Mapping Wetlands Using Ecological Site Descriptions

Richard Weber
Wetland Hydraulic Engineer
Wetland Team
CNTSC, Fort Worth, TX

Goals and Assumptions:

- Need to Spatially Define Wetland *Landscapes*
- Landscapes can be Delineated by Function
- Wetland Functions are Dominated by *Hydrology*
- Hydrologic Function and *Soil Attributes* are Interrelated
- Landscapes Exist as *Watershed Elements*
- Within a Certain “Reference Domain”, Landscapes can be Categorized by Position and Function
- Landscapes can be used to BUILD WATERSHEDS

Available Data Sources and Classification Systems:

- Soil Survey Geographic (SSURGO) Database
  - Raster Data
  - Vector Polygons
  - Large Attribute Database
- Hydrogeomorphic (HGM) Classification System
- Ecological Site Descriptions
- Digital Elevation Data (DED)
  - 30m and 10m
  - High Resolution (LIDAR, IFSAR, etc.)

Cowardin Classification

Based on:

- Hydrologic Regime
- Plant Community
- Broad Landscape Attributes (Riverine, Tidal, Other)

Works well for:

- Mapping jurisdictional wetland boundaries
- Drawing polygons from remotely sensed imagery

Works less well for:

- Analysis of landscape function
- Use in the Watershed Approach

Newer Efforts:

- HGM Informed Cowardin Classification (LLWW)

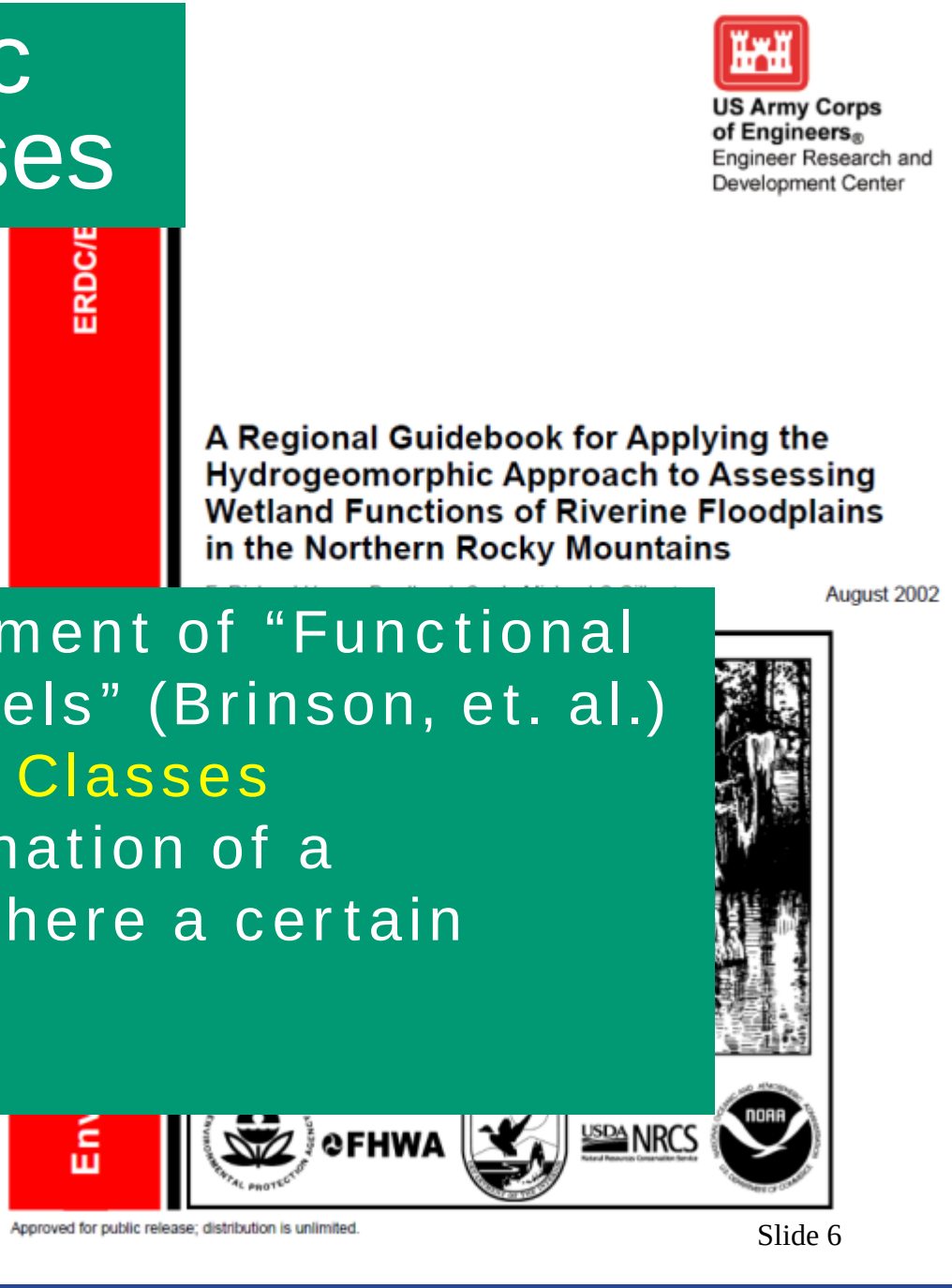
Ecological Site Descriptions:

An ecological site is a conceptual division of the landscape, defined as a “distinctive kind of land based on recurring soil, landform, geological, and climate characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its ability to respond similarly to management actions and natural disturbances

- Vegetation Based
- NRCS, USFS, and BLM Effort

Hydrogeomorphic Landscape Classes

- Originally for Development of "Functional Assessment Models" (Brinson, et. al.)
- Starts with 7 Wetland Classes
- Requires the Determination of a "*Reference Domain*" where a certain "subclass" exists
- Function Based



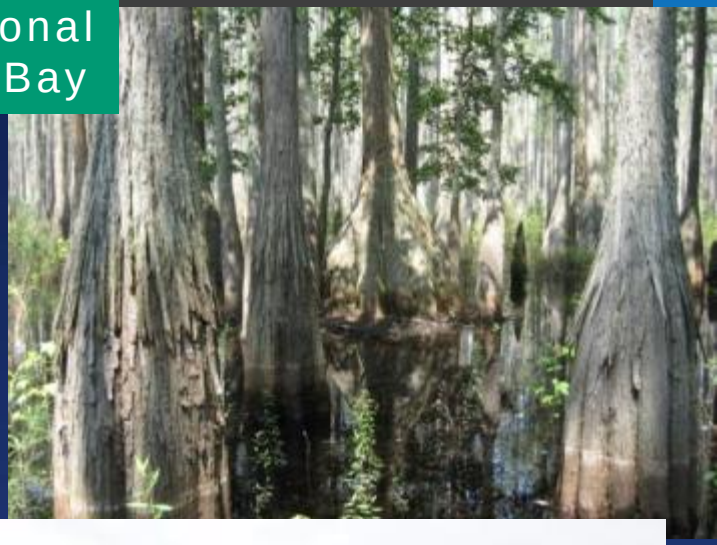
Three Factors that Define HGM *Landscape* Classes

- Landscape Position *in the watershed*
- Dominant Water Source
- Hydrodynamics

The Seven HGM Classes

- RIVERINE
- SLOPE
- MINERAL SOIL FLAT
- ORGANIC SOIL FLAT
- ESTUARINE FRINGE
- LACUSTRINE FRINGE
- DEPRESSION

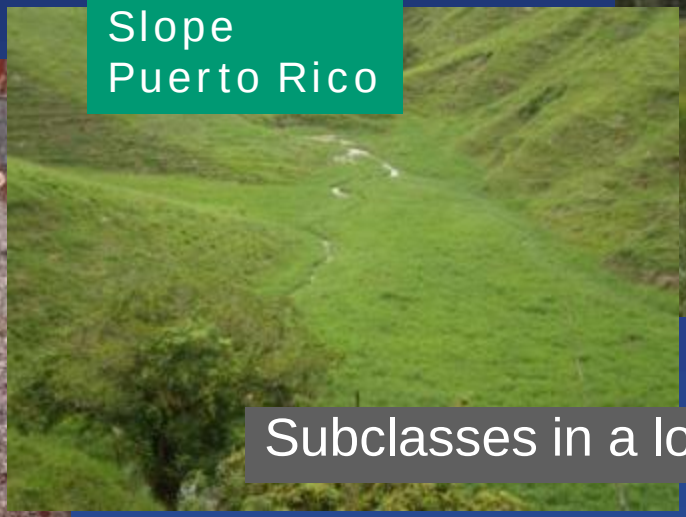
Depressional
Carolina Bay



Estuarine Fringe
Oregon

Mineral Flats
Indiana Flatwoods

Slope
Puerto Rico



Subclasses in a local Reference Domain

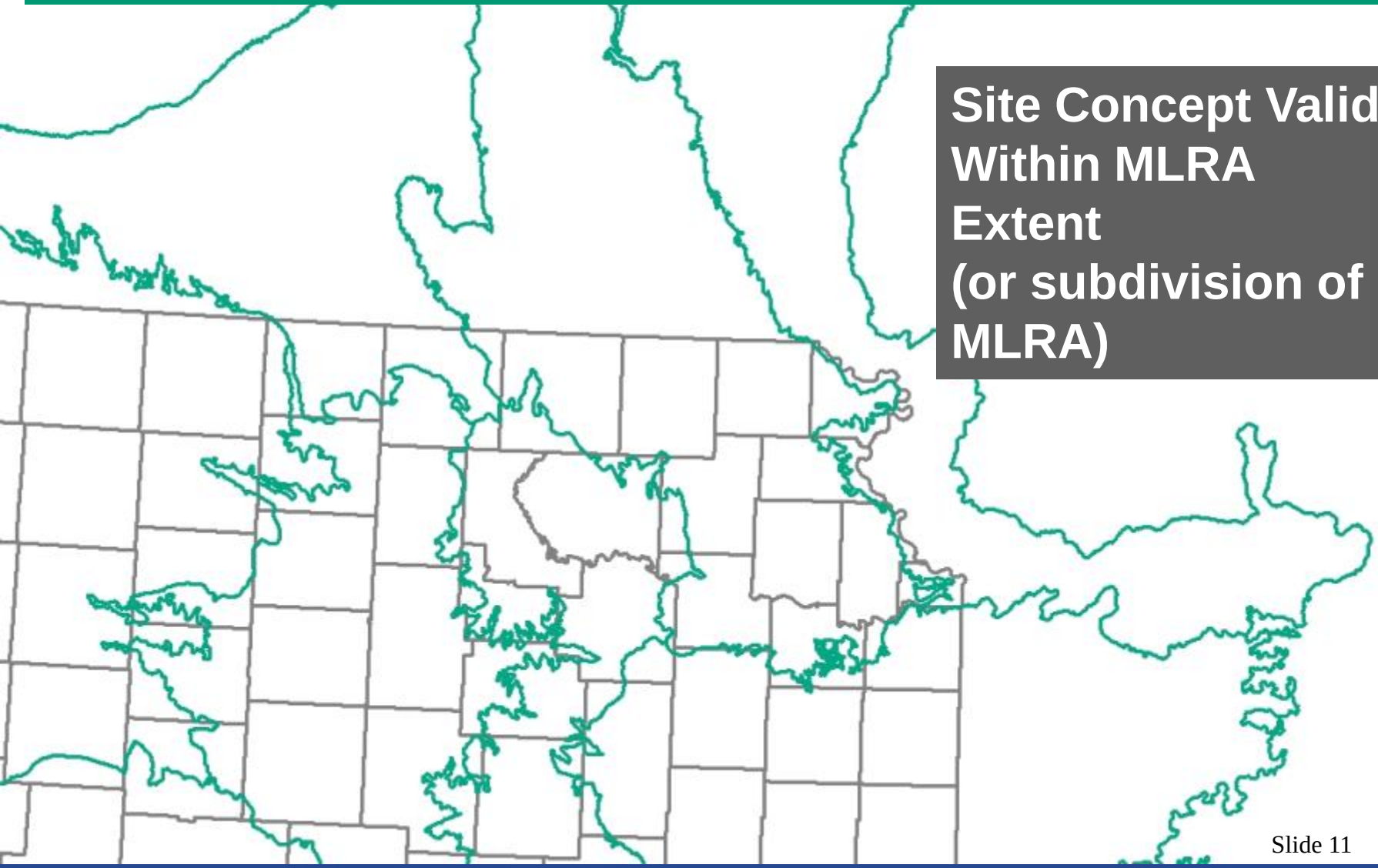
Merging ESD and HGM Concepts

- Landscape Boundaries based on similar soil hydrodynamic processes
- Site Concepts are valid up to the Major Land Resource Area (MLRA) Extent
- Ecological Sites for Wetland Landscapes and HGM landscape classifications are the same
- Valid Site Concepts can be mapped across the MLRA Extent
- Sites may contain landscapes with certain HGM class wetlands, but are NOT wetland boundaries

