



Water Quality Implication of Soil Wetness Determination for Onsite Wastewater Treatment and Dispersal

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Science**

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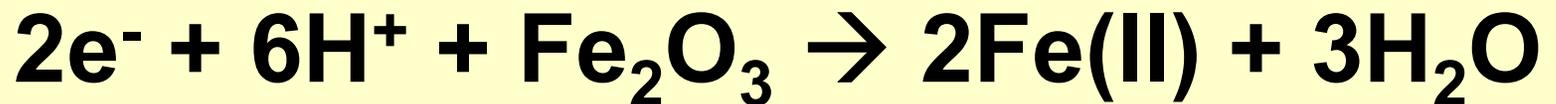
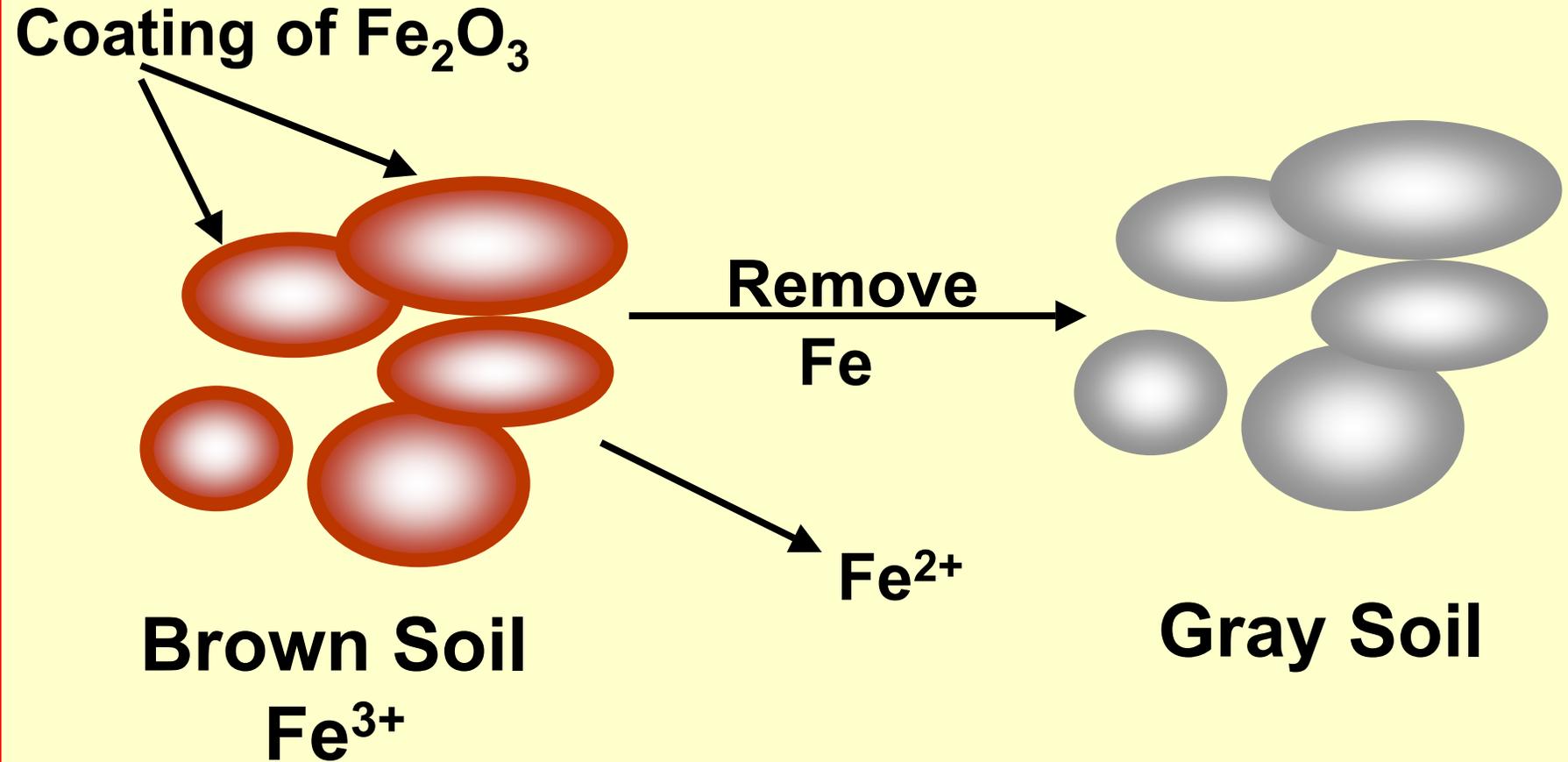
www.soil.ncsu.edu/lockers/lindbo

In folder
CSREES GA

What we know about hydrology/morphology

Redox depletions (gray colors) are formed under saturated and reduced conditions

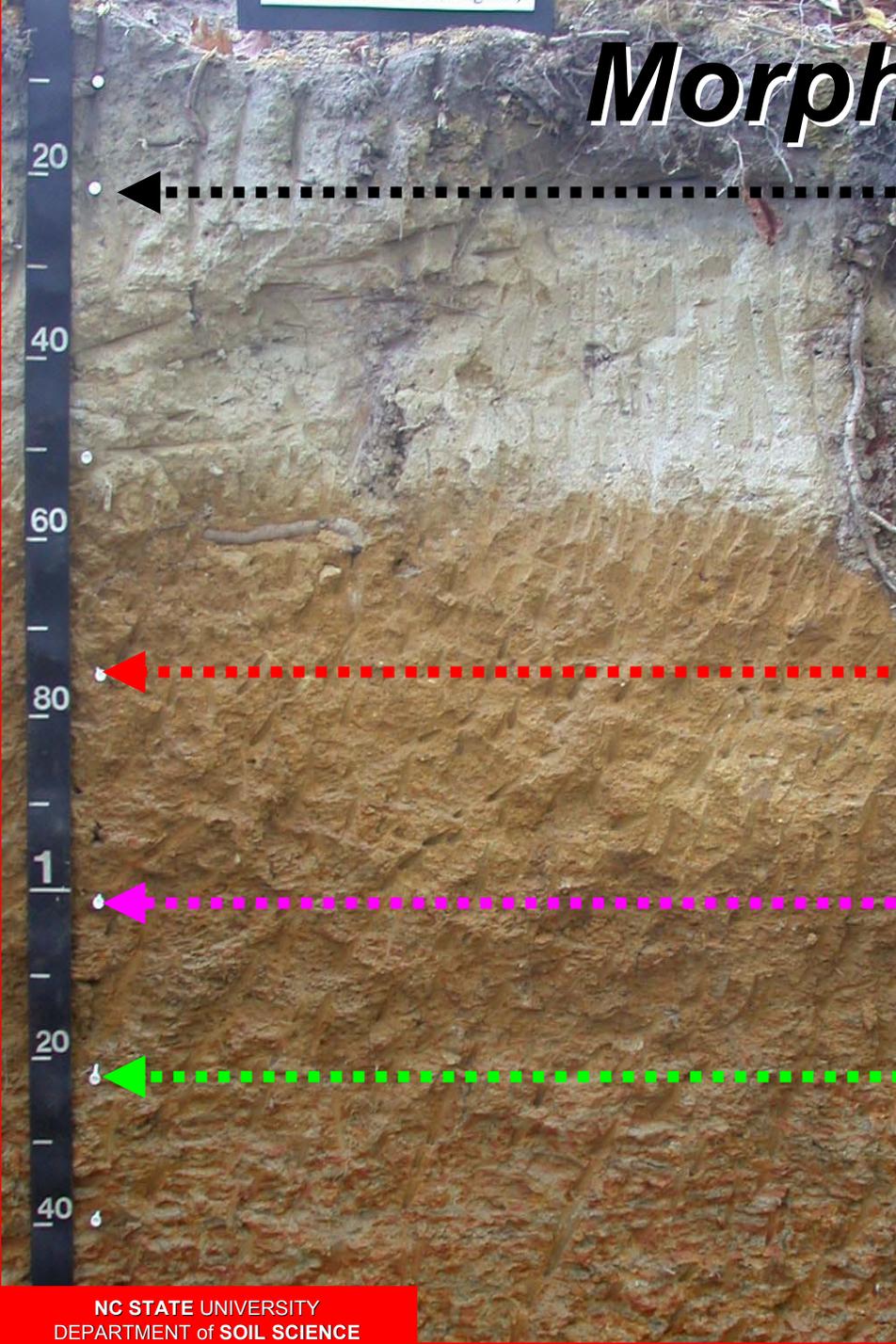
Redox Transformations



What we know about hydrology/morphology

- 2 chroma colors are interpreted as an indicator water table or wetness conditions in several states
- National soil judging teaches 2 chroma colors indicate SHWT
- 2 chroma colors are not exclusively used to determine water table or saturation by USDA-NRCS
- From previous work
 - 21 days required to created reducing conditions (He et al., 2002)
 - Common 2 chroma depletions represented 24 to 102 days of continuous saturation in RI (Morgan and Stolt, 2006)
 - Strong correlation between percent low chroma color and saturation

