid (pH 6.2).

Bs2--21 to 30 inches; dark brown; very gravelly ashy sandy loam; weak medium subangular blocky structure; slightly acid (pH 6.2). (Combined Bs1 and Bs2 horizons are 15 to 30 inches thick)

2Bs3--**30 to 35 inches**; 50% olive/yellowish brown and 50% dark greyish brown; very gravelly sandy loam, some cemented fragments, massive; moderately acid (pH 6.0). (0 to 15 inches thick)

2Bsm--35 to 43 inches; dark grayish brown cemented layer that crushes to very gravelly sandy loam; massive; 40 percent pebbles; moderately acid (pH 6.0). (5 to 20 inches thick)

2Cd--43 to 60 inches; grayish brown compact glacial till that breaks to very gravelly sandy loam; massive; extremely hard; 40 percent pebbles; moderately acid (pH 6.0).

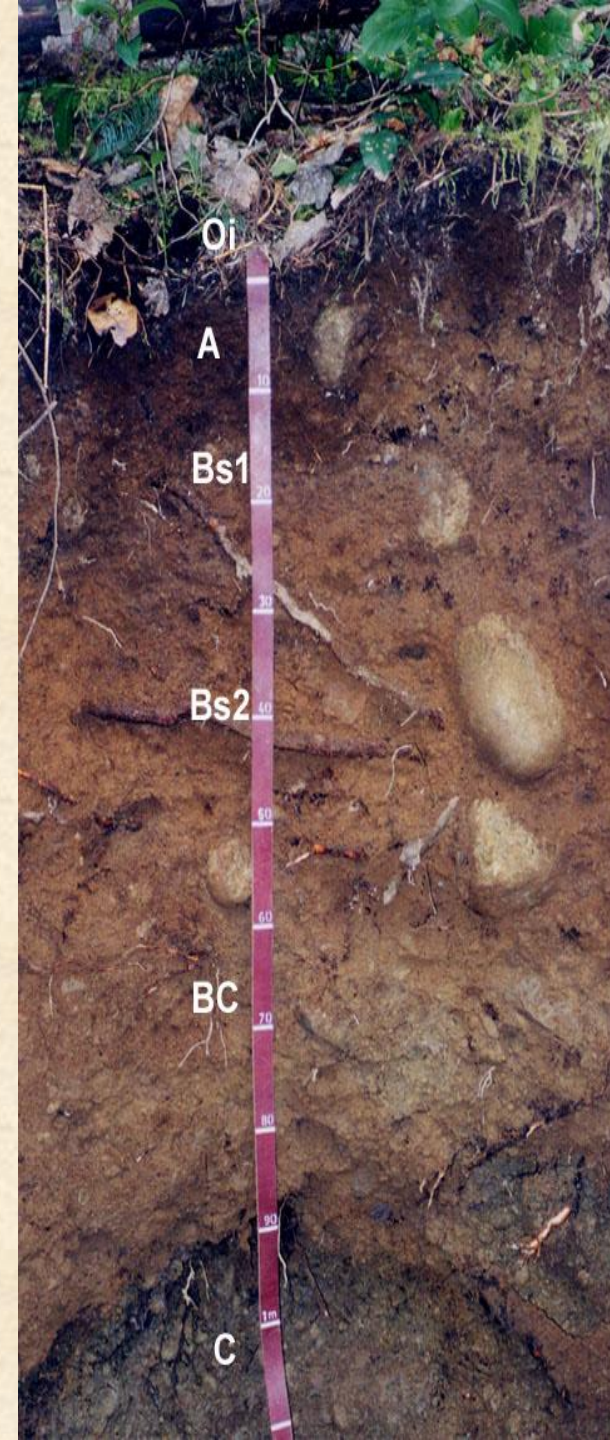


TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only the soils suited to crops are listed]

