

# Newly-Formed Redoximorphic Features in Soils

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# Redoximorphic Features in Soils



- Extended periods of saturation can cause anaerobic conditions to develop leading to the formation of redoximorphic features in the soil profile.
- Features occurring in the upper part of the soil profile may be indicative of hydric soil conditions.
- Major criteria for developing field indicators for identifying and delineating hydric soils
- Morphological evidence documenting wetland function

# Newly-Formed Redoximorphic Features in Soils

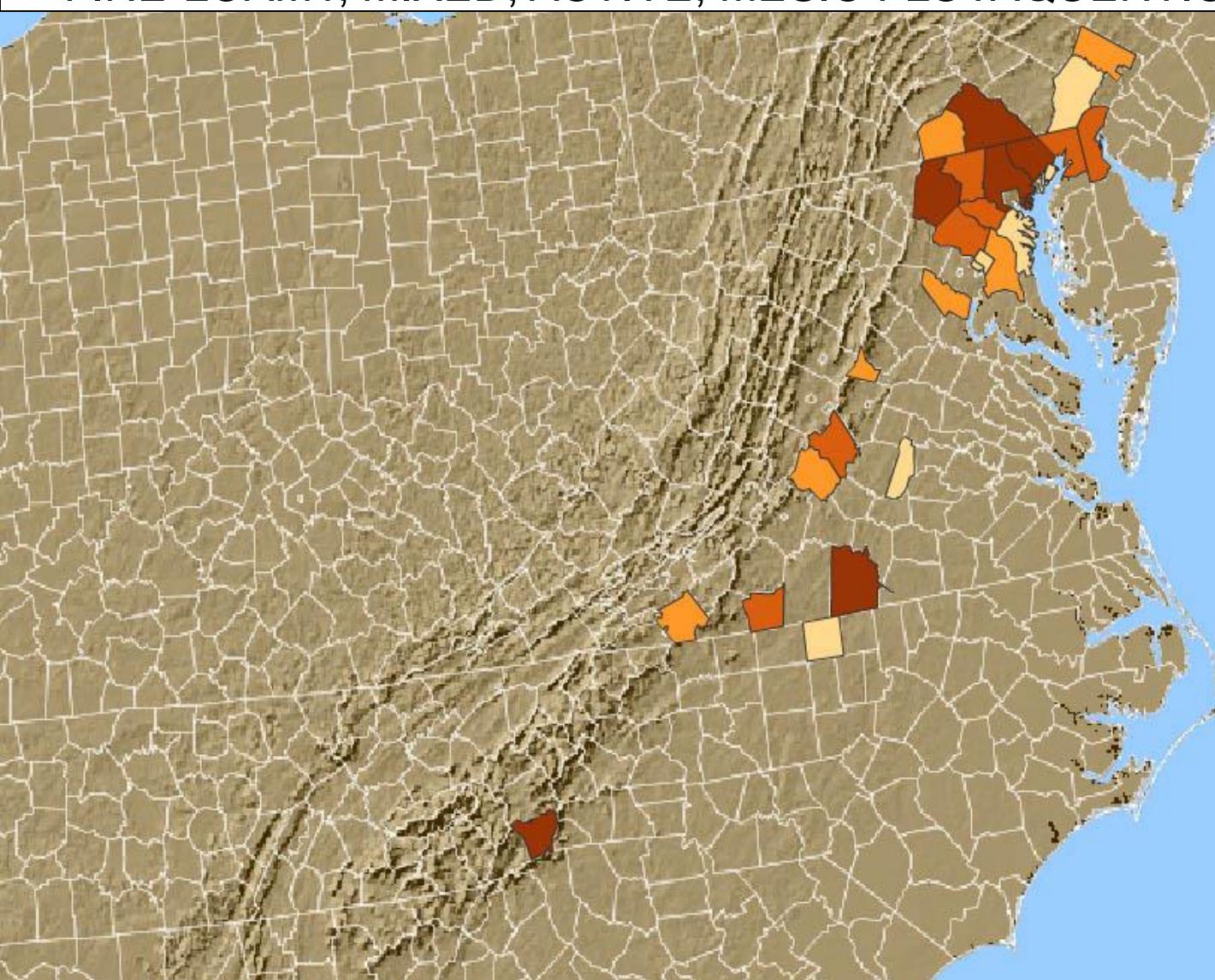
- Quantity and nature of redoximorphic features can be affected by soil texture, mineralogy, temperature, organic carbon content, and vegetation
- Limited knowledge exists regarding the rate of redoximorphic feature development
- Problem settings:
  - recently deposited, exposed, or saturated soil materials such as in floodplains
  - disturbed areas where hydrology has been altered or where fill materials have been added
  - wetland restoration or wetland construction projects

# Experimental Approach

- Collect undisturbed soil cores from soils lacking redoximorphic features in the upper part and establish as experimental mesocosms
- Expose soil mesocosms to saturated conditions for varying lengths of time in both greenhouse and field settings
- Utilize three soil series and two wetland plant species to evaluate effects of differing soil properties and vegetation on redoximorphic feature development
- In set time cycles, dissect cores and described all newly-formed redoximorphic features

