Soil Savvy for Successful Native Plantings in the Landscape

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Landscaping with Colorado Native Plants
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Handouts

- Soil Testing FAQs
- How to Collect Soil Samples
- List of Colorado Extension GardenNotes and Fact Sheets on soil properties – ***get to know as much about your soil as you do your plants!***

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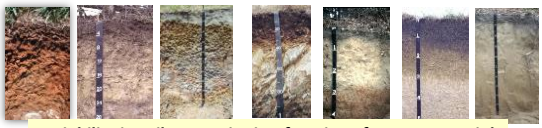
Handout of presentation slides to be made available after the conference

Presentation Outline

- **The ecological relationship between soil properties and native plant communities**
- **Soil concerns for growing natives in your landscape**
  - ***Developing soil savvy: what do you need to know about your soil's properties before making decisions on plant selection and management strategy*** *(irrigation, fertilizer, amendments)*
  - ***Where to find information on soil preferences of various native plants***

Soils are naturally highly variable

>20,000 different kinds of soil classified in the U.S. alone!



Variability in soil properties is a function of parent material, climate, topography, plant community and time

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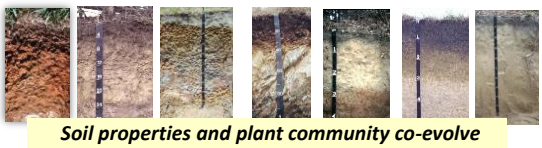


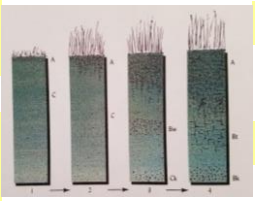
Soil properties and plant community co-evolve over the millennia

Stages of soil development are linked with plant succession

Pioneer Species
- ***Annual Plants usually***
- ***Lichens***
- ***Start of a soil microbial community***

Parent Material

What soil will be made from:
- ***sand dune***
- ***mud flat***
- ***broken up granite***
- ***etc.***



Plants help to modify/improve chemical, physical and biological properties of the soil, allowing new plant species to come in

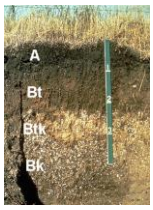
Stages of soil development are linked with plant succession

Pioneer Species
- Annual Plants
- Soil microbes

Sediments

Thousands of years

Climax plant community
(mixed prairie, S. Dakota)



Developed soil profile

Presentation Outline

- The ecological relationship between soil properties and the native plant community
- **Soil concerns for growing natives in your landscape**
  - ***The soil on your property probably is not going to be like the native soil that formed on site over thousands of years.***

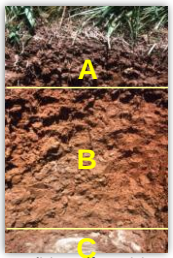
Construction activities drastically alter native soils

Construction turns native soils into urban/landscape soils

Live on an acreage?

The soil near buildings has been disturbed and is an urban soil

Undisturbed
Native Soil



A living, self-sustaining system, thousands of years to develop

Compacted, Unamended
Urban "soil"

Like going back in time to parent material again!
No longer a developed soil

- ✓ Mixed horizons
- ✓ Loss of OM
- ✓ **Compaction**/loss of structure, porosity
- ✓ Poor aeration & water infiltration
- ✓ Few active organisms

Can I grow particular native plants in my landscape? Any major issues?

- **Cultural requirements of the desired native plants**
  - **Exposure to sun**
  - **Moisture**
  - **Hardiness zone** **Zone 3 through 7**
    (range of coldest expected winter temperatures)
  - **Deer/rabbit resistant, attracts pollinators, etc.**

Commonly available information

Can I grow particular native plants in my soil?

- Cultural requirements of the desired native plant
  - Exposure to sun
  - Moisture
  - Hardiness zone
  - Deer/rabbit resistant, attracts pollinators, etc.
- **What kind of soil properties does this plant prefer?**
  - **Picky?**
  - **Tolerate a range of conditions?**
  - **Any major issues?**

Commonly available information

Soil info is less available
- ***Where to find it?***
- ***How to interpret it?***

Some Basic Soils 101 *(Soil Savvy)*

What do you need to know about your soil in order to make good decisions on:

- **plant selection *(both native and introduced)***
- **management practices**
  (irrigation, amendments, fertilizer, mulch)

Get your soil analyzed!

