

Using Lidar to Understand the Landscape



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Small scale: Water (*driving force behind topography*)



Large scale: Water *(driving force behind topography)*



Does not always follow political,
jurisdictional, or social boundary lines



Qulin, Butler County, Missouri

Fluvial Systems *have and still* Function at the Landscape Scale



Swampland late 1880's

Drainage Infrastructure Features
Spring Flood 2011
(soils, hydrology, topography, plants)

Quantifying topography is imperative



Using Lidar for Conservation

- Learning to work with the landscape
 - Wetland Management
 - Wetland Engineering
- Mingo Basin
- Duck Creek Examples
- Recommendations



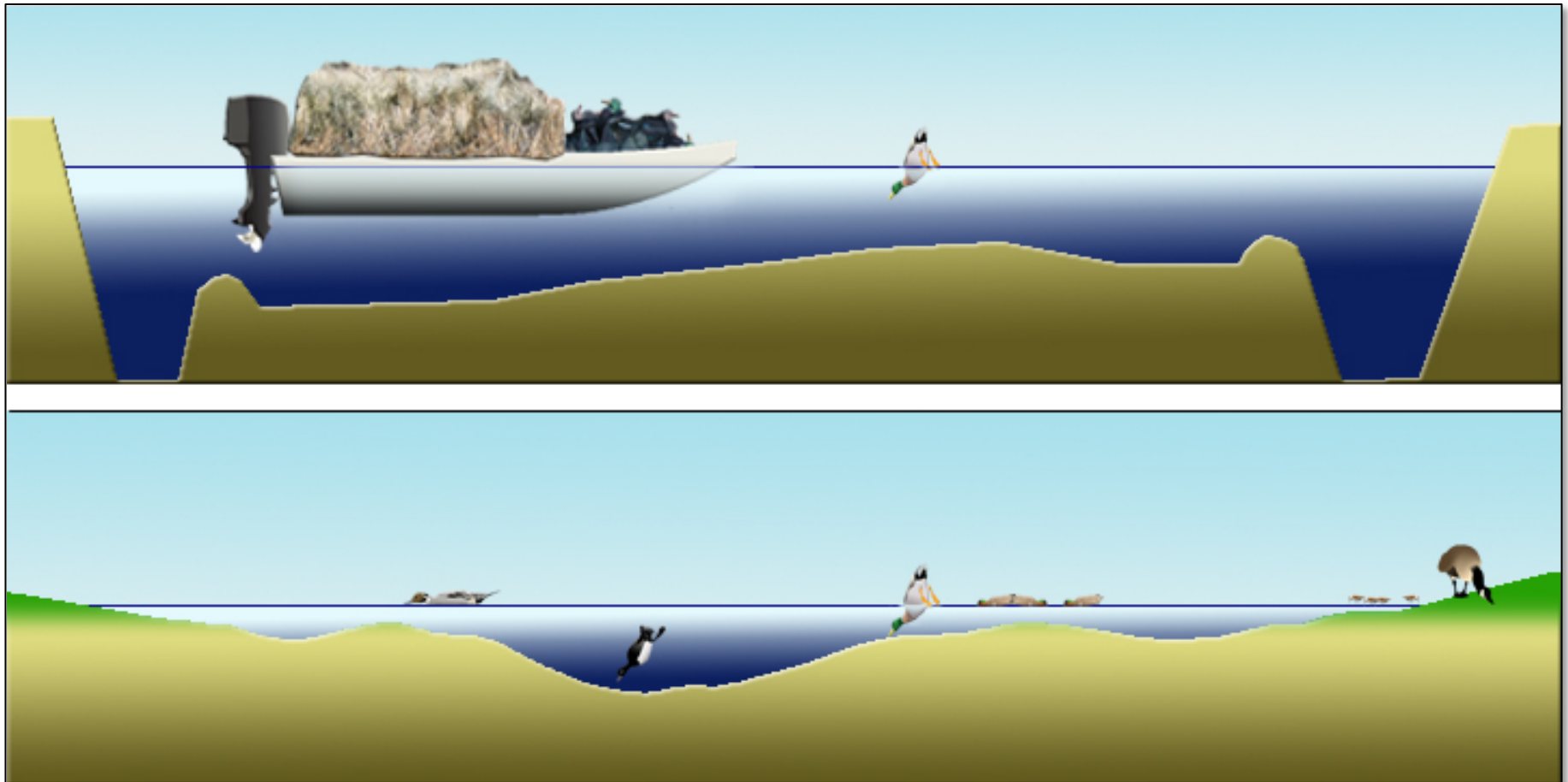
Using Lidar for Conservation

- Communication
- Planning
- Management
- Restoration



Learning to work with the landscape

- Wetland management has evolved over time
 - From hunter access to species requirements



Learning to work with the landscape

- Wetland management has evolved over time
 - From hunter access to species requirements
 - Understanding our place in the landscape (HGM)

Abandoned Channel

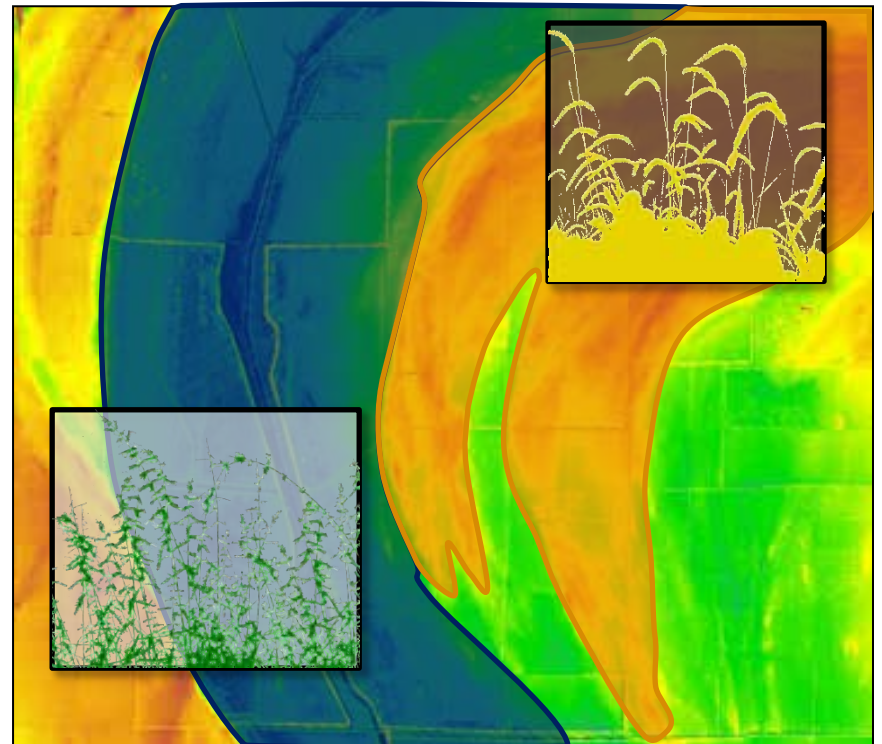
- (wetter, lower, tight soils)

Point Bar

- (drier, higher, sandy soils)

**Interaction of soils,
topography, and water:**

Plant response is different



Learning to work with the landscape

- Wetland management has evolved over time
 - From hunter access to species requirements
 - Understanding our place in the landscape (HGM)
 - Mimicking natural systems



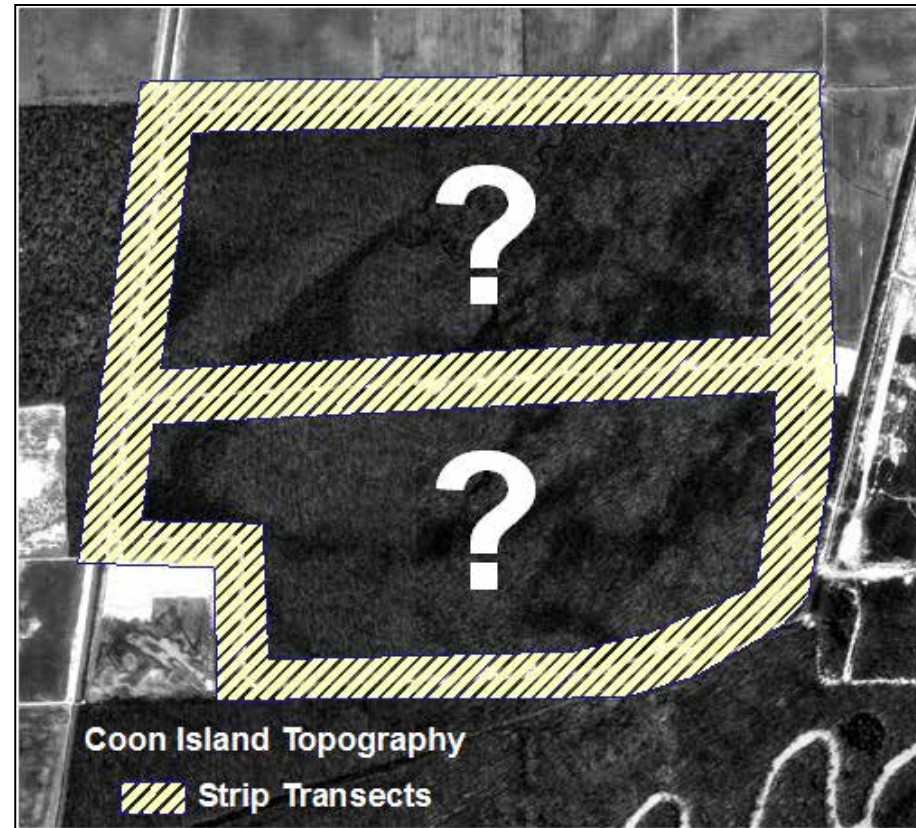
Learning to work with the landscape

- Engineering challenges
 - Scale (boundary lines)



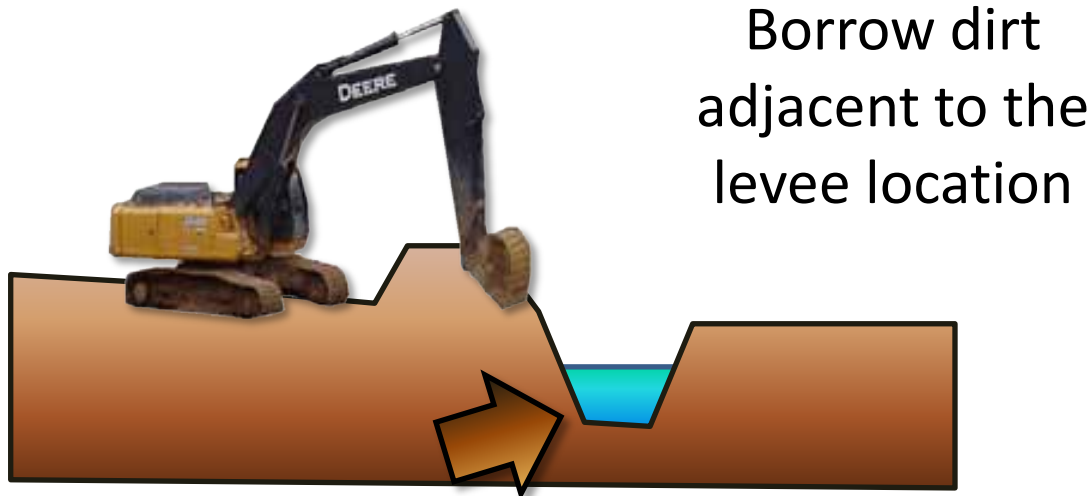
Learning to work with the landscape

- Engineering challenges
 - Scale (boundary lines)
 - Scope (linear, levees)
 - Time constraints
 - Line of site
 - Other priorities:
 - Boundaries
 - Construction



Learning to work with the landscape

- Engineering challenges
 - Scale (boundary lines)
 - Scope (linear, levees)
 - Ease of construction vs long-term maintenance



Pros and Cons

- Cheaper
- Steeper slopes
- Attractive to burrowing animals
- Erosion/repetitive maintenance

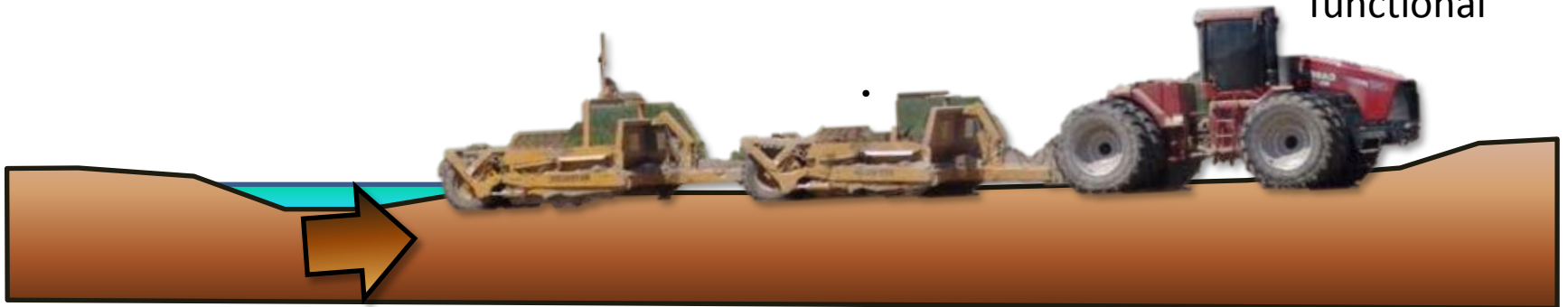
Learning to work with the landscape

- Engineering challenges
 - Scale (boundary lines)
 - Scope (linear, levees)
 - Ease of construction vs long-term maintenance

