Experiences from the ARS Croplands CEAP program (with input from NRCS and NIFA)

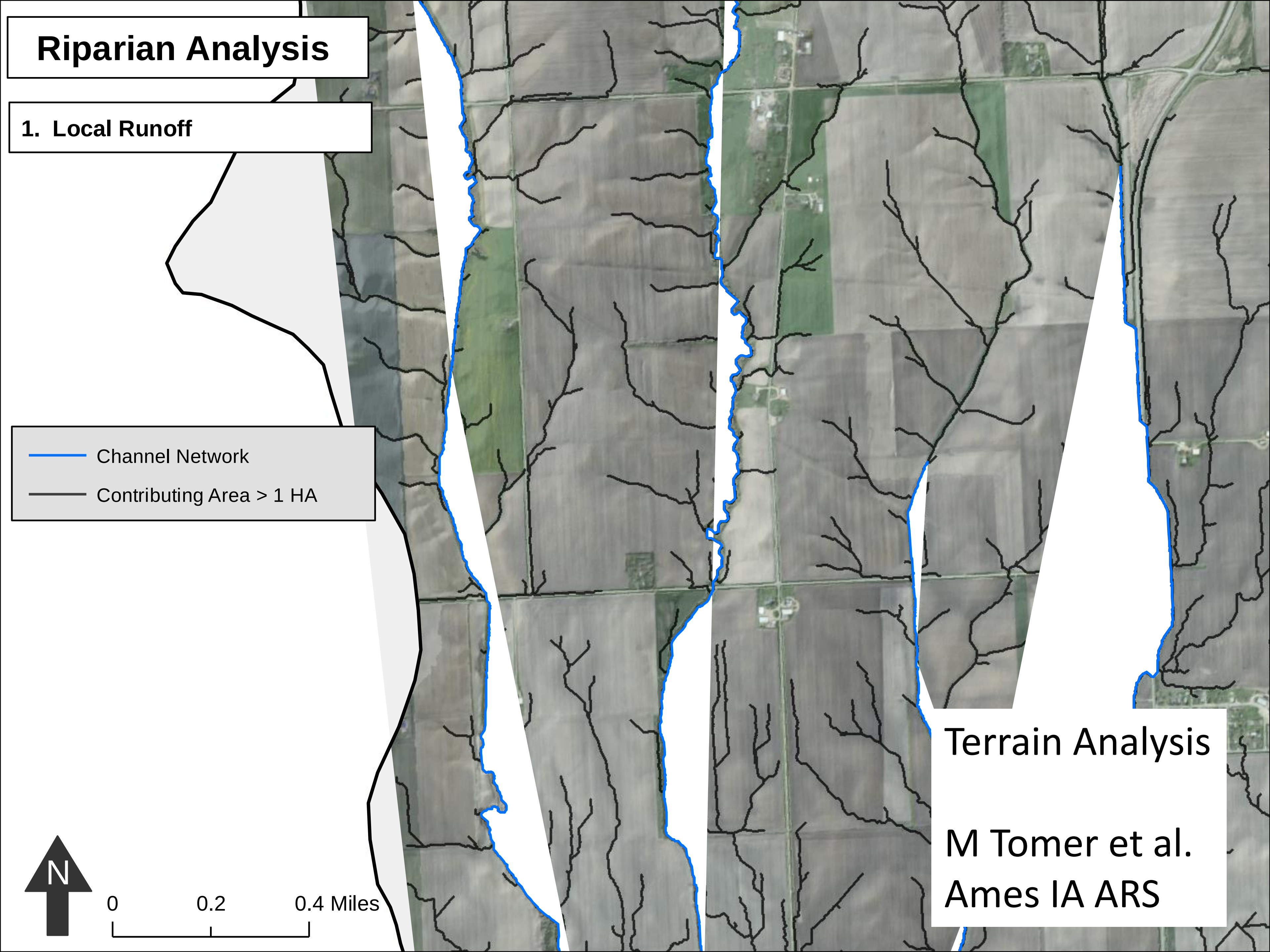
John Sadler and
Lisa Duriancik (NRCS), Deanna Osmond (NIFA),
Mark Tomer, Martin Locke, Pete Kleinman, Paul Adler, Claire Baffaut, Jim Kiniry, Kate Behrman, Daren Harmel, Mark Walbridge (ARS)

ARS CEAP

- Objective was to document the effect of conservation practices, specifically those used by NRCS
  - So we looked at effects of BMPs
  - Some BMPs involve perennials that could be used for biofuel feedstock
- This presentation
  - Subset of specific results relevant to biofuels
  - Some general lessons learned