Know these properties of your soil

- **pH** ***Influences nutrient availability for plant use***
- Free lime ($CaCO_3$)
- Electrical Conductivity (E.C.) salt level
- Texture estimate *(sand, silt, clay)*
- Organic matter content
- Plant-available nutrient concentrations

Incorporate knowledge into plant selection and developing your management strategy

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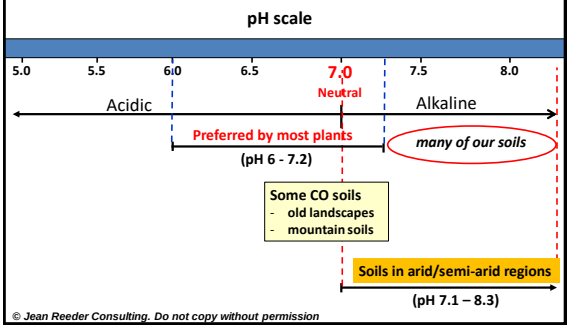
Soil Test: pH



Soil Test: pH

- **Colorado soils usually have a high pH level (pH 7 to 8)**
  - ***High pH makes some nutrients less available for plants***
    Iron, phosphorus, zinc, manganese, boron
- **Most native plants are well adapted to alkaline soils**
  - ***Those that evolved in semi-arid alkaline conditions***
  - ***Higher elevations: neutral to acidic soils; some natives may not do as well in alkaline (high pH) soils***
- **Alkaline soil pH is not easily lowered**
  - **Alkaline soils are well buffered, resist a drop in pH**

Get your soil analyzed!

Know these properties of your soil

- **pH** ***Influences nutrient availability for plant uptake***
- **Lime Estimate ($CaCO_3$)** ***Tends to keep soil pH high***

Low lime content: added acidifiers e.g. S or $FeSO_4$ can lower pH somewhat, but repeated applications are necessary.

Medium to high lime content: cannot effectively lower soil pH by the addition of acidifiers to the soil. (Lime neutralizes added acidifiers)

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Soil Test: Salinity

Electrical Conductivity, E.C. (mmhos/cm = dS/m)

E. C.	Salinity Level	Effect on Plant Growth
<2 *(<1 is better)*	Non-saline	None
2 – 4	Slightly saline	Sensitive plants inhibited *(many introduced landscape plants)*
4 – 8	Moderately saline *(many natives/xerics tolerate)*	Most landscape plants inhibited
>8	Strongly saline	Most plants will not survive

Soil Test: Salinity

Front Range soils are rarely naturally saline

Management Factors Contribute to Soil Salinity
(especially in clayey soils)

- Excessive/Unnecessary Fertilizer Applications
- Soil amendments
  Manure, biosolids (sewage sludge), and composts made with manure or biosolids are often very salty. Even plant-based composts have some excess salts in them.
  - **Use sparingly, and routinely monitor salt levels**

See CSU GardenNotes 241 Organic Amendments
See CSU GardenNotes 224 Saline Soils

Soil Texture: a major determinant of plant selection and management strategy

- **Water movement**
- **Water retention**
- **Gas exchange**
  - ***roots need O_2 as much as they need H_2O***
- Soil temperature
- Erosion potential
- Fertility

Source: CSU Extension

Influences of Texture on Soil H_2O Dynamics

- Clayey soils
  - Water moves into/through the soil very slowly
  - Mainly small pores, can be **poorly aerated**
  - Have high water-holding capacity
    - ***hold lots of water available for plants***

- Sandy soils
  - Water moves into/through the soil very fast
  - Mainly large pores, generally **well aerated**
  - Have low water-holding capacity
    - ***Less water available for plants***

Source: CSU Extension

Influences of Texture on Soil H_2O Dynamics

Example: Looking for a native shrub?

Look for information on plant preference of soil properties

- **"well-drained soil"**
  probably won't do well in a tight clay
  ex. Apache Plume *(Fallugia paradoxa)*
  Red Berry Mahonia *(Mahonia haematocarpa)*

- ***"most soil types including clay"***
  ex. Butterfly Bush *(Buddleia alternifolia)*
  Rabbit Brush *(Chrysothamnus nauseosus)*
  New Mexican Privet *(Forestiera neomexicana)*

source: High Country Gardens

Soil Test: Organic Matter Content

5% = High *Vegetables, fruits, many flowers, some natives*
3% = Moderate *Adequate for most landscape plants*
<2% = Low* *Many natives/xerics prefer*

*Semi-arid native soils: <2%

Match type of plant you want to grow…
With the soil O.M. content the plant prefers

Soil Test: Organic Matter Content

Do some research on plant preferences

- **"low fertility, well-drained soil"**
  don't add compost
  ex. Gaura lindheimeri
  Red Buckwheat (*Eriogonum)*
- **"most soils, including clay"**
  ex. Poppy mallow *(Callirhoe involucrata)*
  Evening primrose (*Oenothera*)
- **"does best in compost-enriched garden soil"**
  ex. Columbine (*Aquilegia*)
  Western Mock Orange *(Philadelphus lewisii)*

source: High Country Gardens

Soil Test: Organic Matter Content

Do some research on plant preferences

- **"low fertility, well-drained soil"**
  don't add compost
  ex. Gaura lindheimeri
  Red Buckwheat (*Eriogonum)*
- **How to improve drainage/aeration of a clay soil?**
  - ***Not compost (adds fertility)***
  - ***Not sand (could form adobe)***
  - ***Expanded shale? (light weight, porous, inert; improves water infiltration/drainage improves aeration)***

source: High Country Gardens

Get your soil analyzed!