Morphology



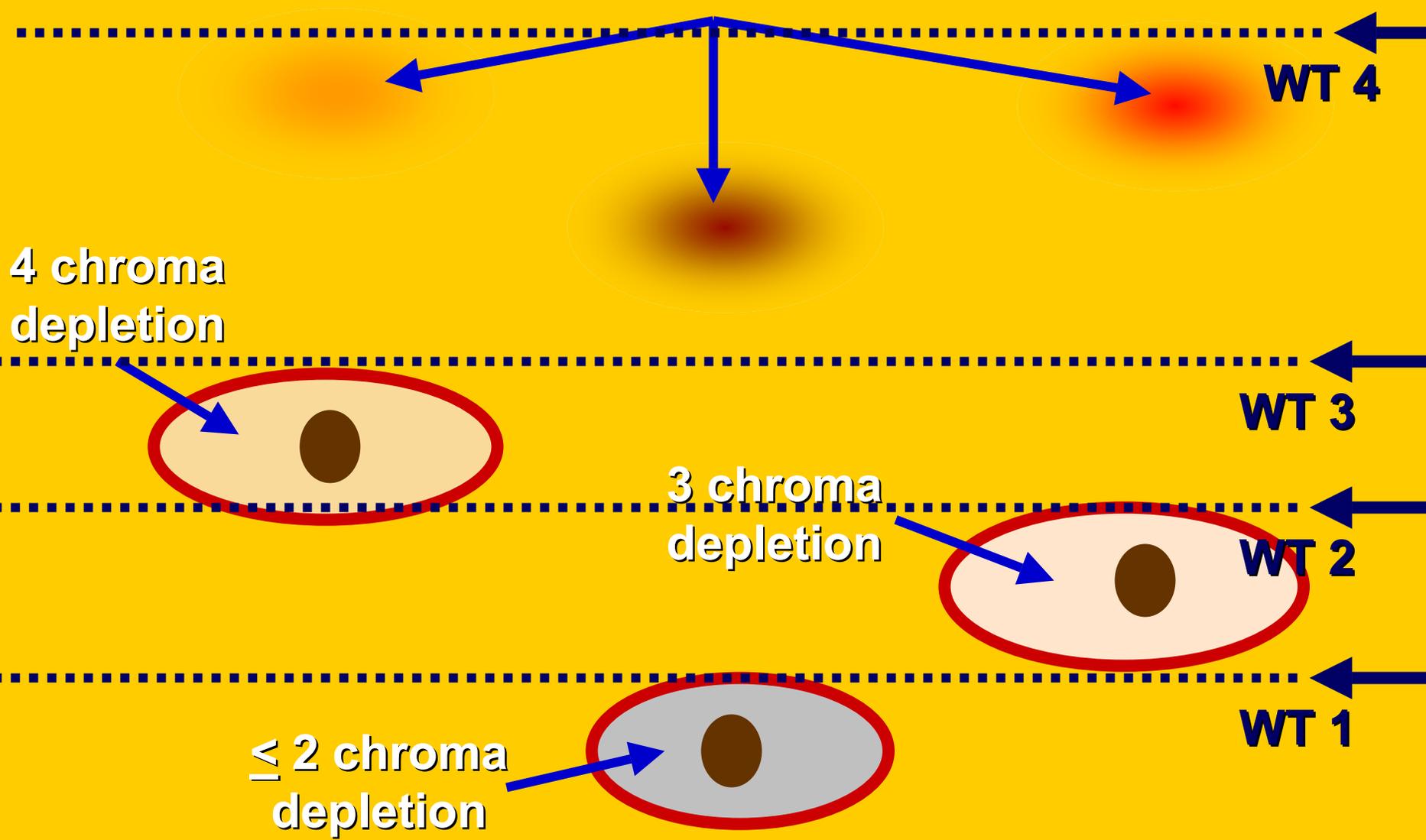
Mottles

Concentrations

3 & 4 chroma
depletions

≤ 2 chroma

Redox concentrations



4 chroma depletion

WT 4

WT 3

3 chroma depletion

WT 2

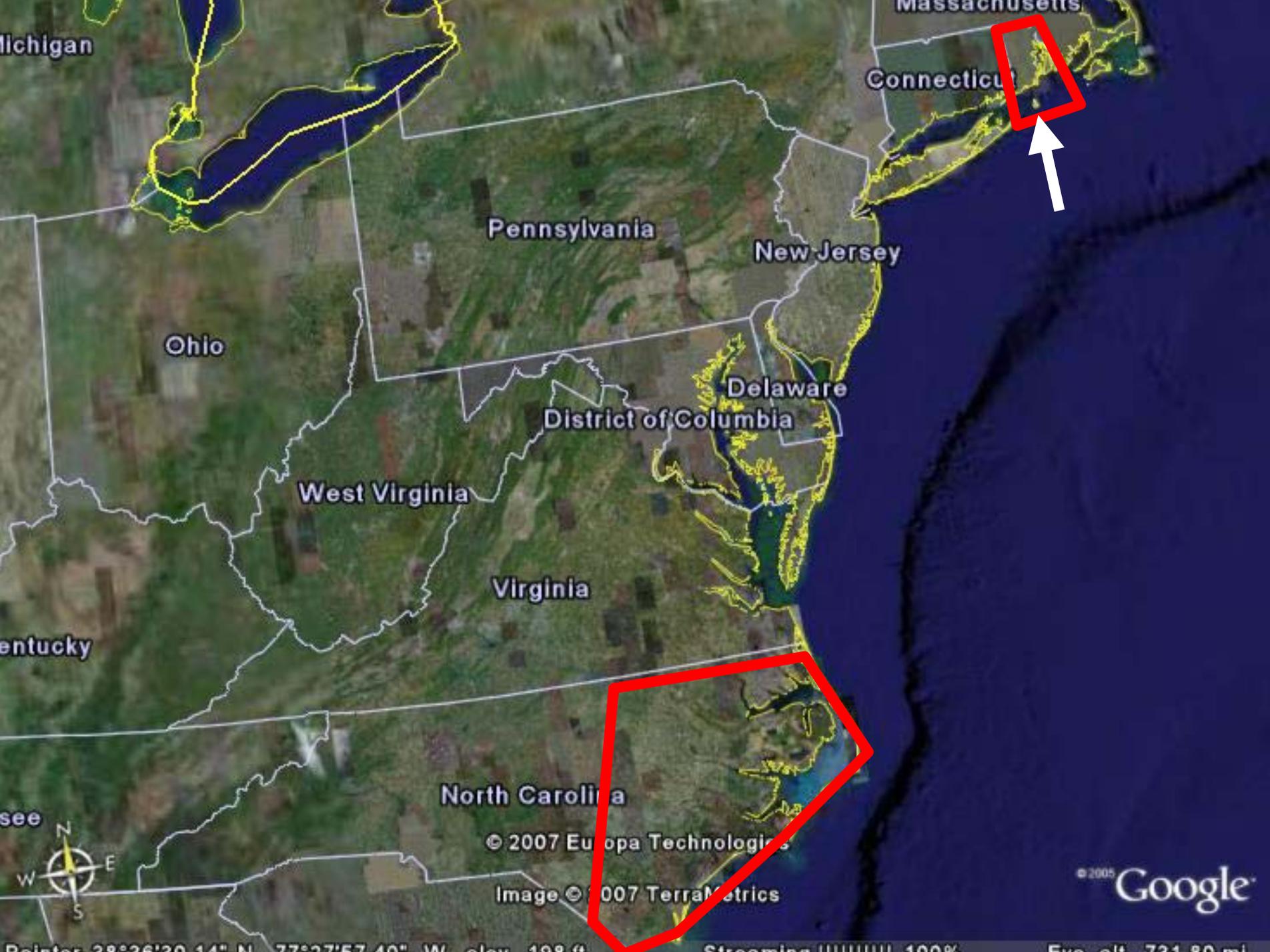
≤ 2 chroma depletion

WT 1

What we do not know

- What do the color patterns of different RMFs mean with respect to saturation
- Are there differences between soils:
 - Textural
 - Depth occurrence

MATERIALS ***and*** ***METHODS***



Michigan

Connecticut

Massachusetts

Pennsylvania

New Jersey

Ohio

Delaware

District of Columbia

West Virginia

Virginia

Kentucky

North Carolina

see

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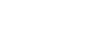
© 2005 Google

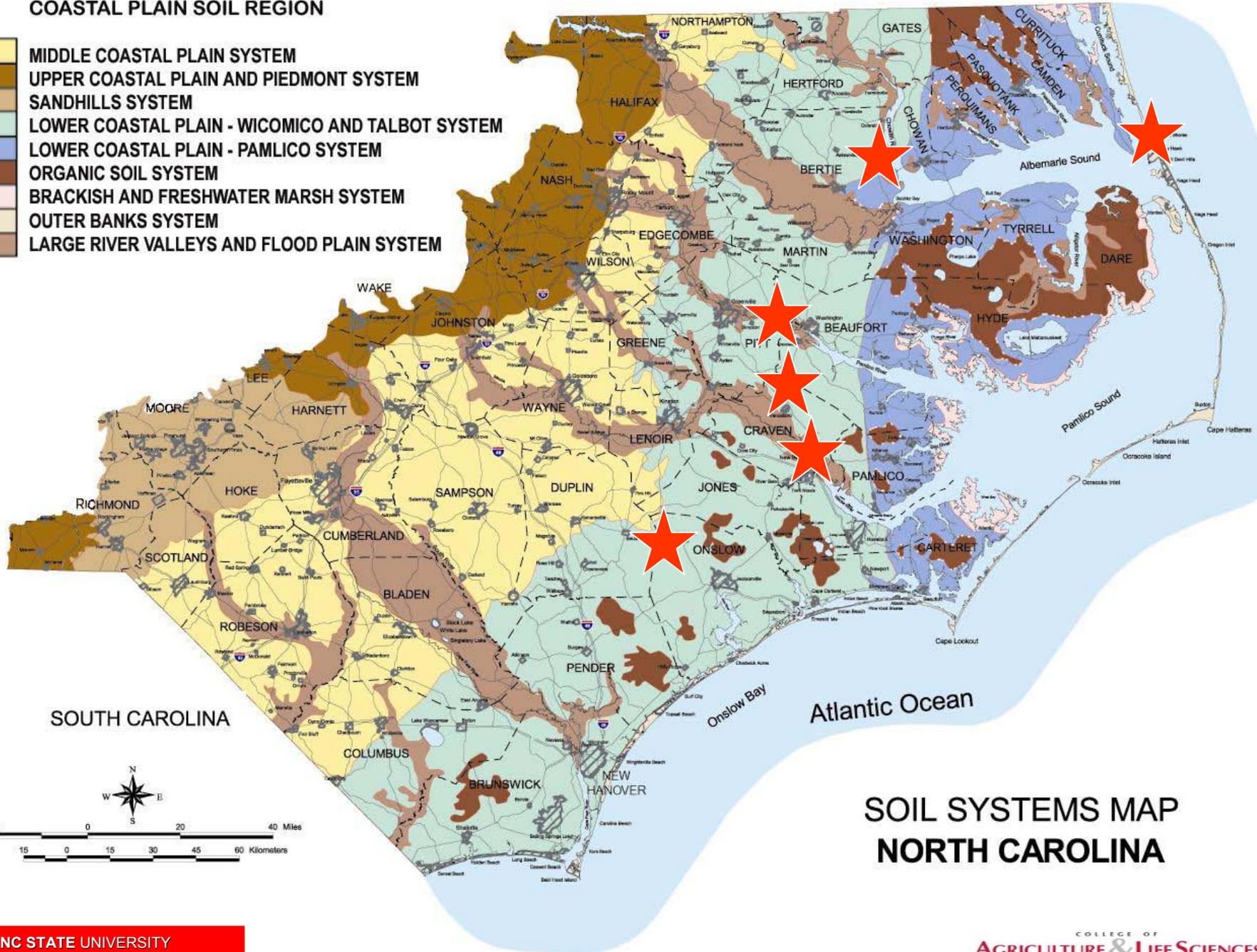
Pointer 38°26'20.14" N 77°27'57.10" W elev 198 ft