Riparian Analysis

1. Local Runoff

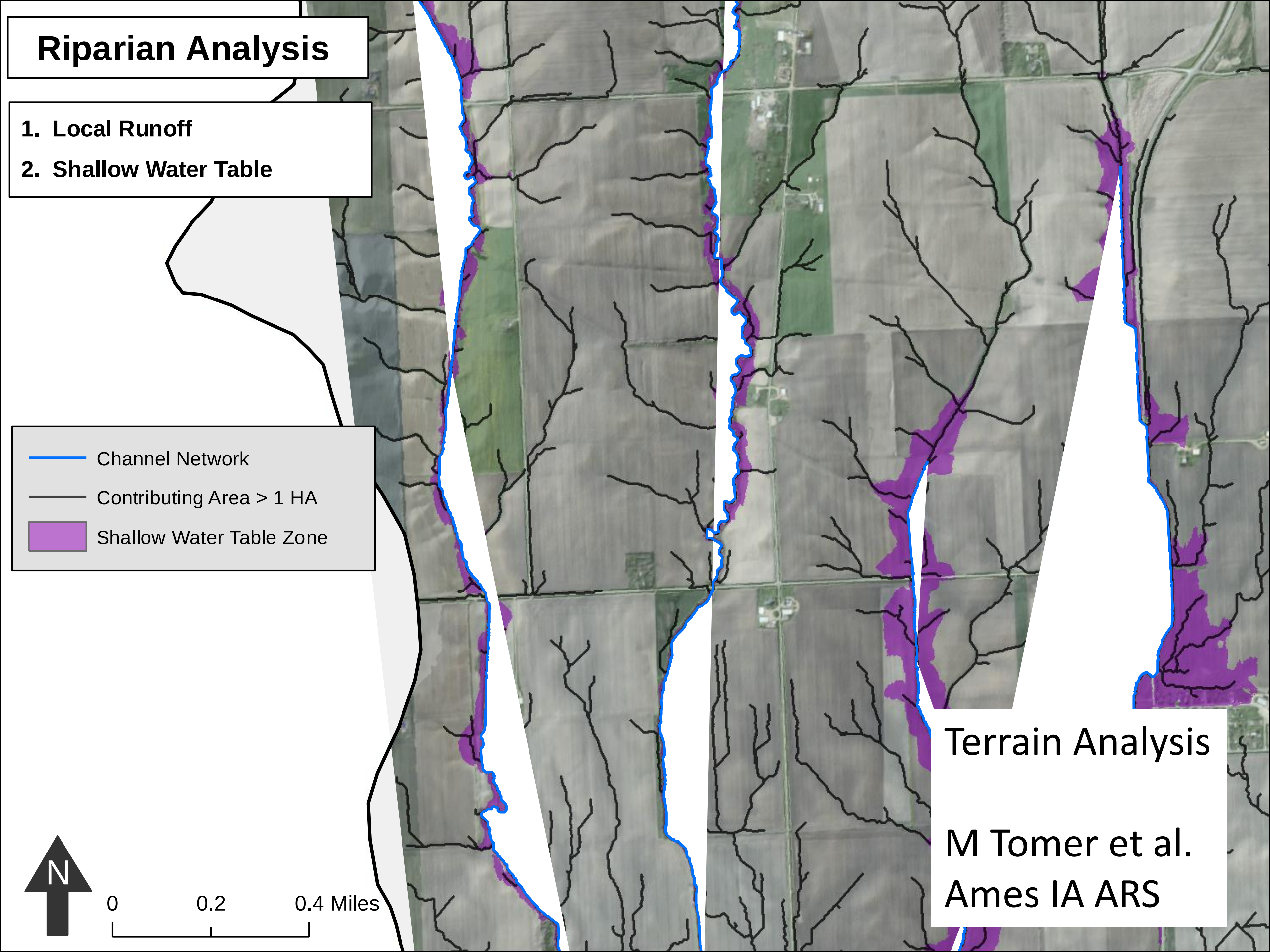


Terrain Analysis

M Tomer et al.
Ames IA ARS

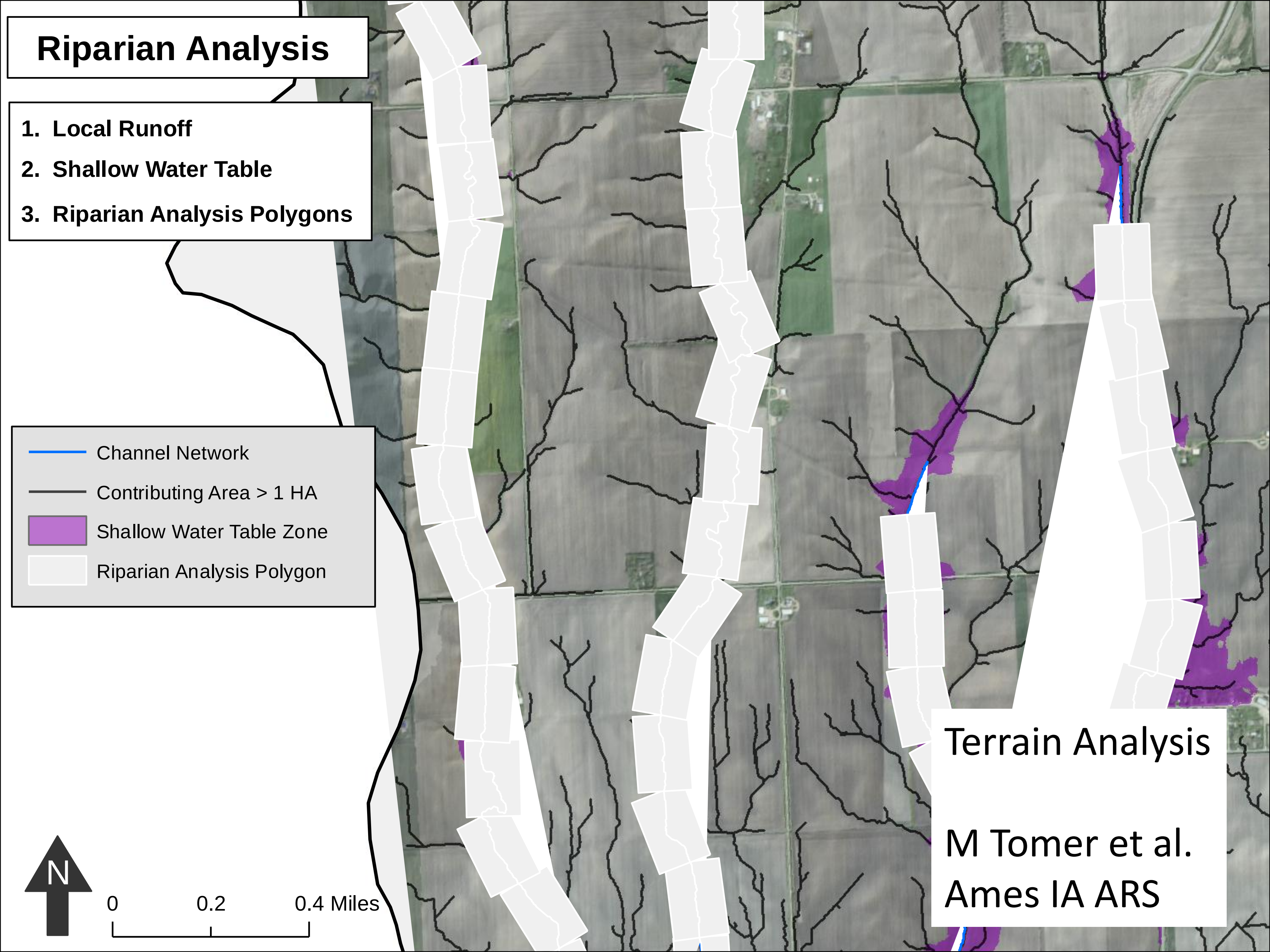
Riparian Analysis

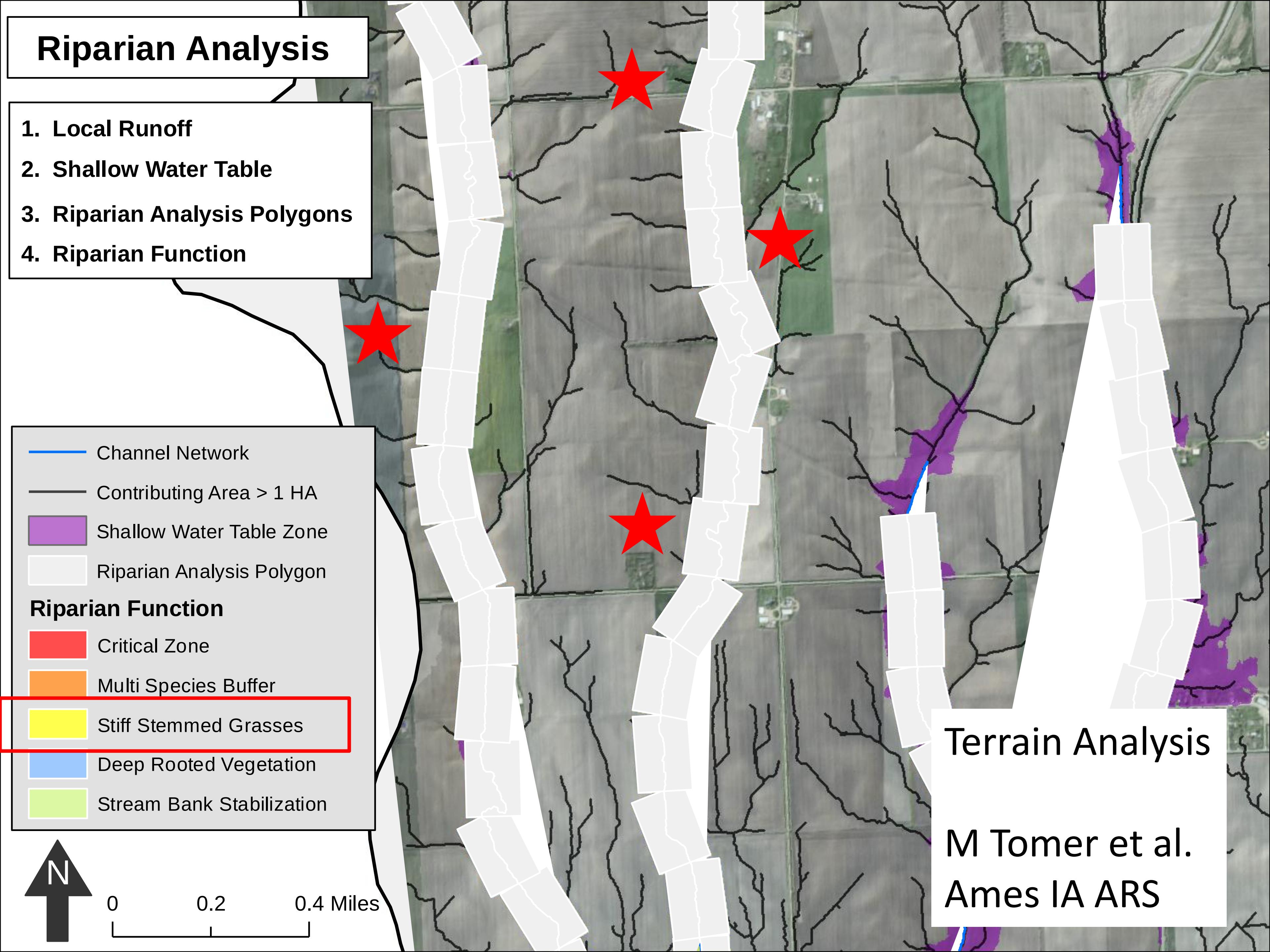
1. Local Runoff
2. Shallow Water Table



Terrain Analysis