Borrow dirt within the pool
and hauling it to the levee

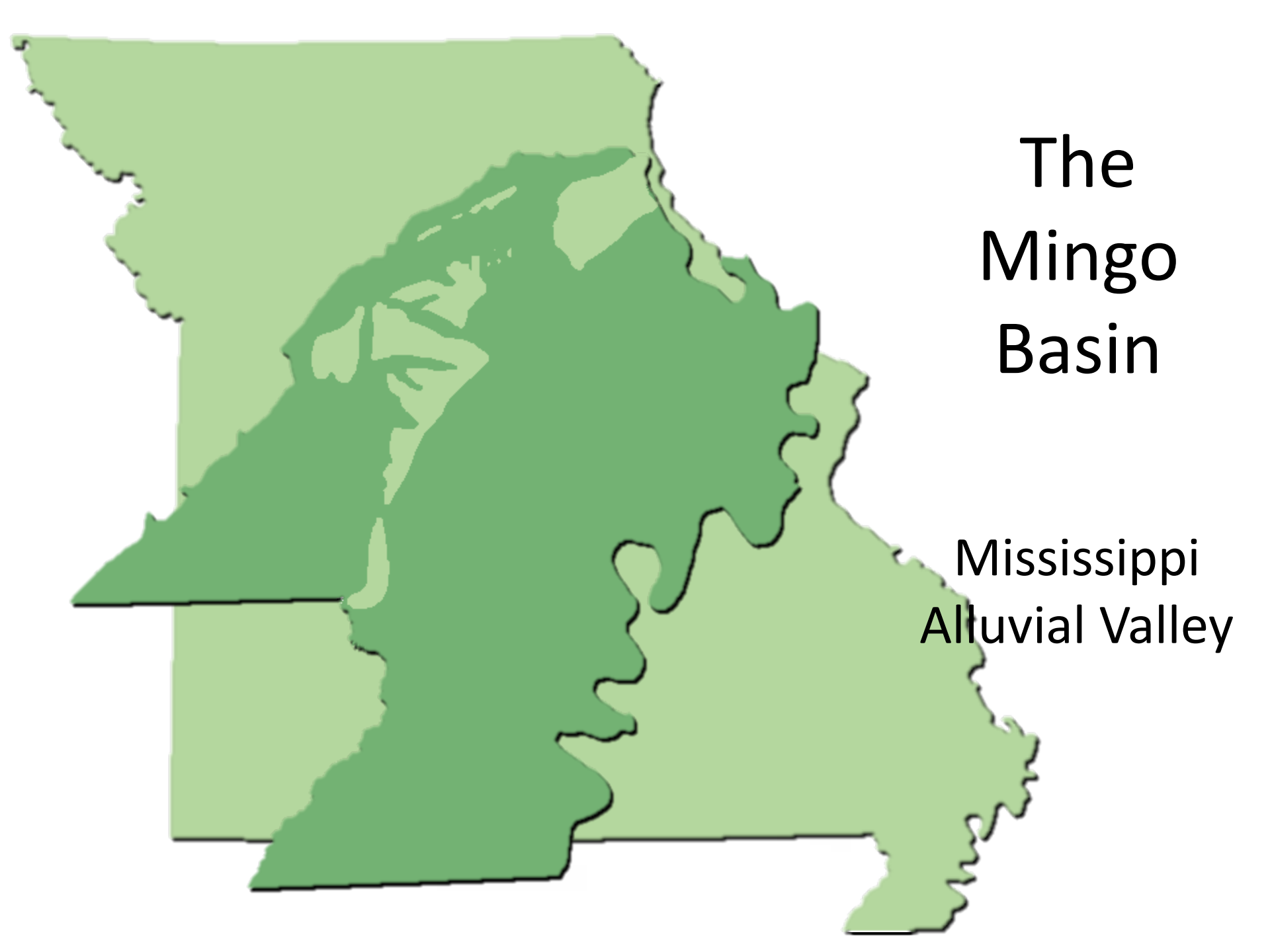
Pros and Cons

- | | |
|--------------------|---------------------------|
| • Different equip. | • Less maintenance |
| • Gradual slopes | • Habitat more functional |