Streaming 100%

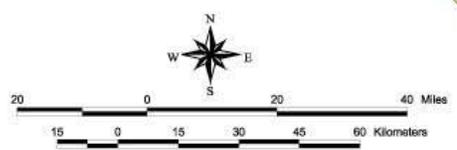
Eye alt 731.80 mi

COASTAL PLAIN SOIL REGION

-  MIDDLE COASTAL PLAIN SYSTEM
-  UPPER COASTAL PLAIN AND PIEDMONT SYSTEM
-  SANDHILLS SYSTEM
-  LOWER COASTAL PLAIN - WICOMICO AND TALBOT SYSTEM
-  LOWER COASTAL PLAIN - PAMLICO SYSTEM
-  ORGANIC SOIL SYSTEM
-  BRACKISH AND FRESHWATER MARSH SYSTEM
-  OUTER BANKS SYSTEM
-  LARGE RIVER VALLEYS AND FLOOD PLAIN SYSTEM



**SOIL SYSTEMS MAP
NORTH CAROLINA**



Richlands, NC

Foreston Soil

(Coarse-loamy,
siliceous,
semiactive, thermic
Aquic Paleudults)

Textures:

topsoil - loamy sand

argillic - sandy

loam

subsoil - sand

A

AE

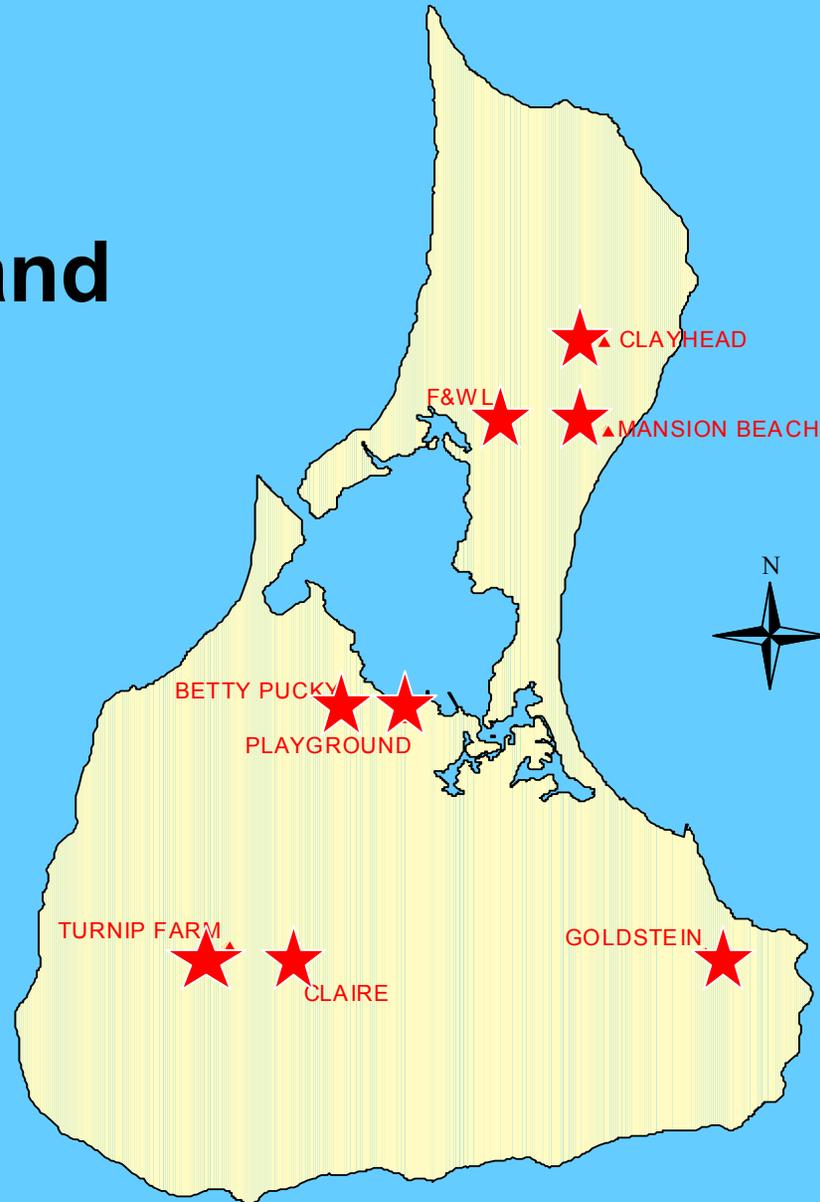
E

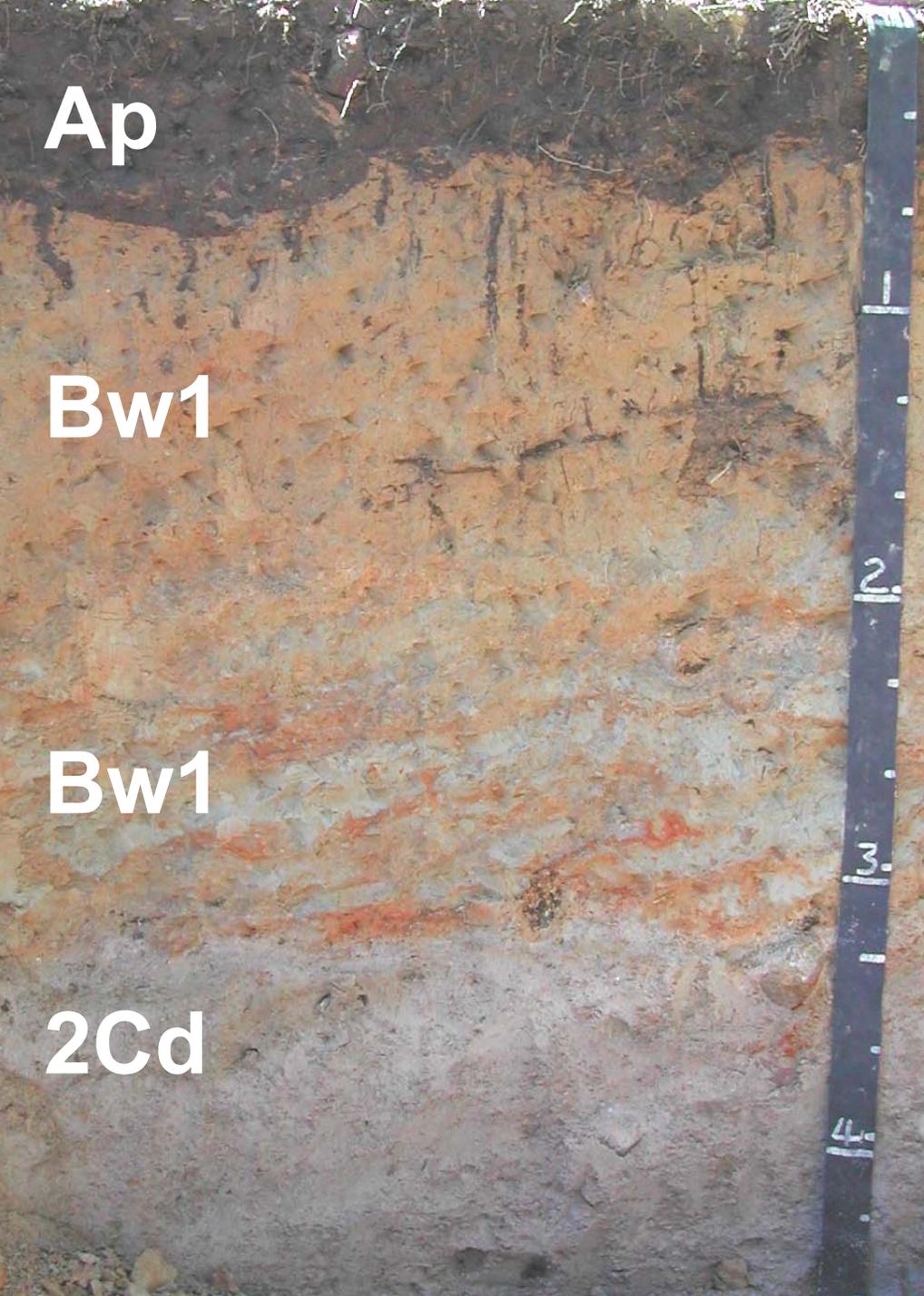
Bt1

Bt2

BC

Block Island





Ap

Bw1

Bw1

2Cd

Block Island, RI

Rainbow Soil

(Coarse-loamy,
mixed, active, mesic
Aquic Dystrudepts)

Textures:

topsoil - silt loam

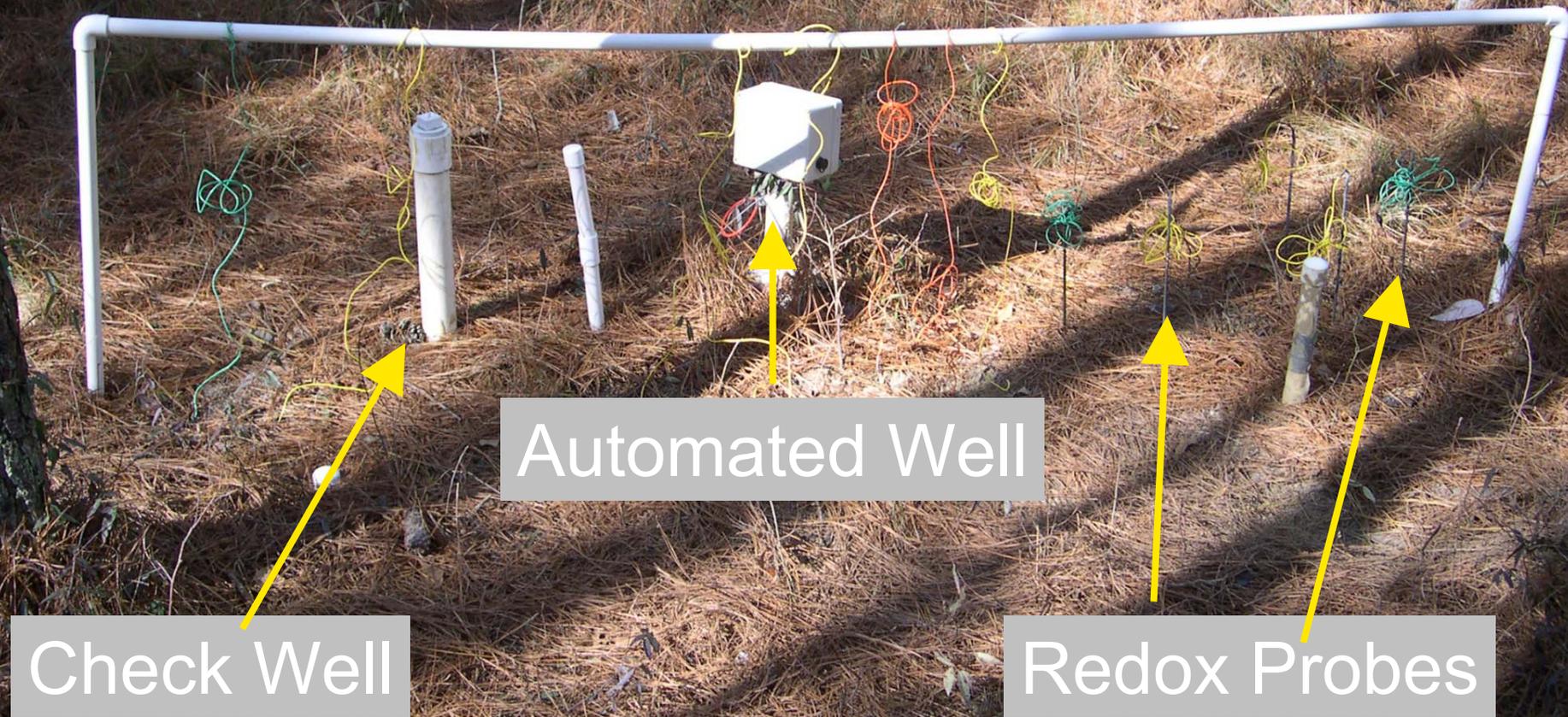
argillic - silt loam

subsoil - fine sandy
loam

Measurements

- At all sites for each soil plot at each site
 - Soil Profile Descriptions
 - Percentages of redoximorphic features (estimated by eye)
 - Daily water table levels (or maximum level) and rainfall