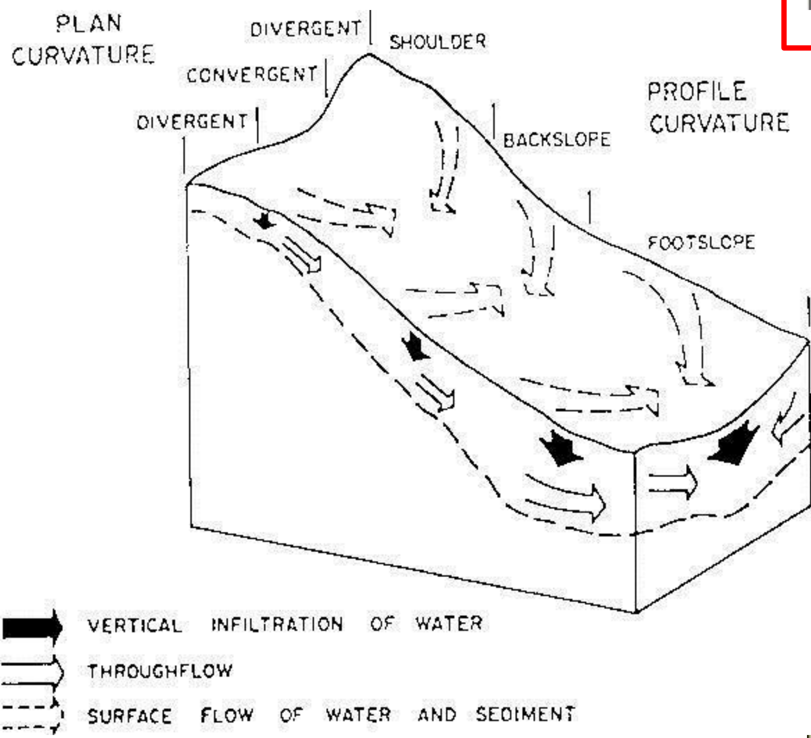
M Tomer et al.
Ames IA ARS

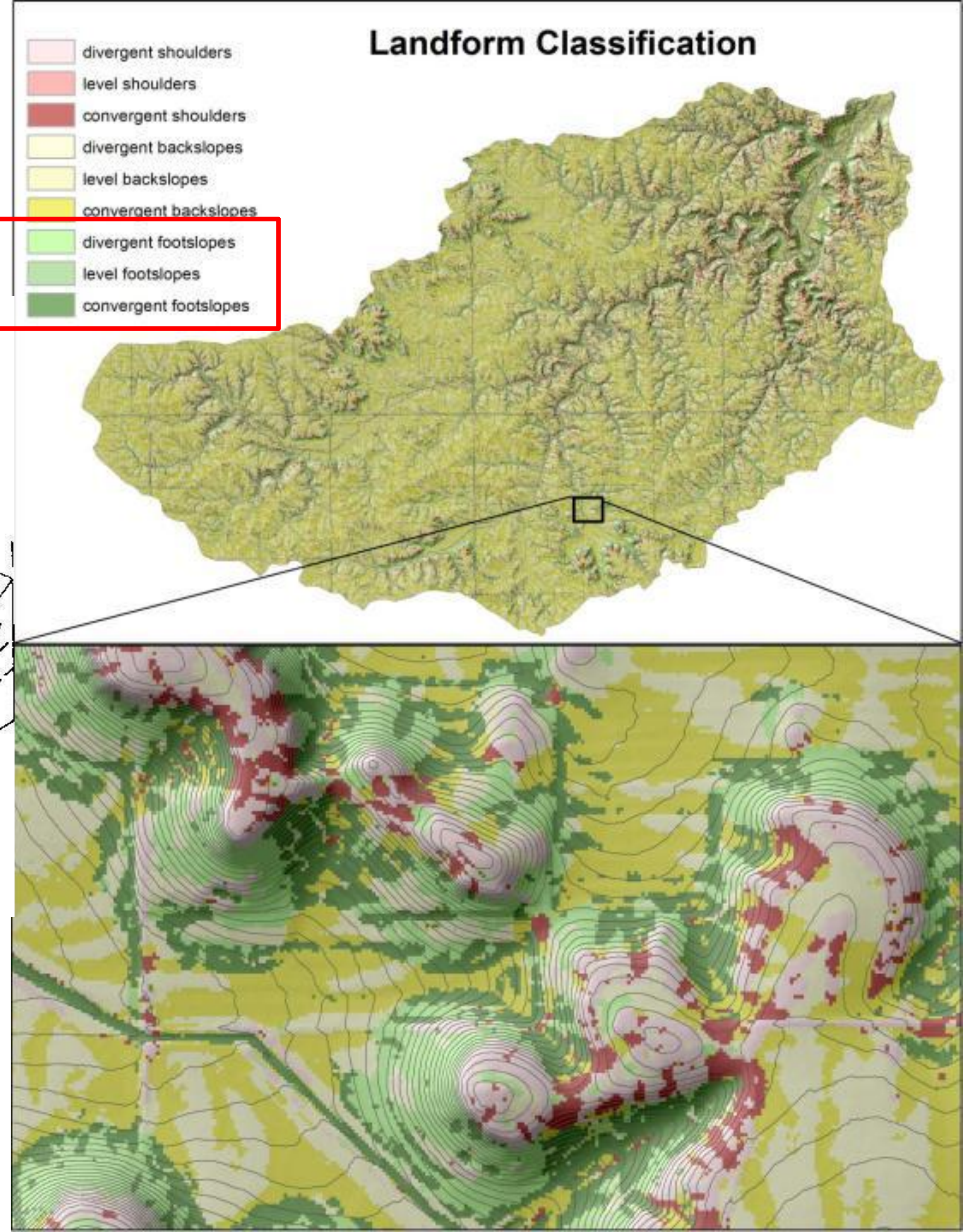

Riparian Analysis
1. Local Runoff
2. Shallow Water Table
3. Riparian Analysis Polygons
Channel Network
Contributing Area > 1 HA
Shallow Water Table Zone
Riparian Analysis Polygon
N
0
0.2
0.4 Miles
Terrain Analysis
M Tomer et al.
Ames IA ARS


Riparian Analysis
1. Local Runoff
2. Shallow Water Table
3. Riparian Analysis Polygons
4. Riparian Function
Channel Network
Contributing Area > 1 HA
Shallow Water Table Zone
Riparian Analysis Polygon
Riparian Function
Critical Zone
Multi Species Buffer
Stiff Stemmed Grasses
Deep Rooted Vegetation
Stream Bank Stabilization
N
0
0.2
0.4 Miles
Terrain Analysis
M Tomer et al.
Ames IA ARS

LANDFORM ANALYSIS (EXPERIMENTAL)

Slope position and shape
can determine water flow pathways:

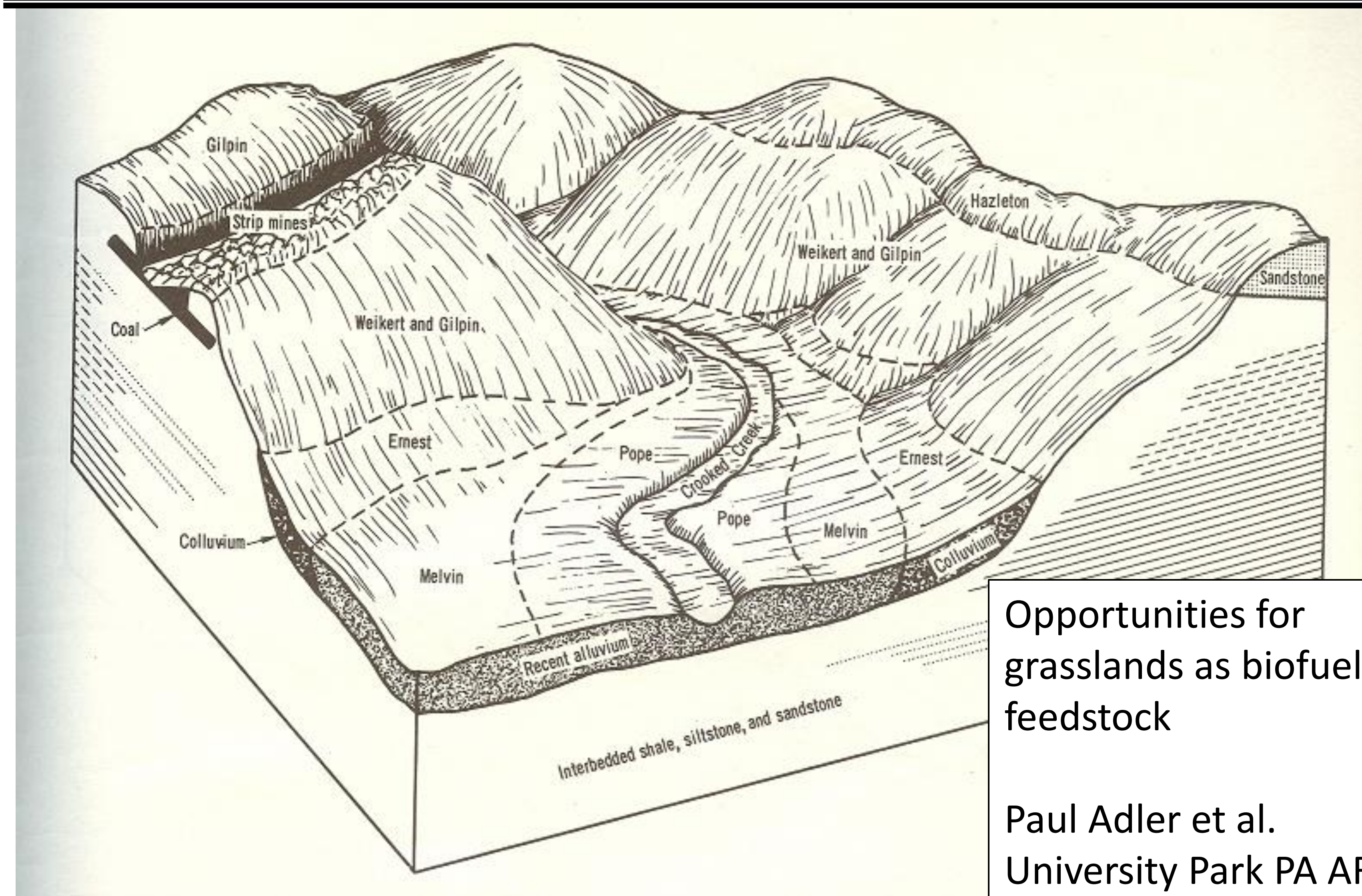




Terrain Analysis

M Tomer et al.
Ames IA ARS + ISU

Marginal croplands



Opportunities for grasslands as biofuel feedstock

Paul Adler et al.
University Park PA ARS

- Prime soils in valley, steep slopes forested, previously cropped marginal soils between

Targeting the vulnerable areas in the landscape

Account for:

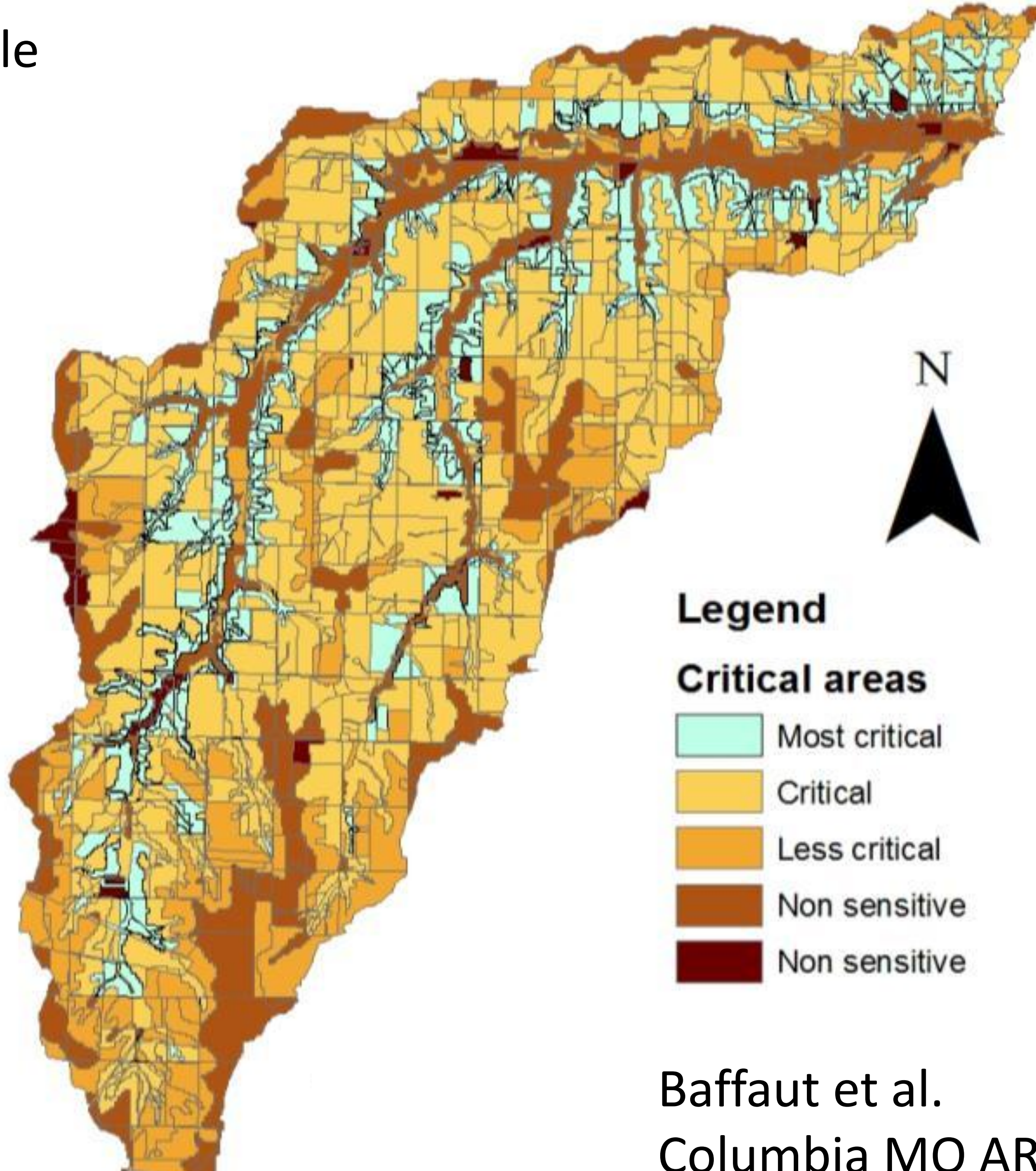
Soil (SSURGO)