# **Geographic Extent of the Codorus Soil Series**

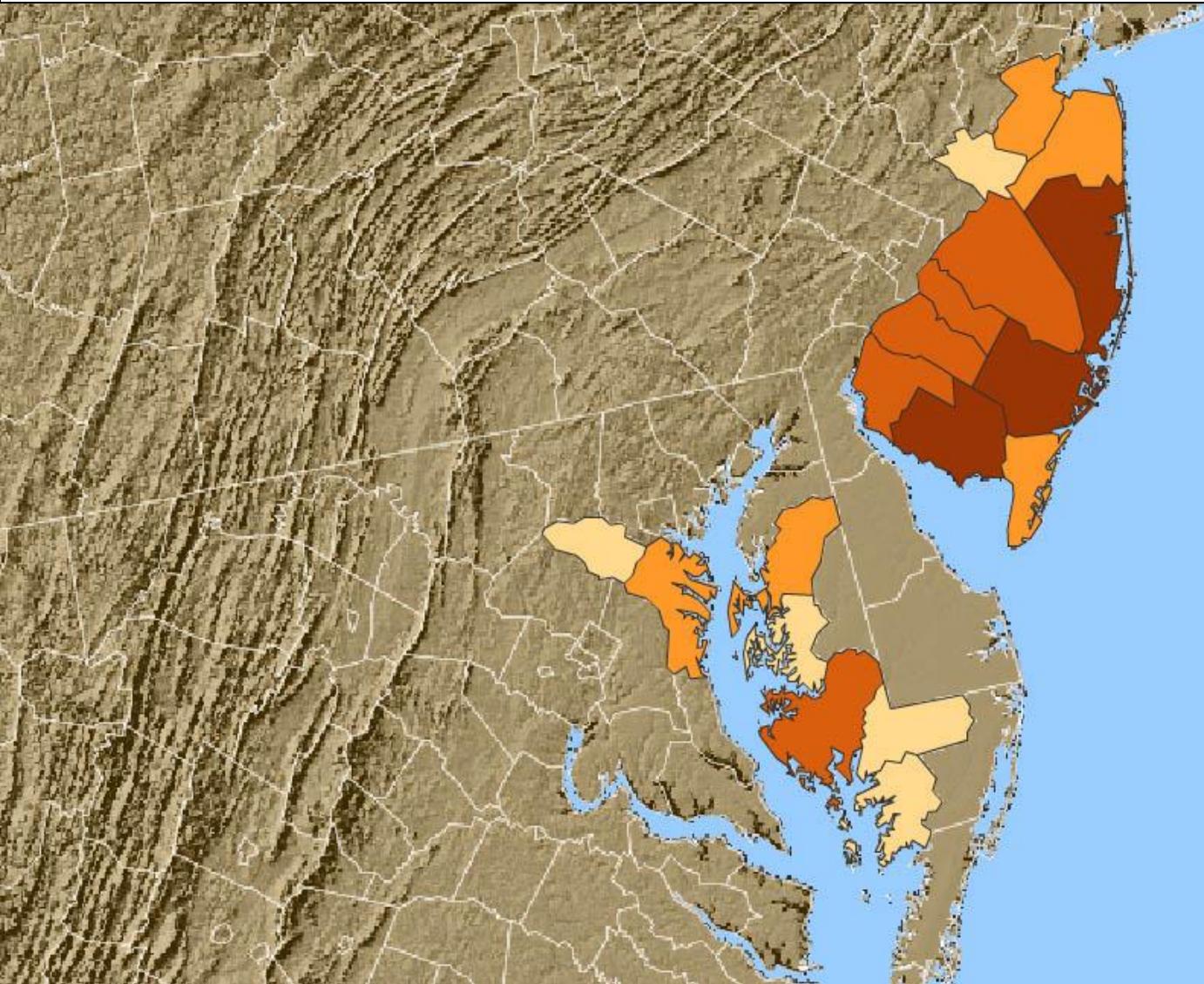
## **FINE-LOAMY, MIXED, ACTIVE, MESIC FLUVAQUENTIC DYSTRUDEPTS**



117 mi  
188 km

# **Geographic Extent of the Downer Soil Series**

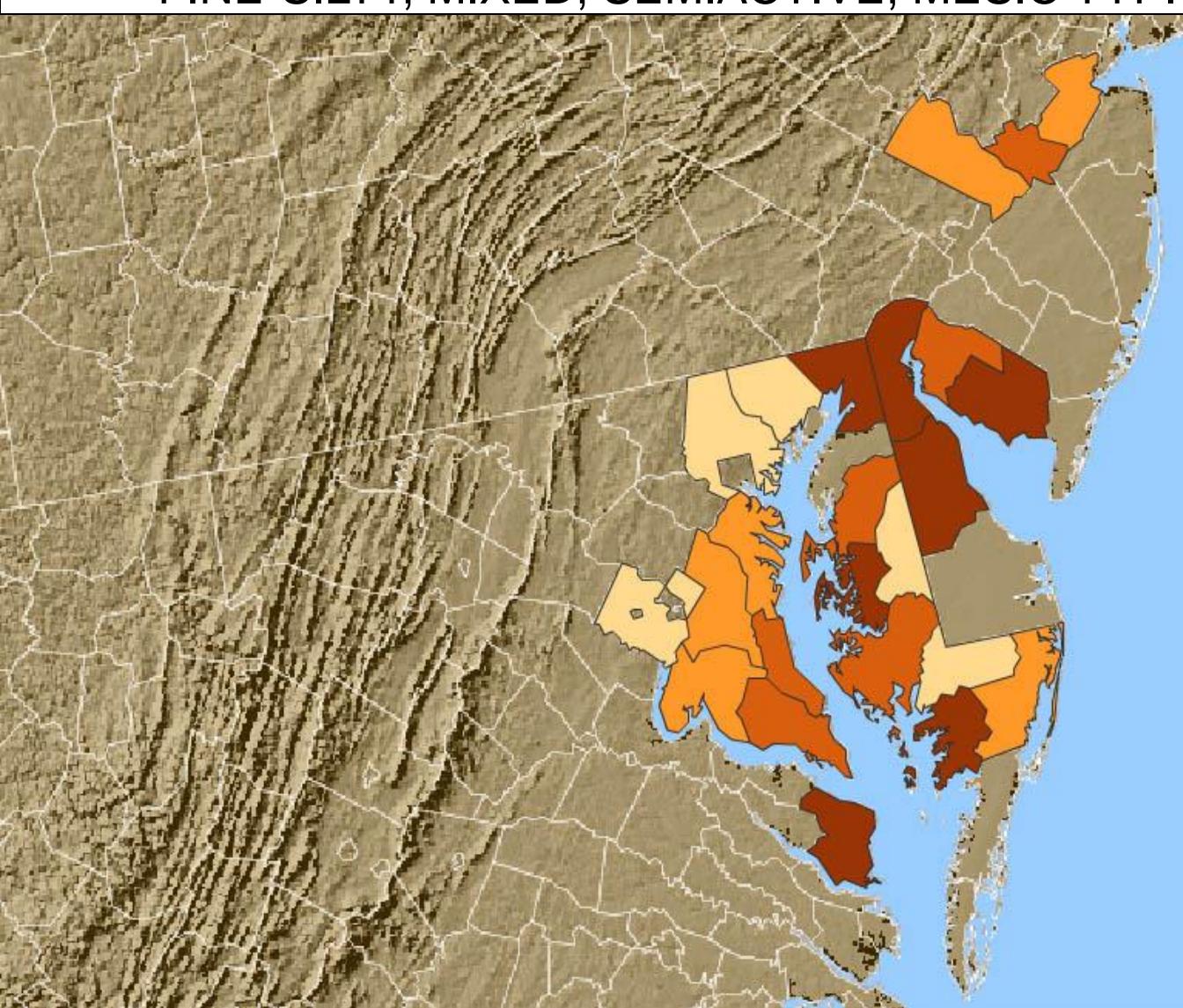
**COARSE-LOAMY, SILICEOUS, SEMIACTIVE, MESIC TYPIC HAPLUDULTS**



55 mi  
88 km

# **Geographic Extent of the Matapeake Soil Series**

**FINE-SILTY, MIXED, SEMIACTIVE, MESIC TYPIC HAPLUDULTS**



62 mi  
100 km

# Vegetation Treatments



Soft Rush (*Juncus effusus* L.)

- Three vegetation treatments:
- 1) control, non-vegetated
- 2) *Echnichloa crusgalli* (barnyard grass)
- 3) *Juncus Effusus* (soft rush)



Barnyard Grass (*Echnichloa crusgalli* L.)