The Mingo Basin

Mississippi
Alluvial Valley

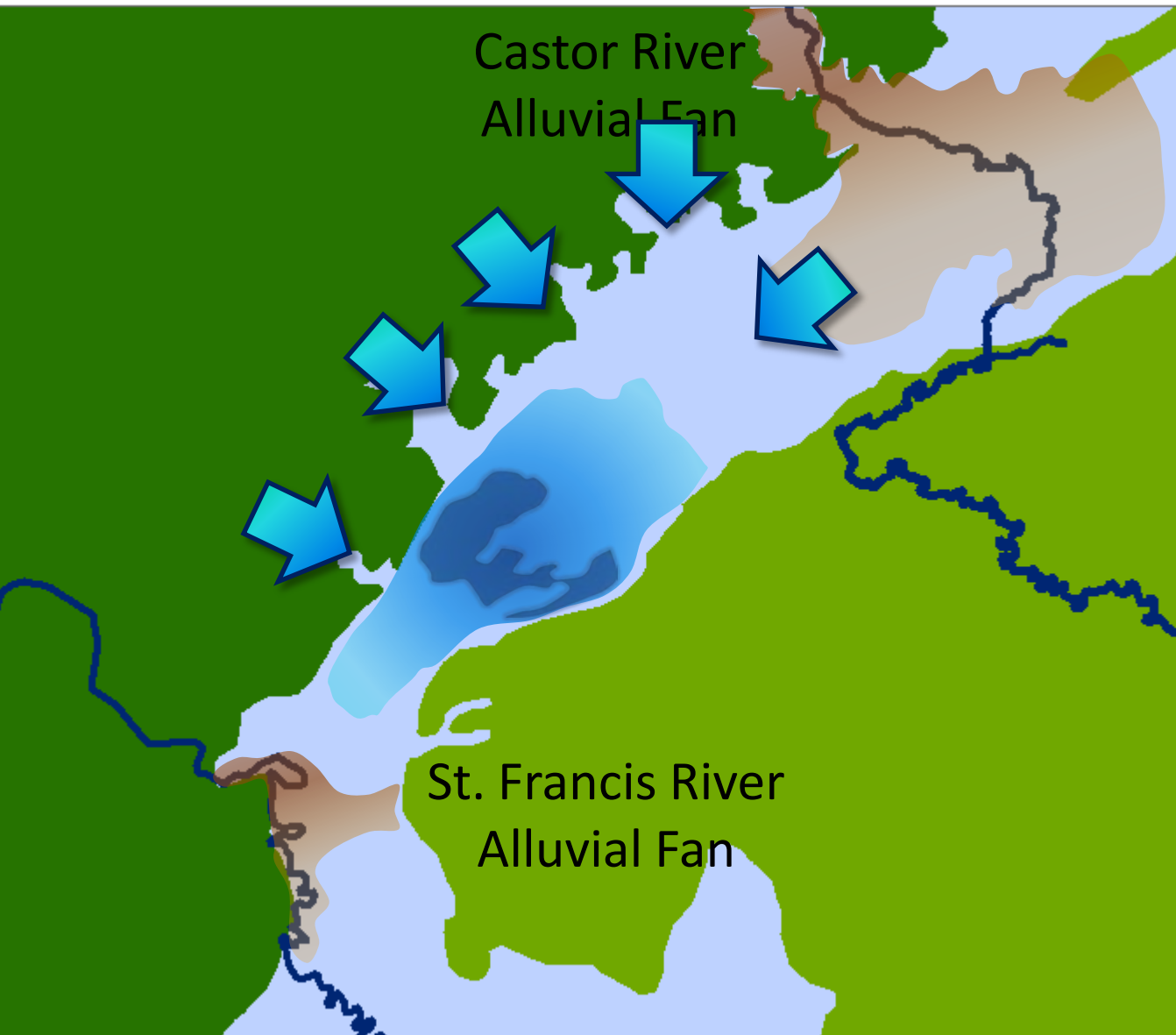




The Mingo Basin

Mississippi
Alluvial Valley

The Mingo Basin

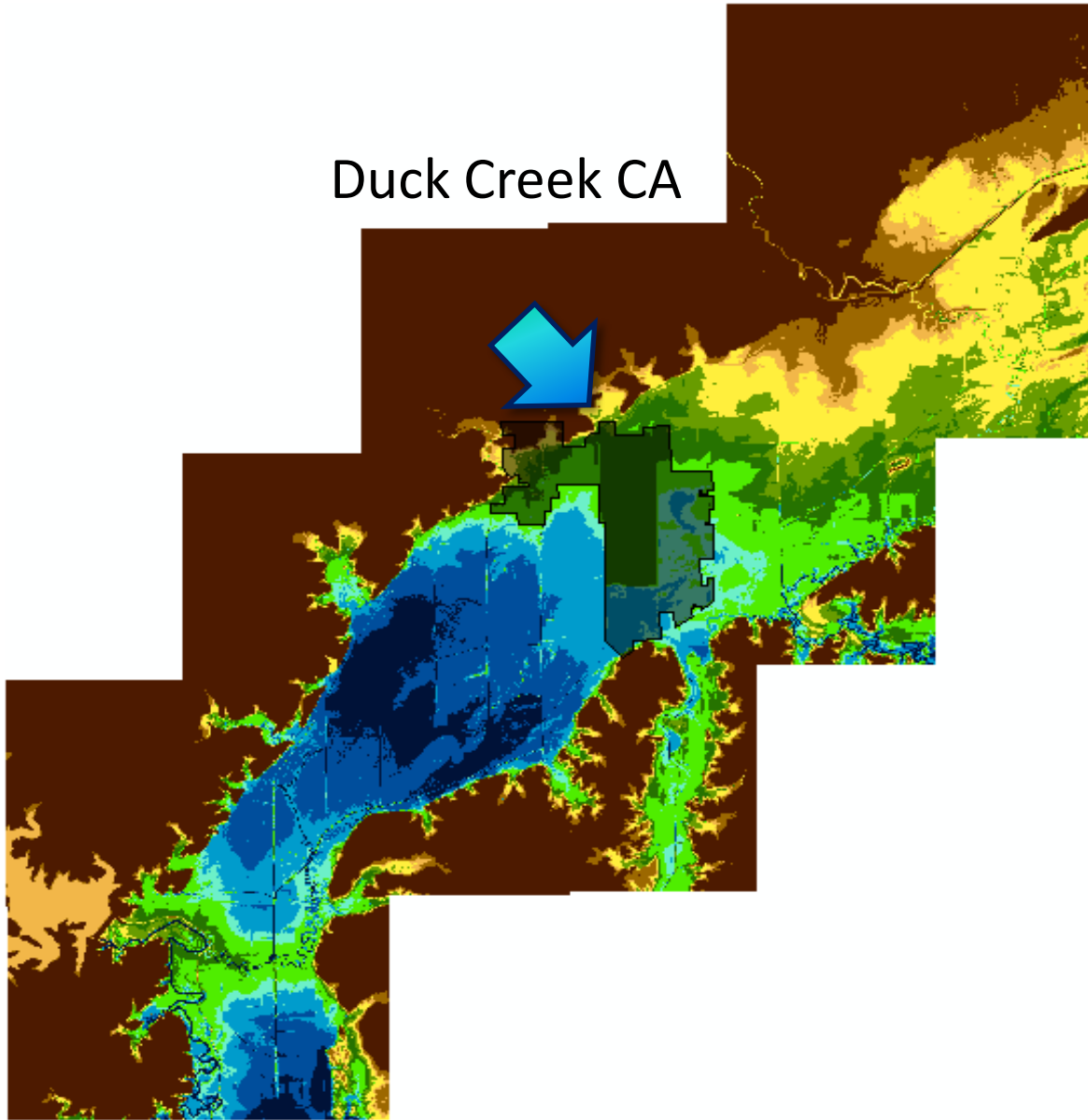




The Mingo Basin

Lidar: Helps
quantify the
shape of the
land

Duck Creek CA



The Mingo Basin

Lidar: Helps quantify the shape of the land...and provide context

Useful communication tool

Spring flood of 2011 in SE Missouri

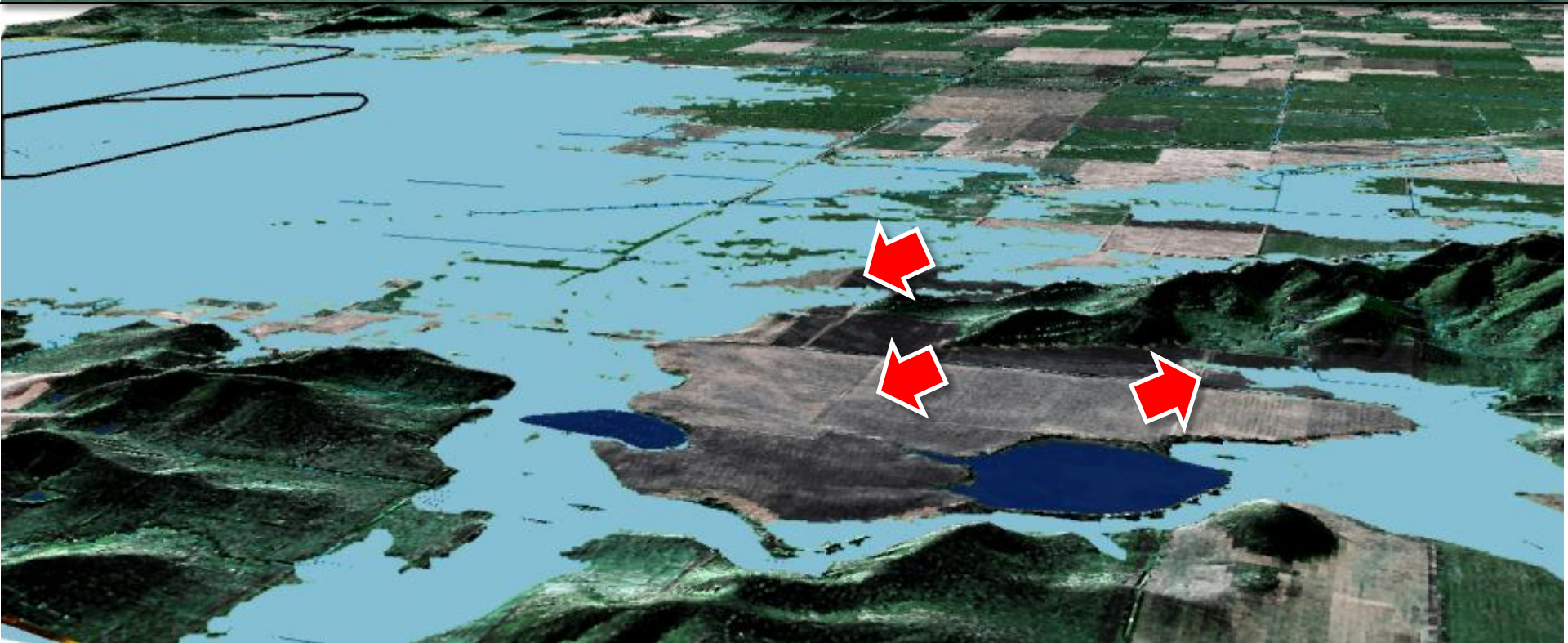
+24 inches of rain within 10 days

??????

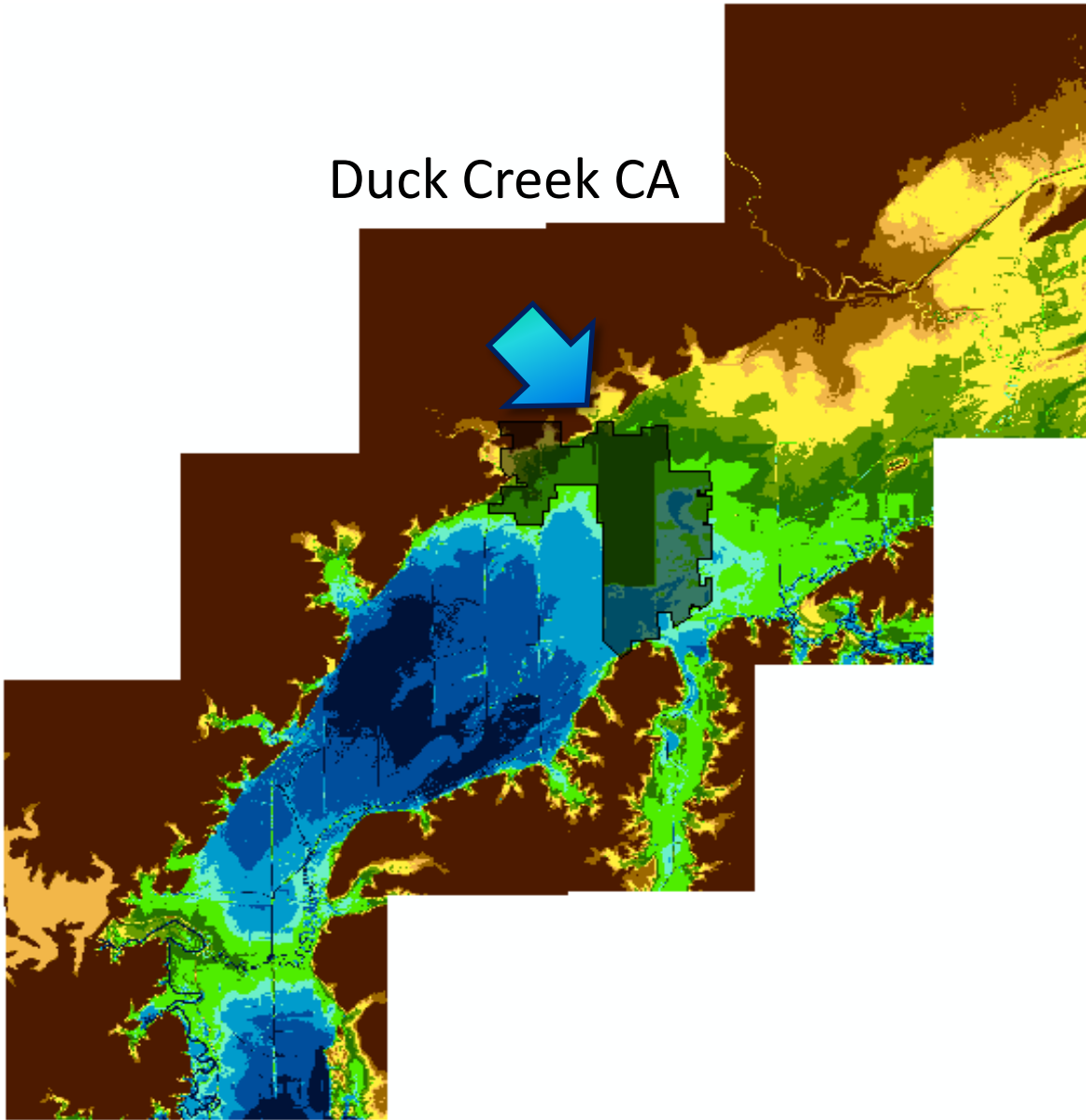


Blue is flooded area based upon satellite imagery





Duck Creek CA



The Mingo Basin

Lidar: Helps quantify the shape of the land...and provide context

Useful planning and management tool



Pool 3: Bottomland Hardwood Forest

- Green-tree reservoir
- Seasonally flooded
- Boat-lanes and blind openings for waterfowl hunting

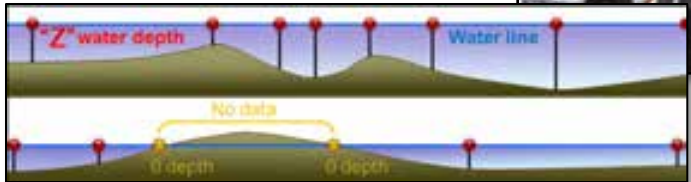
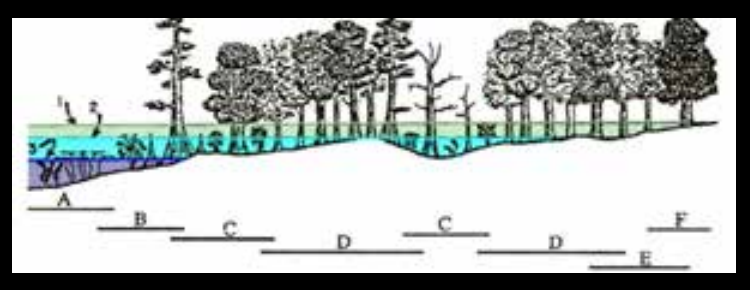
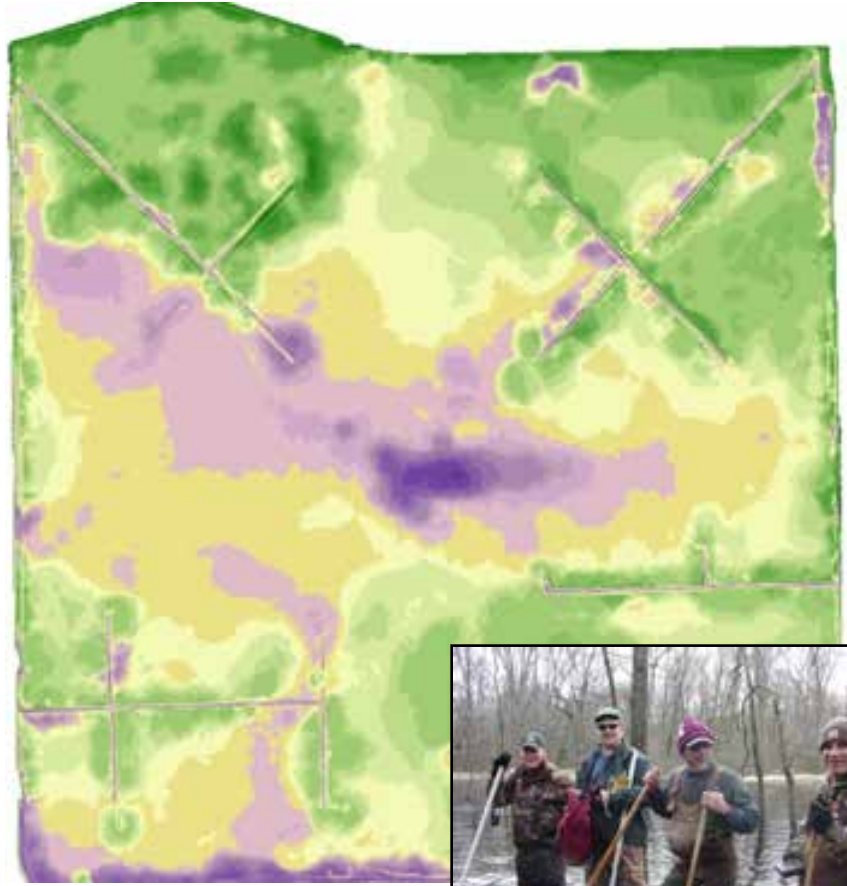
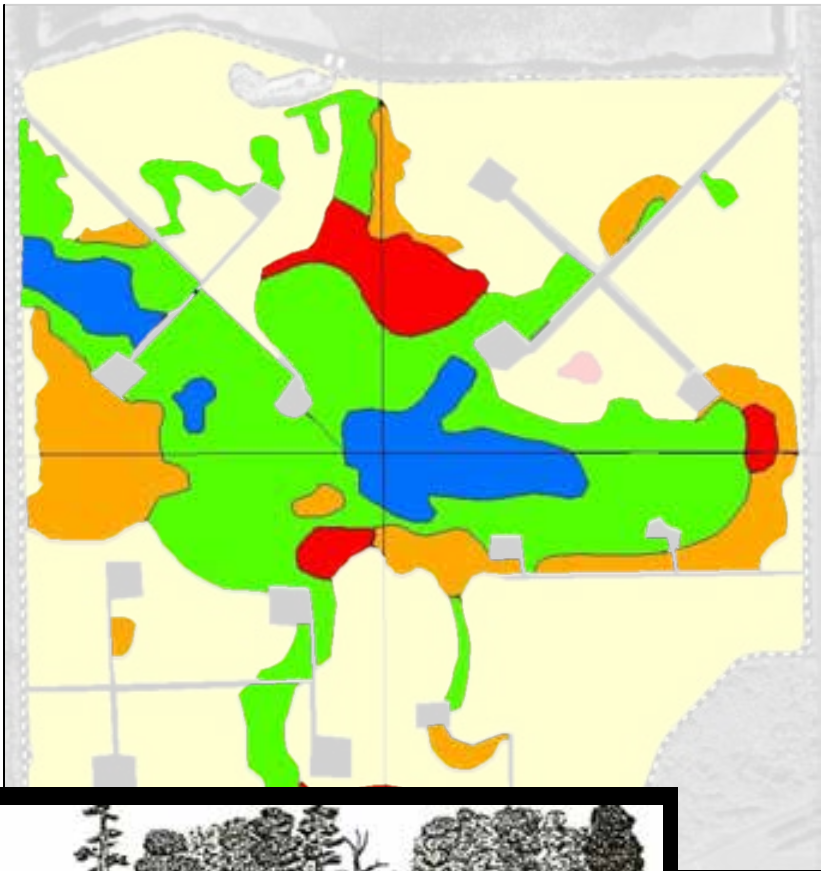