- Depth to clay
- Ksat

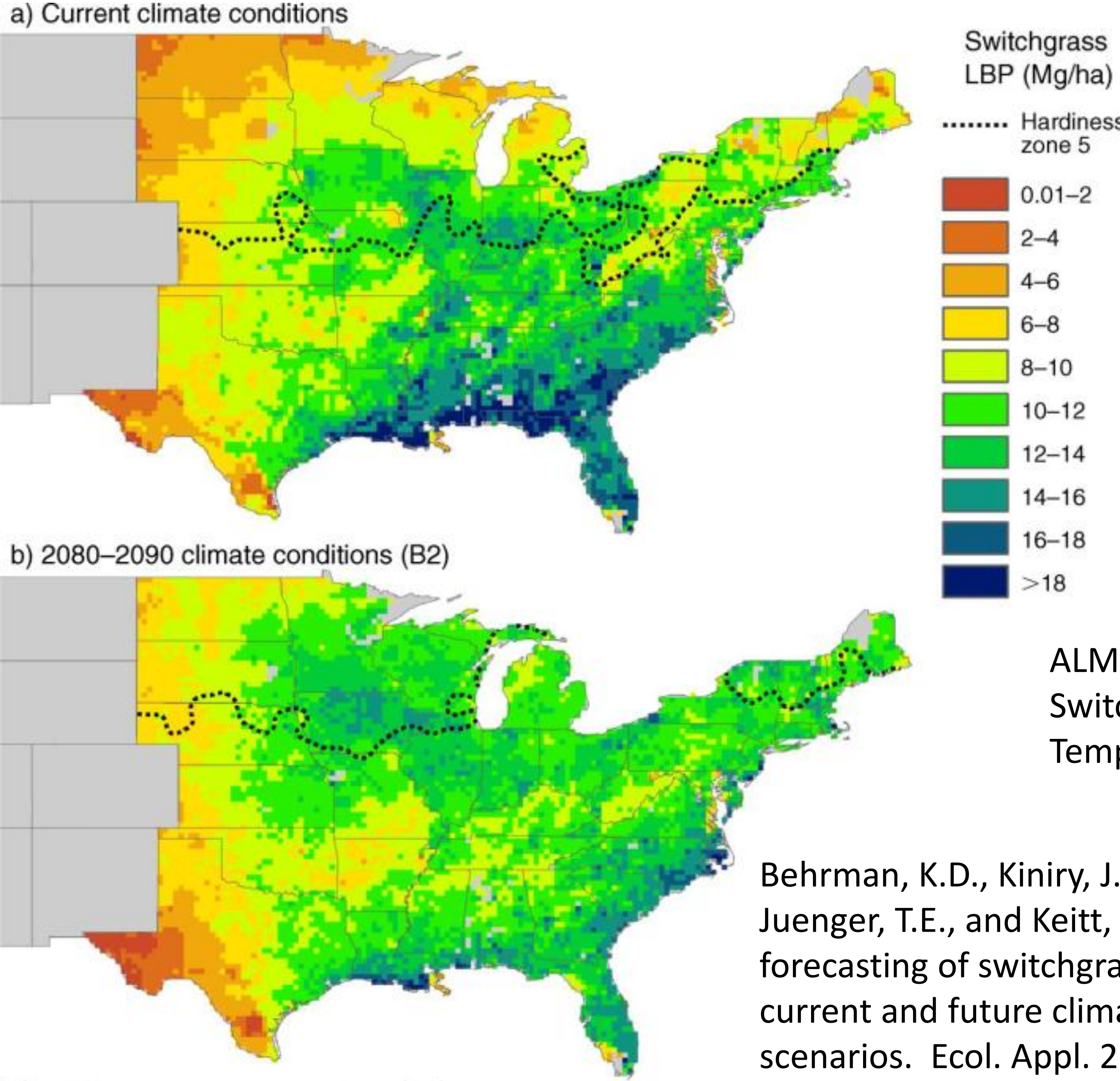
Slope (DEM)