Site Instrumentation



Check Well

Automated Well

Redox Probes

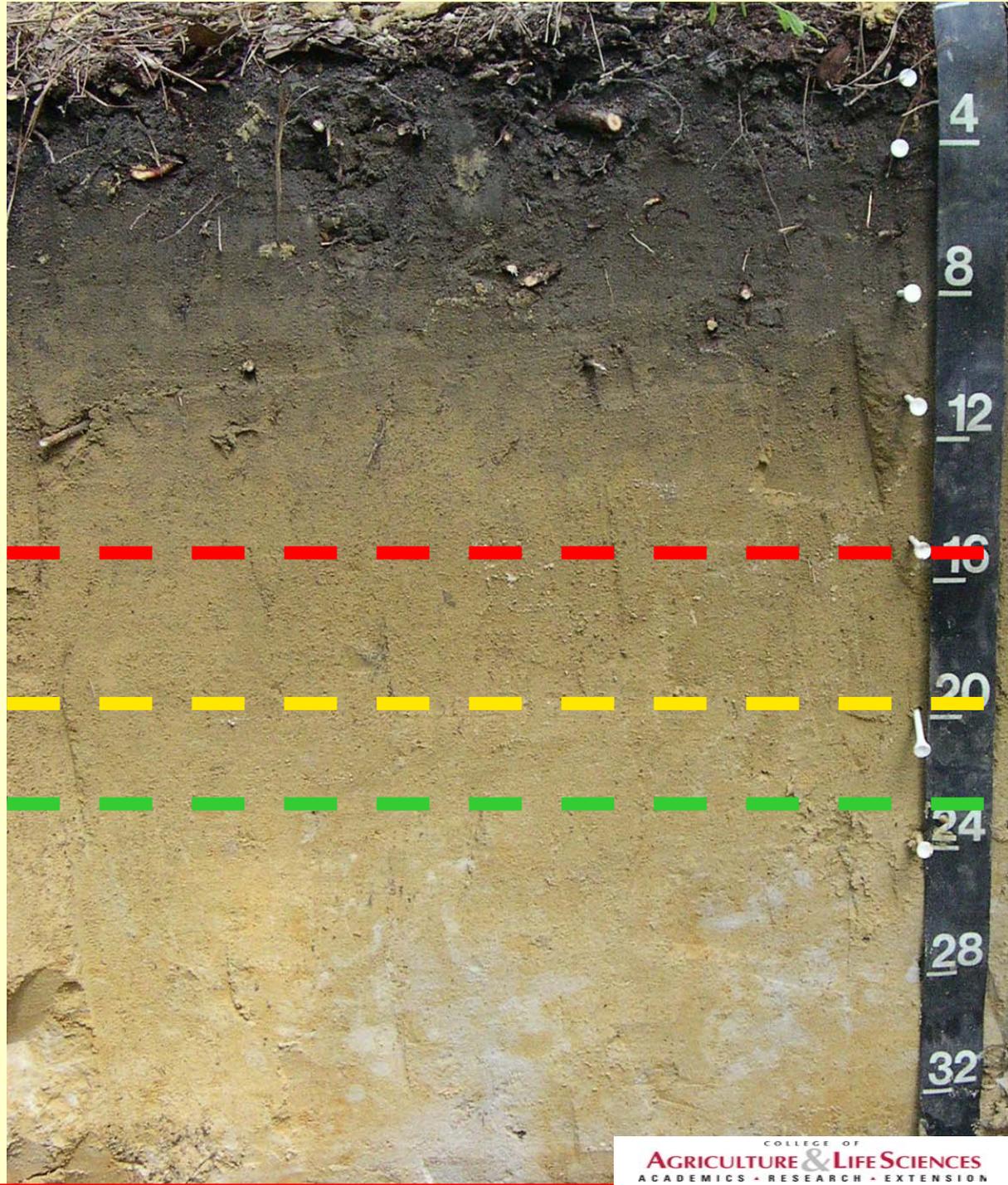
Assessment of Soil Wetness

Morphology

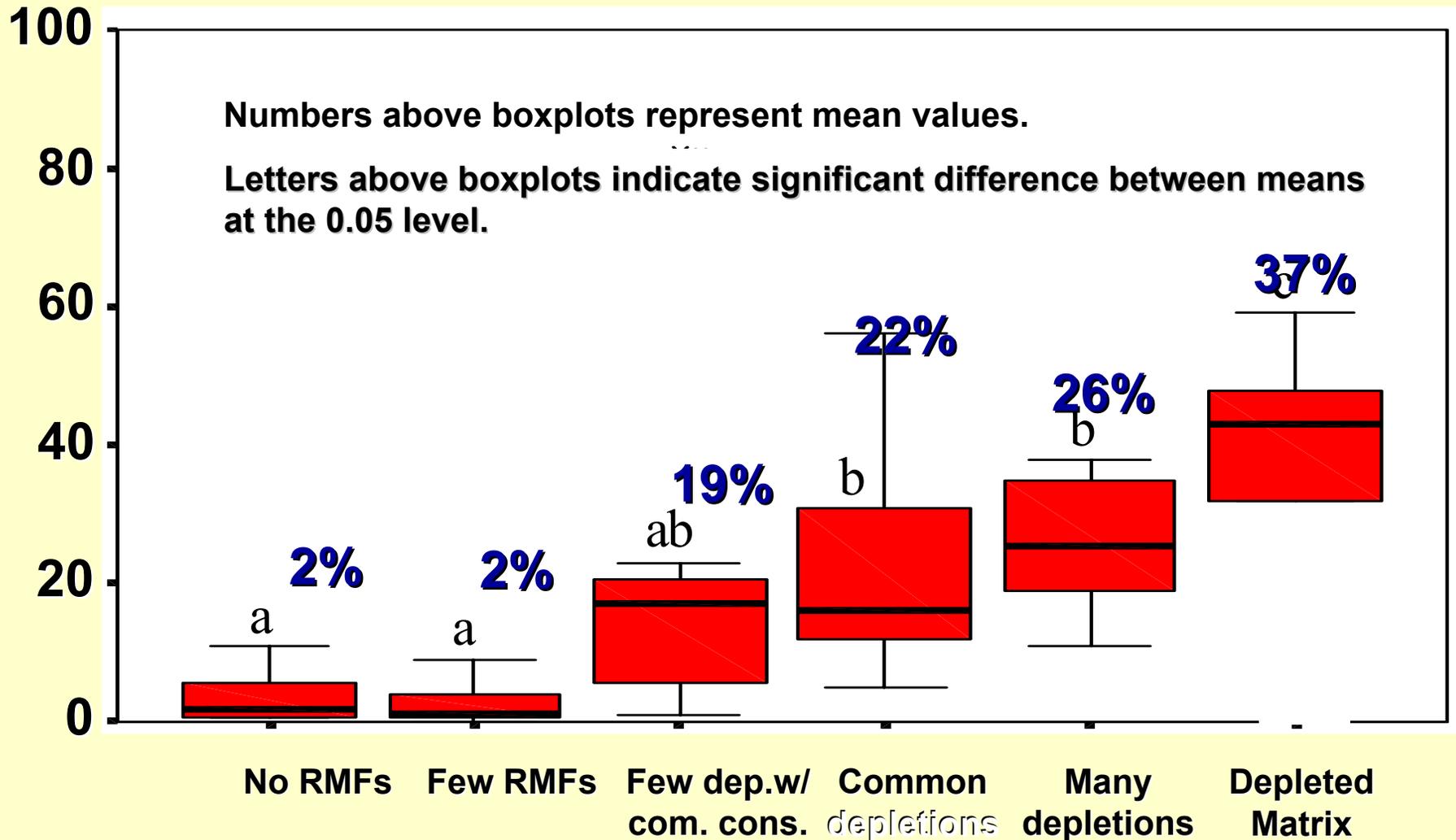
Concentrations

3 Chroma

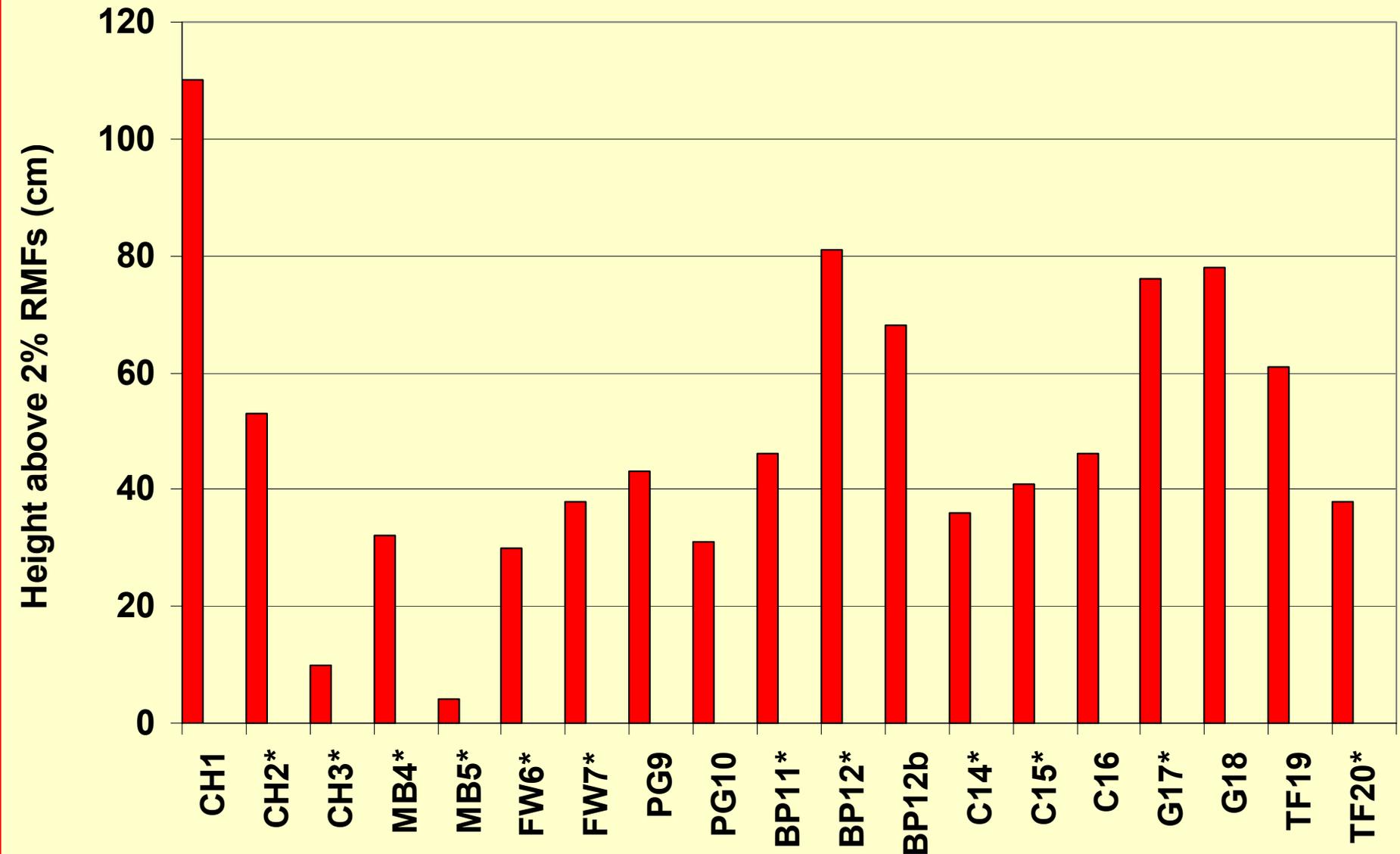
≤ 2 Chroma



Loamy Textured Horizons



Maximum water table height above first horizon with common RMFs at each site.