Pool 3: Bottomland Hardwood Forest

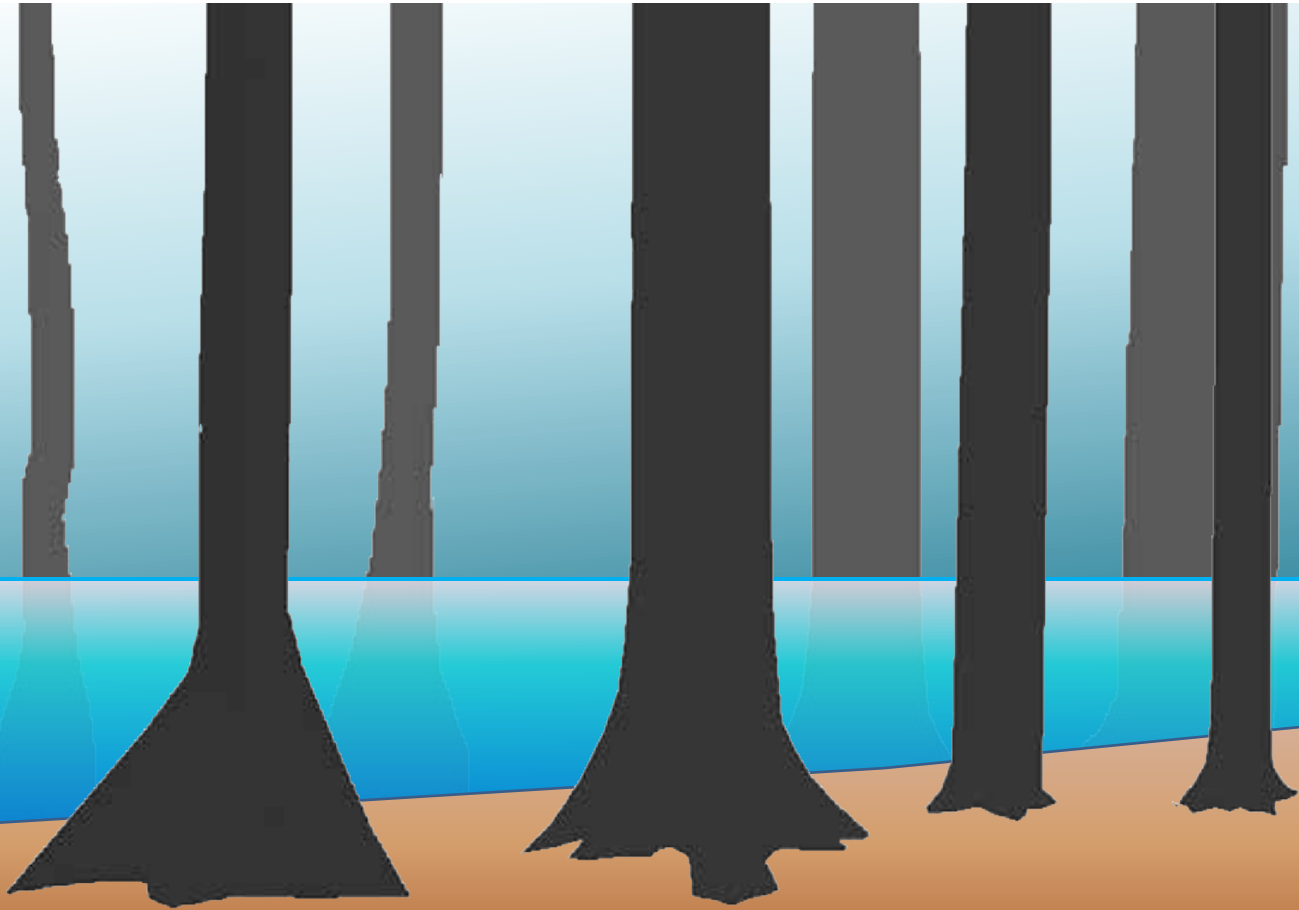
- Red oak decline
- Little regeneration
- Maple, ash, gum mid-story
- How to manage water?

Pool 3: Forest Community

- Flood Tolerance**
- Community Type
 - Health and Recruitment



Flooding for Winter Migrants

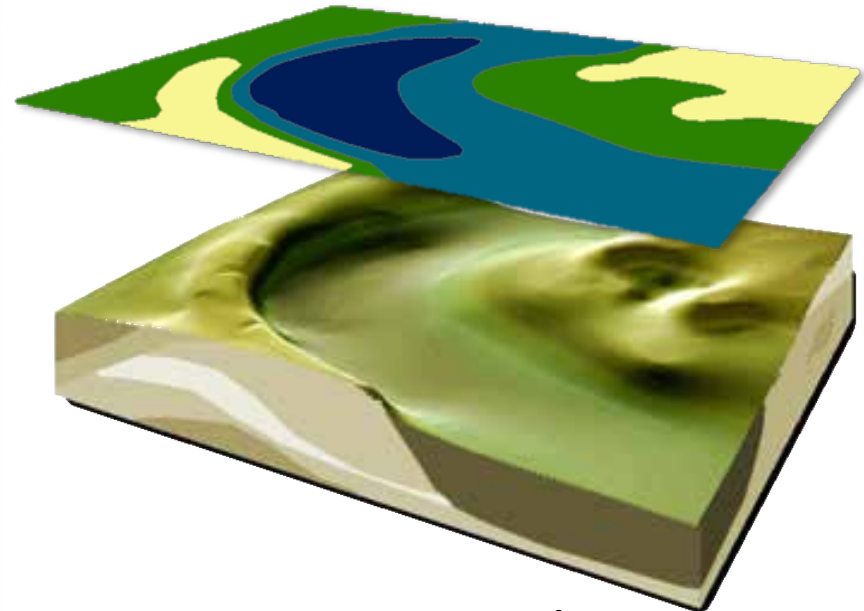


Pool 3: Topography Information Management Tool:



Species foraging depth

Extent of Suitable Habitat



Topography

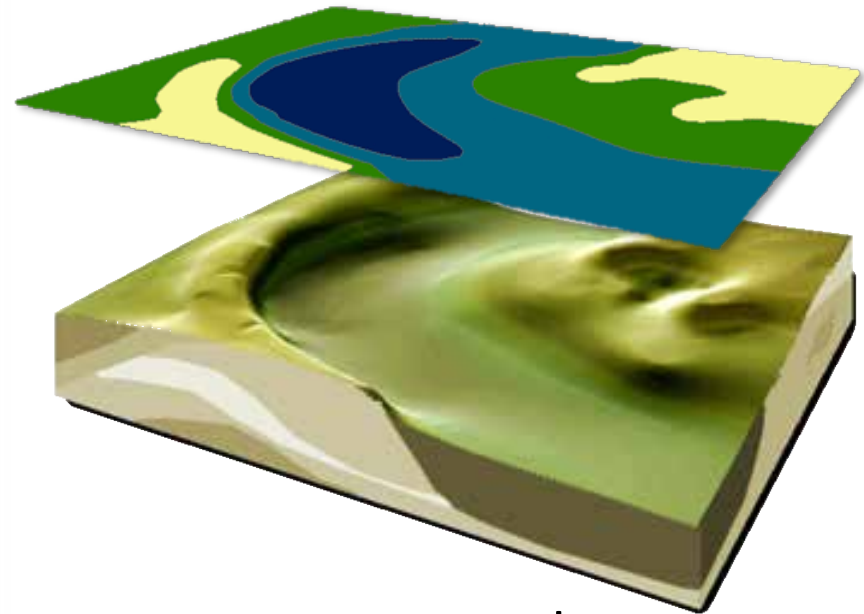
Pool 3: Topography Information Management Tool:

**Provides biologist
with depth and
extent of flooding to
help guide decisions**



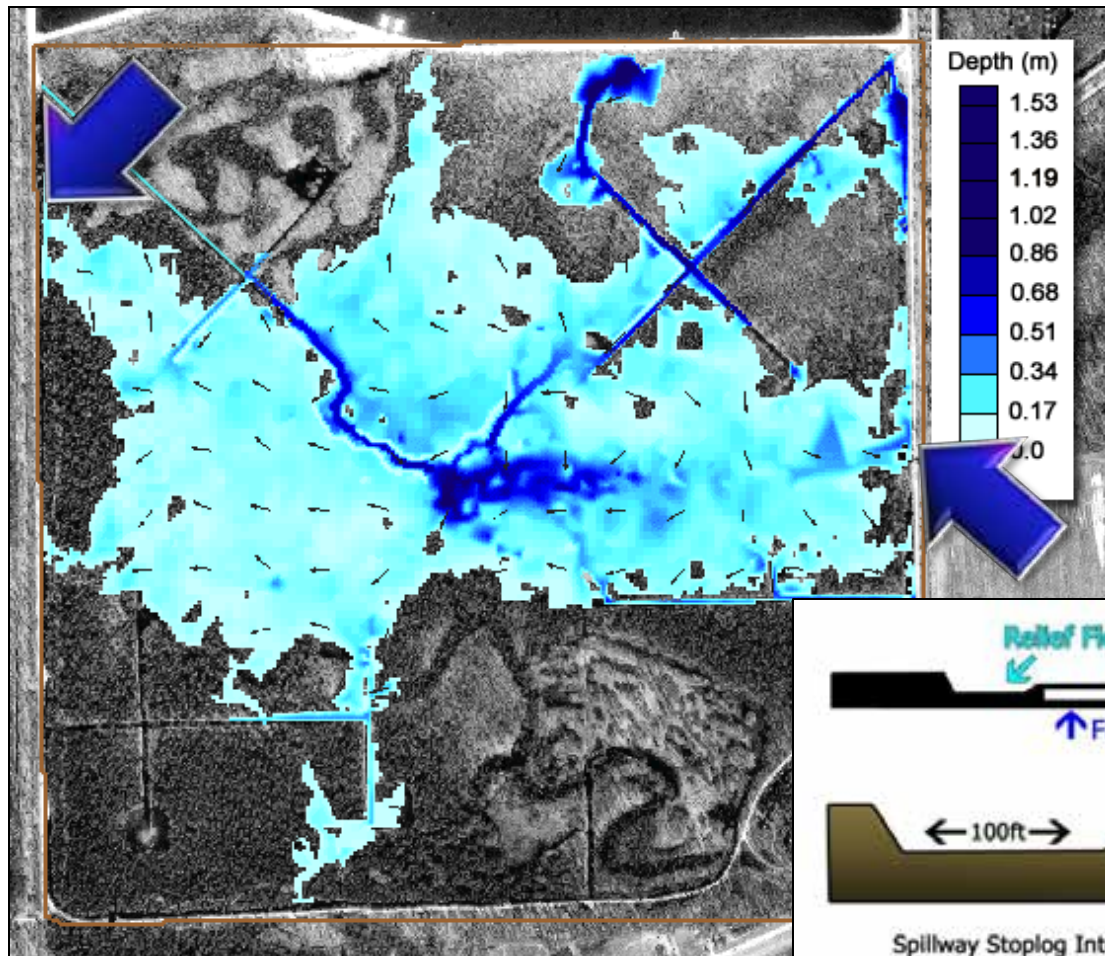
Species foraging depth

Extent of Suitable Habitat



Topography

Pool 3: Flow Modeling



2D Flow Model:

Evaluate proper placement of flood relief spillways

Redneck Lidar DEM



Restoring Natural Water Flow Patterns



April 2011's Historic Flooding

Broad spillways kept the water moving through the basin as designed

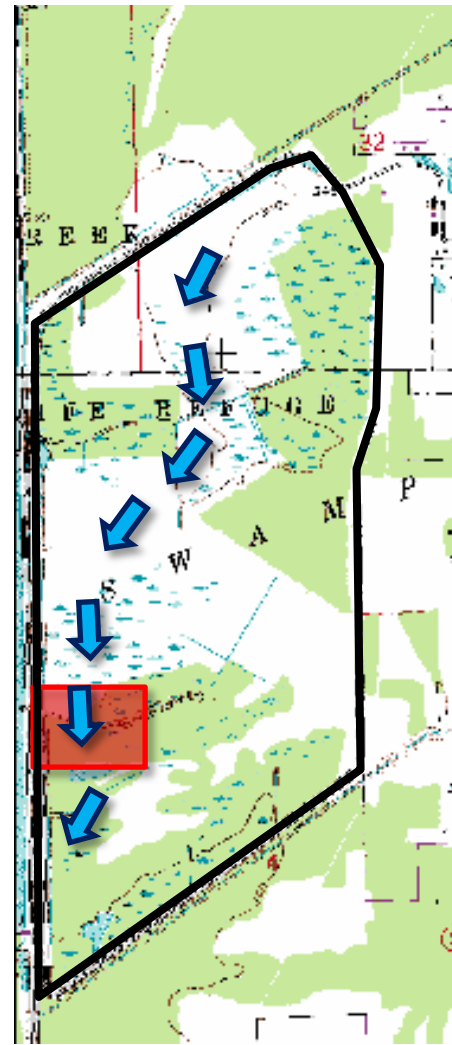
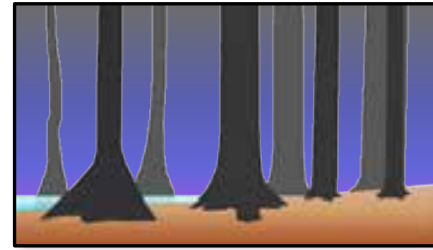
Spillways worked because we accounted for the topography within the unit