# Collection of Soil Mesocosms



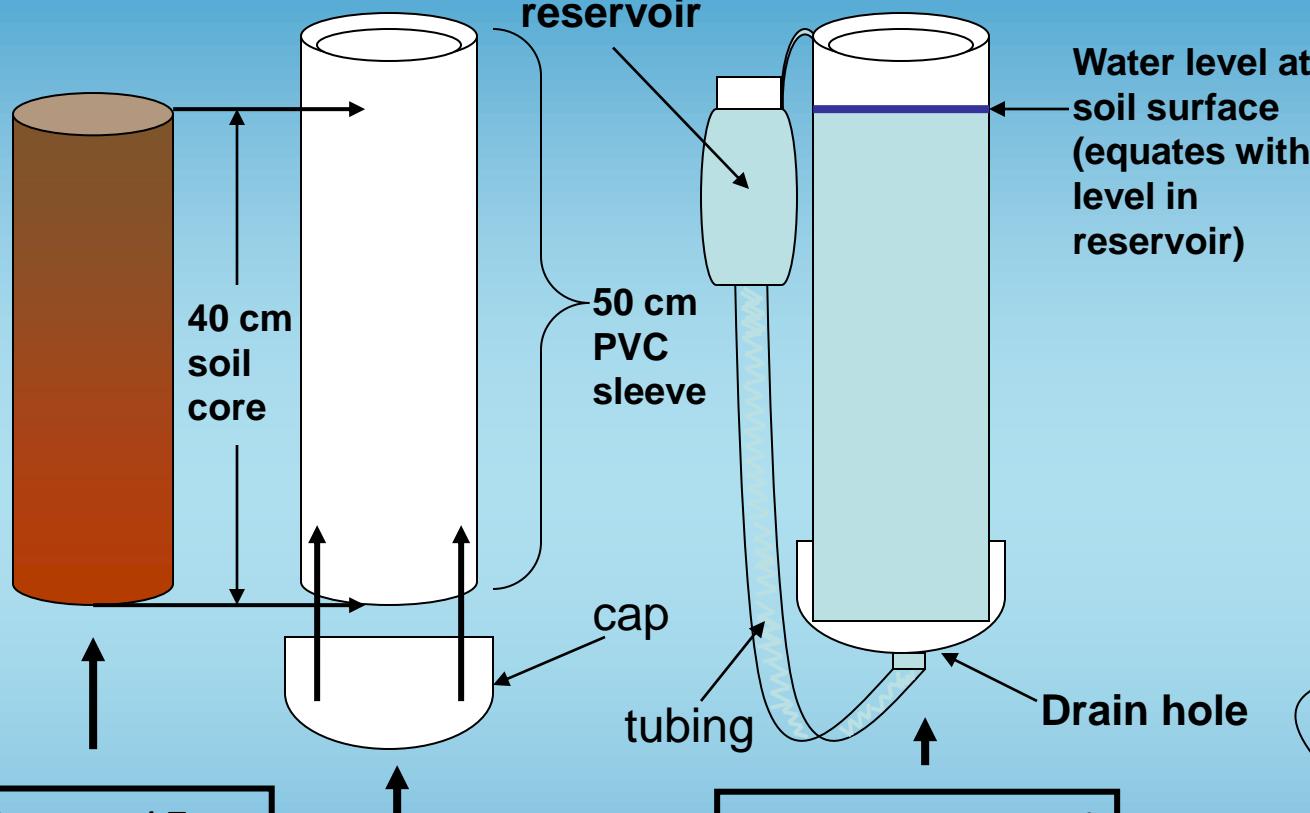
## Assembled Mesocosm Schematic



### 8 week wet cycle:

water table at or near soil surface

Water reservoir



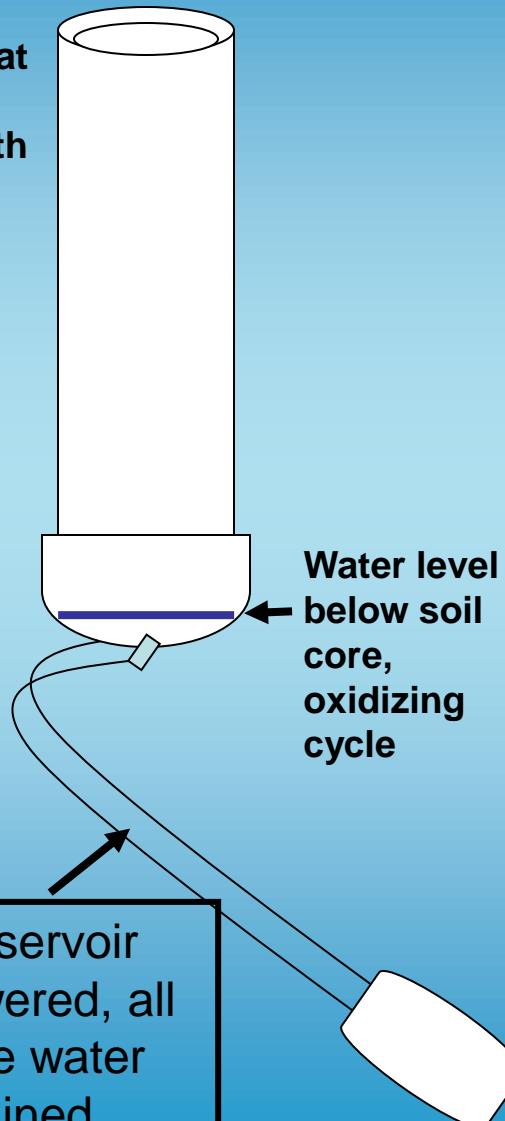
40 cm x 15 cm soil core, extracted with PVC sleeve (50 cm in length)

Sleeved soil core, PVC cap sealed to bottom

Water reservoir / tubing attached, filled to level of soil surface (10 cm below top of sleeve)