| Soil name and map symbol | Sweet corn | Grass- legume hay | Pasture | Green chop | Corn silage | Green peas | Straw- berries |
|-----------------------------|------------|----------------------|-------------|------------|-------------|------------|-------------------|
| | <u>Ton</u> | <u>Ton</u> | <u>AUM*</u> | <u>Ton</u> | <u>Ton</u> | <u>Ton</u> | <u>Crate</u> |
| 1, 2-- Alderwood | --- | 4.0 | 11 | 10 | --- | --- | --- |
| 32-- McKenna | --- | 2.5 | 5 | --- | --- | --- | --- |
| 39-- Norma | 6.0 | 4.0 | 10 | 10 | --- | --- | --- |

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

| Soil name and map symbol | Ordination symbol | Management concerns | | | | Potential productivity | | Trees to plant |
|---------------------------|-------------------|----------------------|--------------------|-------------------|-------------------|---|--------------------------|------------------------------|
| | | Equipment limitation | Seedling mortality | Wind-throw hazard | Plant competition | Common trees | Site index | |
| 1, 2, 3----- Alderwood | 3d | Slight | Slight | Moderate | Severe | Douglas-fir----- Western redcedar---- Western hemlock---- Red alder----- | 108 --- --- --- | Douglas-fir, red alder. |
| 32----- McKenna | 4w | Severe | Moderate | Severe | Moderate | Red alder----- Western redcedar---- Western hemlock---- | 90 --- --- | Red alder, western redcedar. |
| 39----- Norma | 2w | Severe | Moderate | Moderate | Moderate | Red alder----- Western redcedar---- Western hemlock---- Bigleaf maple----- | 106 --- --- --- | Red alder. |

(Major soil limitations:

slight=use is not limited to a particular kind of equipment or time of year,

moderate=short seasonal limitation because of soil wetness, a fluctuating water table, or some other factor,

severe=seasonal limitation, a need for special equipment such as cable yarding system, or a hazard in the use of equipment.)

TABLE 7.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails | Golf fairways |
|--------------------------|-------------------------------|-------------------------------|--|---------------------------------------|--|
| Alderwood | Slight | Slight | Severe: small stones. | Slight | Moderate: small stones, droughty, thin layer. |
| 32 McKenna | Severe: ponding. | Severe: ponding. | Severe: small stones, ponding. | Severe: ponding, erodes easily. | Severe: ponding. |
| 39 Norma Alderwood | Severe: ponding. slope. | Severe: ponding. slope. | Severe: ponding. slope, small stones. | Severe: ponding. slope. | Severe: ponding. small stones, droughty, thin layer. |

(degree of soil limitations:

slight=soil properties are generally favorable and that limitations are minor and easily overcome,
 moderate=limitations can be overcome or alleviated by planning, design, or special maintenance,
 severe=soil properties are unfavorable and that limitations can be offset only by costly soil reclamation,
 special design, intensive maintenance, limited use, or by a combination of these measures.)

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Potential for habitat elements | | | | | | | Potential as habitat for-- | | |
|--------------------------|--------------------------------|---------------------|--------------------------|---------------------|--------|----------------|---------------------|----------------------------|-------------------|------------------|
| | Grain and seed crops | Grasses and legumes | Wild herba- ceous plants | Conif- erous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Woodland wildlife | Wetland wildlife |
| 1----- Alderwood | Poor | Fair | Good | Good | Good | Poor | Very poor. | Fair | Good | Very poor. |
| 32----- McKenna | Poor | Fair | Poor | Fair | Poor | Poor | Very poor. | Poor | Poor | Very poor. |
| 39----- Norma | Fair | Fair | Good | Fair | Good | Good | Good | Good | Good | Good. |

TABLE 9.--BUILDING SITE DEVELOPMENT

Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|--------------------------|---|-----------------------------|--|----------------------------|-------------------------|--|
| Alderwood | Moderate: cemented pan, wetness. | Slight----- | Moderate: wetness, cemented pan. | Moderate: slope. | Slight----- | Moderate: small stones, droughty, thin layer. |
| 32----- McKenna | Severe: ponding. wetness, slope. | Severe: ponding. | Severe: ponding. cemented pan, slope. | Severe: ponding. | Severe: ponding. | Severe: ponding. droughty, thin layer. |
| 39----- Norma | Severe: cutbanks cave, ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. | Severe: ponding. |

(Limitations are considered:

slight=if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome,
 moderate=if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed
 to overcome or minimize the limitations,

severe=if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required where the soil limitations are severe.)