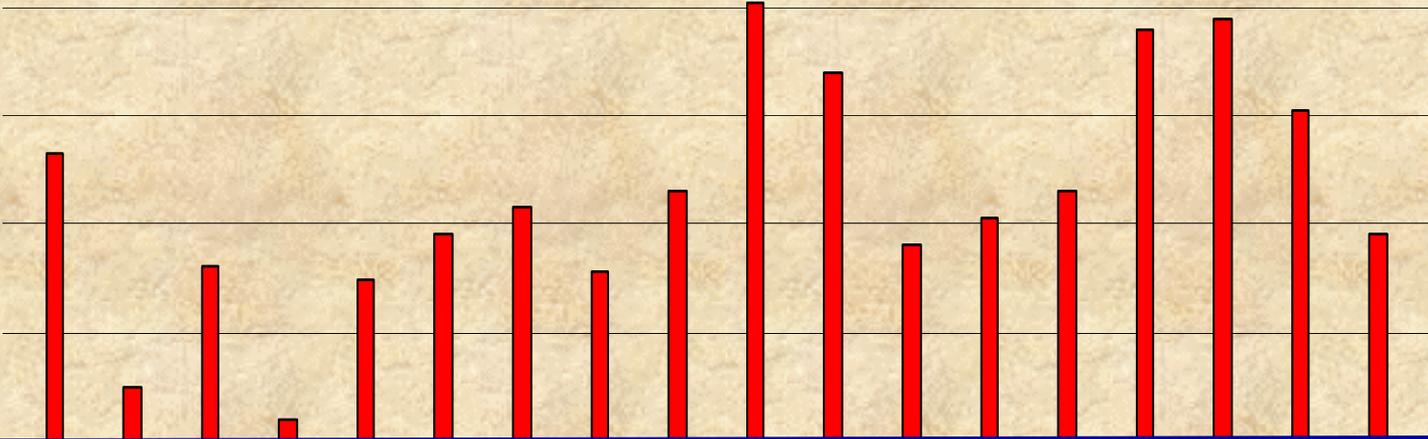


Soil surface

Drain field
trench

Treatment zone

120 cm



Common RMF = SHWT



15%

27%

80%

Sandy

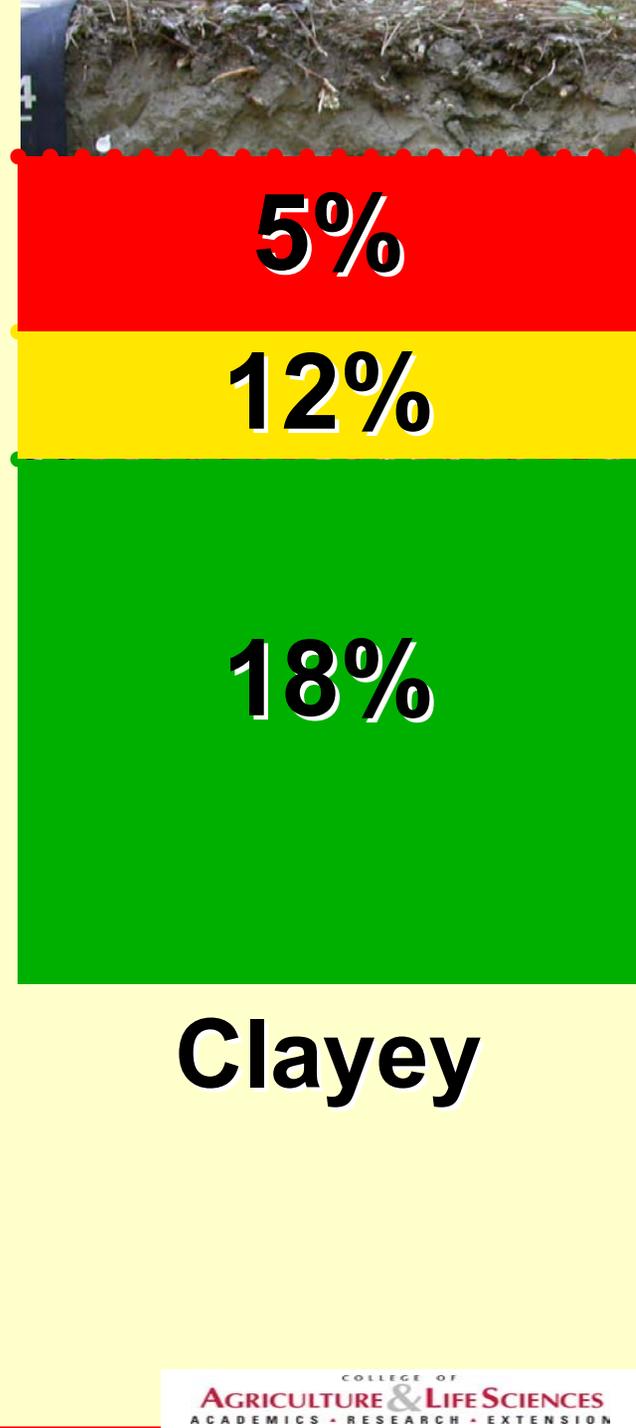


14%

17%

27%

**Coarse-
loamy**

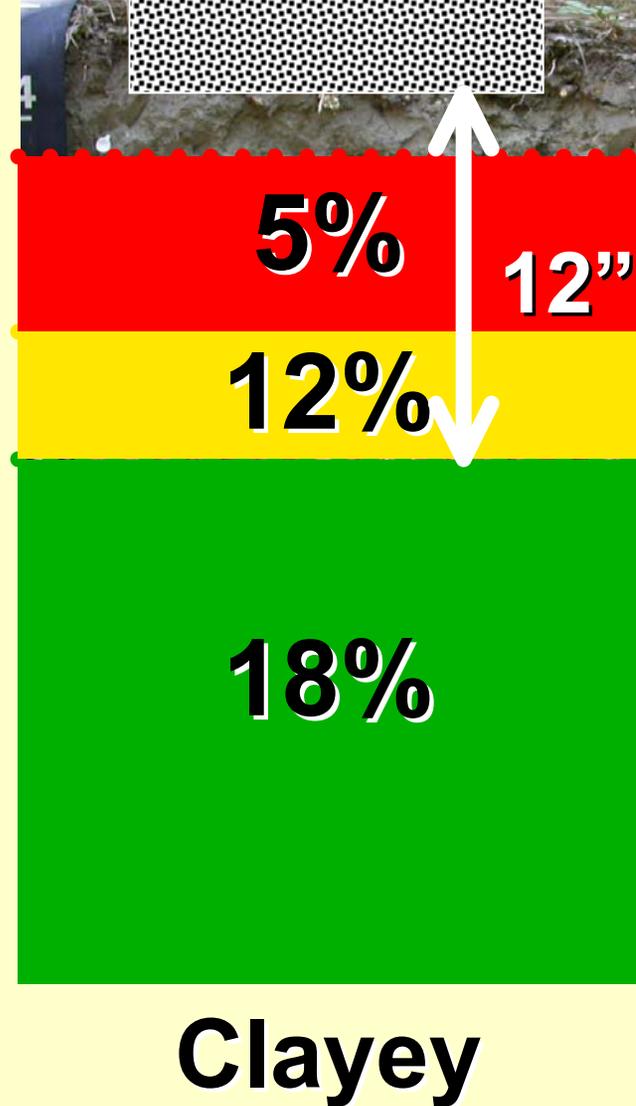
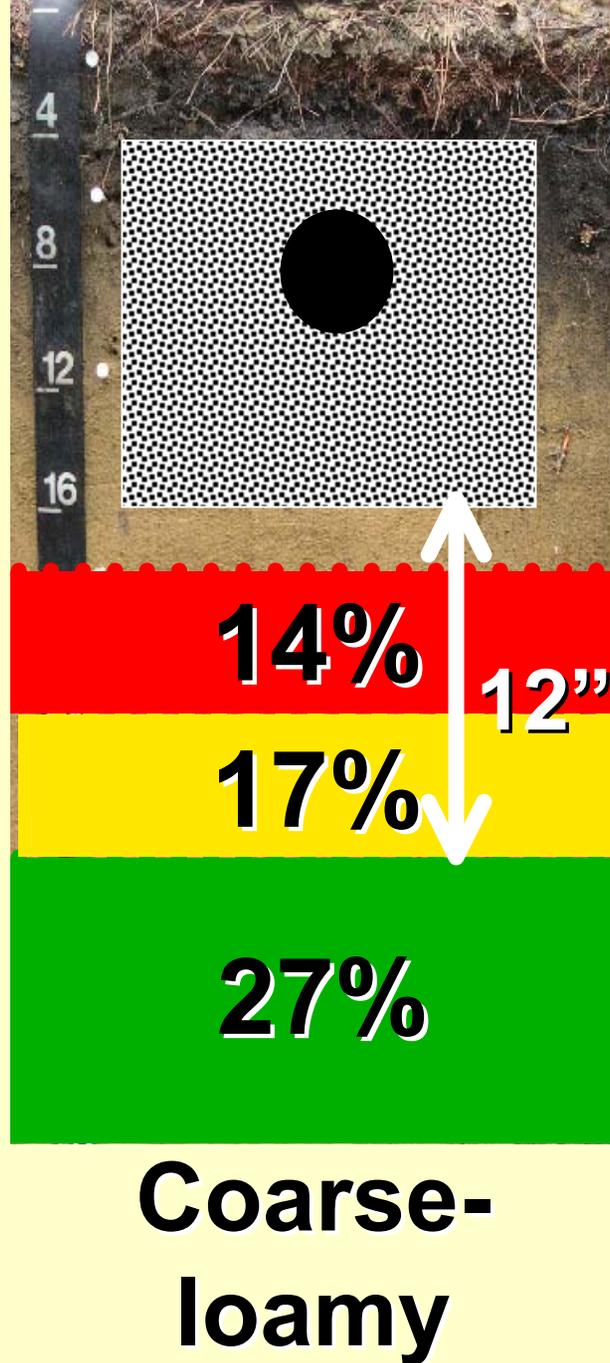
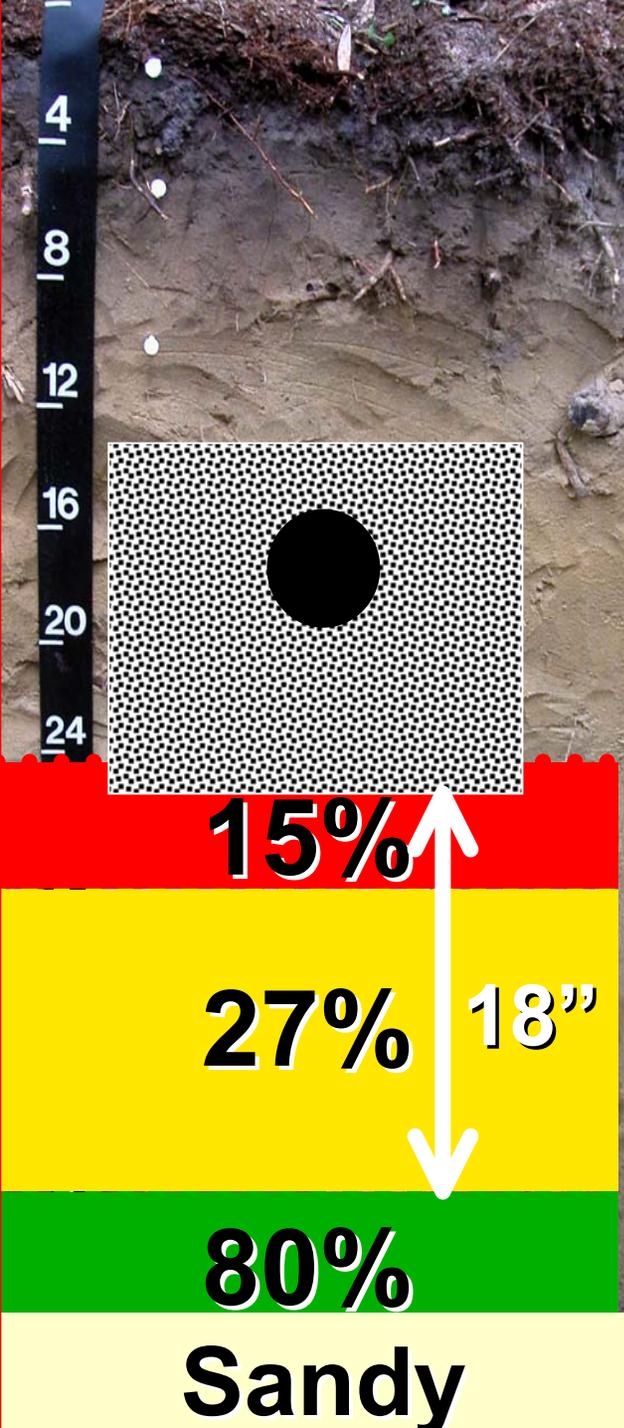