### 8 week dry cycle:

reservoir drained, core unsaturated

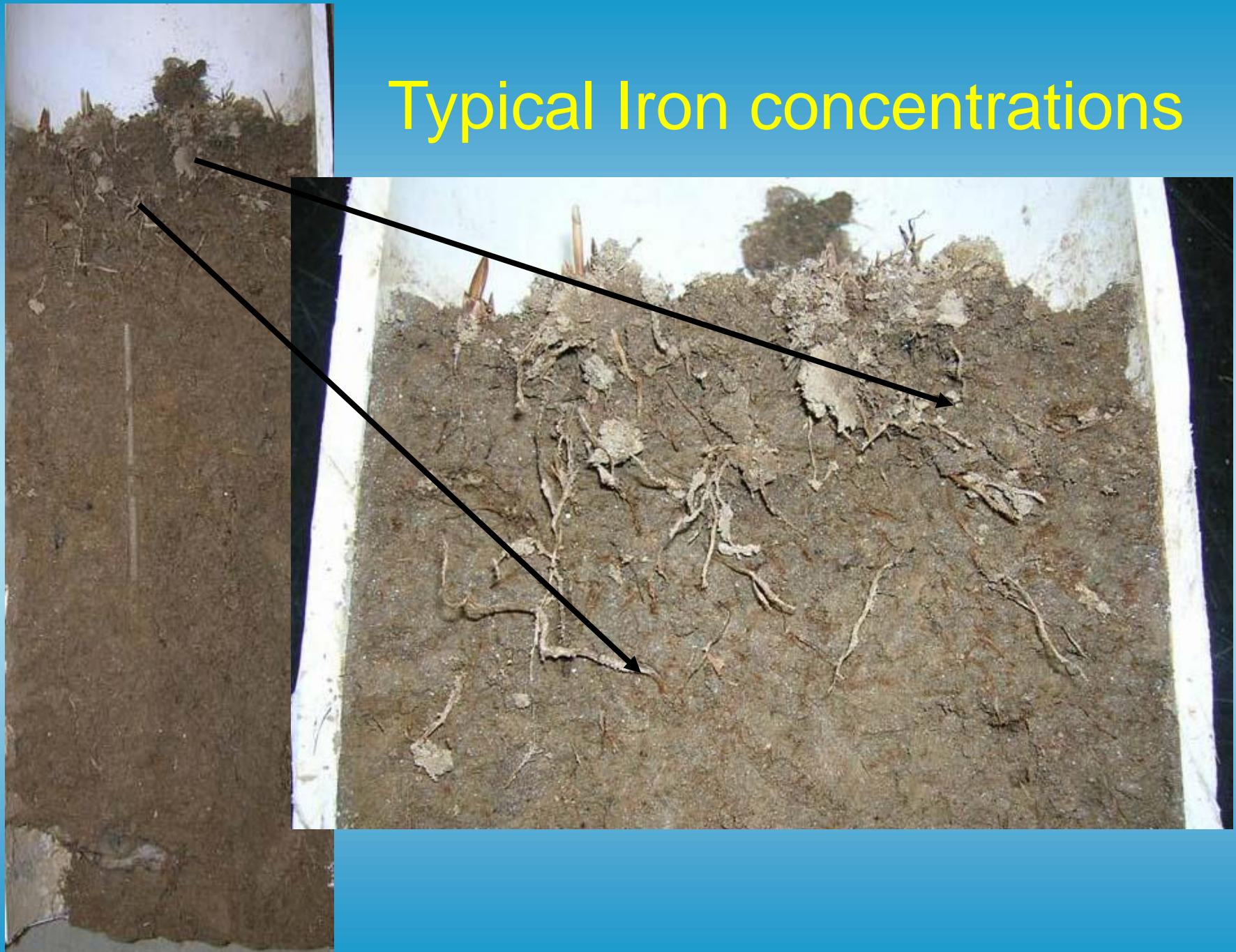


# Greenhouse Experimental Design

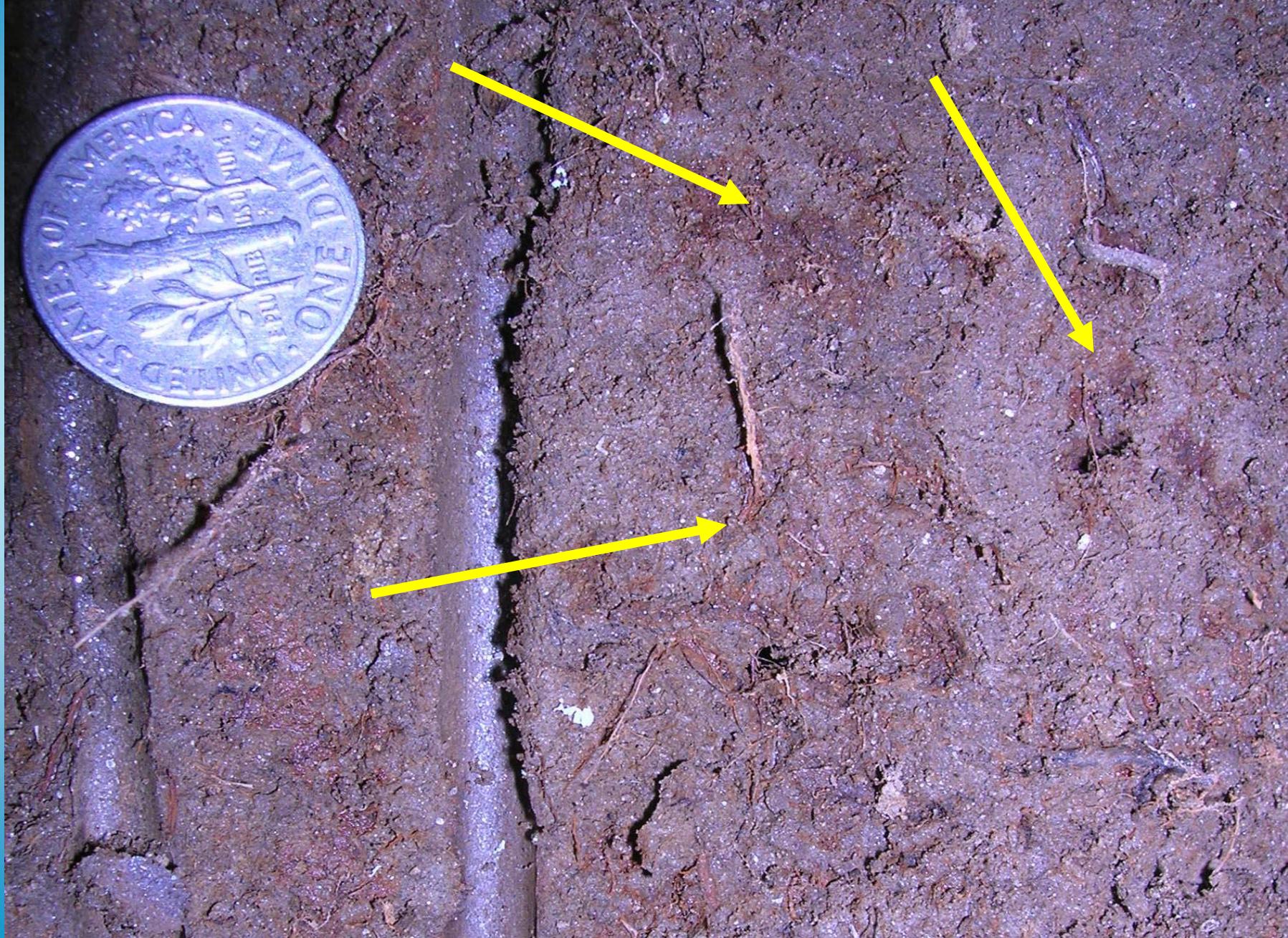
- Randomized Block Design
  - Three soil series
  - Three vegetation treatments (including control)
  - Each treatment combination replicated
  - Total of 108 mesocosms
- Time Series
  - 6 16 week hydrologic cycles in the greenhouse (8 weeks of saturation, 8 weeks of oxidation)
  - At the end of each cycle, a sampling set of 18 cores was removed, dissected, and all newly-formed redoximorphic features were documented