Pool 2:

Evaluating Opportunities with a Broader View

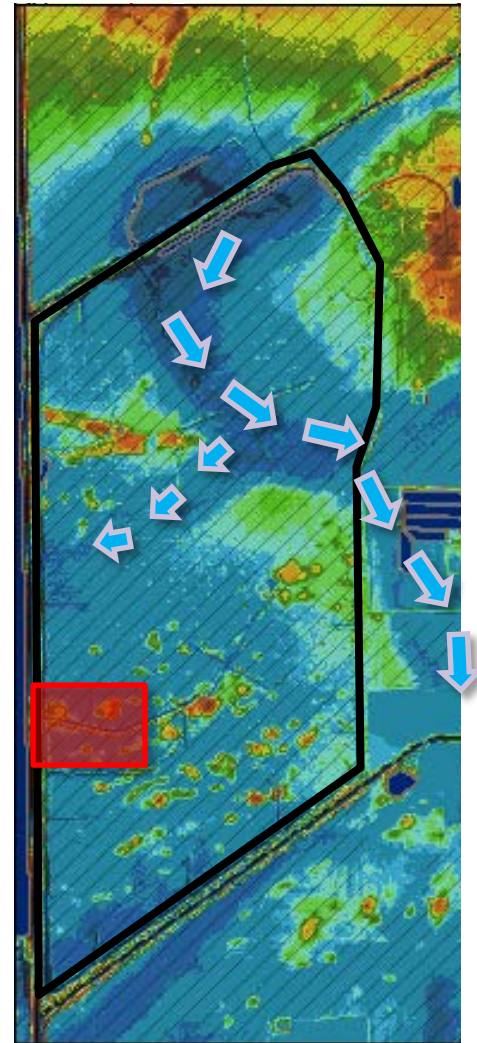
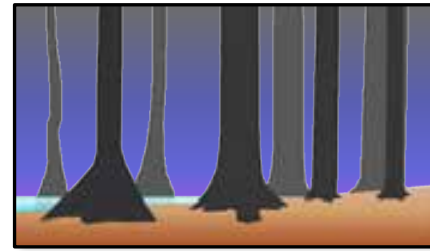
- Remove obstacles to sheetflow within Pool 2
- Our focus was SW



Pool 2:

Evaluating Opportunities with a Broader View

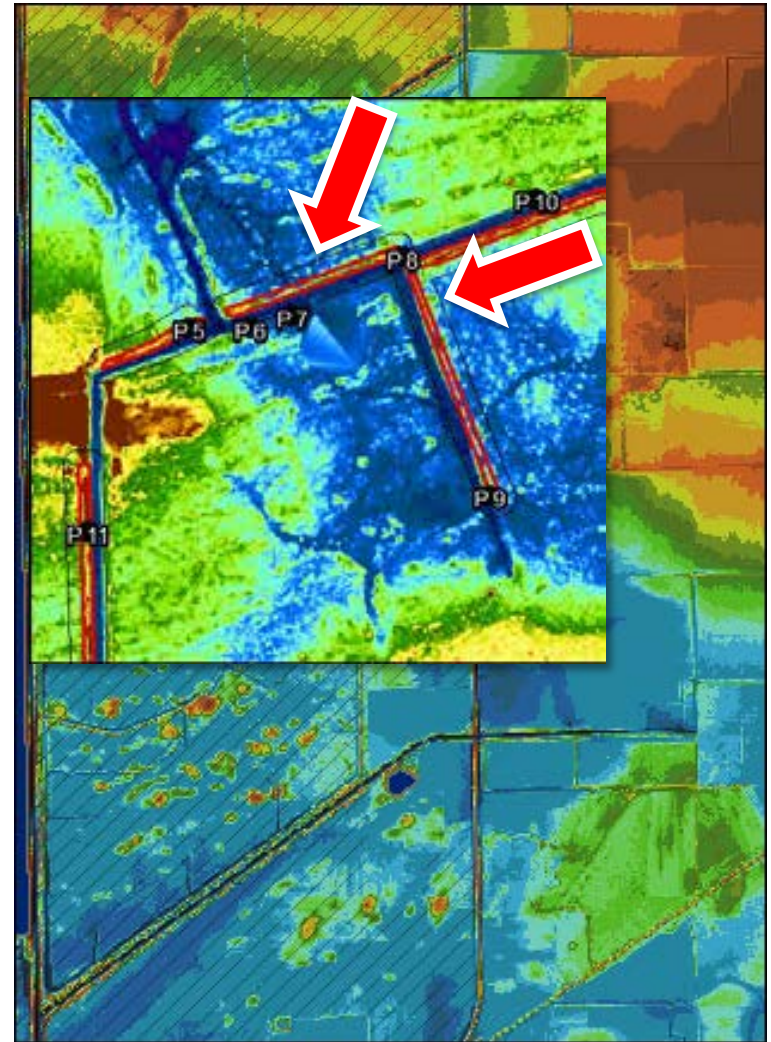
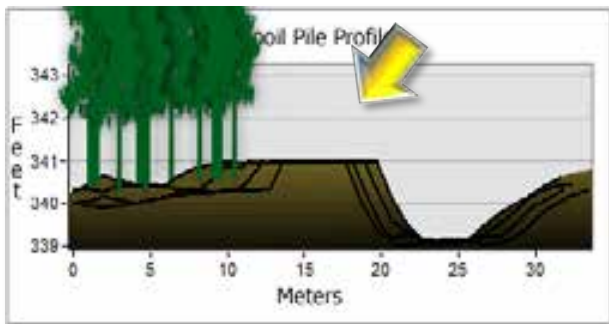
- Remove obstacles to sheetflow within Pool 2
- Our focus was SW
- Lidar widened our view
- Historic drainage went across levee to the east
- Switched our focus to the NE...almost 180°



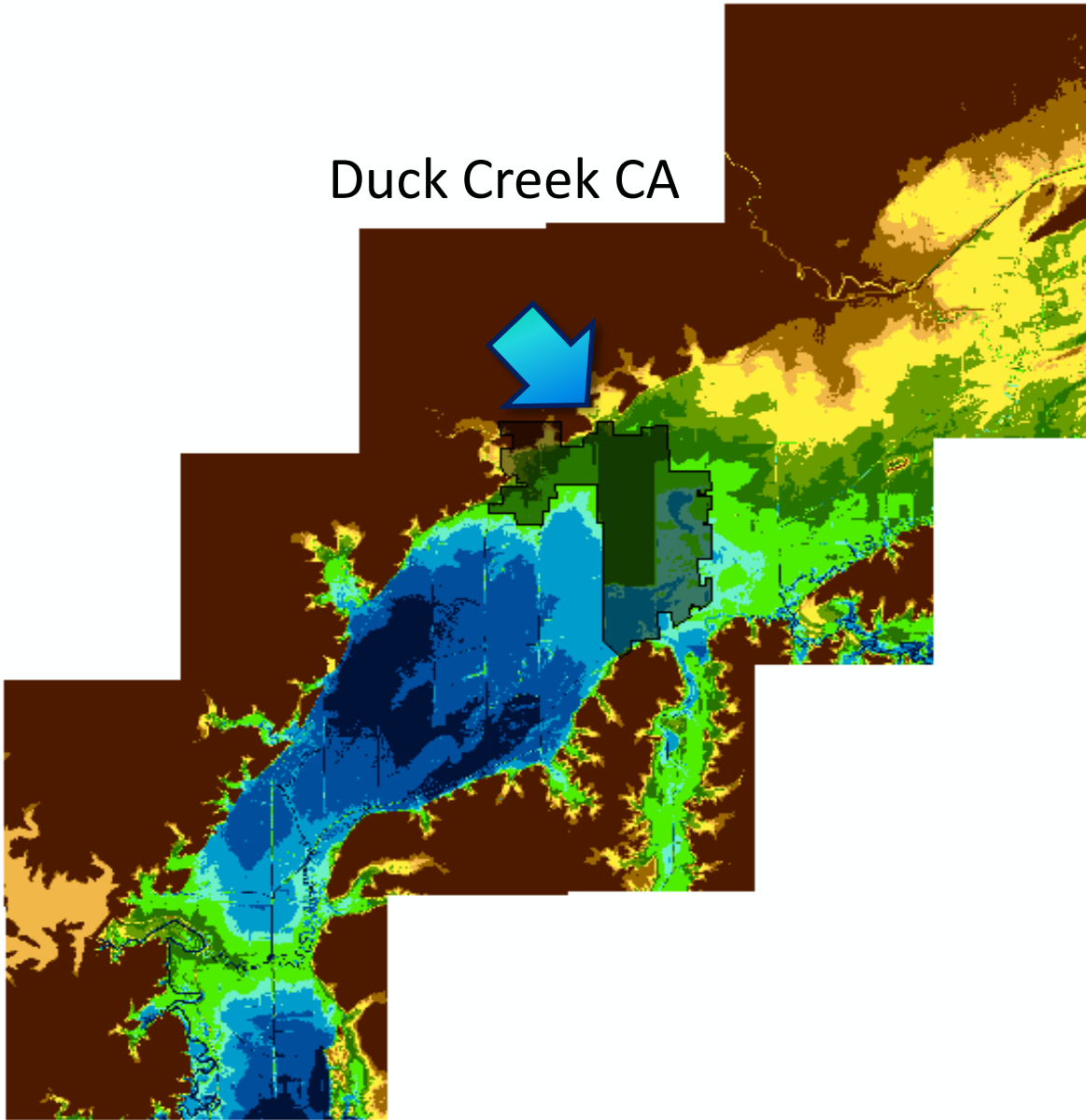
Pool 2:

Evaluating Opportunities with a Broader View

- Zoomed into the pool
- Identified spoil piles that cut across major drainages
- Prohibit flooding or draining
- Target spoil pile removal



Duck Creek CA



The Mingo Basin

Lidar: Helps quantify the shape of the land...and provide context

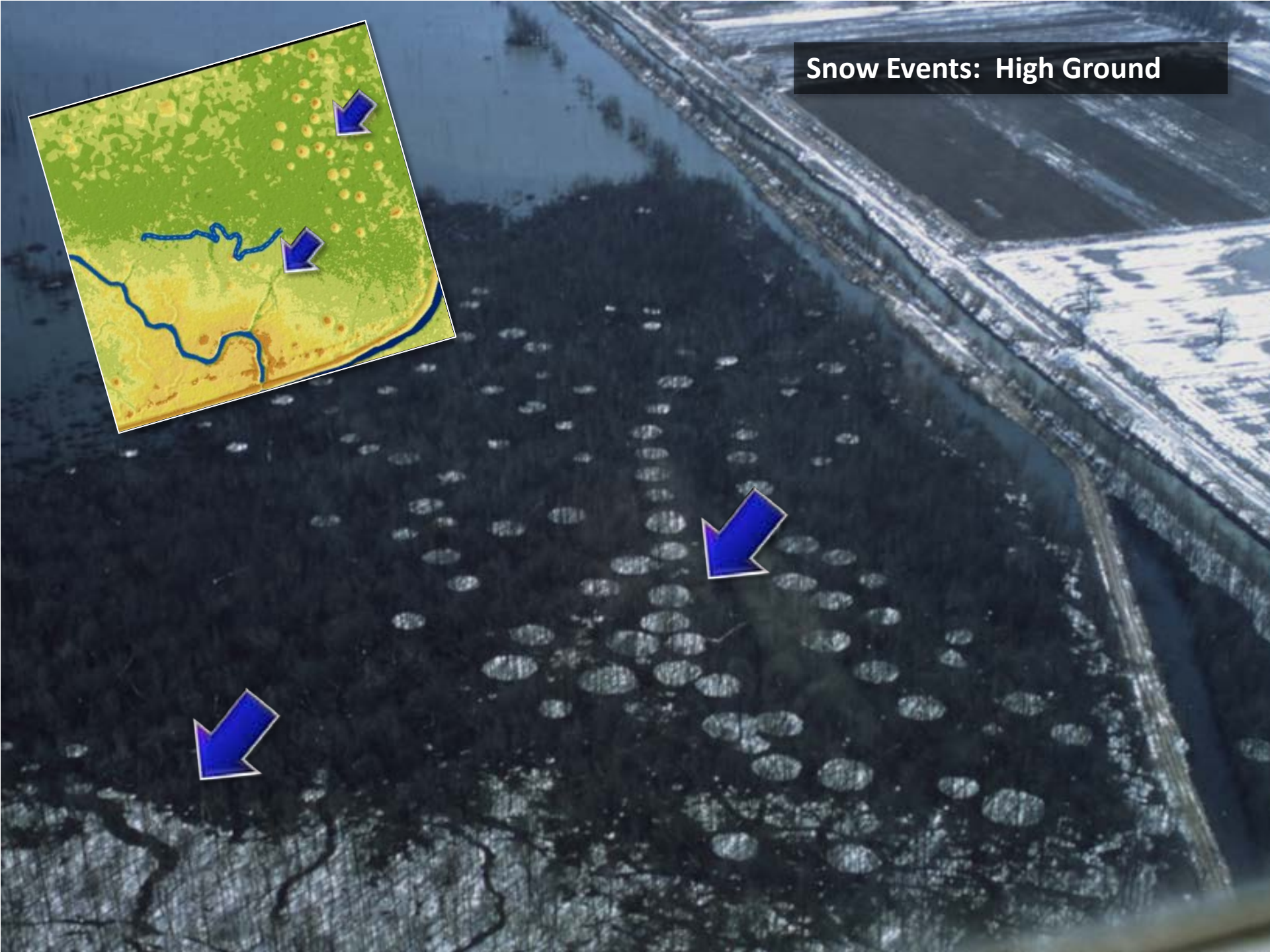
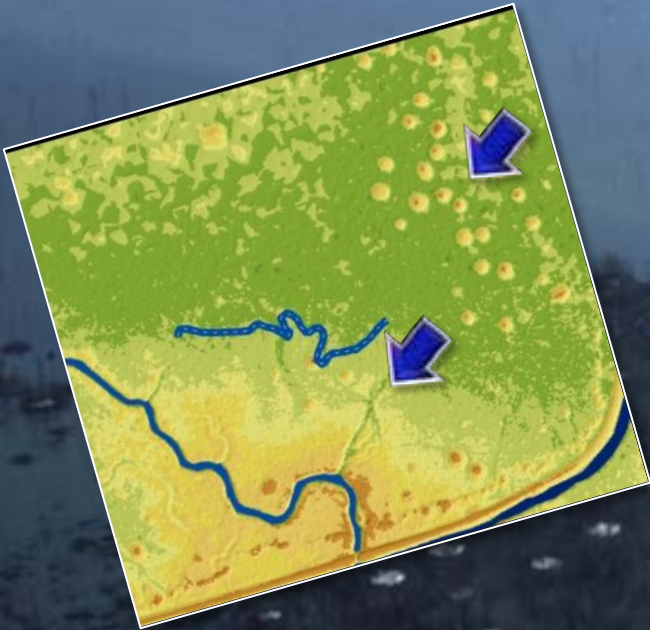
Useful restoration tool