Basic Data, Tools, and Skillset:

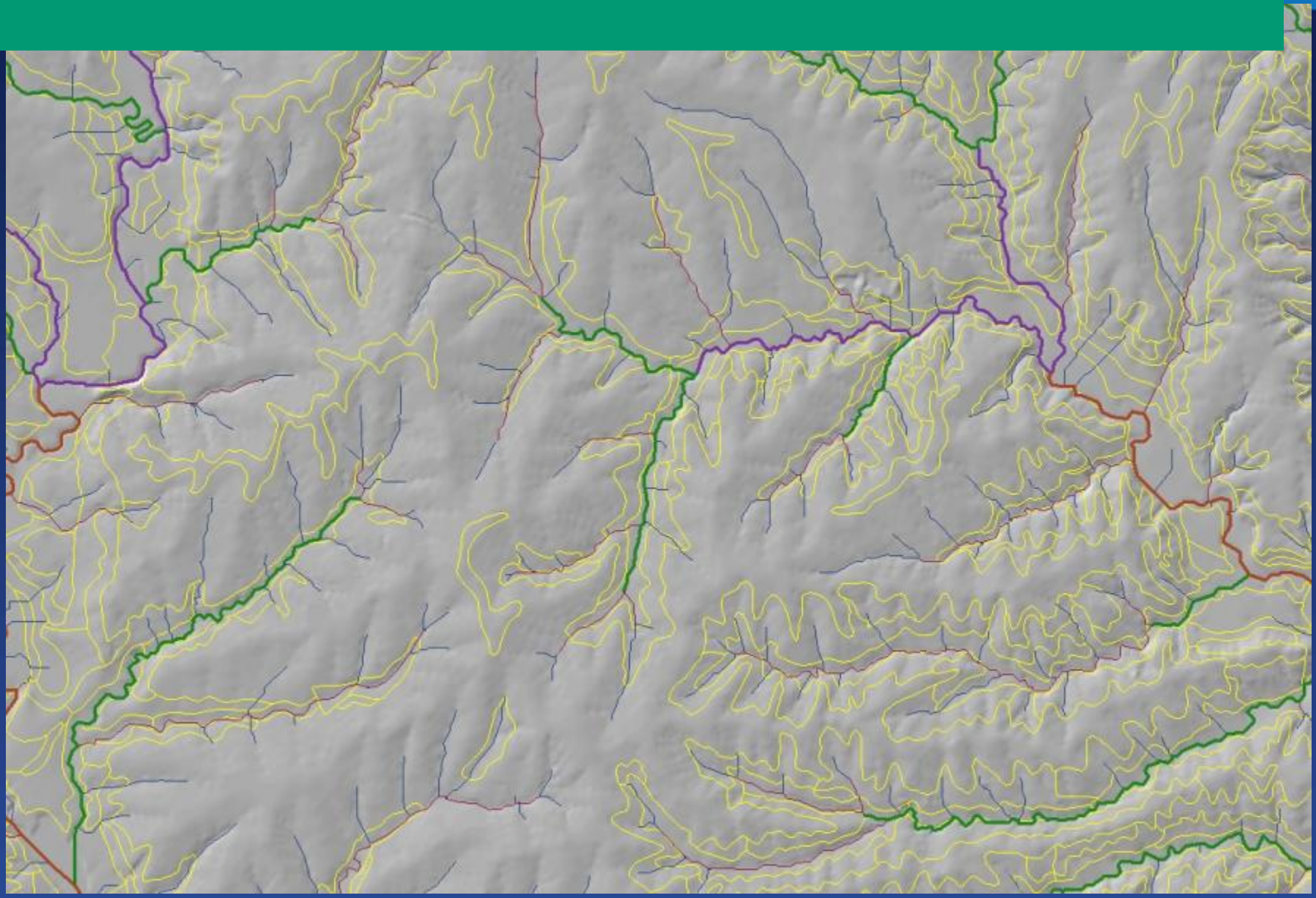
- SSURGO (raster or vector, and tabular data)
- Digital Elevation Data
- GIS Software
- Knowledge of Spatial Analyst Tools
- Knowledge of SSURGO dataset
- MLRA Boundary Data
- HUC Boundary Data
- Aerial Imagery

Major Land Resource Areas

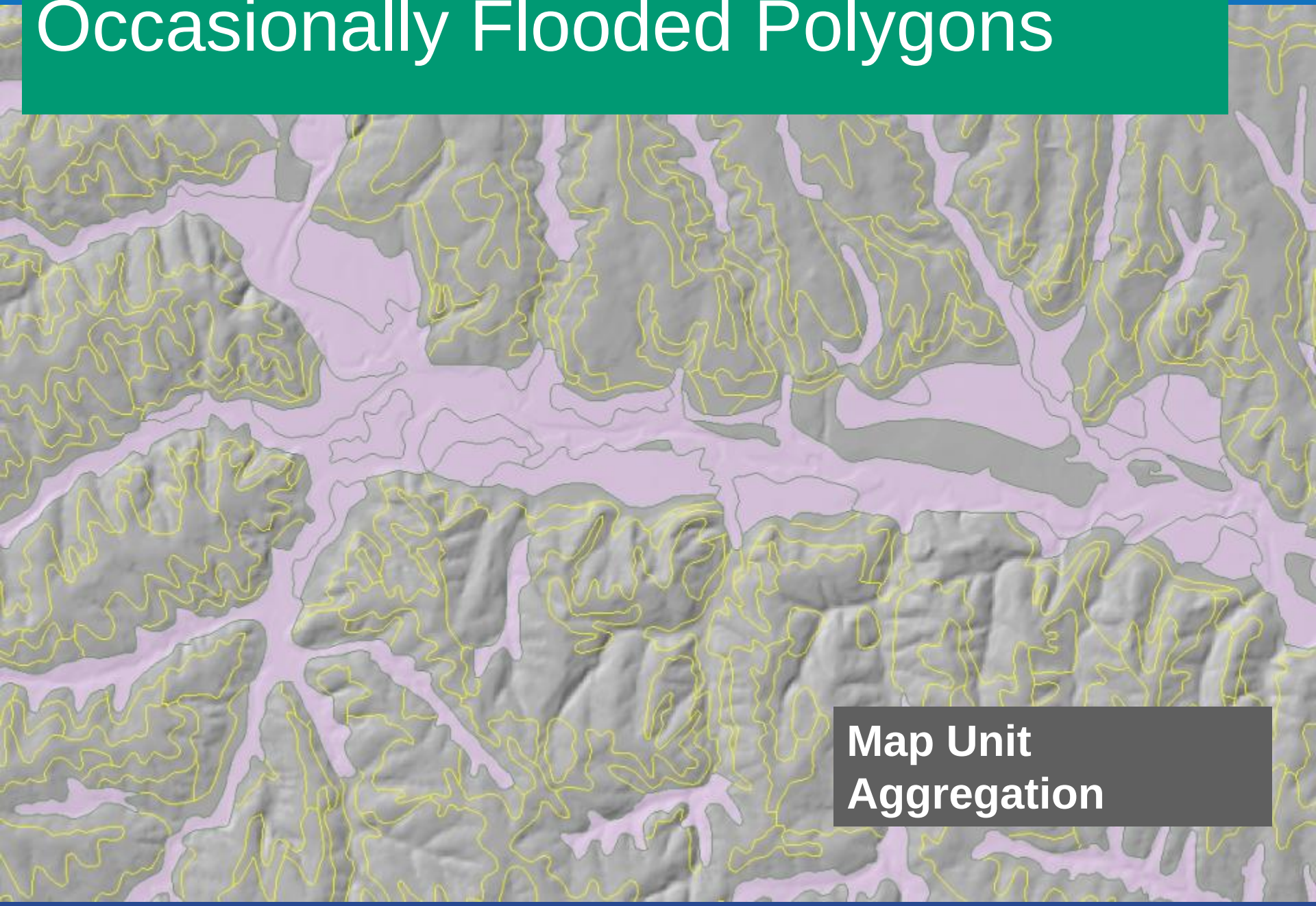


Site Concept Valid Within MLRA Extent (or subdivision of MLRA)