# Typical Iron concentrations



## CLOSE-UP OF REDOX CONCENTRATIONS



**DEPLETED ZONE ALONG ROOT CHANNEL**

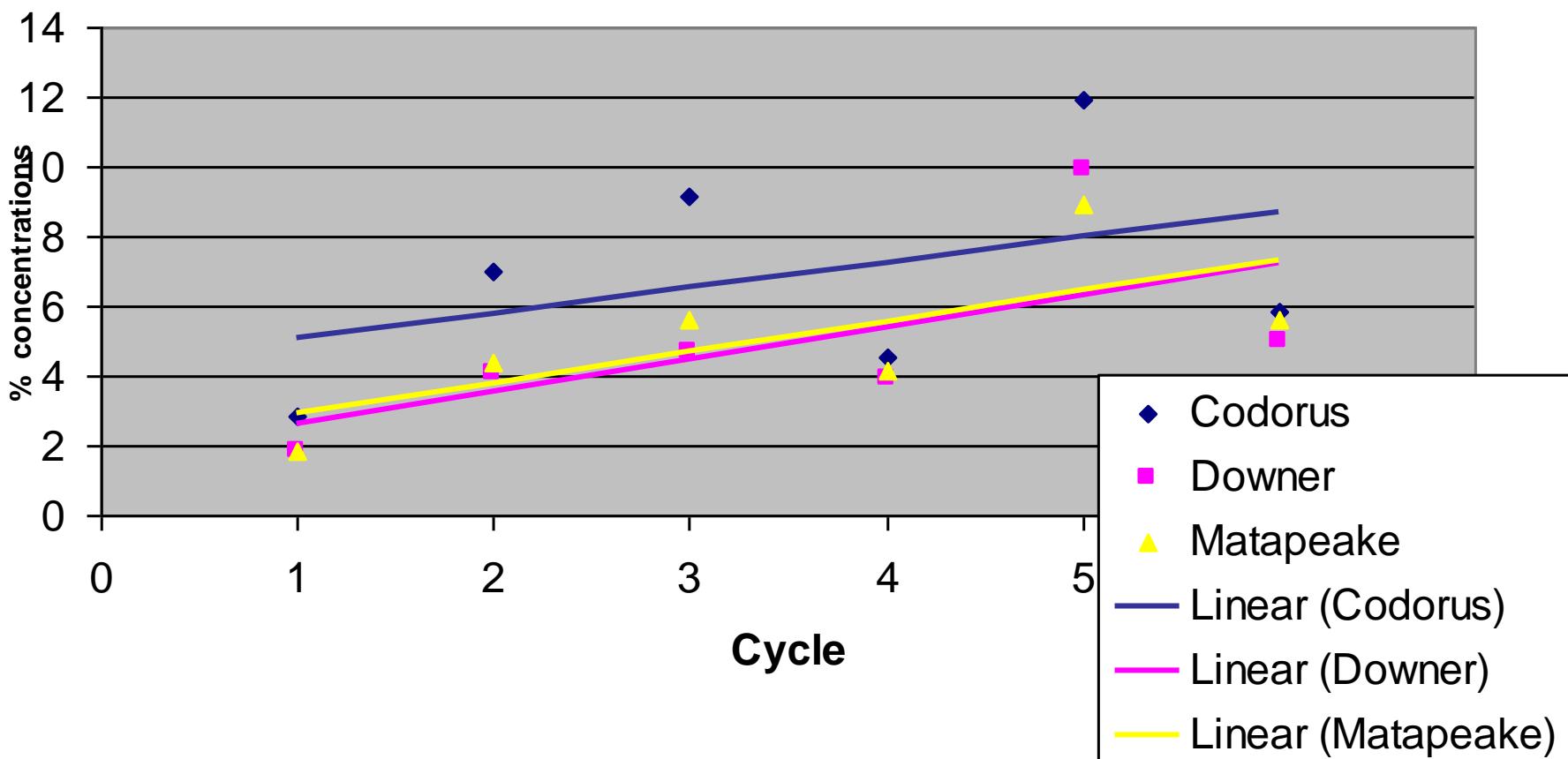


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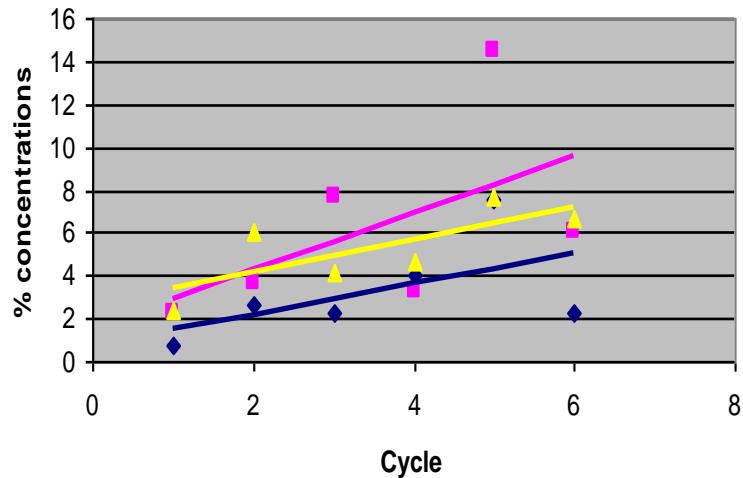