Microtopography and slough systems are features that create diverse habitat conditions



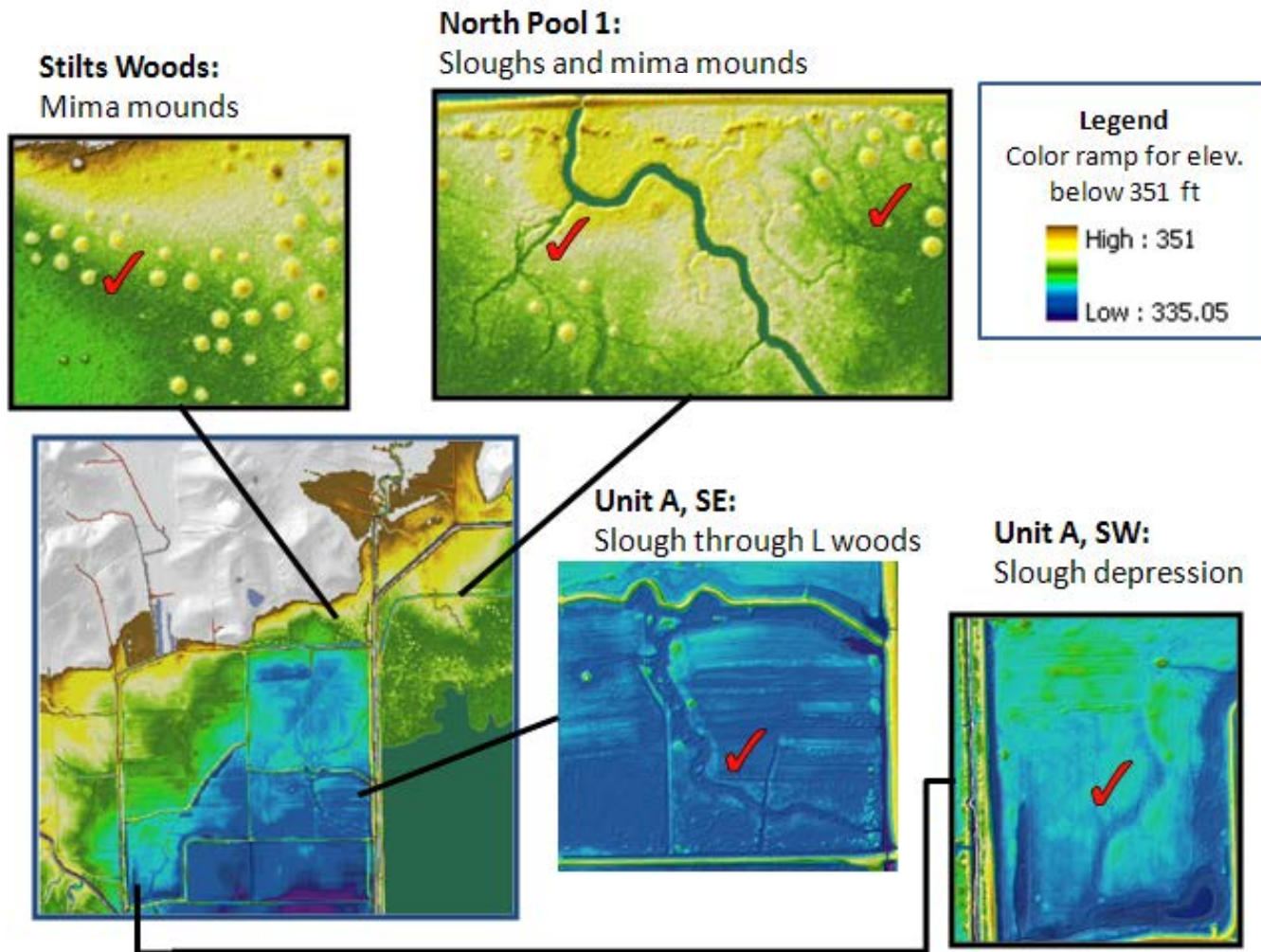
In its place we've straightened and flattened the landscape

Snow Events: High Ground

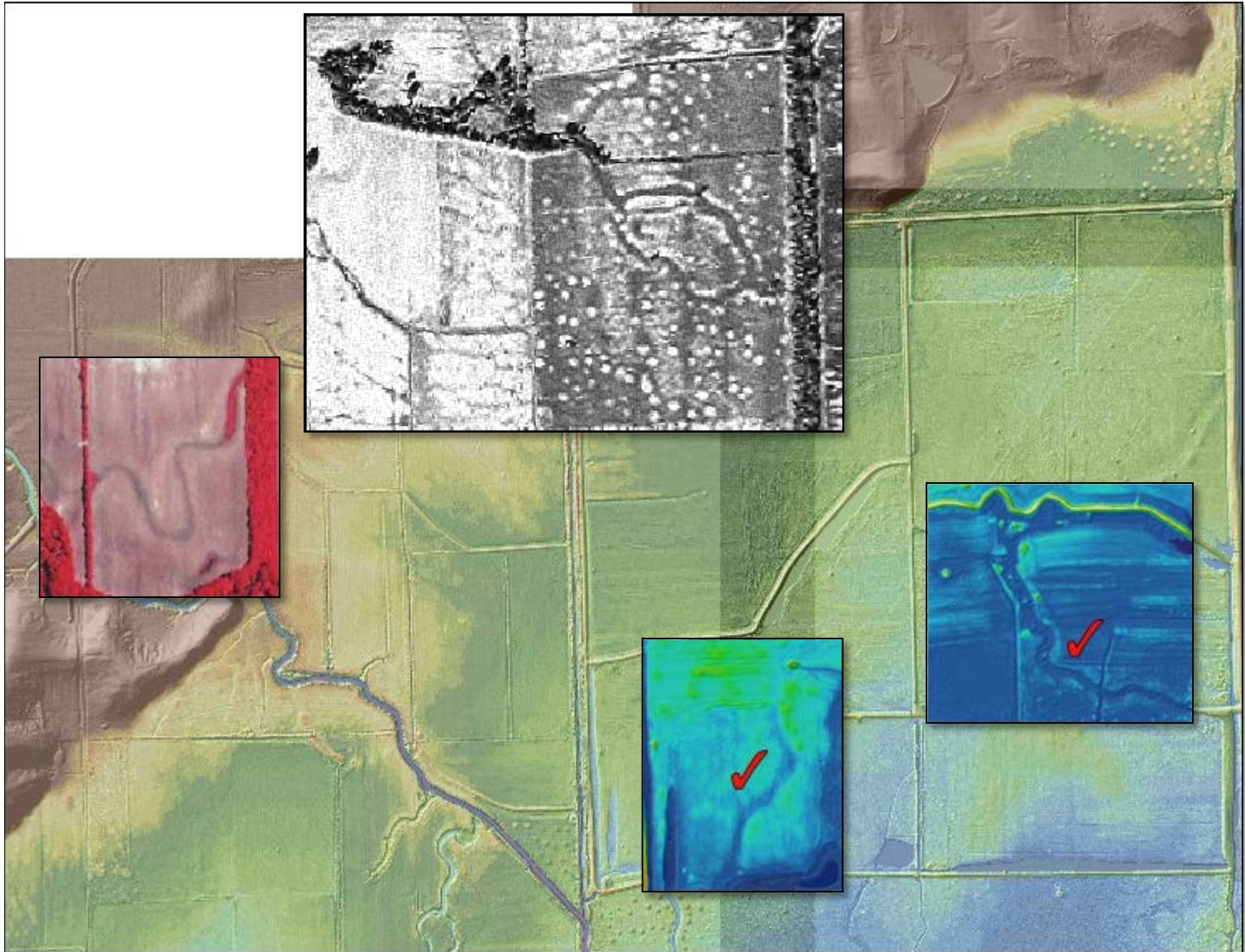


Clues of a diverse past

Fine Resolution of Curvature and Shape of the Land



Paired elev. data with historical photos
to identify location of historic features



Reconfiguring Infrastructure

Filled in straight lines that ignored the fall of the land

Leveling spoil and field ditches to the natural ground to accommodate sheetflow



An aerial photograph of a construction or land reclamation site. A large, diagonal, orange-colored area, likely a spoil pile or a large-scale earthwork project, dominates the left and center of the frame. To the right of this area, there are several winding, light-colored ditches or channels that snake through a green, vegetated landscape. The overall scene suggests a major engineering or environmental project.