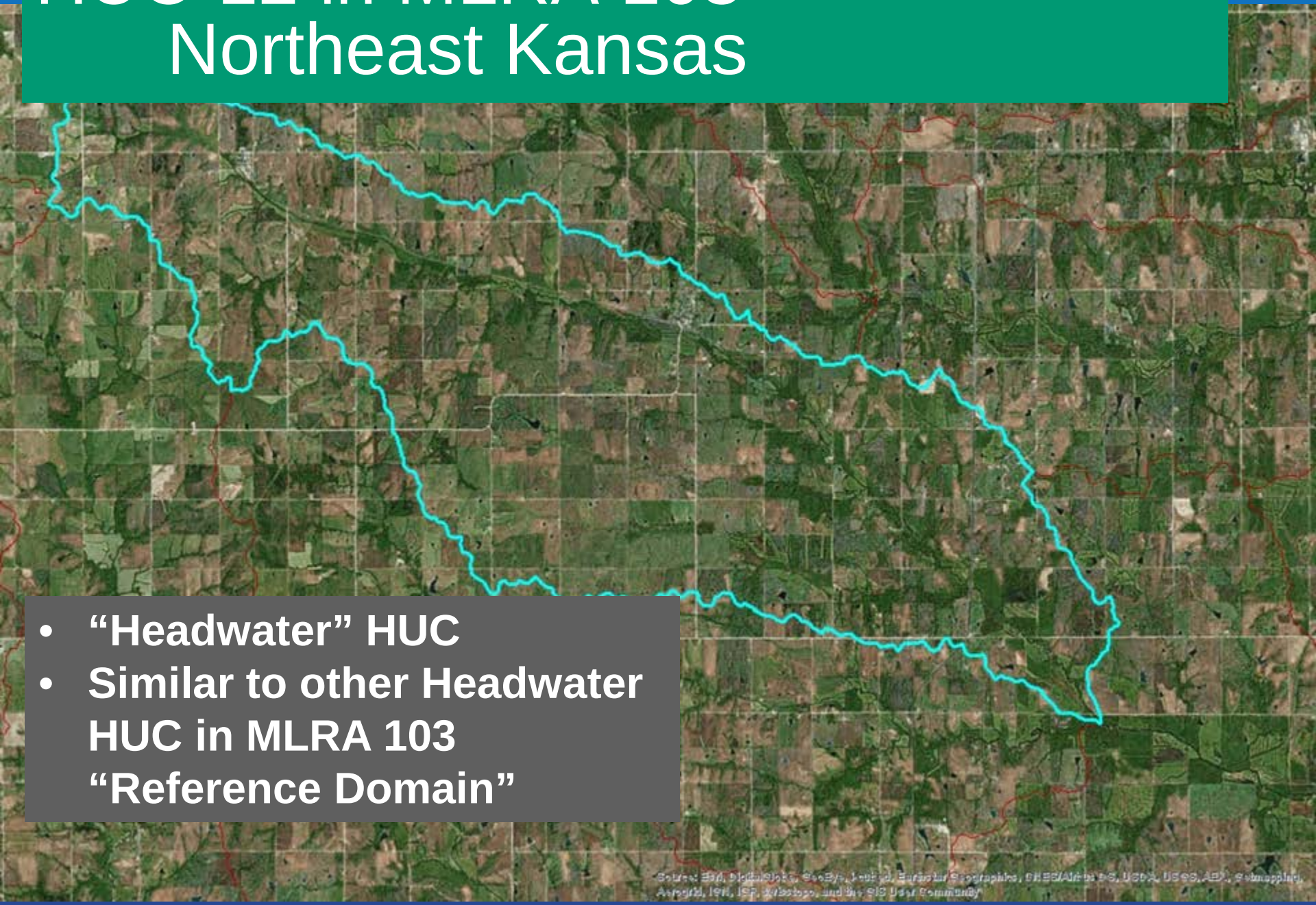
Map Unit Polygons



Occasionally Flooded Polygons

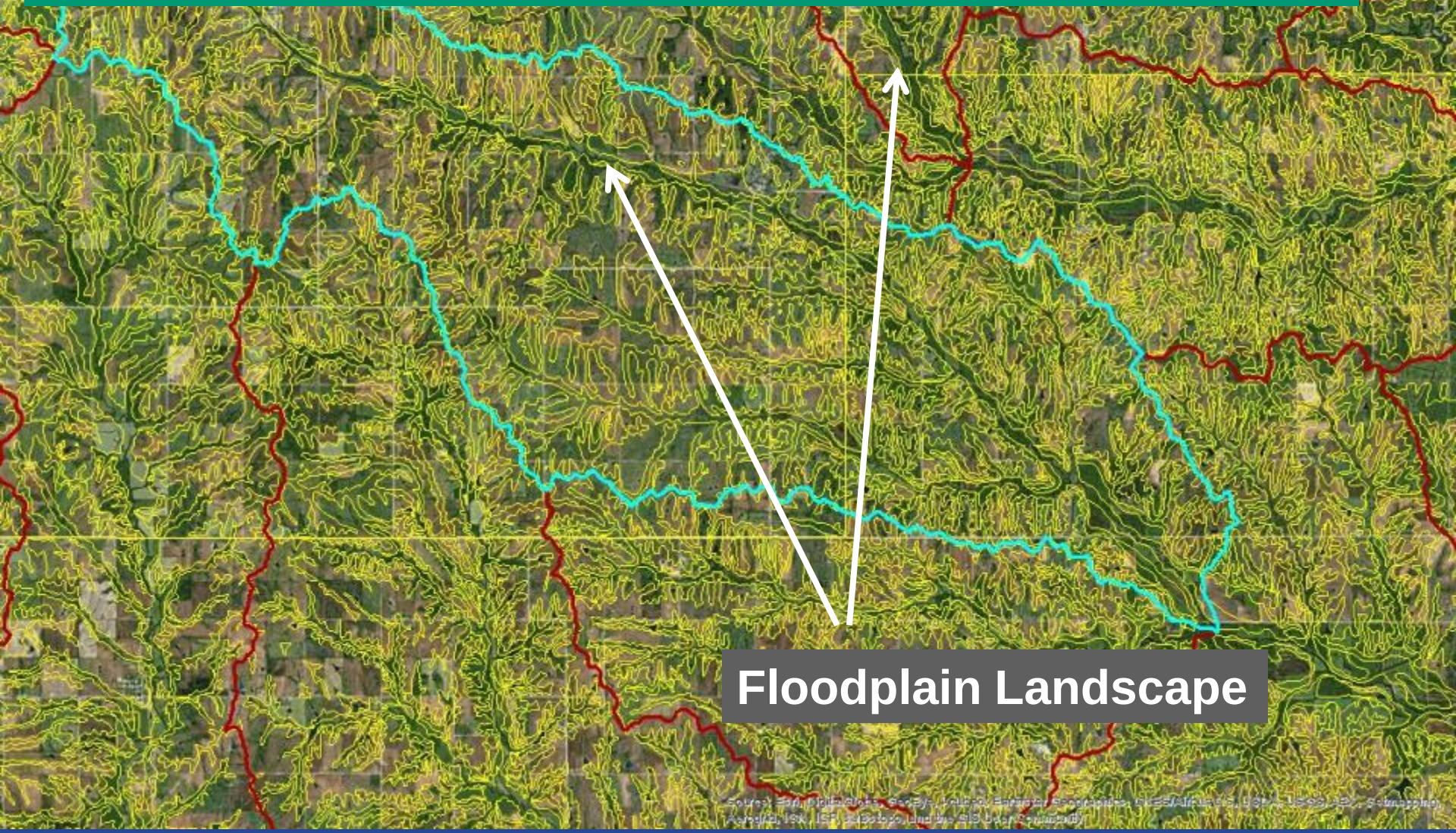


HUC-12 in MLRA 103
Northeast Kansas

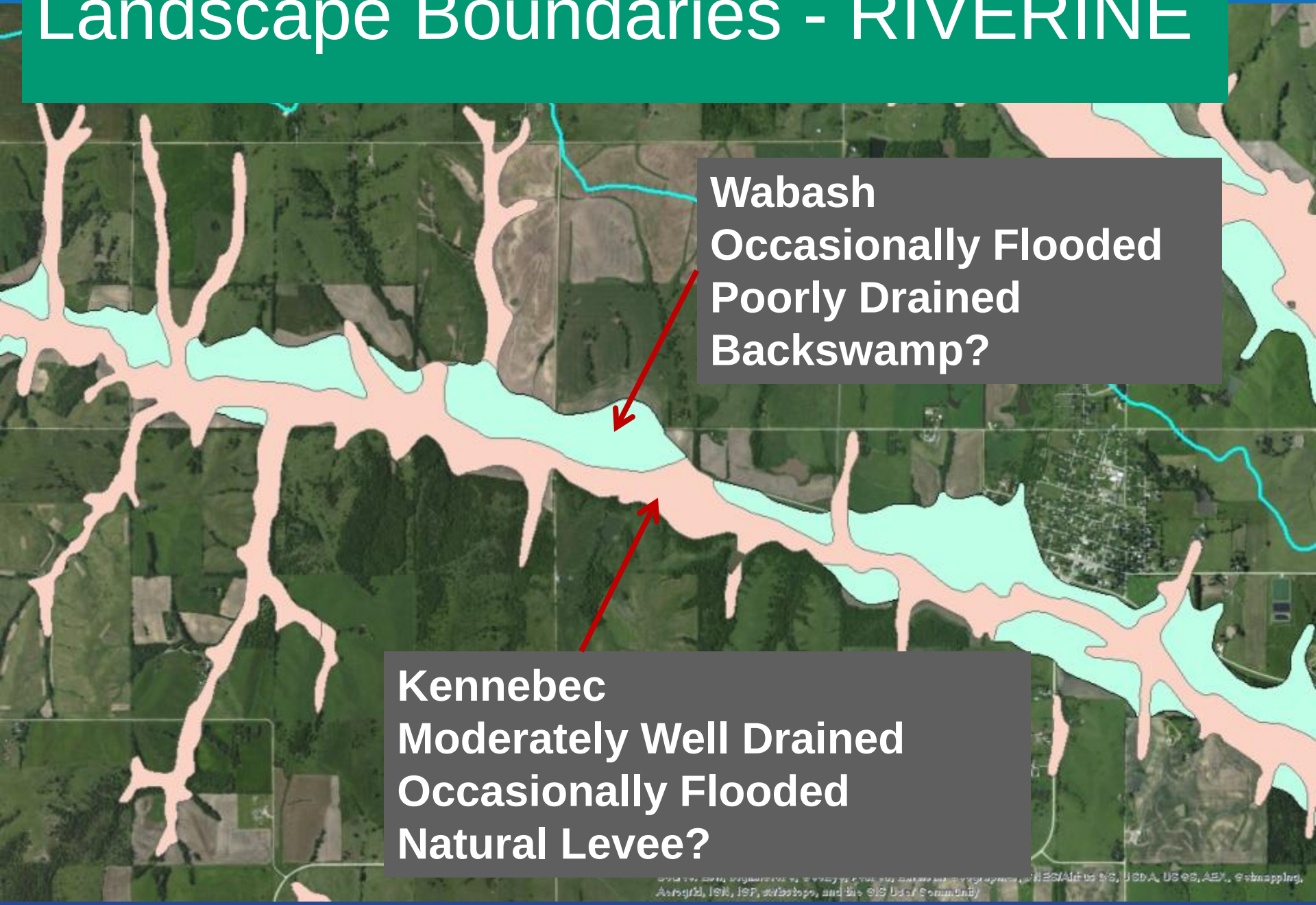


- **“Headwater” HUC**
- **Similar to other Headwater HUC in MLRA 103 “Reference Domain”**

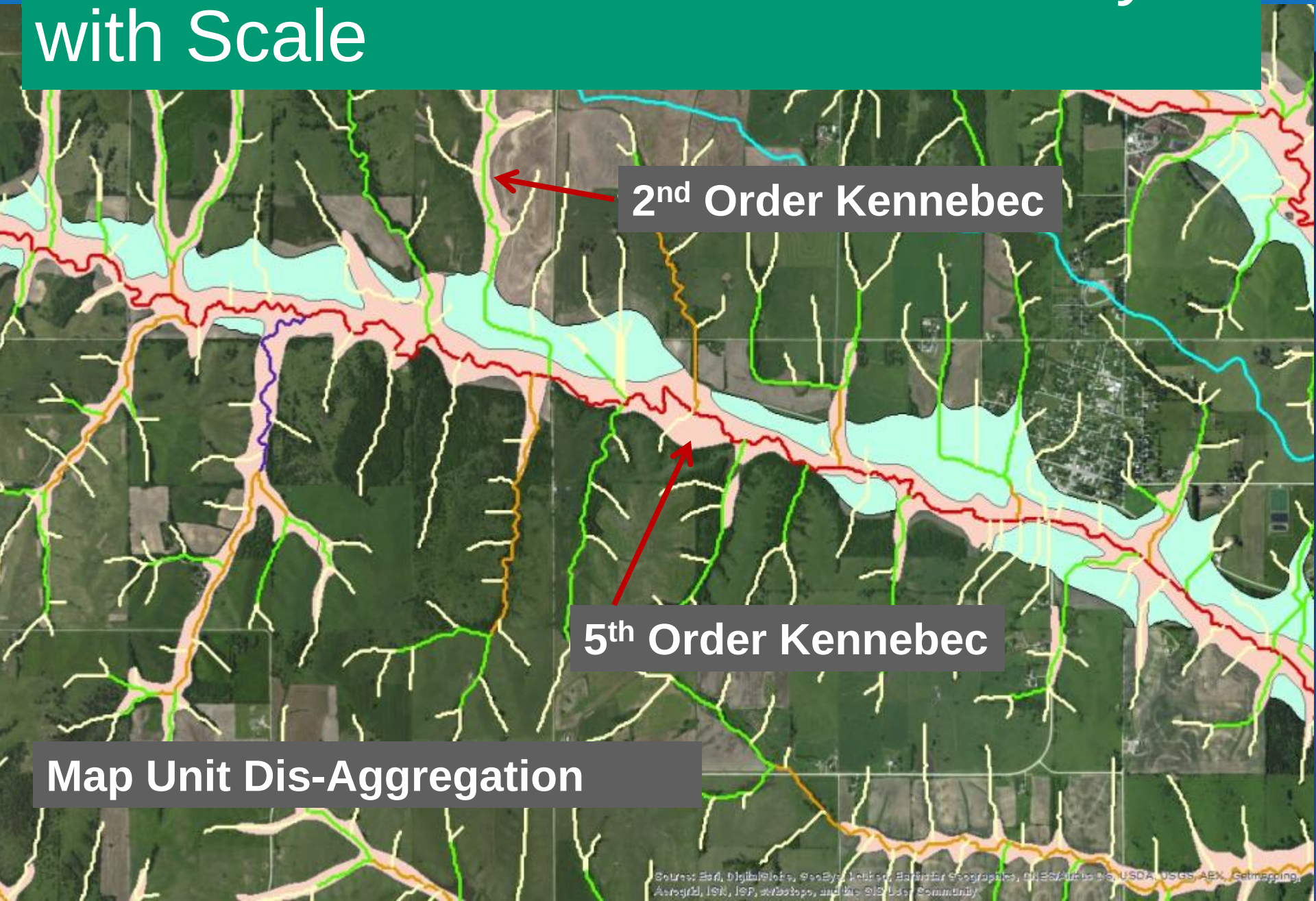
Same Map Units Correlate to Similar Landscapes in Adjacent HUCS (Same MLRA)



Landscape Boundaries - RIVERINE



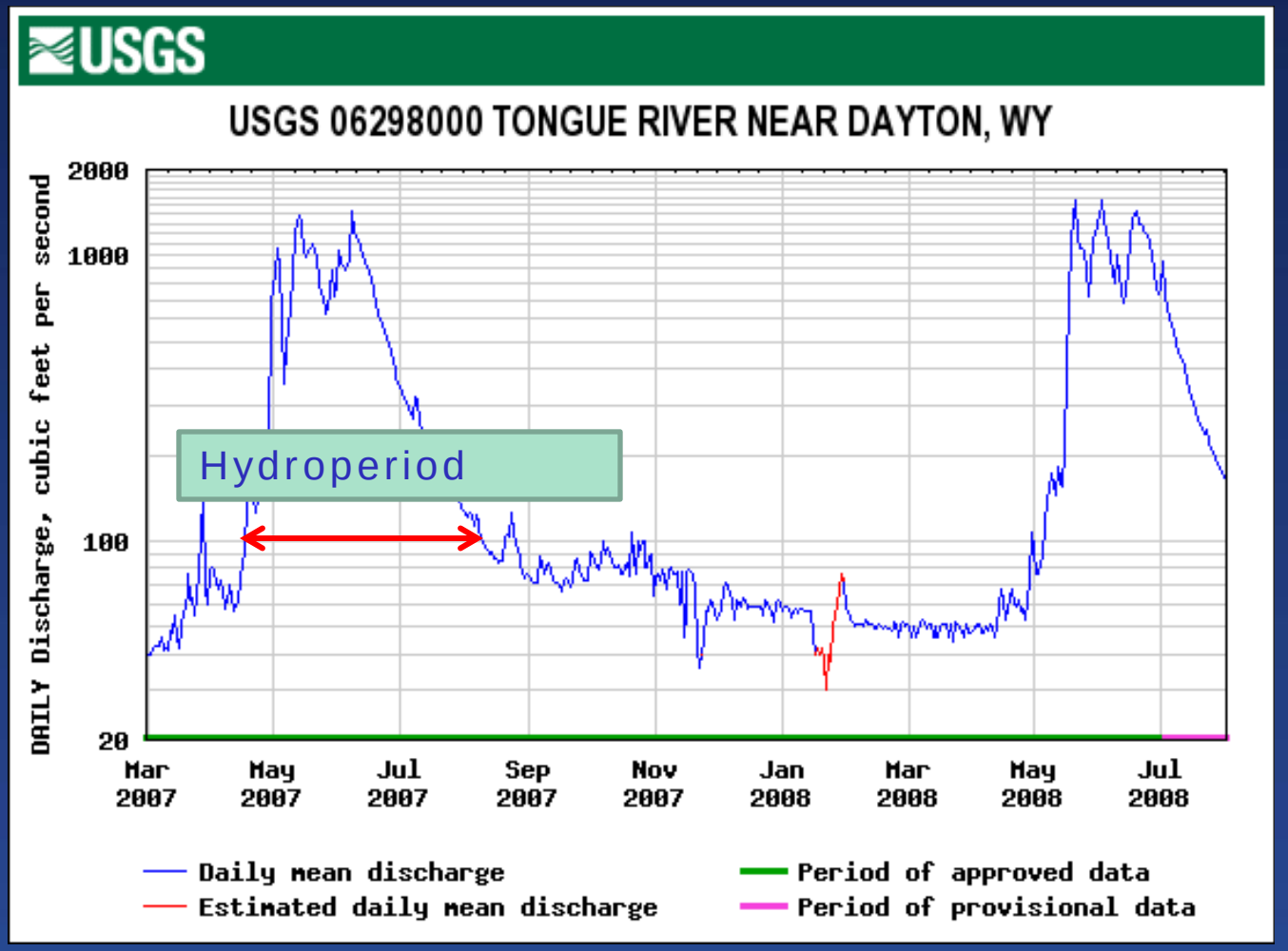
Problem! – Stream Functions Vary with Scale