Iron oxide coating along macropore

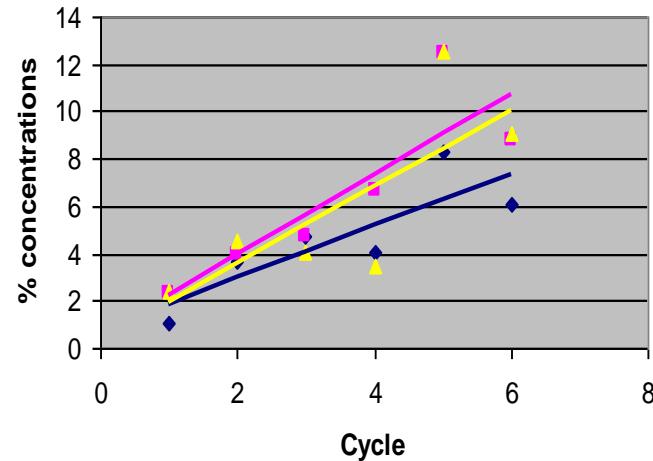
## Redox Concentrations in Surface Horizon for Soil Series



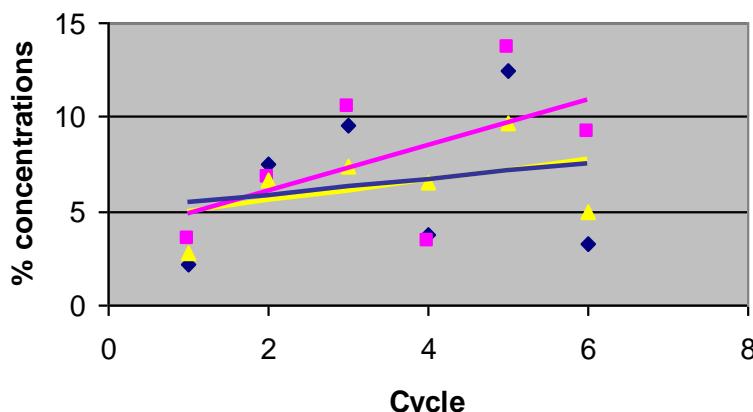
### Vegetation Effects on Downer in Surface Horizon



### Vegetation Effects on Matapeake in Surface Horizon



### Vegetation Effects on Codorus Features in Surface Horizon



# Feature Formation Trends

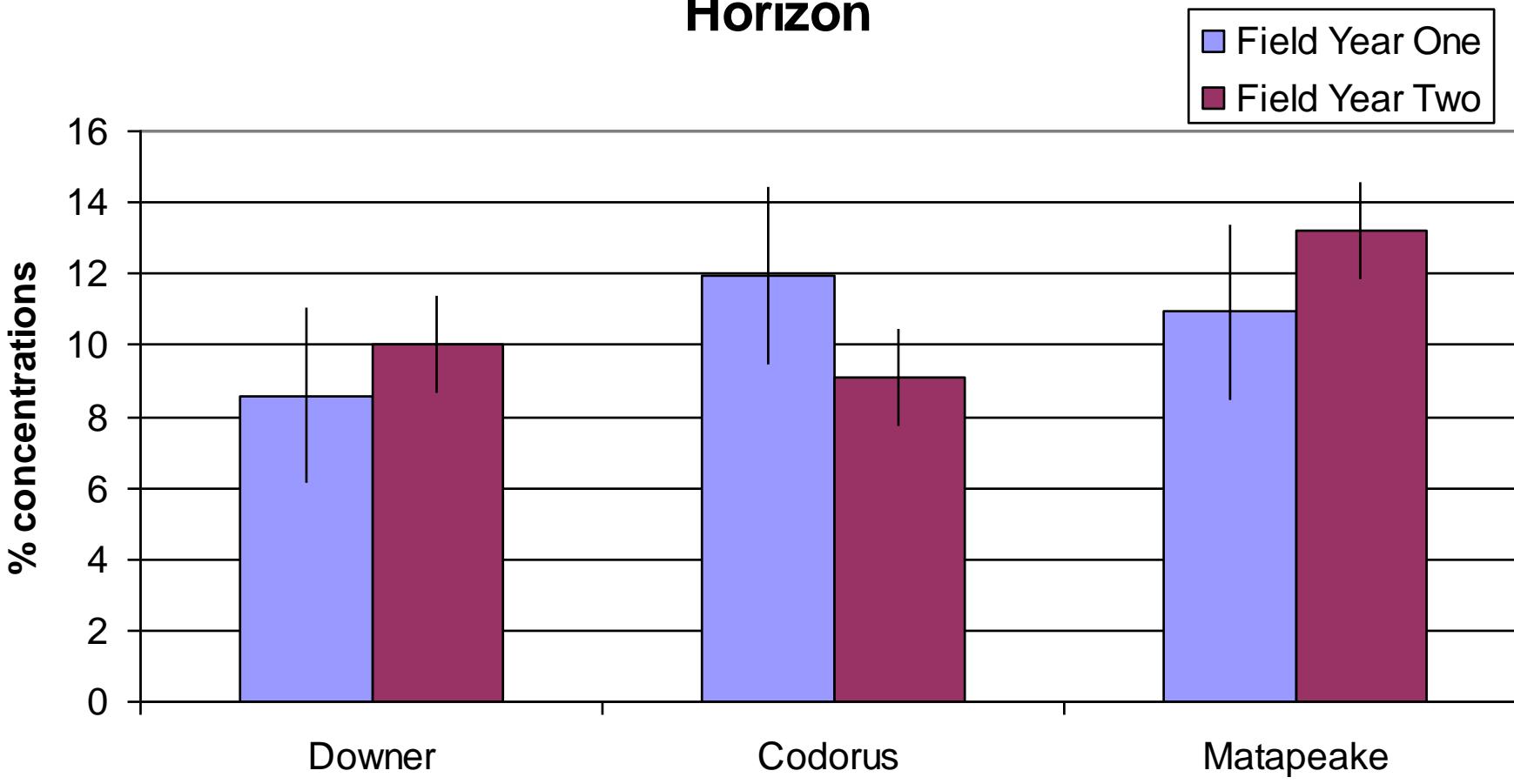
- Majority of features are iron concentrations, fine to very fine, mostly faint to distinct along root channels, pores, and ped faces
- Percentage of feature expression has increased in later sampling cycles
- Mesos from the codorus series have the greatest feature expression (mostly likely due to higher carbon content (1.5-2.0%) and better structure)
- Vegetation treatment can influence the type of concentration