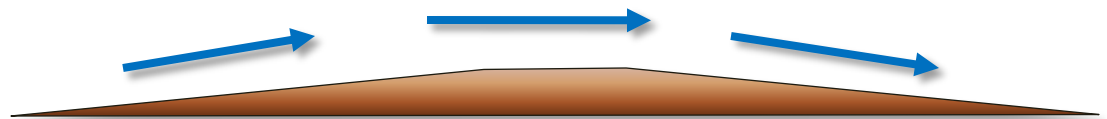
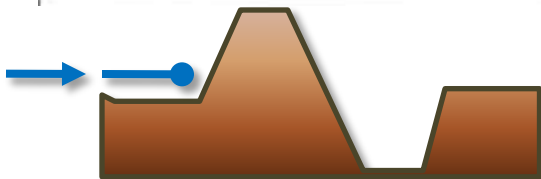
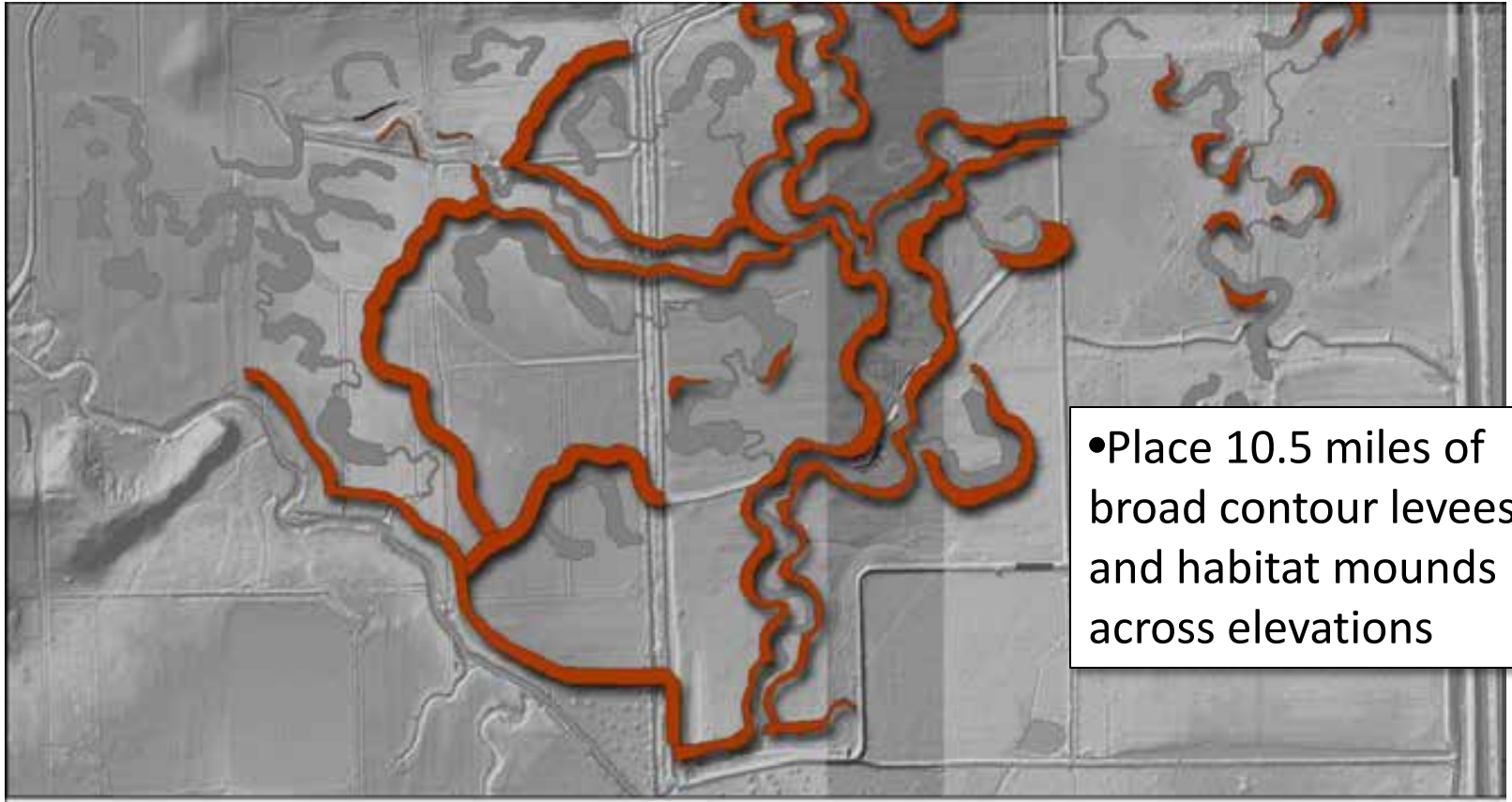
**Filling in ditches
And spoil piles**



Reconfiguring Infrastructure

Put levees on the contours (2-2.5 feet)

Contour levees: 10:1 side slopes, located along 2-2.5 contours, <6 inch freeboard



Contour or Landscape Levees

- Broad features
- Gradual slopes



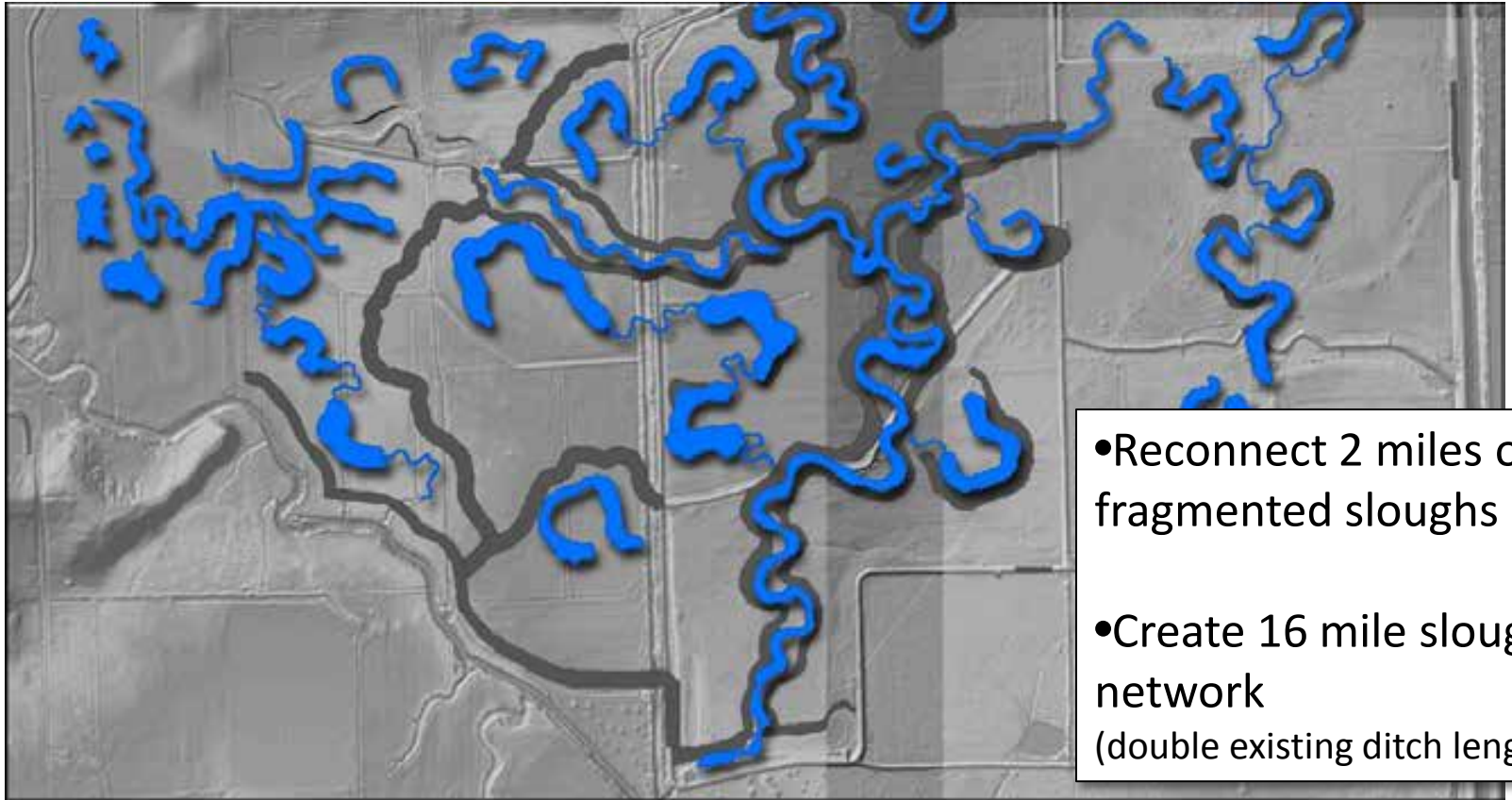
Reduce long-term maintenance problems

- Burrowing
- Erosion

Reconfiguring Topography

Used cut/fill to increased topographic diversity of area

Stream Restoration and Creative Scours:



- Reconnect 2 miles of fragmented sloughs
- Create 16 mile slough network (double existing ditch length)

Historic

Ag. Altered

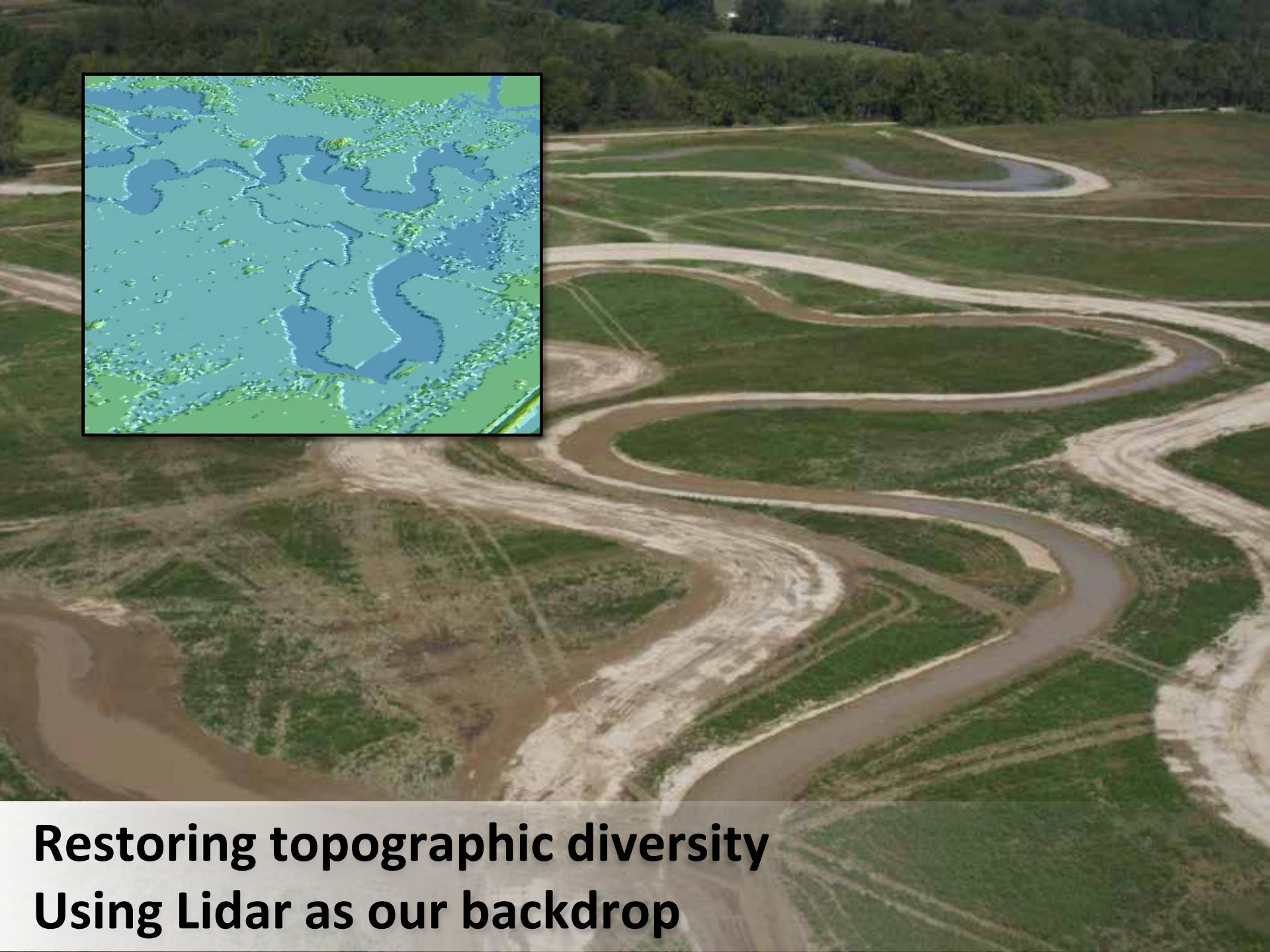
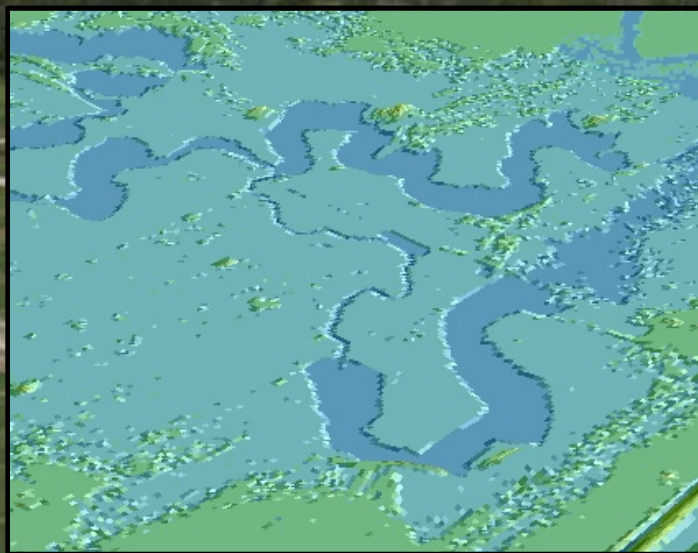
Enhanced



Creative borrowing :