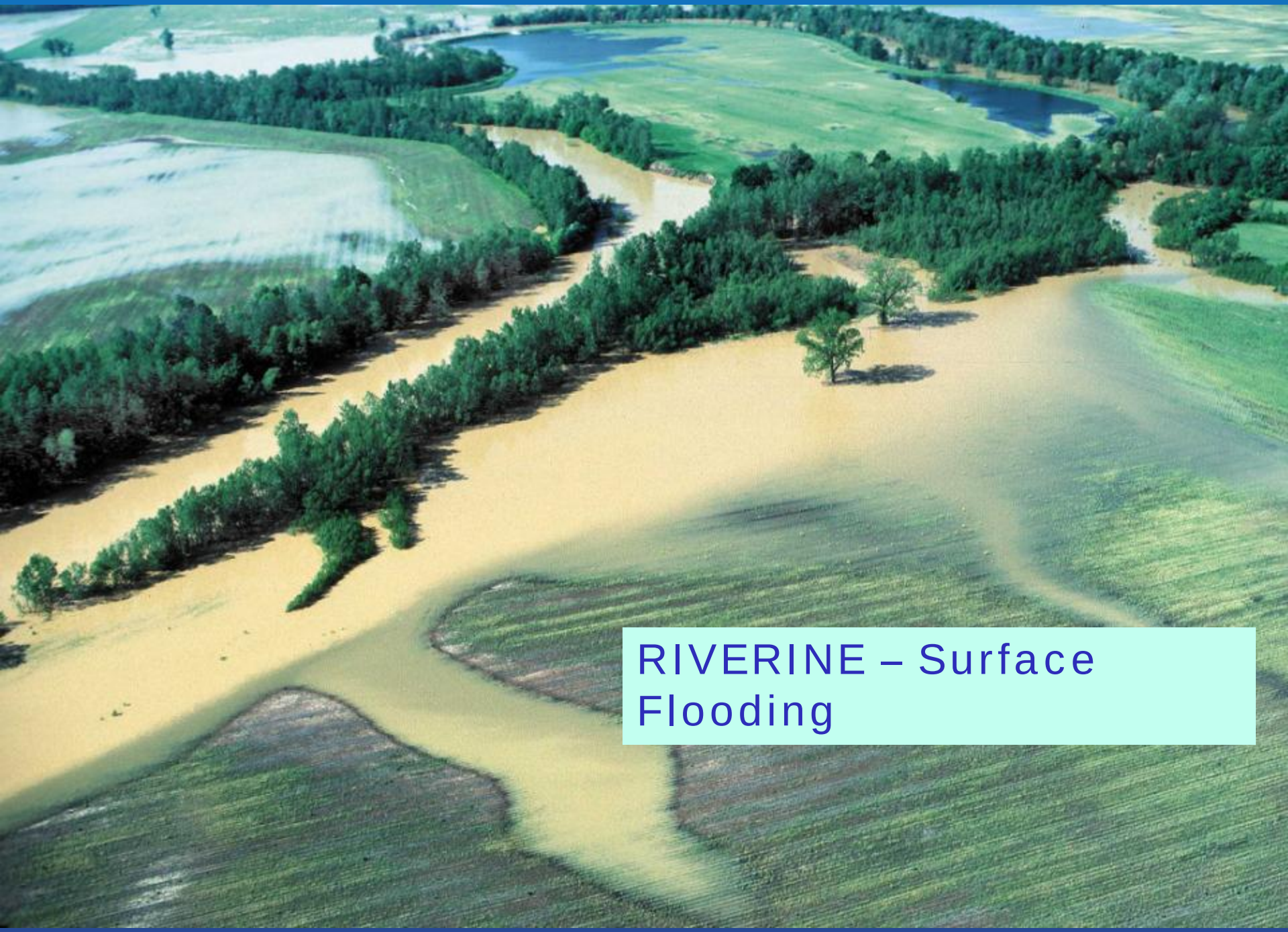


RIVERINE – Dominant Water Source – Stream Hydrograph

SSURGO Water Features

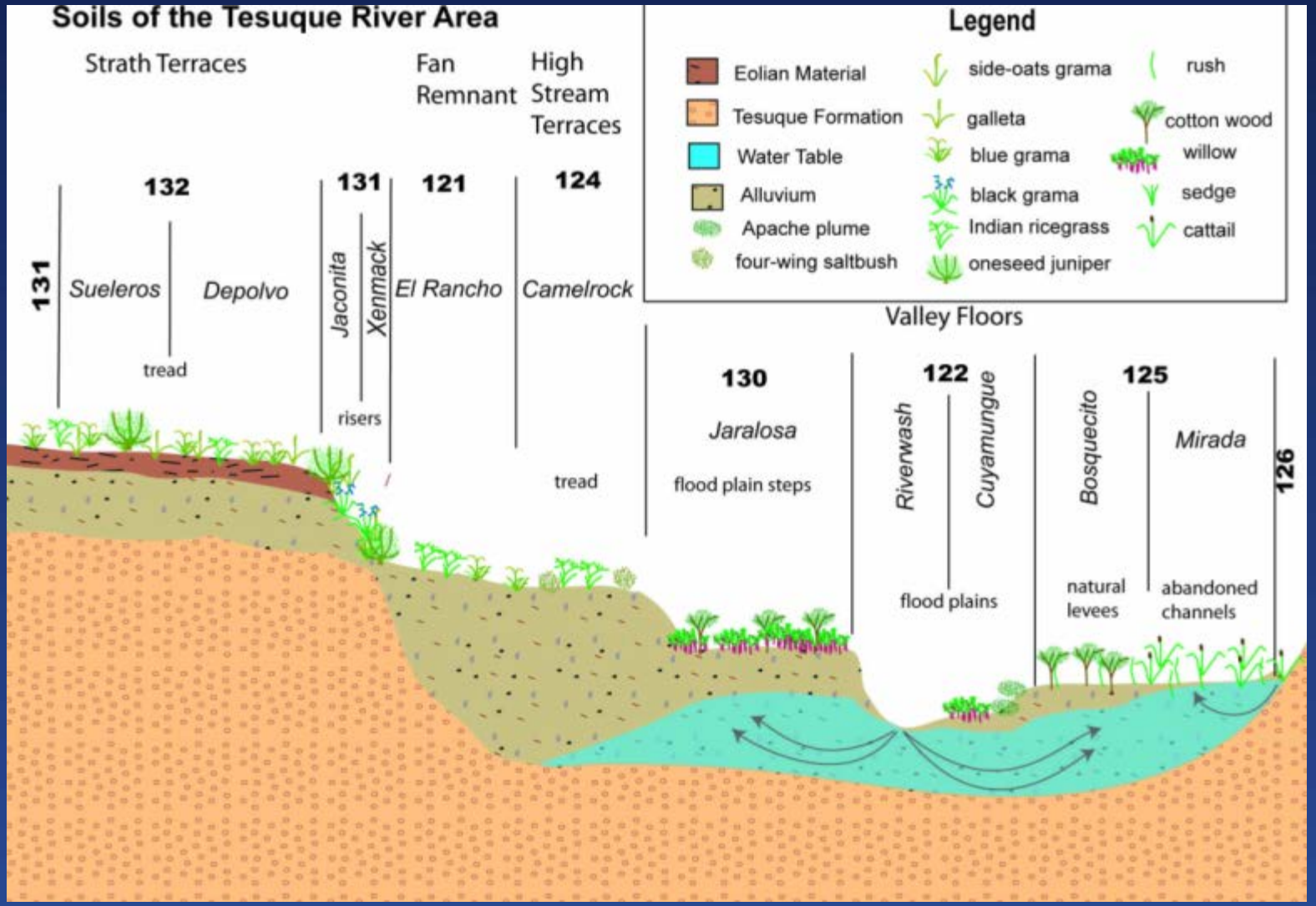
- **Flooding**
- **Ponding**
- **Groundwater**