Scale variable

- Subfield
- Field
- Multiple field



Baffaut et al.
Columbia MO ARS

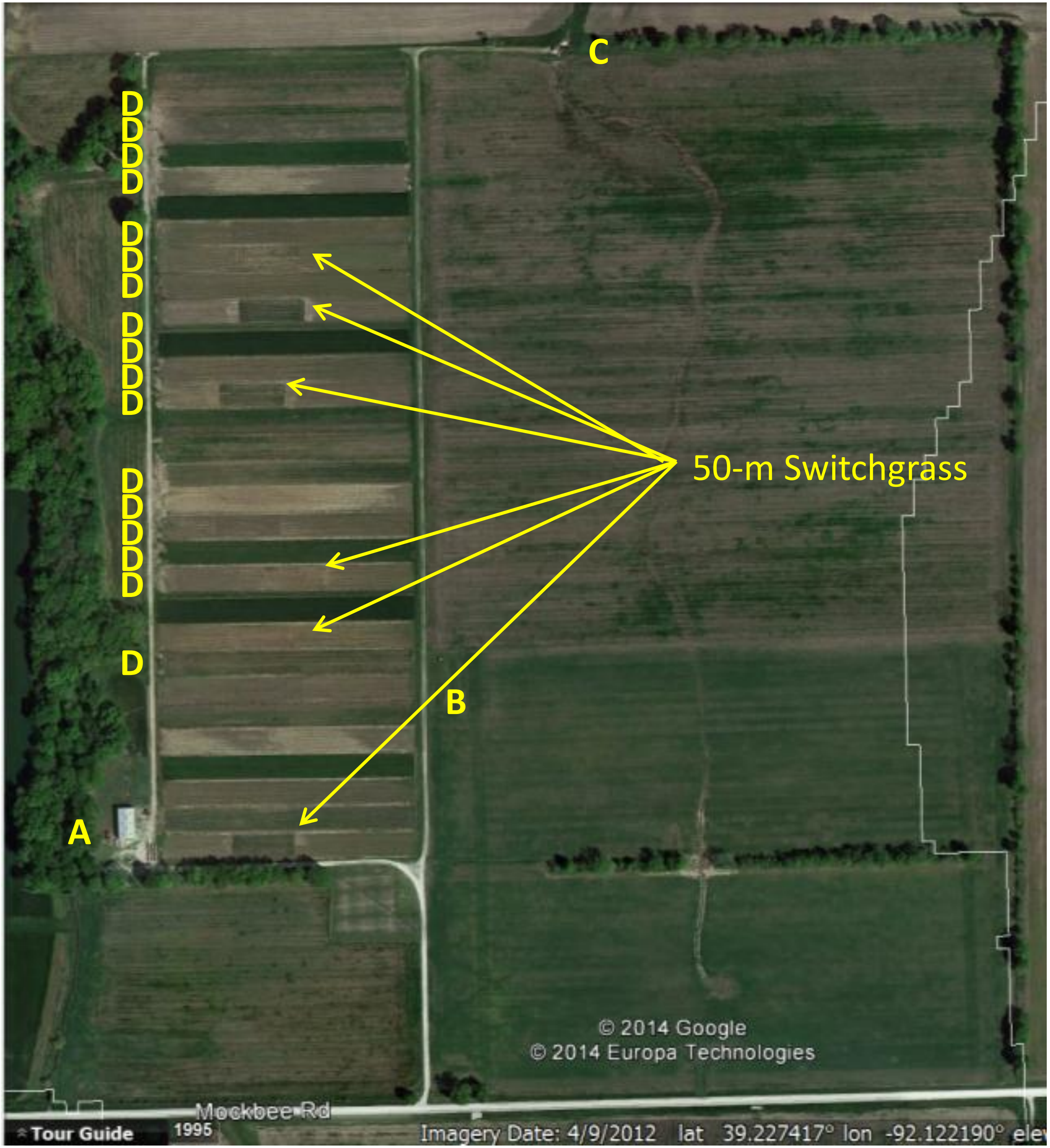


ALMANAC model
Switchgrass,
Temple TX ARS

Behrman, K.D., Kiniry, J.R., Winchell, M., Juenger, T.E., and Keitt, T.H. Spatial forecasting of switchgrass productivity under current and future climate change scenarios. Ecol. Appl. 23(1):73-85. 2013.

Legacy of erosion

- Areas that have had erosion in the past
  - Current erosion
  - Current low crop yields, and worse during drought
  - Current off-site transport of nutrients and pesticides
- Appear to be attractive sites for perennials
  - Reduce the above
  - Rebuild the soil
  - Have moderate yields, and more stable yields during drought



In the plots shown, the 50-m section that had the lowest claypan conductivity index was converted to switchgrass.

In a field, this would look like contour farming, where the steepest section with thinnest soil was grass.

We will measure water flow and quality on some of these plots.

Addressing the degraded landscape

Summary – Problems of Scale

- Scales of problems and scales of solutions are both tricky (and perhaps / probably not the same)
- It is difficult to scale up or down
- Solutions may exist at sub-field scale but not be visible at watershed scale
- Disproportionality hypothesis suggests that placement is critical

Tomer and Locke (2011) ARS lessons

- The importance of targeting conservation to address specific pathways and sources of contaminants was demonstrated in several watersheds.
- Lag effects and historical legacies had a major impact on our observations and are a major reason that long-term research is needed.
- Few experiments quantified individual CP effects on water quality in five years.

Tomer, M.D., and M.A. Locke. 2011. The challenge of documenting water quality benefits of conservation practices: A review of USDA-ARS's conservation effects assessment project watershed studies. Water Science & Technology 64(1) 300–310.

NIFA CEAP lessons learned

- Watershed planning (which is mostly not happening) should occur first. Part of this planning is to know the pollutant, pollutant source, and hydrology before BMPs are selected, implemented and targeted.
- The human dimension aspect of BMP implementation is huge and multi-faceted but beyond economics one of the biggest impediments is management time.
- Models are tools that can aid in watershed work, but they should be used with care.
  - Hydrology done better than nutrient loads
- Water quality monitoring can be difficult and must be done with the appropriate design and longevity.

Osmond, D., D. Meals, D. Hoag, and M. Arabi, eds. 2012 How to Build Better Agricultural Conservation Programs to Protect Water Quality: The NIFA-CEAP Experience. Ankeny, IA: Soil and Water Conservation Society. 387 pgs.

Questions?