- Broad
- Shallow < 2 ft

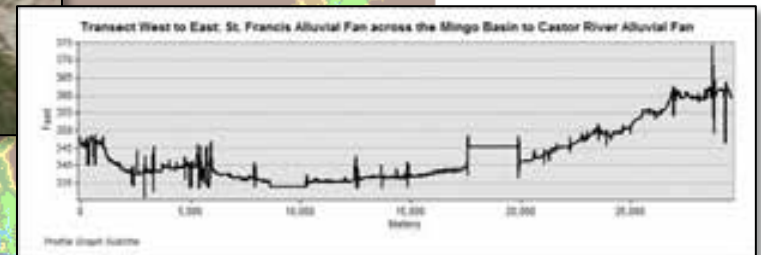
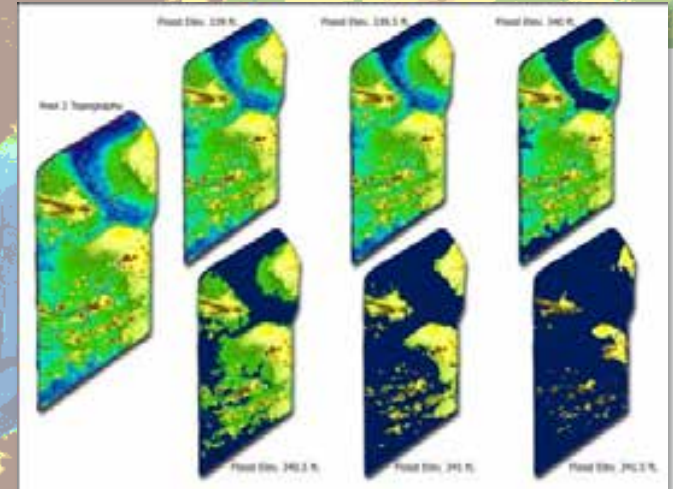




**Restoring topographic diversity
Using Lidar as our backdrop**

Lidar is a useful tool for:

- Communication
- Planning
- Management
- Restoration



Communication is also necessary for acquisition

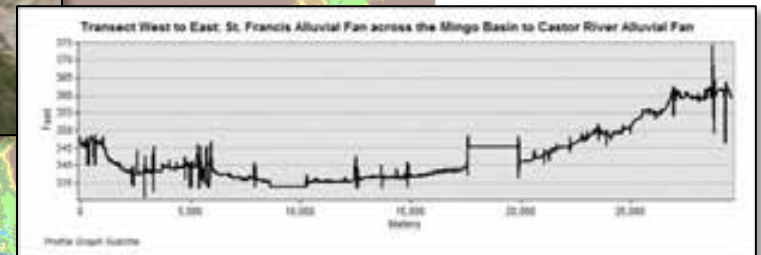
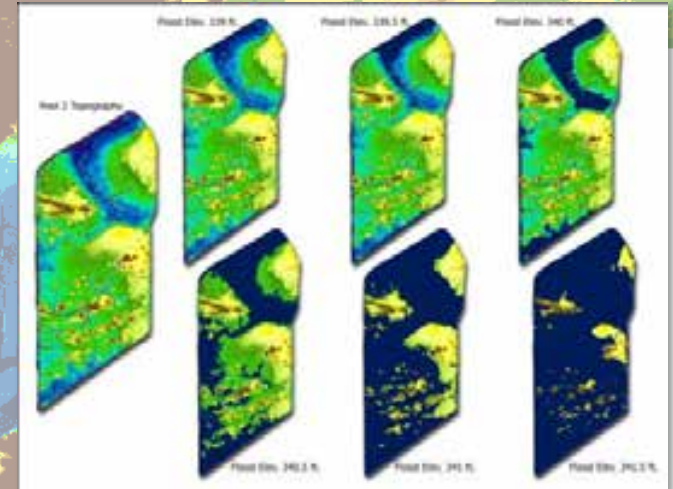
MDC:

Gene Gardner,
Mike Schroer,
Kevin Borisenko,
Tony Spicci

Partners:

USFWS
USGS
USACOE

NRCS: Liz Cook

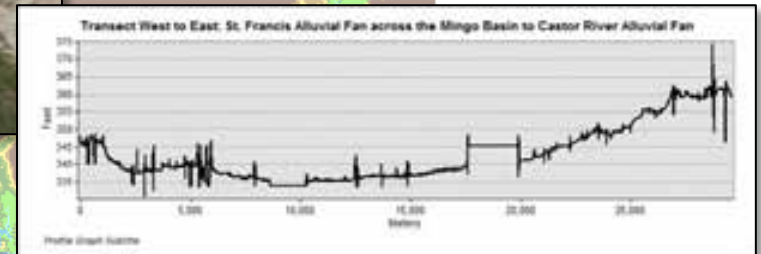
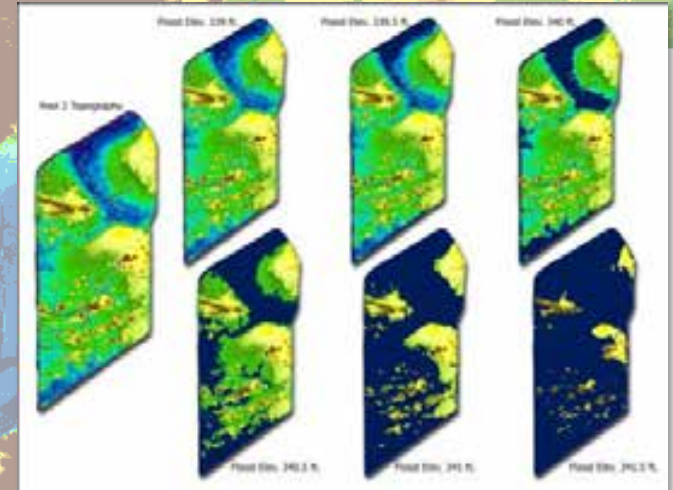


Communication is also necessary for acquisition

Preparing sites (dewatering)

Timing of flight (leaf-off)

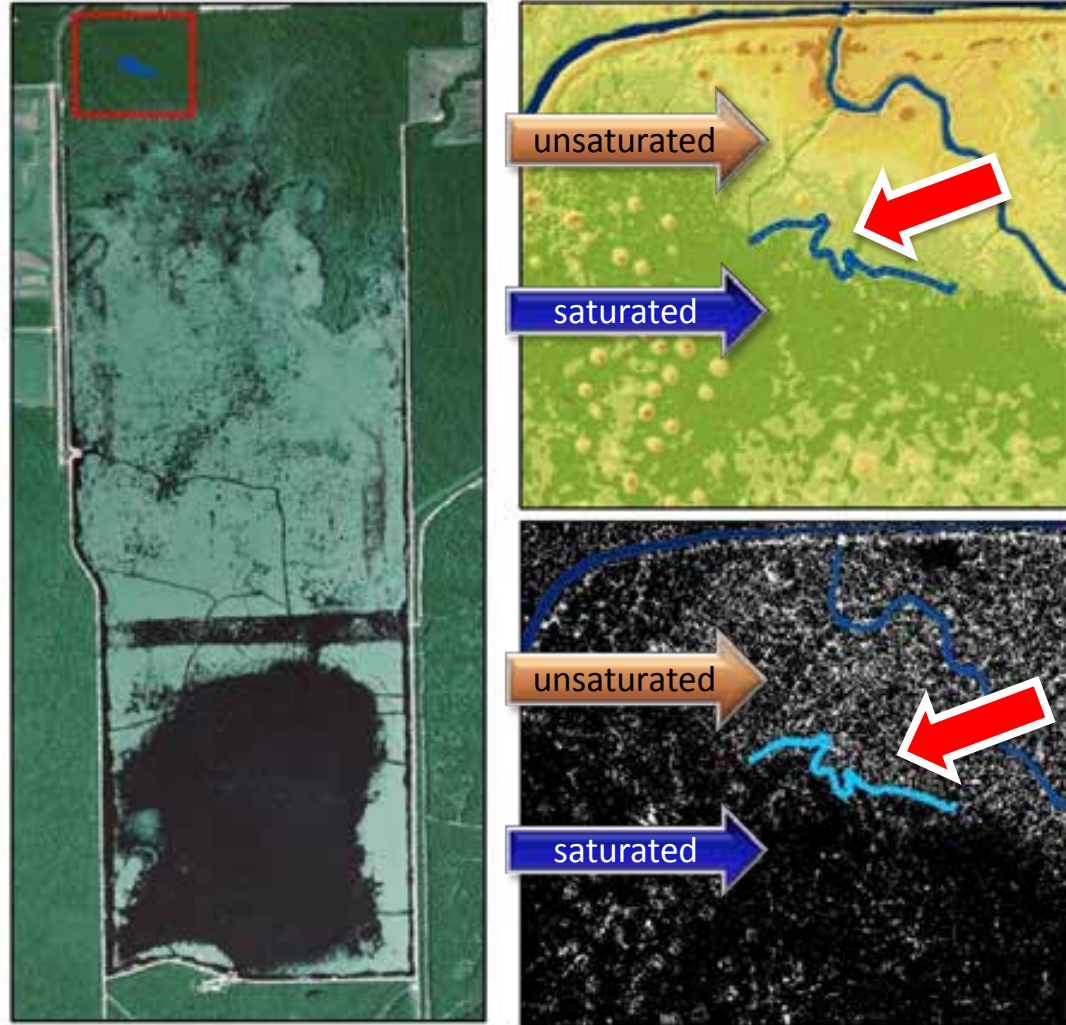
Verification (water lines)



Verification using Intensity Data: Forest Inundation

Flooded Timber in Pool 1

- GPS Waterline
 - Trimble unit path
- Known Pool Elevation
 - Pool 1: 346 ft
- Lidar Intensity Data
 - Darker = Low Intensity (saturated zone)
 - Lighter = High Intensity (unsaturated zone)

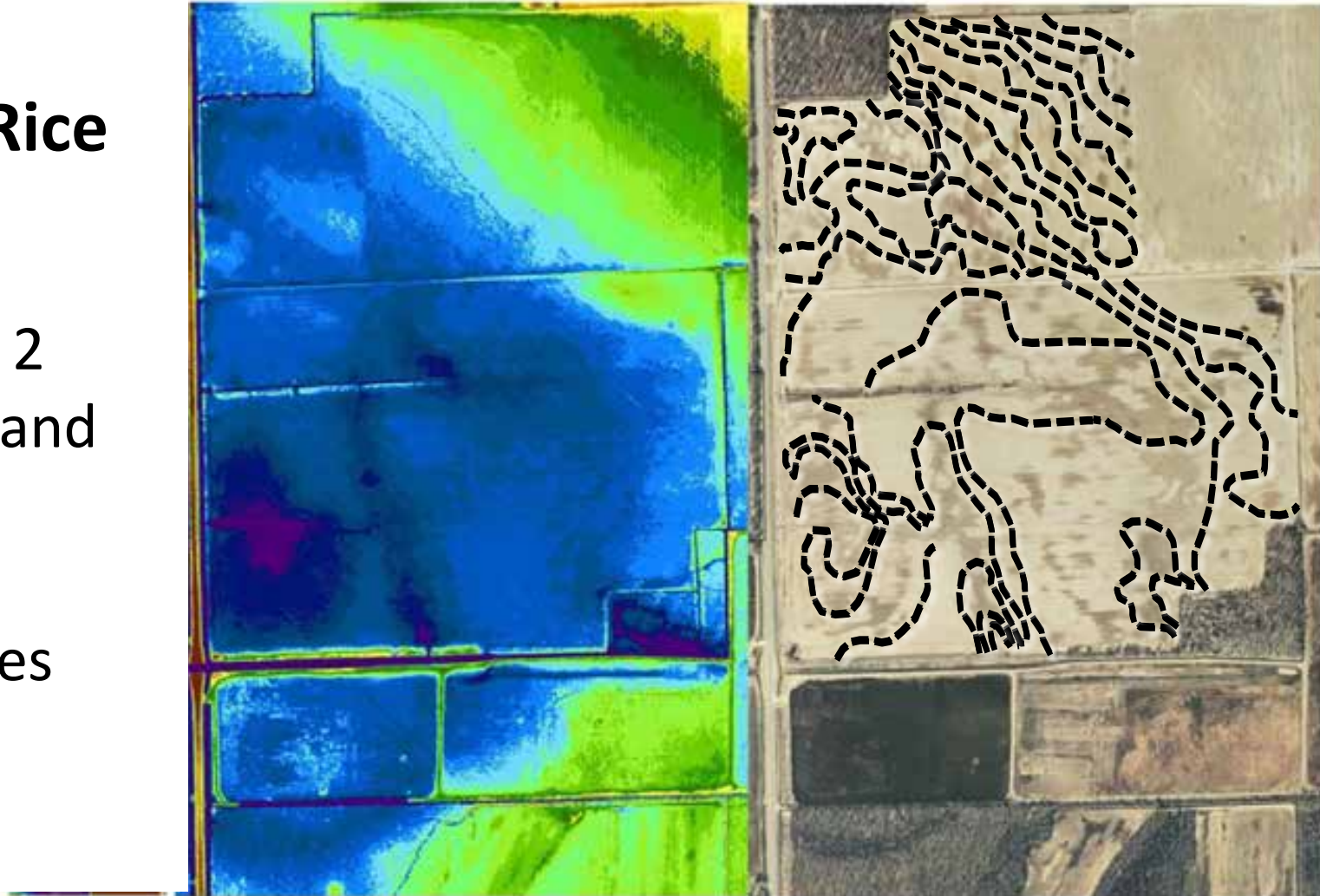


Verification using NAIP imagery

Adjacent Rice Levees

East of Pool 2
on Private Land

Levees =
Contour Lines





The Mingo Basin

Lidar: Helps
quantify the
shape of the
land



A tool for
broader
regions

nering up to
nd the landscape
imize damages in
he future