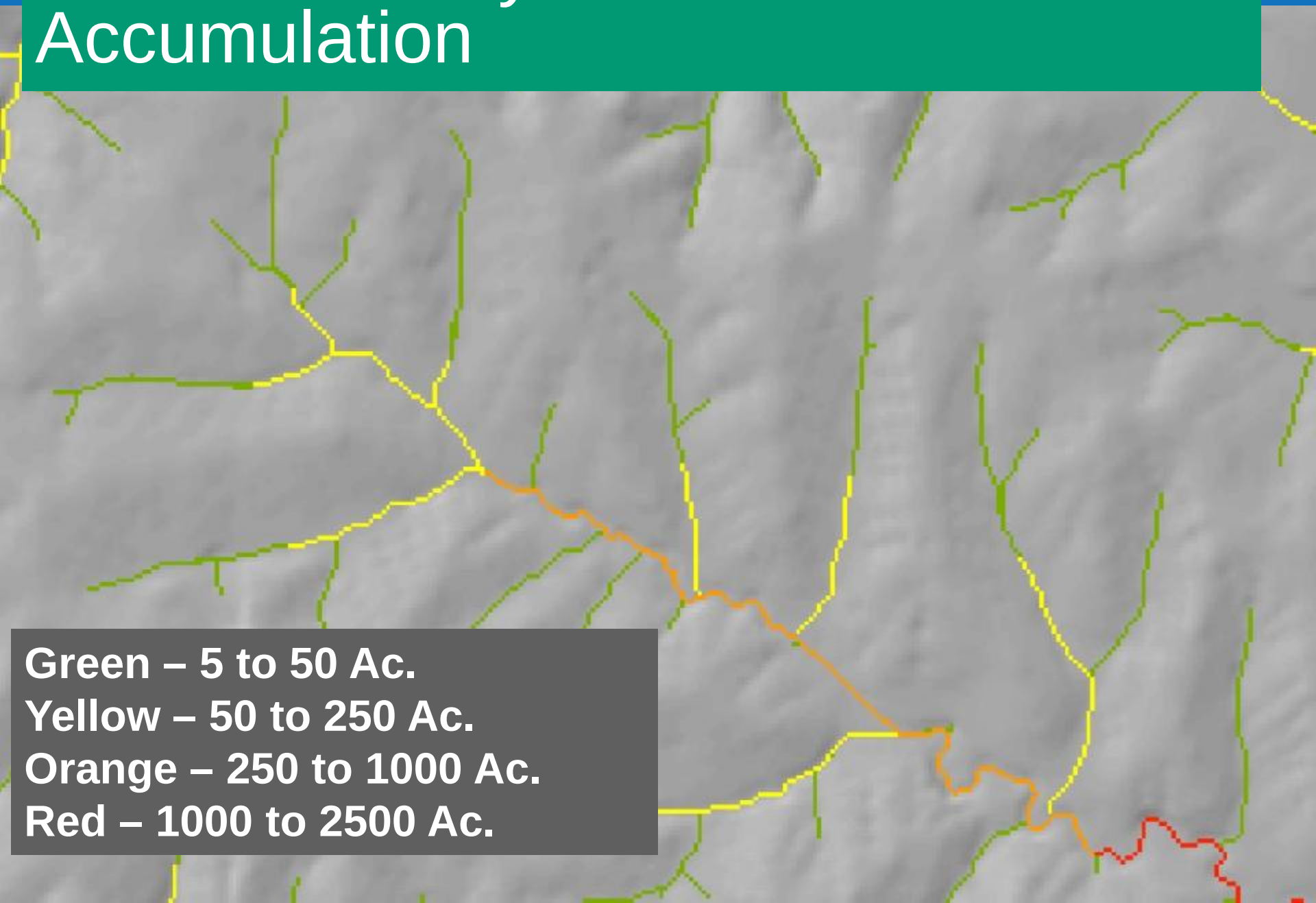

RIVERINE – Surface Flooding

RIVERINE Soil System

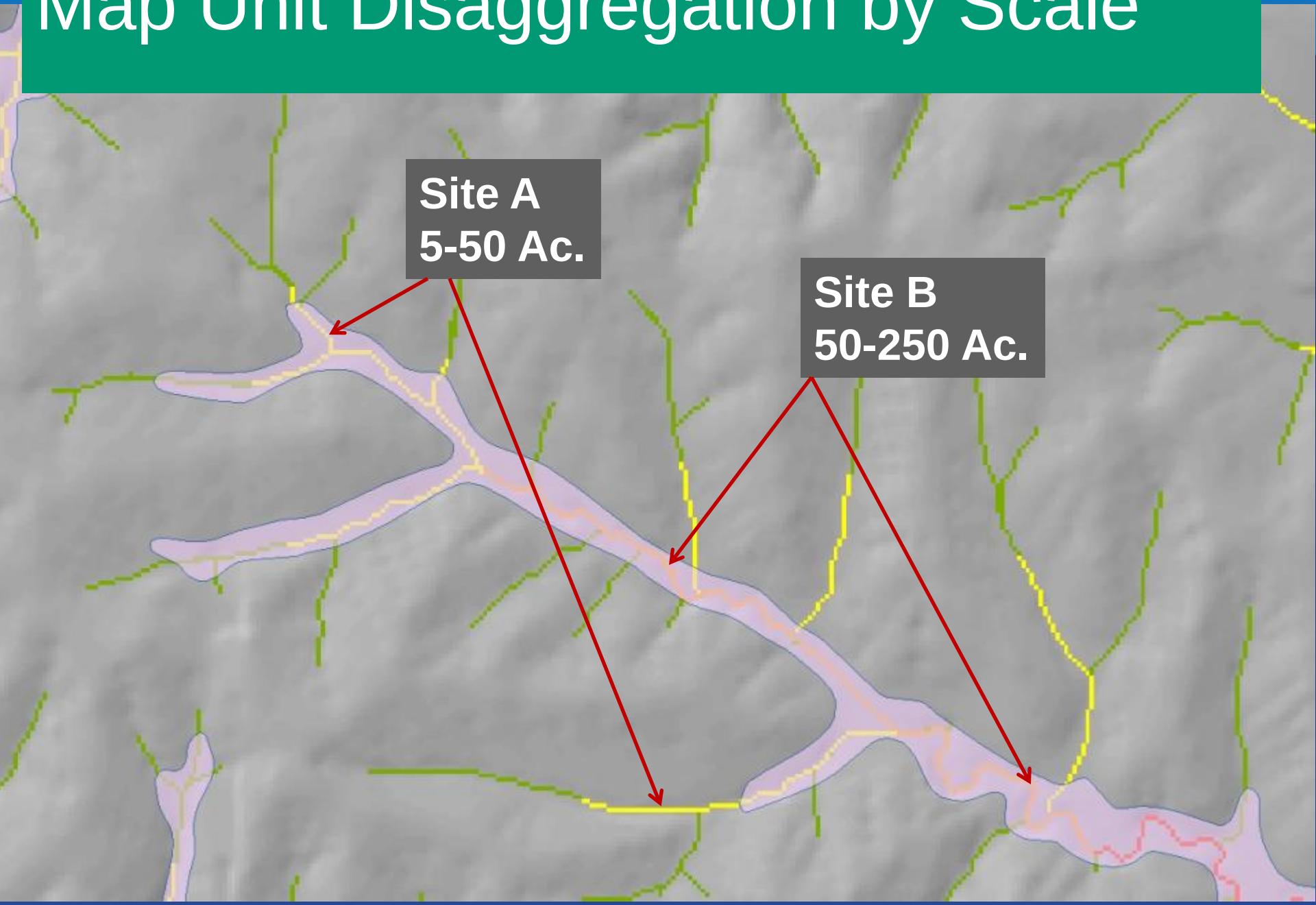
- One Complex Site?
- Several Simple Sites?



Stratification by Scale – Flow Accumulation



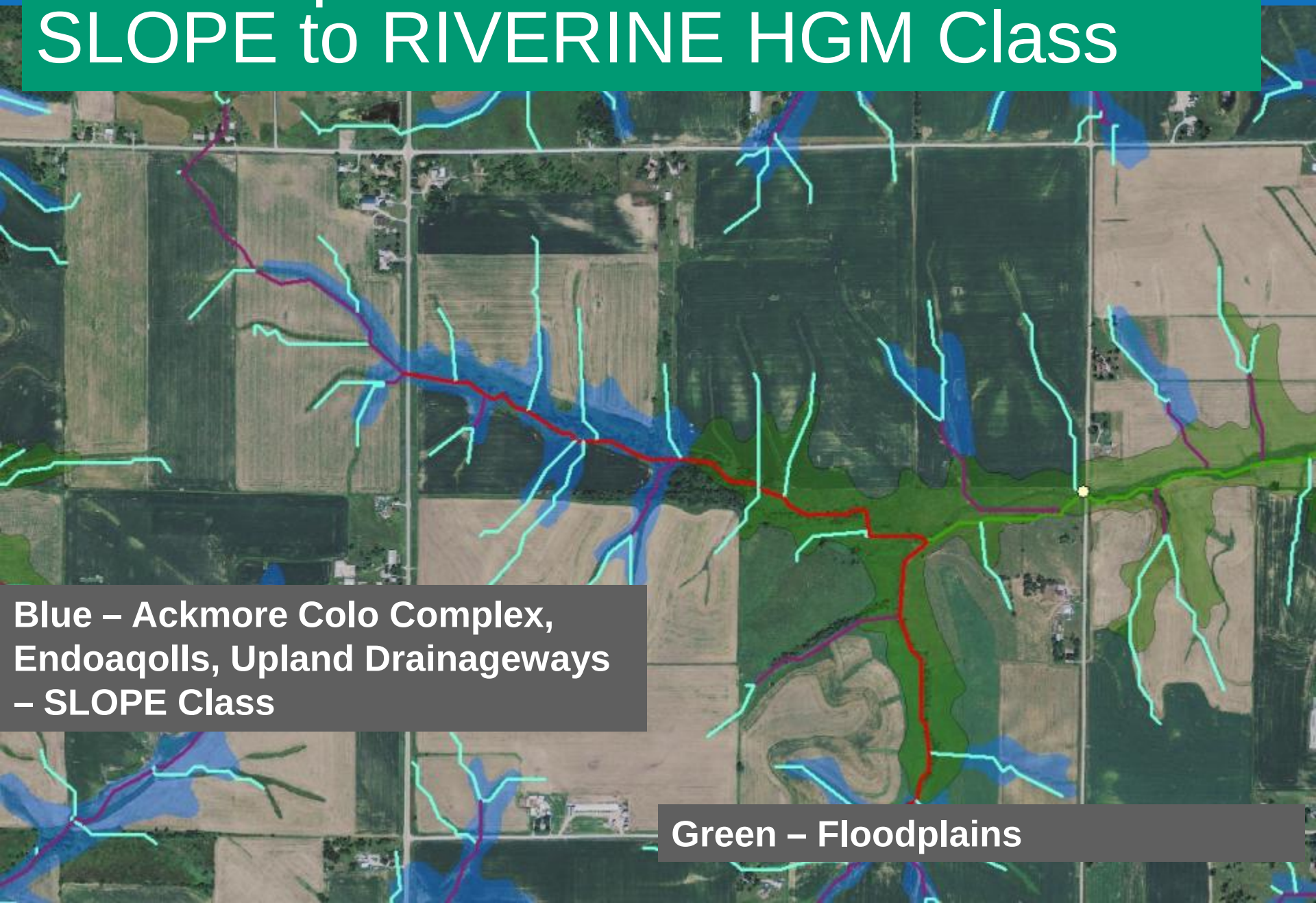
Map Unit Disaggregation by Scale



SLOPE – Headwater Reaches

- Dominant Water Source – Groundwater
- No geomorphic Channel
- Vegetated

Landscape Functional Break: SLOPE to RIVERINE HGM Class



Blue – Ackmore Colo Complex, Endoaqolls, Upland Drainageways – SLOPE Class

Green – Floodplains

SLOPE Wetlands – Unique Functions

Kansas Headwater

Idaho Headwater Fen

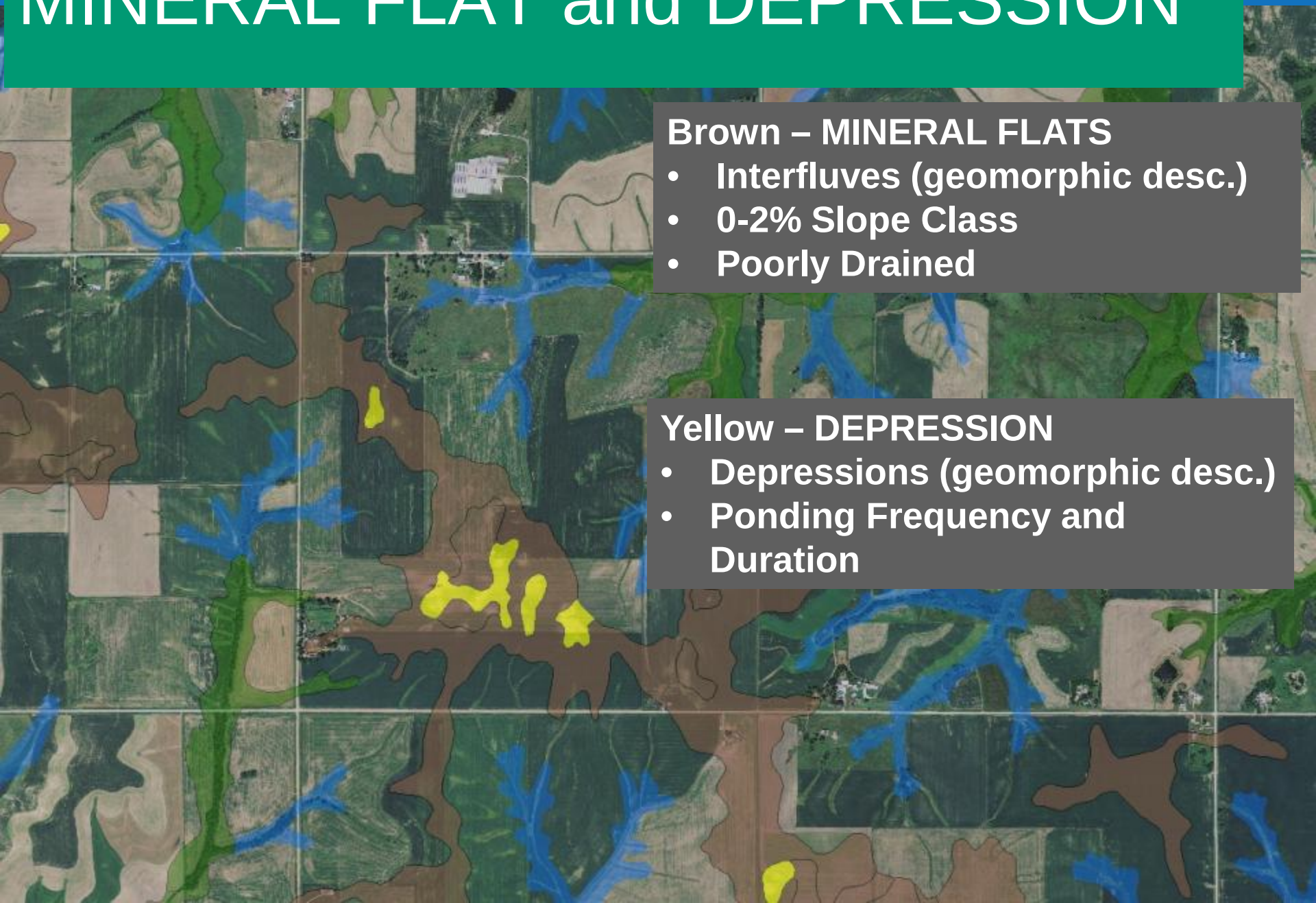
New York Headwater Fen

- Aquifer Storage/groundwater discharge
- Sequestration of Organic Carbon
- Critical Upland Water Sources
- Downstream Baseflow Maintenance

SLOPE Wetland Before "Restoration"

SLOPE Wetland After “Restoration”