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|--------------------------|---|--------------------------------------|--------------------------|--------------------------------------|---|
| 1----- Alderwood | Severe: cemented pan, wetness. | Severe: seepage, cemented pan. | Severe: seepage. | Severe: cemented pan, seepage. | Poor: area reclaim, small stones. |
| 32----- McKenna | Severe: cemented pan, ponding, percs slowly. | Severe: cemented pan, ponding. | Severe: ponding. | Severe: cemented pan, ponding. | Poor: area reclaim, small stones, ponding. |
| 39----- Norma | Severe: ponding. | Severe: seepage, ponding. | Severe: ponding. | Severe: seepage, ponding. | Poor: ponding. |

(Soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills are considered:

- slight—if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome,
- moderate—if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations,
- severe—if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required;

OR

Soil limitations that can affect the suitability of its use as daily cover for landfills are considered:

- slight—if soil properties and site features are favorable for the use and good performance and low maintenance can be expected,
- fair—if soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good,
- poor—if one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.)

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

| Soil name and map symbol | Limitations for-- | | | Features affecting-- | | |
|--------------------------|--------------------------------------|------------------------------------|-----------------------------|--|--|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Aquifer-fed excavated ponds | Drainage | Irrigation | Terraces and diversions |
| 1----- Alderwood | Severe: seepage. | Severe: seepage. | Severe: no water. | Cemented pan, slope. | Wetness, droughty, cemented pan. | Cemented pan. |
| 32----- McKenna | Moderate: cemented pan, slope. | Severe: thin layer, ponding. | Severe: no water. | Ponding, percs slowly, cemented pan. | Ponding, droughty, percs slowly. | Cemented pan, erodes easily, ponding. |
| 39----- Norma | Severe: seepage. | Severe: piping, ponding. | Severe: cutbanks cave. | Ponding, cutbanks cave. | Ponding----- | Ponding, too sandy. |

(Degree and kind of soil limitations are considered:

- slight—if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome,
- moderate—if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations,
- severe—if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.)

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

| Soil name and map symbol | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Organic matter |
|--------------------------|-------|-----------|--------------|--------------------------|---------------|------------------------|-----------------|---|----------------|
| | | | | | | | K | T | |
| | In | Pct | In/hr | In/in | pH | | | | Pct |
| 1, 2, 3--- Alderwood | 0-7 | 5-10 | 2.0-6.0 | 0.07-0.11 | 5.1-6.5 | Low----- | 0.20 | 2 | 5-10 |
| | 7-35 | 5-10 | 2.0-6.0 | 0.07-0.11 | 5.6-6.5 | Low----- | 0.20 | | |
| | 35 | --- | --- | --- | --- | --- | --- | | |
| 32--- McKenna | 0-8 | 10-25 | 0.6-2.0 | 0.16-0.19 | 4.5-7.3 | Low----- | 0.32 | 3 | 3-15 |
| | 8-33 | 20-35 | 0.06-0.2 | 0.12-0.16 | 5.1-7.3 | Moderate----- | 0.32 | | |
| | 33 | --- | --- | --- | --- | --- | --- | | |
| 39--- Norma | 0-10 | 10-15 | 0.6-2.0 | 0.19-0.21 | 5.6-6.5 | Low----- | 0.24 | 5 | 5-15 |
| | 10-28 | 5-10 | 2.0-6.0 | 0.12-0.15 | 5.6-6.5 | Low----- | --- | | |
| | 28-60 | 5-20 | 0.6-2.0 | 0.12-0.15 | 5.6-7.3 | Low----- | --- | | |