# Field Study: North Branch Rock Creek



- Two randomized plots of nine mesocosms each, three soil types in triplicate (18 cores)
- Implanted into a documented wetland area. Plot 1 extracted after one year, Plot 2 extracted after two years
- Extracted cores will be described for all newly-formed redoximorphic features

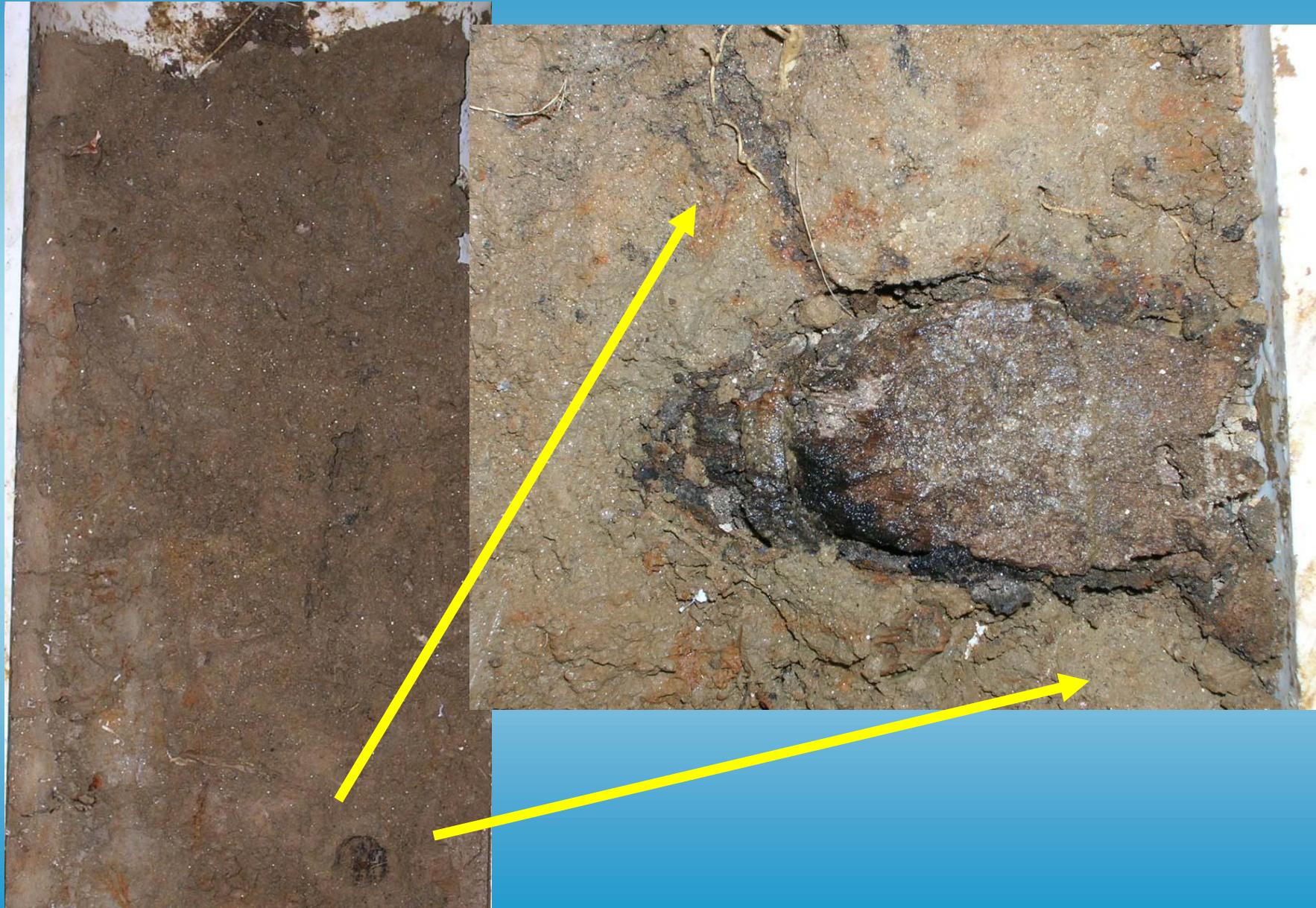
# Field Study: Redox Concentrations in Surface Horizon



# Matapeake Field Year 1



# Codorus Field Year 1



# Conclusions

- Length of time soils are exposed to saturation conditions has greatest effect on feature expression
- Soil properties and vegetation both affect redoximorphic feature development
- Amount of carbon in soils is a limiting factor
- Rate of feature formation faster in one year in field as opposed to one year in the greenhouse

# Anticipated Benefits

- Expand the knowledge regarding the rate of newly-formed redoximorphic features in soils
- Provide insight interpreting hydromorphology and hydric status in In areas of recent deposition, exposure, landscape alteration or disturbance, and wetland restoration/ construction

We would like to express appreciation  
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- Mid-Atlantic Hydric Soil Committee