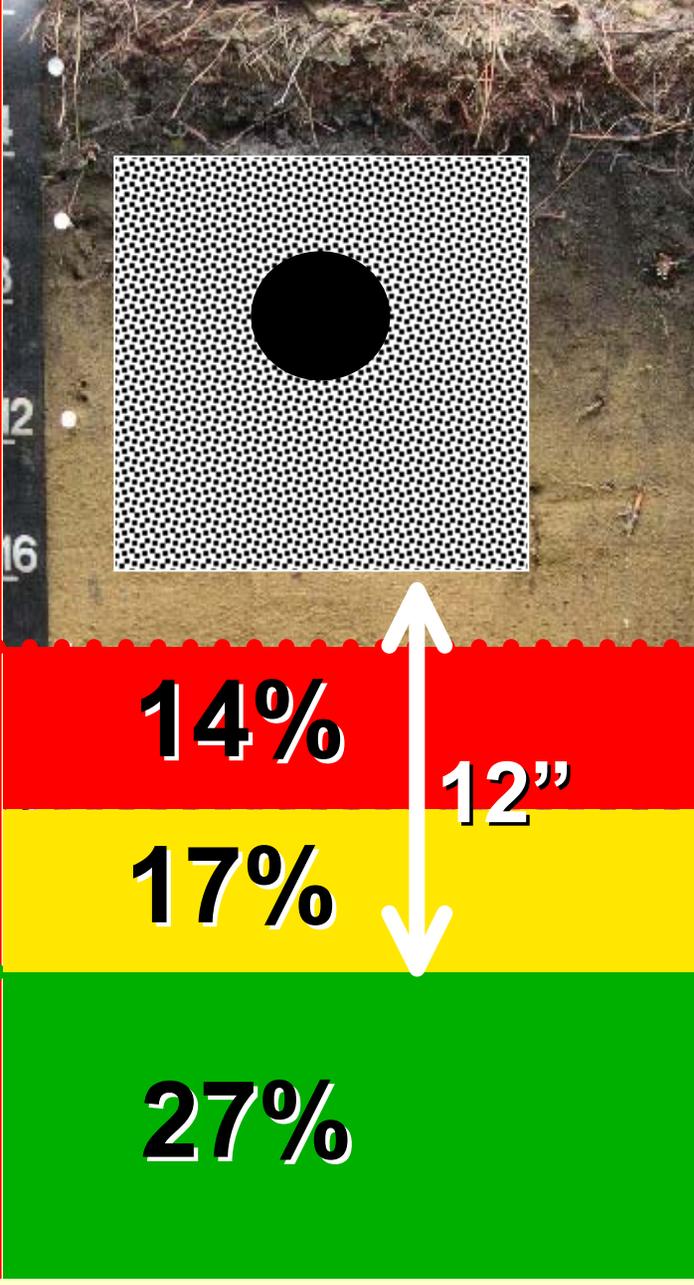
5%

12%

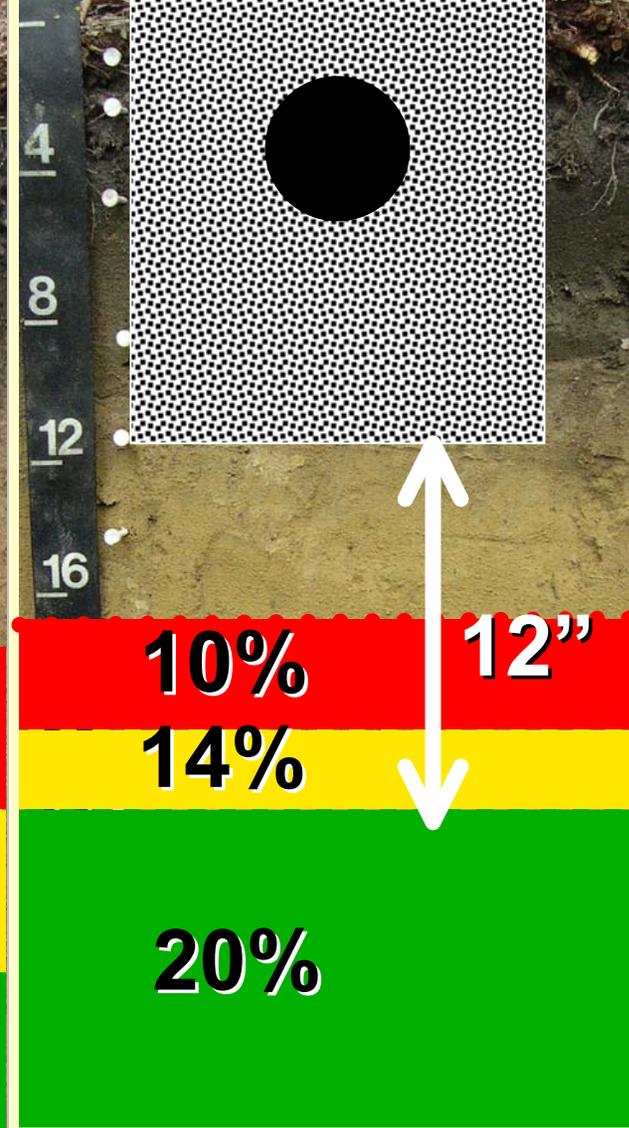
18%

Clayey

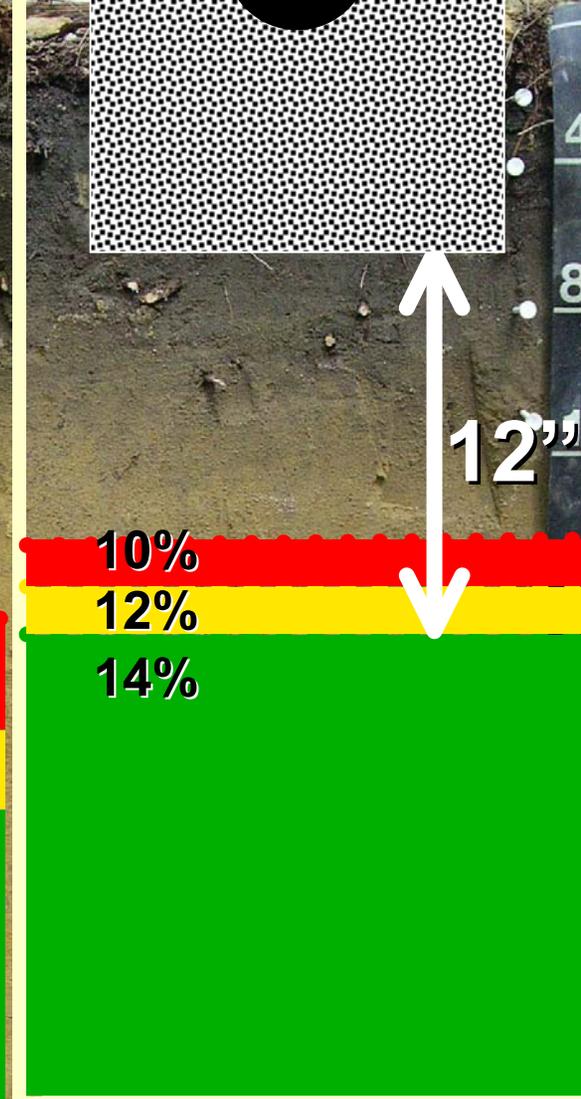




Foreston



Wet-Foreston



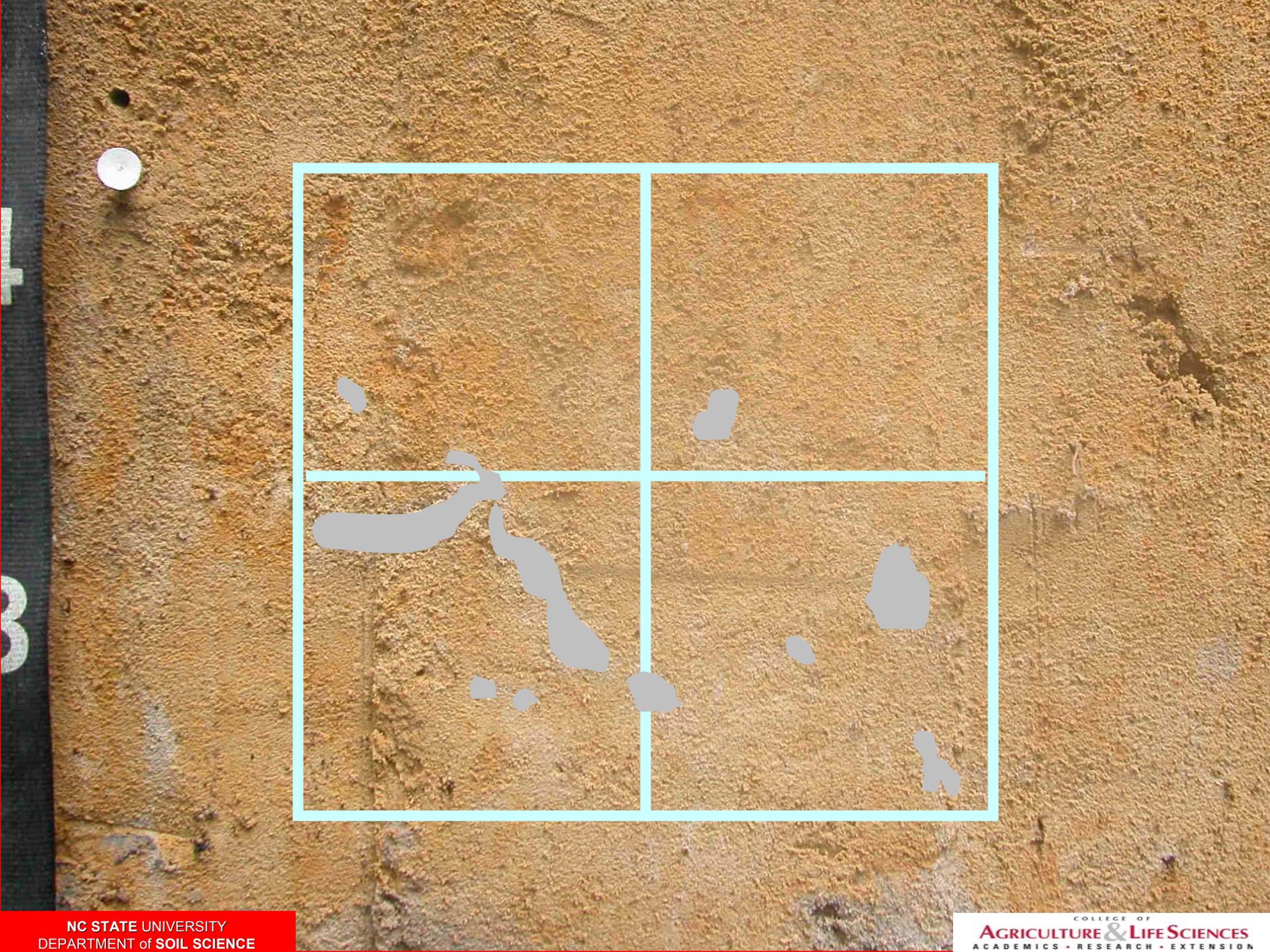
Stallings

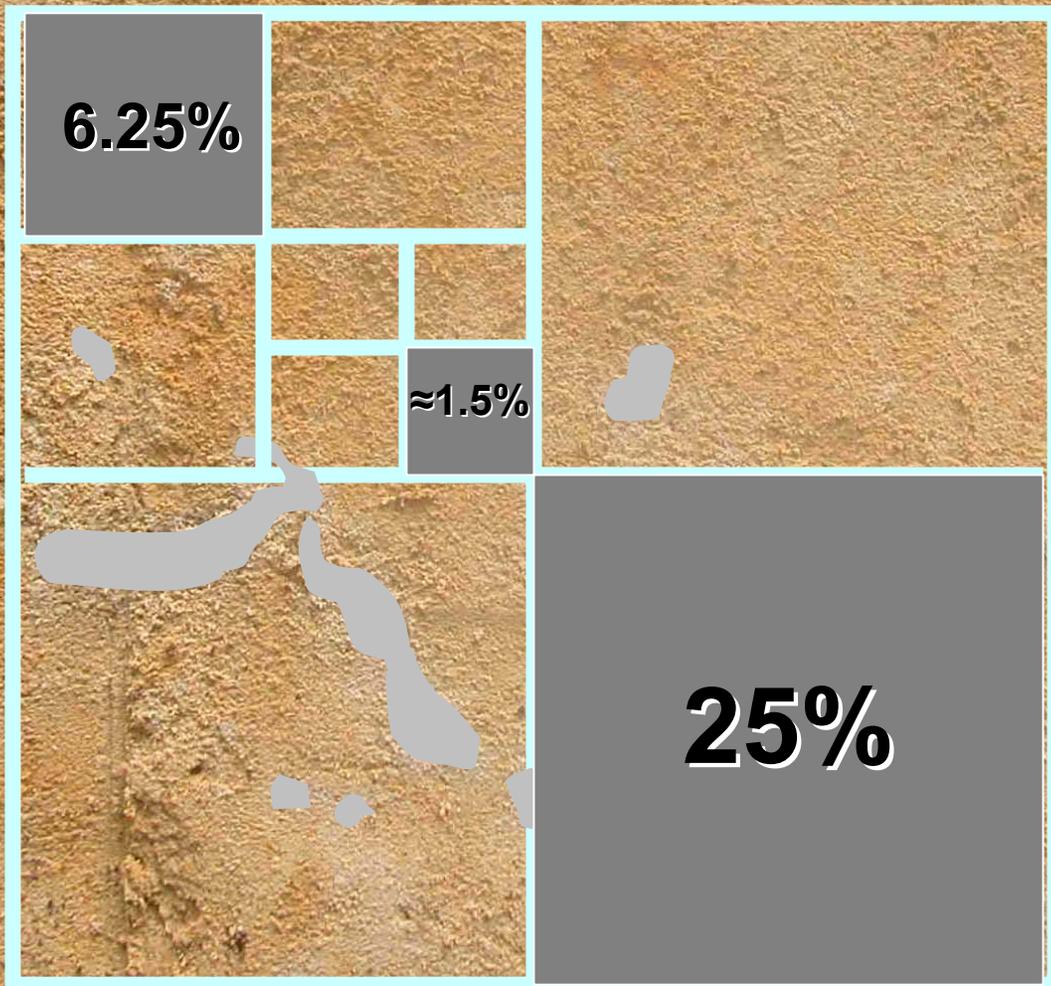
Conclusions

1. Redoximorphic features indicate a water table shallower than ≤ 2 chroma features
2. 2 chroma depletions correspond to different cumulative saturation depending on depth and texture
3. Design of system using 2 chroma features solely may result in trench saturation for part of the year
4. Trench saturation is likely to reduce treatment and water quality