MINERAL FLAT and DEPRESSION



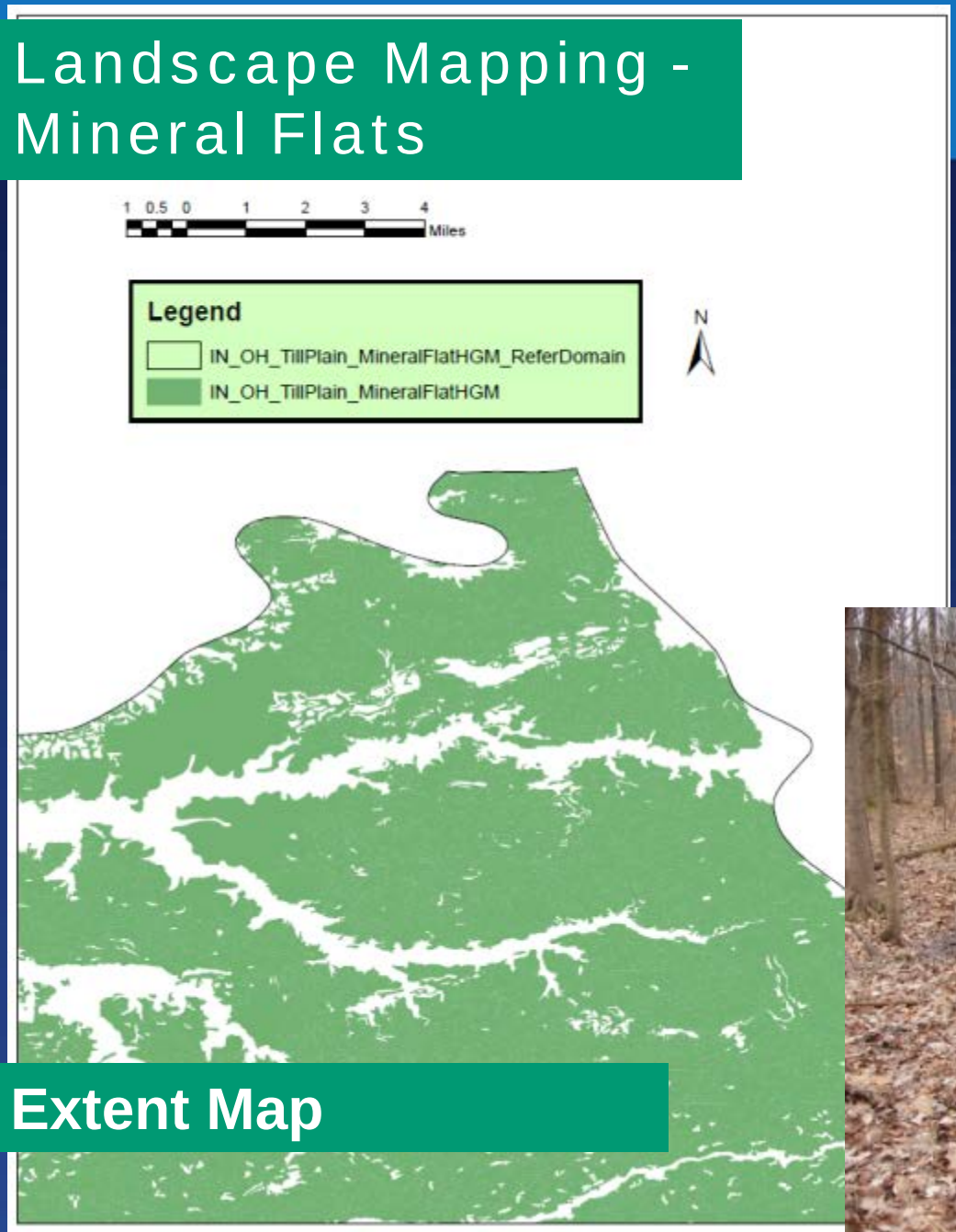
Brown – MINERAL FLATS

- **Interfluves (geomorphic desc.)**
- **0-2% Slope Class**
- **Poorly Drained**

Yellow – DEPRESSION

- **Depressions (geomorphic desc.)**
- **Ponding Frequency and Duration**

Landscape Mapping - Mineral Flats



Extent Map

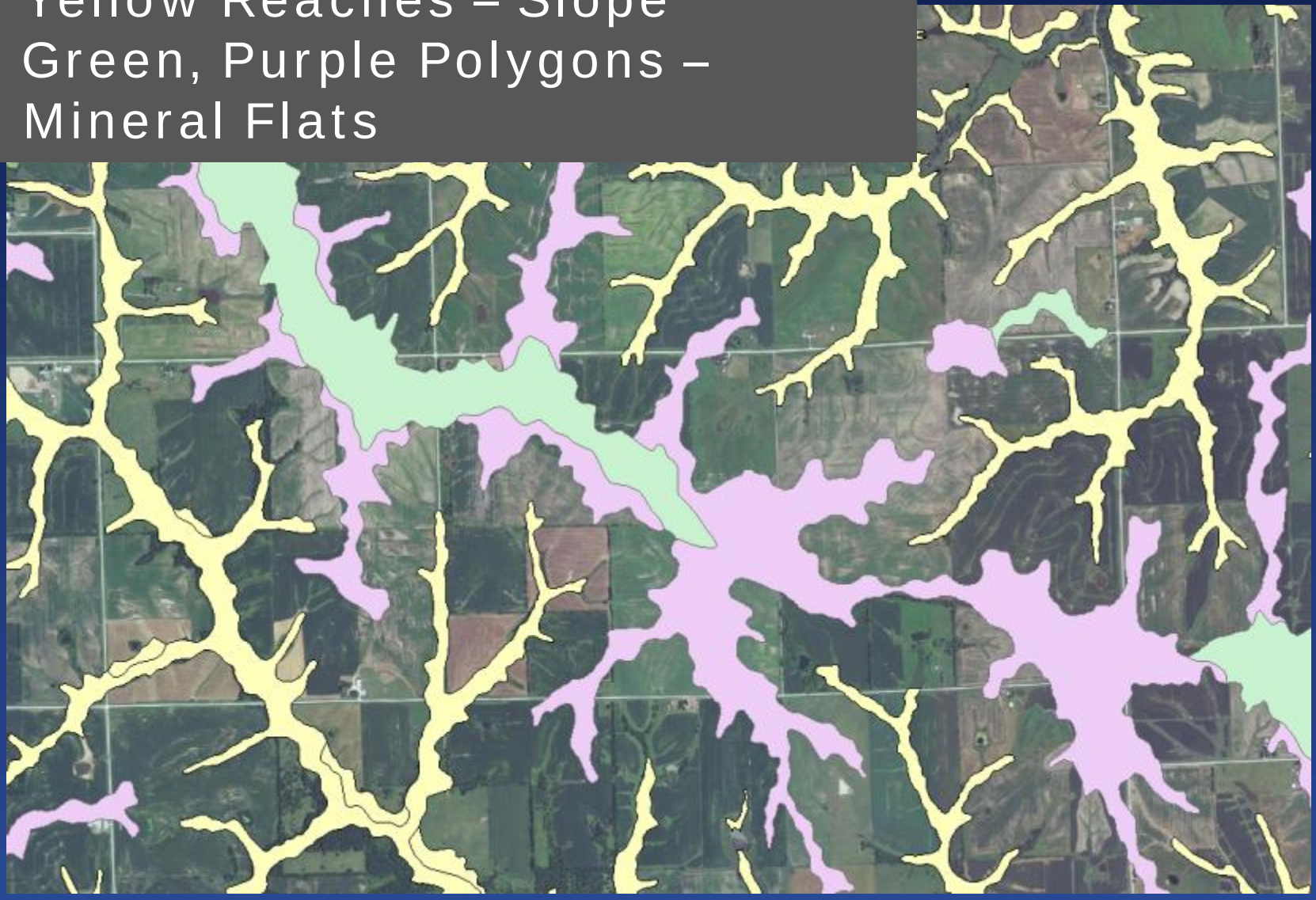
By definition:

- **Below Flow Accumulation Threshold**
- **Outside the Watershed Network**

Headwater SLOPE
Wayne County, Iowa

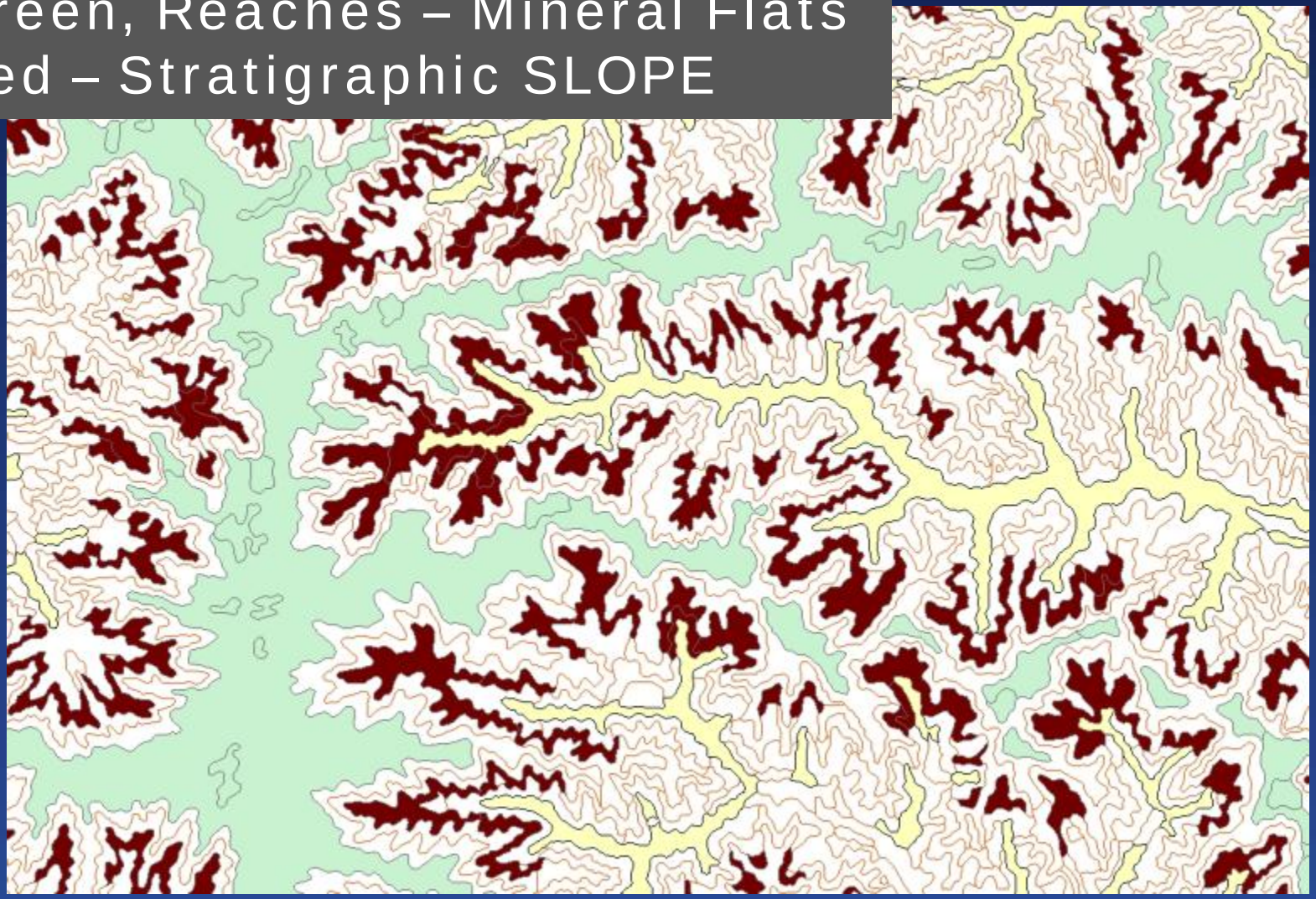
Yellow Reaches – Slope

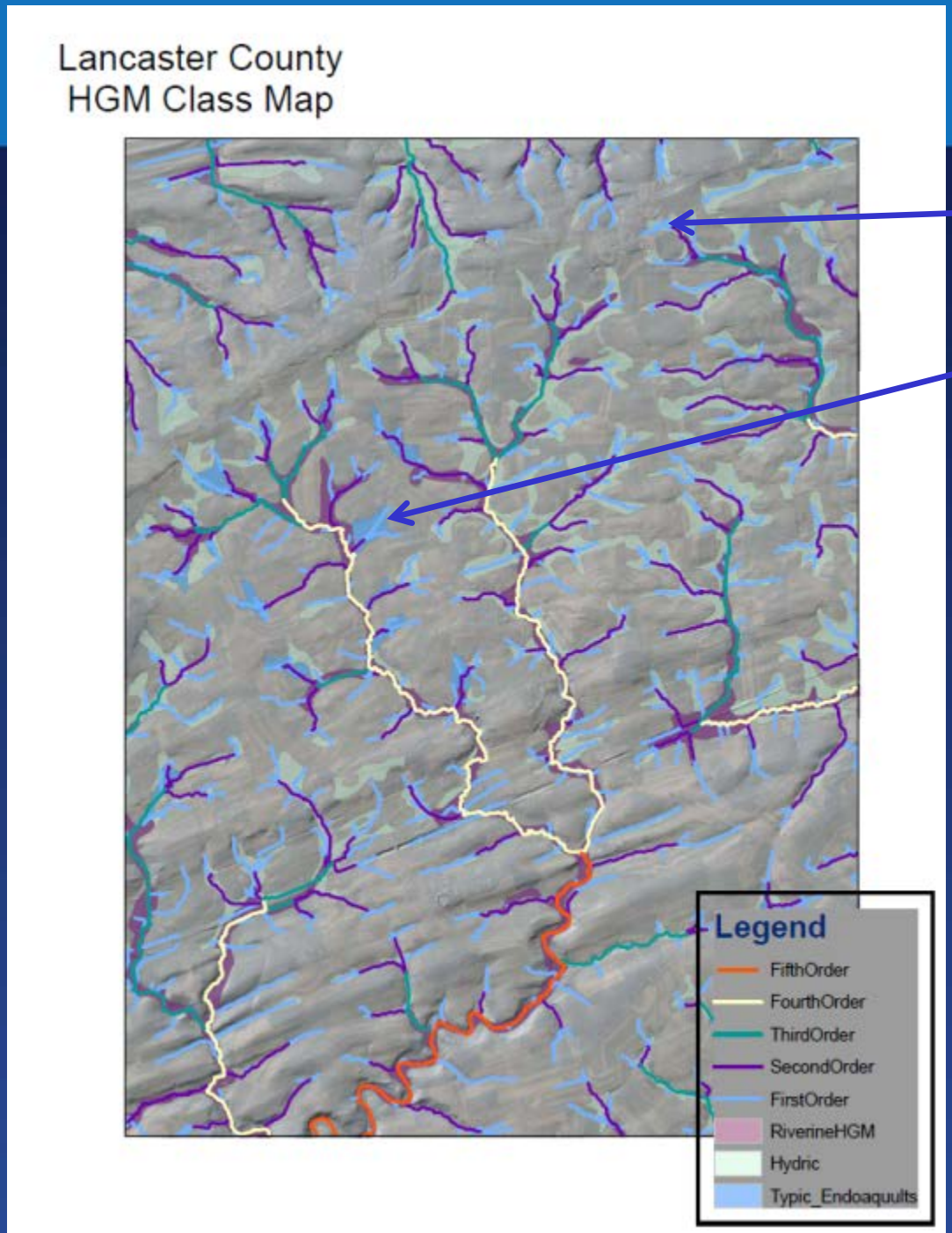
Green, Purple Polygons – Mineral Flats



Stratigraphic SLOPE
Lucas County, Iowa

Yellow Reaches – Slope
Green, Reaches – Mineral Flats
Red – Stratigraphic SLOPE





Potential Bog Turtle Habitat

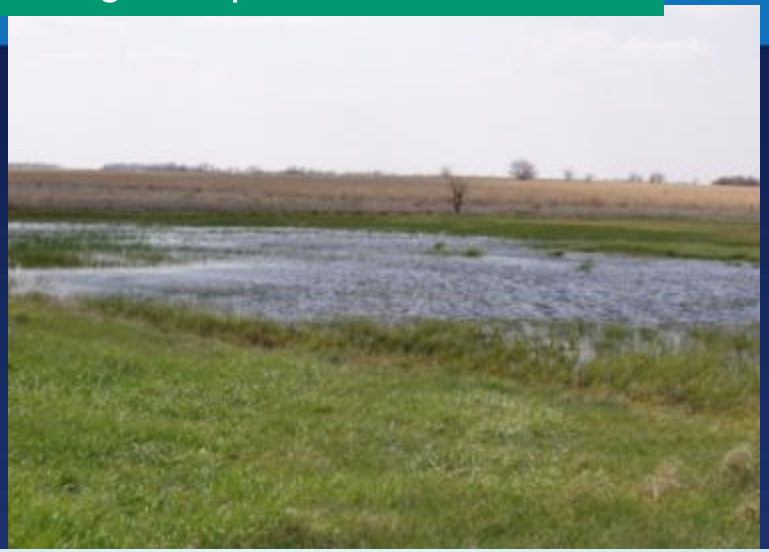
“Typic Endoaquults

Groundwater Dominated Soils In Low Stream Order Landscapes

MINERAL SOIL FLAT Dominant Water Source- Direct Precipitation

DEPRESSIONAL

Nebraska Rainwater Basin – Recharge Depression



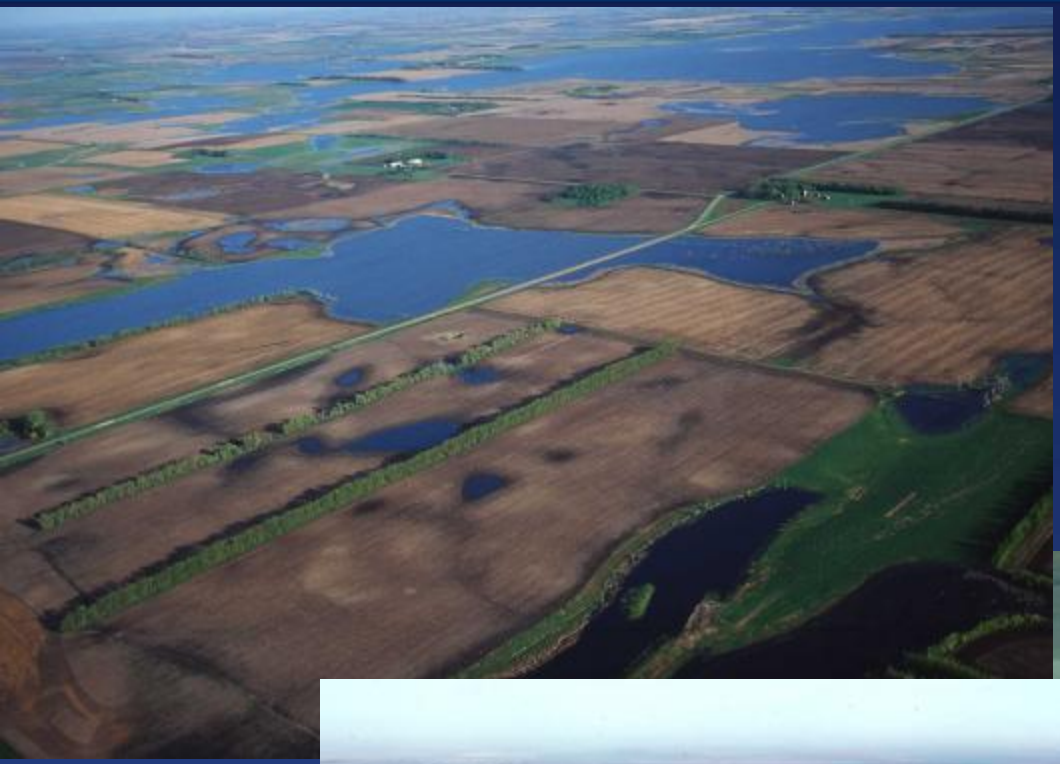
Wyoming – Recharge Depression, Gillette

South Carolina – Carolina Bay

South Dakota Prairie Pothole

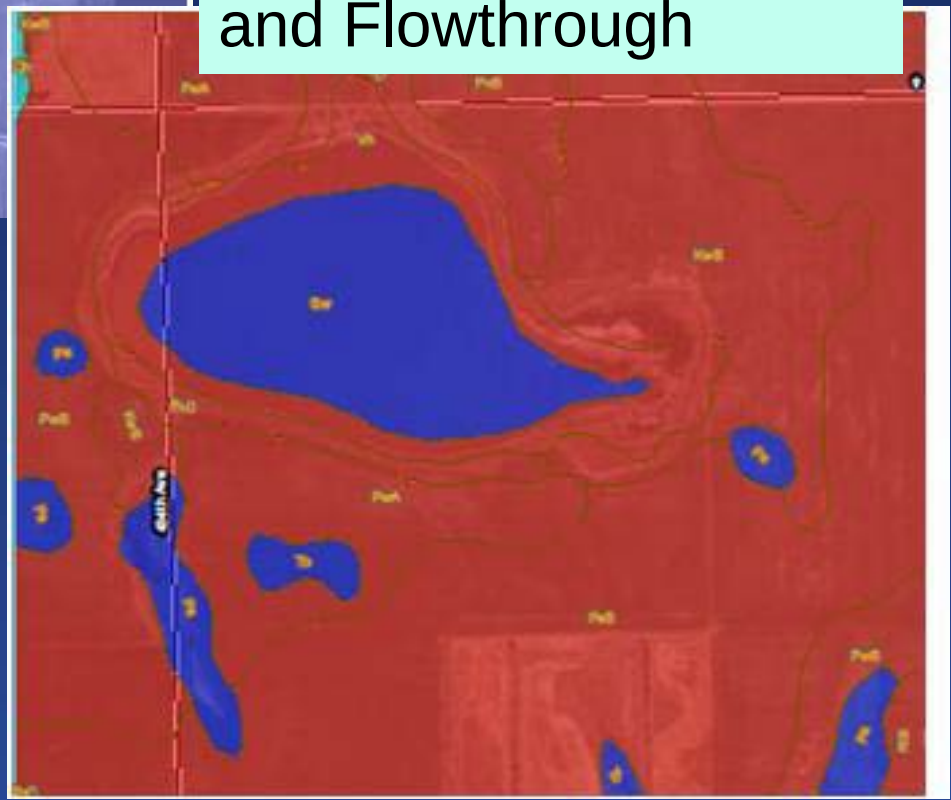
DEPRESSIONAL

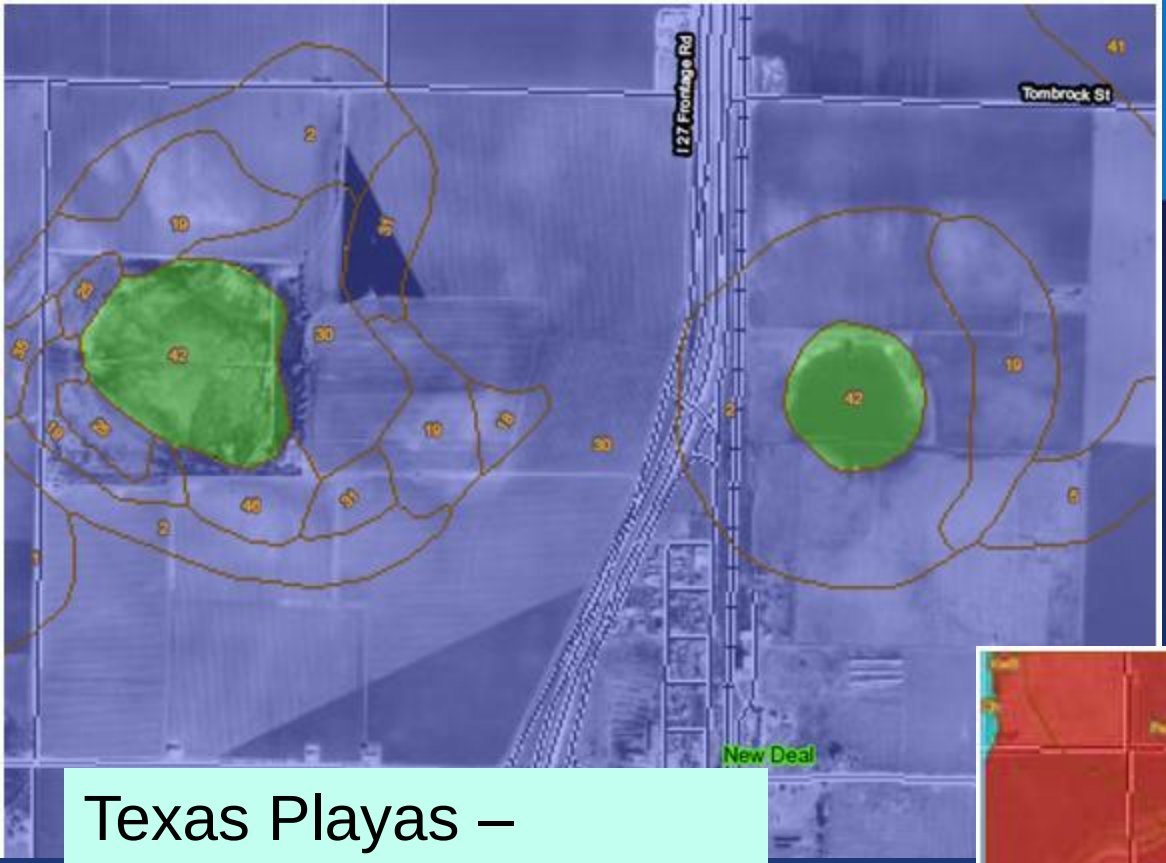
Dominant Water Source – Surface Runoff and/or Groundwater