Some Climate and Soil Survey Websites

Climate data

Snotel - snow, water equivalent, air temps

<http://www.wcc.nrcs.usda.gov/snow/>

National Climatic Data Center (NCDC) - NOAA satellite service

<http://gis.ncdc.noaa.gov/maps//>

National Weather Service Forecast Office

<http://www.wrh.noaa.gov/sew/>

Soils data

Natural Resources Conservation Service (NRCS) Soil Surveys by State

http://soils.usda.gov/survey/printed_surveys/

NRCS - Snohomish County Survey

http://soildatamart.nrcs.usda.gov/Manuscripts/WA661/0/wa661_text.pdf

NRCS - Washington state Soil Surveys

http://soils.usda.gov/survey/printed_surveys/state.asp?state=Washington&abbr=WA

WA Soil Survey Reports

http://www.or.nrcs.usda.gov/pnw_soil/wa_reports.html

Soils' App for Smartphones

Apple Store Mac iPod iPhone iPad iTunes Support


iTunes Preview

Overview Features iTunes Charts

SoilWeb for the iPhone

By CA Soil Resource Lab

Open iTunes to buy and download apps.



[View in iTunes](#)

Free

Category: Education
 Updated: Jun 14, 2010
 Version: 1.2
 Size: 0.1 MB
 Language: English
 Seller: Dylan Beaudette
 © 2010 CA Soil Resource Lab
 Rated 4+

Compatibility: Requires iOS 2.1.2 or later. Compatible with iPhone, iPad, and iPod touch.

Customer Ratings

Current Version: ★★★★★ 37 Ratings
 All Versions: ★★★★★ 57 Ratings

Description


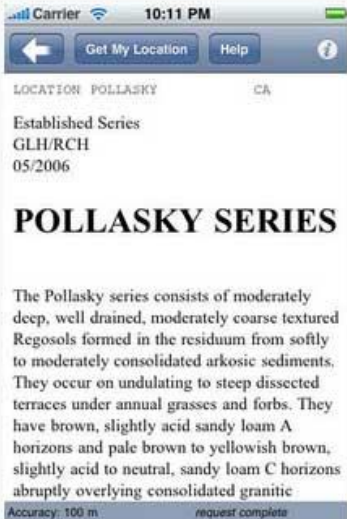
GPS based, real-time access to USDA-NRCS soil survey data, formatted for the iPhone. This application retrieves graphical summaries of soil types associated with the iPhone's current geographic location, based on a user defined horizontal precision. Sketches of soil profiles are linked to their official soil series description (OSD) page. Soil series

[CA Soil Resource Lab Web Site](#) | [SoilWeb for the iPhone Support](#) | [More](#)

What's New in Version 1.2

New interface, online help, and calibrated GPS accuracy threshold.

iPhone Screenshots

Customer Reviews

Link Issues ★★★
by AKClarka

This is a great app that our entire team is using to find soil types but the OSD link does not work. This is really discouraging as it costs us extra time to copy and paste the link and retrieve the information through extra steps. Could you please check this out and fix the link if possible. We are trying to get our entire agronomy group and

[More](#)

Great tool ★★★★★
by Alfred Hartemink

Excellent teaching tool and great for anyone traversing the country and wanting to know what soils are underfoot. I took the train from Lincoln, Nebraska to Chicago and the whole journey soil web informed me on the soil series.

Environmental and Resource Assessment Uses

Critical Area Ordinances

Environmental Impact Statement

Endangered Species Act

Habitat Conservation Plan

Forest Certification

Vegetation Management Plan

Non-Industrial Private Forestland owner

Forest Stewardship Plan

Factors to consider on ESRM 304 field trips!