**Thanks
for your
attention!**





1. Plant root grows into soil

2. Root dies and starts to decompose

3. Water table rises

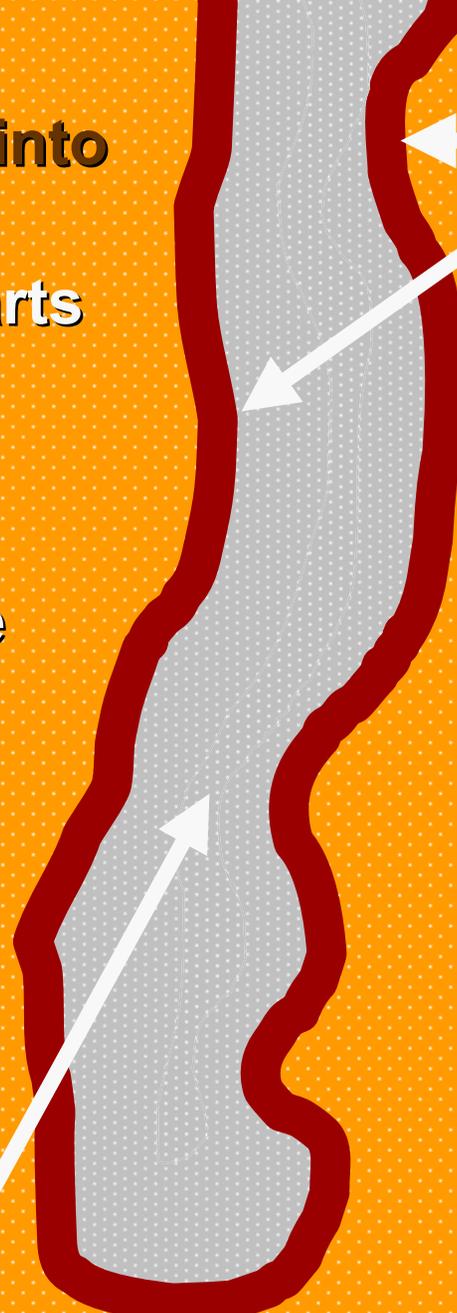
4. Bacteria continue to decompose root

Oxygen reduced

Nitrate reduced

Fe reduced and removed, soil turns **gray**

Redox depletion



Redox Concentration (Pore lining)

5. Reduced Fe moves away from decomposing root

Reduced Fe oxidizes, soil turns **red**

6. Water drains from root channel

7. Root completely decomposed

8. Water table drops

Recording Rain Gauge



Soil	Conc.	Chroma 3 dep.	Chroma ≤ 2 dep.
-----% of year-----			
Fripp (sandy)	15	30	80
Foreston (coarse- loamy)	14	17	27
Lenoir (clayey)	5	12	18

**Metal rod painted
with rust resistant
paint**



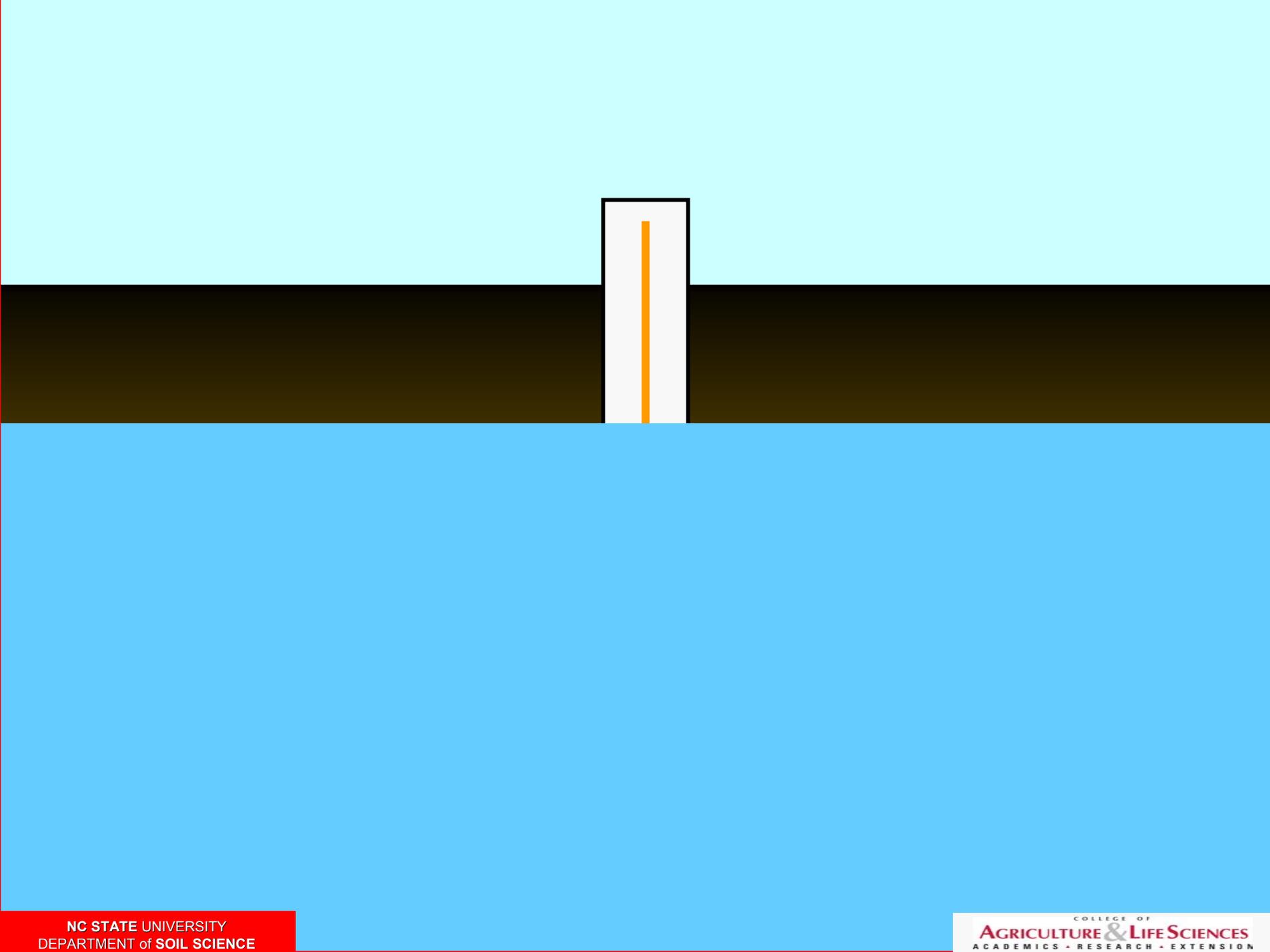
**Rod goes
through
screw cap to
help keep
rod centered
in well**

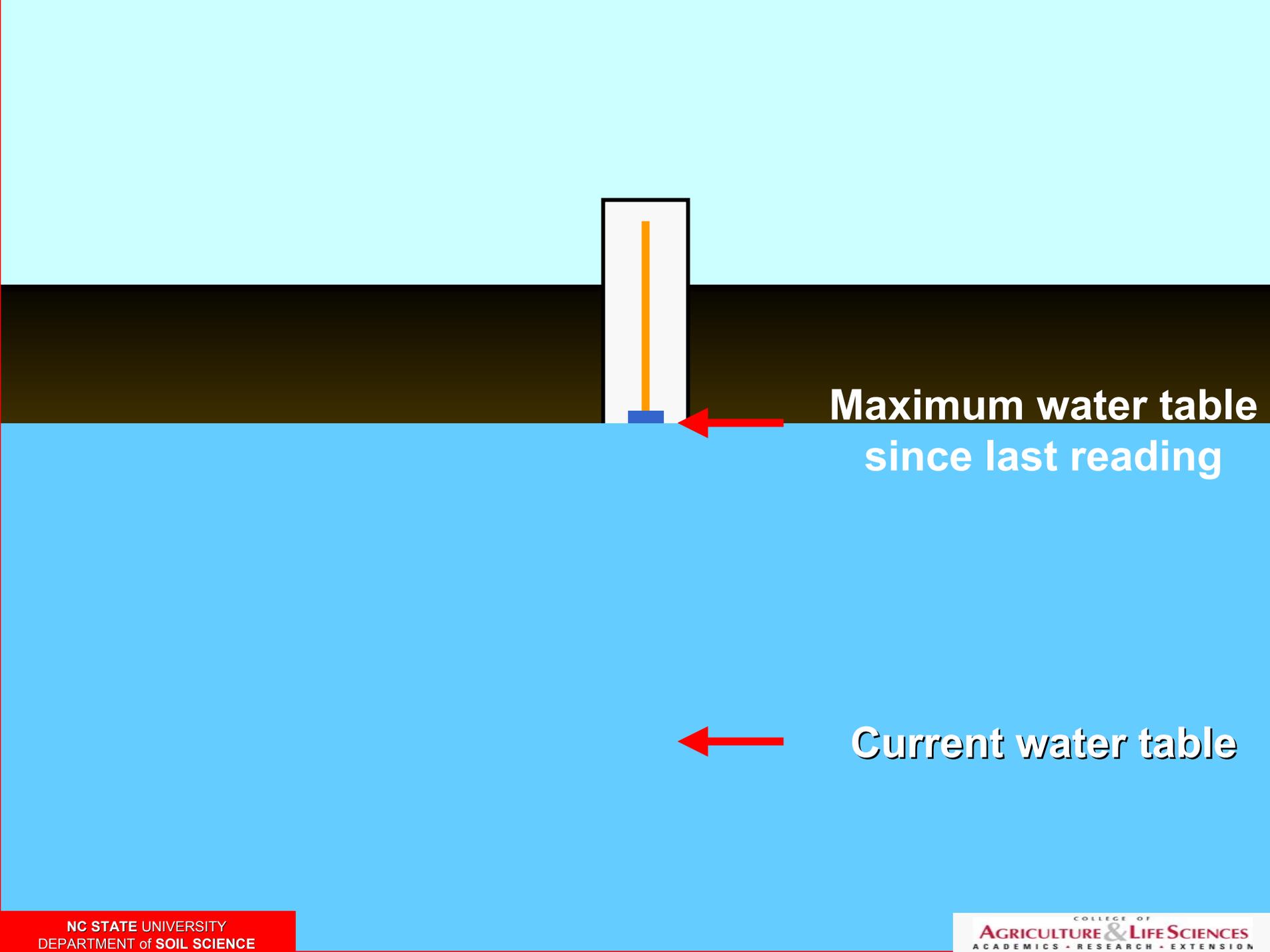
**Metal rod painted
with rust resistant
paint**

**Float – need
to check to
make sure it
floats**

**Plastic
washer**

**Steel washer
at base of rod**





**Maximum water table
since last reading**

Current water table