Depressional- Default if not found on other HGM class

South Dakota Prairie Potholes – Recharge, Discharge, and Flowthrough





Texas Playas – Recharge

Randall Clay

Extent Map Issues

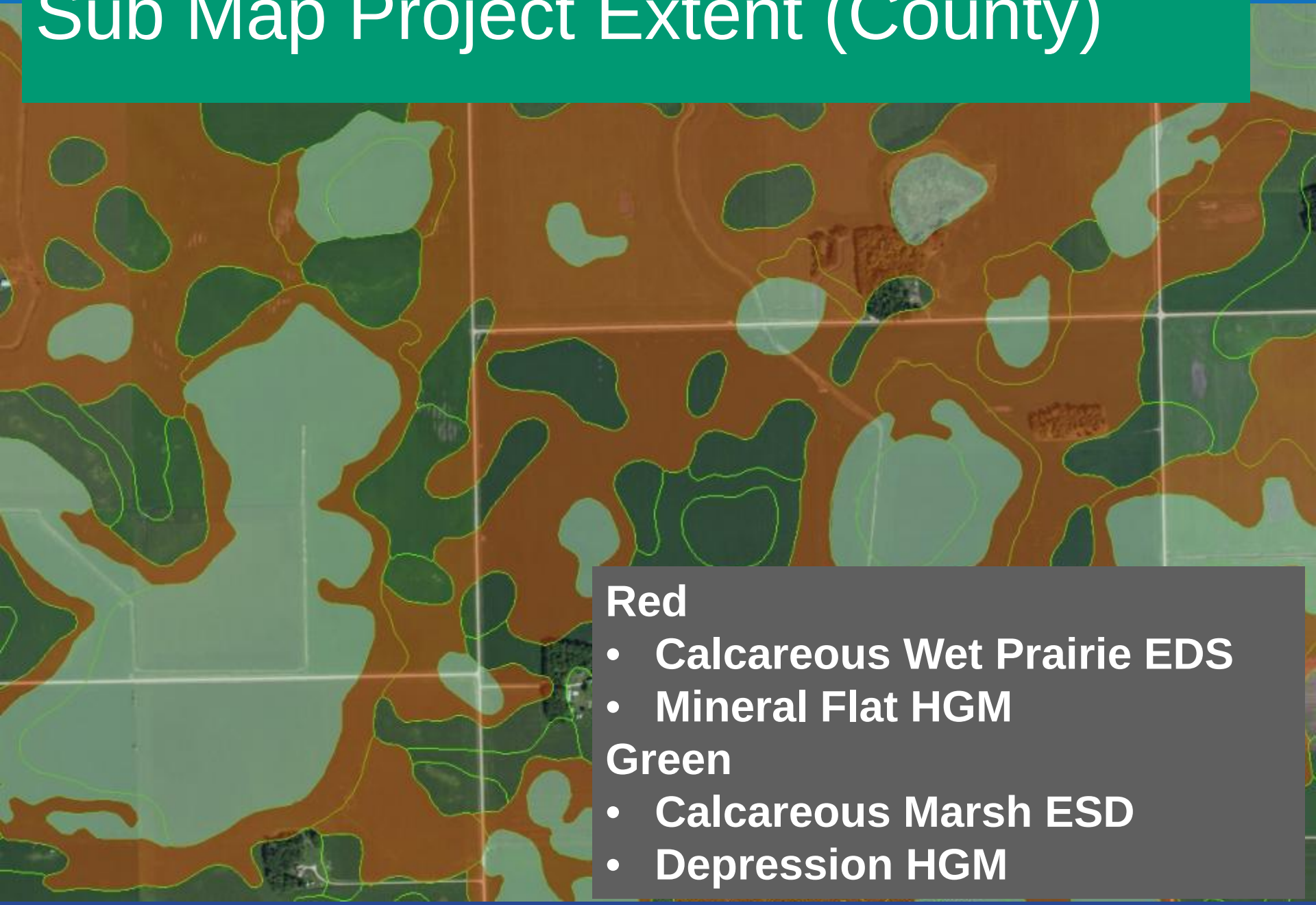
- Soil Mapping on County Scope
- Attributes are not Always Consistent

Ecological Site Extent Map of:

- **Calcareous Marsh**
- **Calcareous Wet Prairie**

Only Map Units Used

Sub Map Project Extent (County)



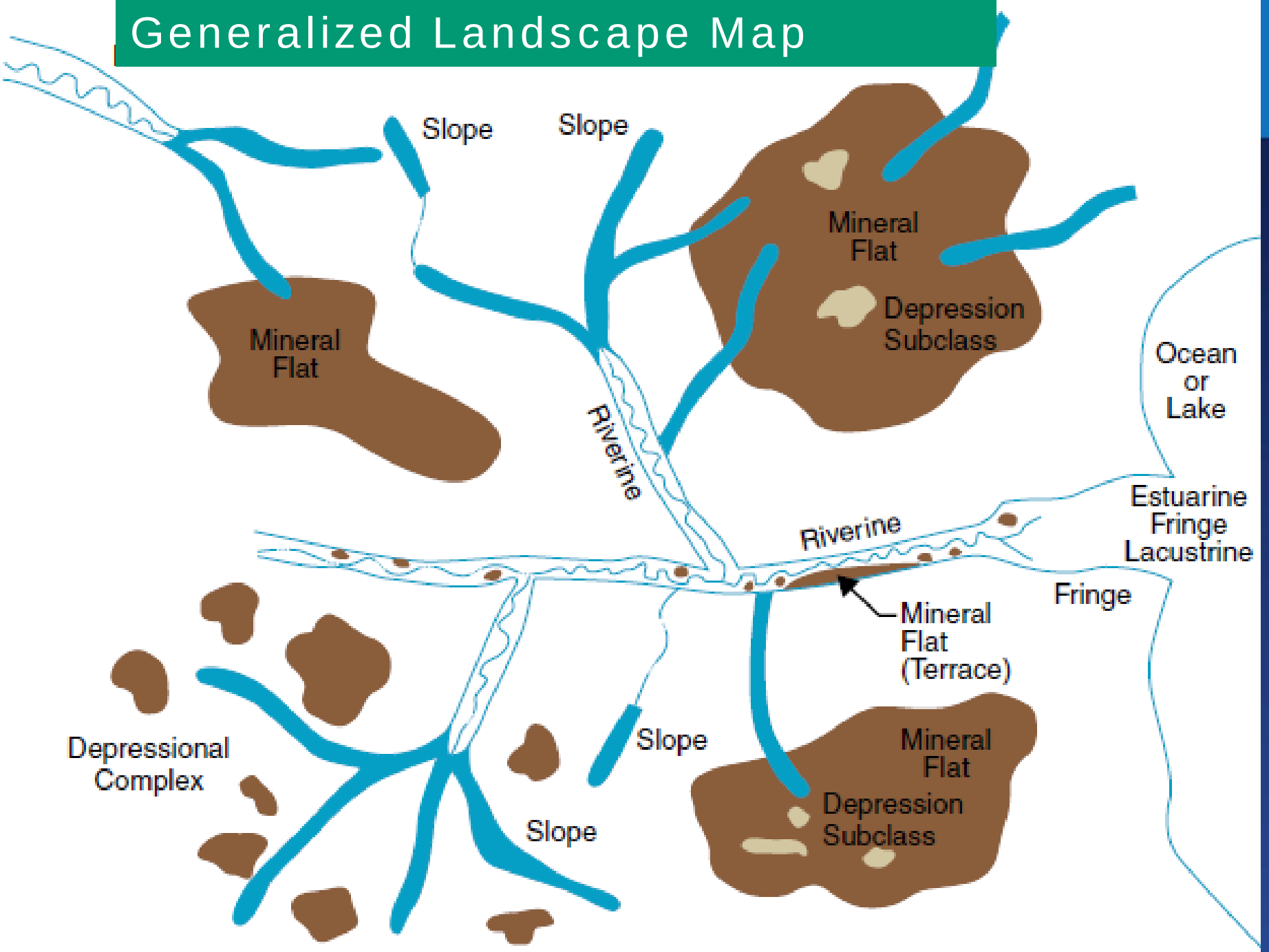
Red

- **Calcareous Wet Prairie EDS**
- **Mineral Flat HGM**

Green

- **Calcareous Marsh ESD**
- **Depression HGM**

Generalized Landscape Map



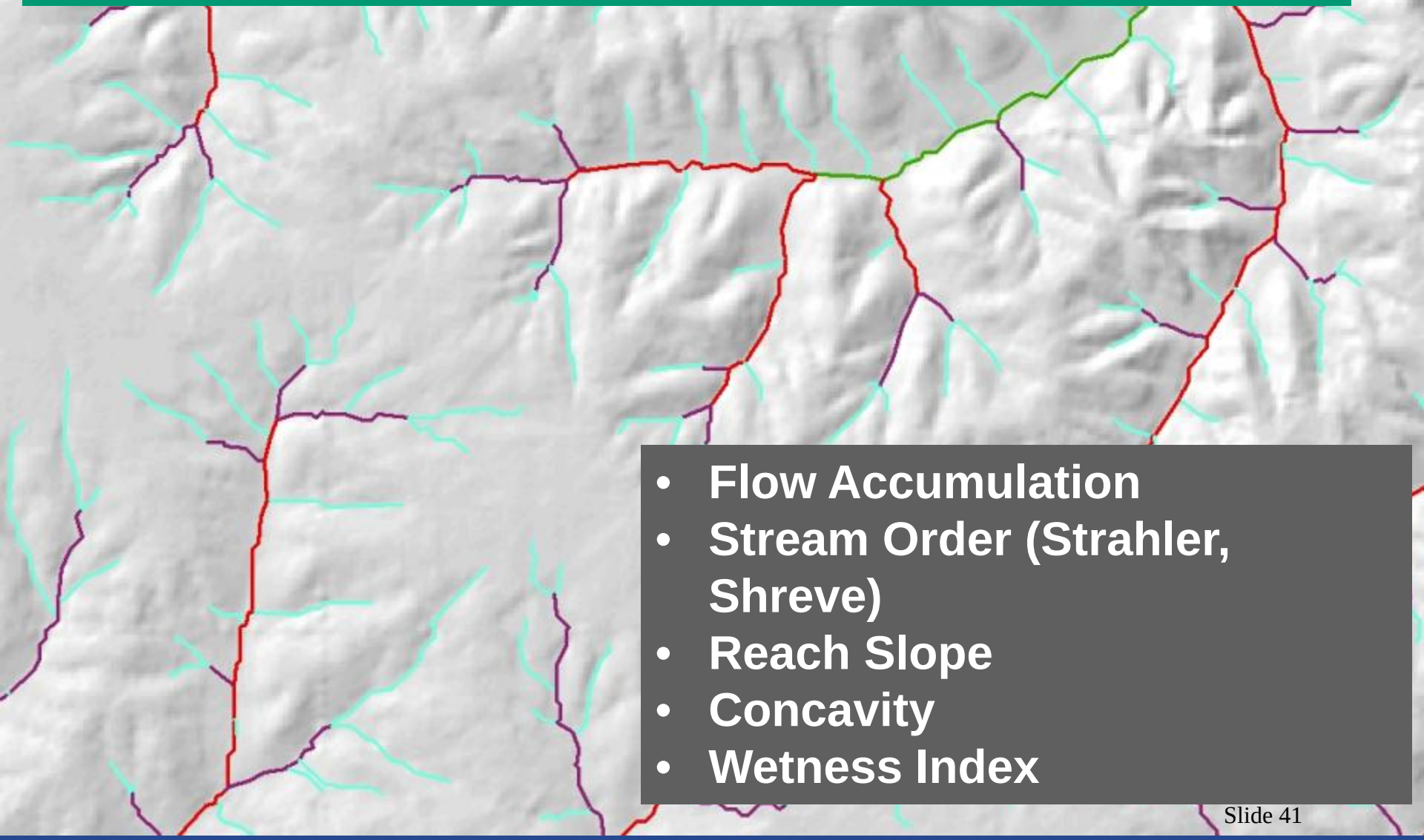
Some Useful Soil Attributes from SSURGO:

- **Geomorphic Description**
- **Drainage Class**
- **Slope Class**
- **Taxonomy**
- **Water Features**
  - **Flooding Freq. and Dur.**
  - **Ponding Freq. and Dur.**
  - **Groundwater Depths**

Useful Database Tables:

- **Component**
- **Map Unit**
- **Map Unit Aggregated Attributes (muaggat)**

Some Useful Spatial Analyst Derivatives from DEM:



- **Flow Accumulation**
- **Stream Order (Strahler, Shreve)**
- **Reach Slope**
- **Concavity**
- **Wetness Index**

The Vision:

- **Use the best of "Worldwide" Classification Systems for Landscapes, Streams, Wetlands, Etc.**
  - **Cowardin**
  - **Rosgen**
- **Use Existing Spatial Definitions for Land as Part of the Local Classification**
  - **HGM Subclass**
  - **Ecological Site**
- **Description Includes**
  - **Where it's at – MLRA**
  - **Spatial Context – Flow Accumulation, Stream Order**
  - **What part of the Watershed it Occupies**
  - **What hydrologic process it performs – recharge, discharge, runoff, runon**
  - **Extent map**

Thanks!

Questions?

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