Index Productivity by assessing site for:

Nutrients

Water

Aeration

Anchorage

Plants

Species

Age

Tree rings

Canopy cover - light

Understory?

Forest floor – depth, wood, litterfall?,

Roots – nodules, mycorrhizas

Chlorosis?, breakage tree tops, stunted, pistol butt,
tip overs,

Mushrooms – decomposers, mycorrhizas,

Wildlife – manure, browsing/herbivory, pedoturbation,
tree hollow – birds/squirrels

Tree decay?

???

Soils

Slope – erosion?

Color – OM, biosolids, minerals

Charcoal?

Texture and coarse material – drainage,

Dense horizon/layer – argillic, compacted, ?

Depth to bedrock, water table

Moisture – evidence of standing water, mottles,
aquatic species

Microbes, insects, worms, etc

???

Bulk Density Calculations

Bulk Density = dry soil mass / volume

Dry Mass:

O horizon (organic detritus) dried at 70 – 75C

Mineral soil dried at 105C

Volume:

Mineral Soil: e.g.,

core volume of 2 rings = 137.4 cm^3 ($\pi r^2 h = \text{vol}$)

Organic horizons: e.g.,

Volume = average depth of 4 measurements x 18 cm x 11.5 cm
(area of cut-out template)

so:

Bulk Density = dry weight / field volume

and:

With element (or molecule) concentration, bulk density and soil depth, you can calculate the total quantity of an element (or molecule) in a soil horizon or the total soil.

How much resource?

Ecosystem Nitrogen (kg/ha)

| | Agriculture | Forest |
|------------|-----------------|-----------------|
| Vegetation | 100 - 1,000 | 1,000 - 2,000 |
| Soils | 25,000 - 30,000 | 10,000 - 15,000 |

Hint: To calculate how much consider mass (eg, kg) and concentration (eg, %) !!

How to calculate the amount of N in a soil horizon or in the soil profile!

e.g. Soil N conc

e.g. Soil BD

e.g. Horizon Depth

Mass Conver

Area Conver

$$\frac{3 \text{ mg N}}{1 \text{ g soil}} \times \frac{1.1 \text{ g soil}}{\text{cm}^2 \cdot \text{cm}} \times \frac{8 \text{ cm}}{1} \times \frac{1 \text{ kg}}{10^6 \text{ mg}} \times \frac{10^8 \text{ cm}^2}{\text{ha}}$$

$$= \frac{2640 \text{ kg N}}{\text{ha}} \text{ per } 8 \text{ cm horizon} \text{ or } \frac{2.64 \text{ Mg N}}{\text{ha}}$$

For total N in SOIL, calculate N Mg/ha for each horizon, then sum N for all horizons

How to calculate the amount of NH₄-N in the Thrufall!

e.g. NH₄-N Conc

e.g. Thrufall amount

Volume Conver

Mass Conver

Area Conver

$$\frac{0.18 \text{ mg NH}_4\text{-N}}{1 \text{ L Thrufall}} \times \frac{50 \text{ cm Thrufall}}{\text{yr}} \times \frac{1 \text{ L}}{10^3 \text{ cm}^2 \cdot \text{cm}} \times \frac{1 \text{ kg}}{10^6 \text{ mg}} \times \frac{10^8 \text{ cm}^2}{\text{ha}}$$

$$= \frac{2.2 \text{ kg NH}_4\text{-N}}{\text{ha} \cdot \text{yr}}$$

For Total N (kg/ha/yr) in Thrufall, *analyze/calculate* for all N forms (eg, NO₃-N, organic N, etc) and sum all N, OR analyze/calculate for Total N.

Soils and MicroClimate

- Obtaining Soils and climate data
 - Maps, NRCS County Soil Surveys, NOAA, etc
- How much N in ecosystems, and
- How to calculate how much soil N is there
 - soil N conc x soil bulk density x depth