Know these properties of your soil

- pH
- Lime estimate ($CaCO_3$)
- Electrical Conductivity (E.C.) salt level
- Texture estimate
- % Organic matter content
- **Plant-available nutrients:** ***is the level of available nutrient in my soil deficient, sufficient, or excessive for good plant growth?***

Soil Test: Plant-available nutrients

- ***Over-fertilizing and over-amending are common problems***
- **Native plants that prefer low fertility will not thrive in high nutrient/high OM soil *(but the weeds will!)***
- **What happens to excessive concentrations of plant-available nutrients:**
  - ***plants won't use***
  - ***nutrient ratios out of balance: high levels of one nutrient can interfere with plant uptake of another* (ex. ↑P : ↓ Fe)**
  - ***potential pollutants to the environment***
    - ***Nitrate: leaches into the groundwater***
    - ***Phosphorus: surface runoff, eutrophication of ponds***

Develop Some Soil Savvy

You risk making bad decisions on plant selection if you don't know anything about the properties of your soil.

- **Know the basic properties of your soil**
  - **Chemical composition** ***(nutrient supply, pH, OM, texture)***
    get these data from a soil test
  - **Physical condition: compaction**
    - ***(poor drainage &aeration shallow & small root volumes)***

See CSU GardenNotes #215 Soil Compaction

Soil preference/tolerance information for native plants

Books

- ***Native Plant Master Manual,*** **CSU Extension**
- ***Xeriscape Plant Guide*****, Denver Water**
- ***Pretty Tough Plants*****, Plant Select**

Websites

- **Plant Select (CSU, DBG, Green Industries)**
- **High Country Gardens**

Different source don't always agree completely on soil preferences Check out more than one source

Soil preference/tolerance information for native plants

Native Plant Master Manual**, CSU Extension, 2008**
(Where do you find the plant in nature)

"Soil Requirements": ***usually/not always***

- **Sulfur Flower (*Erigonum umbellatum*)**
  "loose, gravelly, well drained"
- **Pink Pussytoes (*Antennaria rosea*)**
  "prefers well-drained sandy soil; tolerates clay"
- **Golden aster *(Heterotheca villosa) "any"***
- **Rocky Mountain Maple *(Acer glabrum)*** ***no Soil Req. info***

Soil preference/tolerance information for native plants

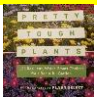
***Xeriscape Plant Guide*, Denver Water, 1996**

Soil subheading in Culture section

- **Blue flax *(Linum perenne) "prefers well drained, but tolerates clay"***
- **Gayfeather *(Liatris punctata)***
  - ***"Prefers infertile, dry, gravelly, shallow soil; grows compactly under these conditions. In richer, moist soil, may become more rangy."***
- **Winterfat *(Ceratoides lanata) "grows in a wide variety of soil textures including clay, sandy and rocky. Does well in alkaline soil"***

Soil preference/tolerance information for native plants

***Pretty Tough Plants* Plant Select, 2017**



"Culture"

- **Engelmann's daisy *(Engelmannia peristenia) "clay, loam or sandy soil"***
- **Black-eyed Susan *(Rudbeckia hirta) "clay or loam; performs best in good garden soil" (good water-holding capacity, higher OM)***
- **Sunset hyssop *(Agastache rupestris) "well-drained loam or sandy soil"***

Soil preference/tolerance information for native plants

Plant Select (CSU, DBG, Green Industries)

- ***www.plantselect.org***
  "Search the Plant Database"
  - **Plant: type, size, flower color & season, zone hardiness**
  - **Sun/water needs, deer resistant, attracts pollinators**
  - **N. American native y/n**
  - **SOIL: clay, loam, sandy, gravelly**

Soil preference/tolerance information for native plants

High Country Gardens *www.highcountrygardens.com*

- **Plant Finder**
  - **Enter the plant name**
  - **Zip code/region/zone**
  - **Sun/water needs**
  - **Flower color, bloom season**
  - **Plant size, planting time**
  - **Advantages: deer/rabbit resistant, attracts birds/butterflies/pollinators**
  - **SOIL: clay, sandy, average, compost-enriched garden loam low fertility, well-drained, drought/dry**

Soil preference/tolerance information for native plants

Soil information is not as well developed as requirements for sun/moisture/zone

- **for either native or introduced plants**
- **soil info available: focus generally on texture & OM**
- **little info on tolerance to pH or salinity, nutrient requirements, etc.**

Going to have to make some inferences

- **ex. columbine evolved at higher elevations**
  - **may be more sensitive to high pH and salinity**
- **ex. common juniper, found over whole N. hemisphere**
  - **less sensitive to soil conditions**

Plants also can be too aggressive

- **Example: my yard (fine sandy loam soil)**
  - **Little bluestem *(Schizachyrium scoparium)***
    - **Took over! Had to completely remove**
  - **May Night Salvia *(Sylvestris)***
    - **Took over! Had to completely remove**
  - **Neither of these were a problem in my former Fort Collins landscape (clayey)**
  - **This info may not show up in references**