

# Integrating Modeling and Regional Classification to Improve Watershed Management

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# Outline

- Overview of CEAP Synthesis objectives
- Current Management Tools
  - The Role of Hydrologic modeling
  - The Role of Regional Classification
- Improved Regional Targeting
  - Example: Paradise Creek

# Objectives of CEAP Synthesis

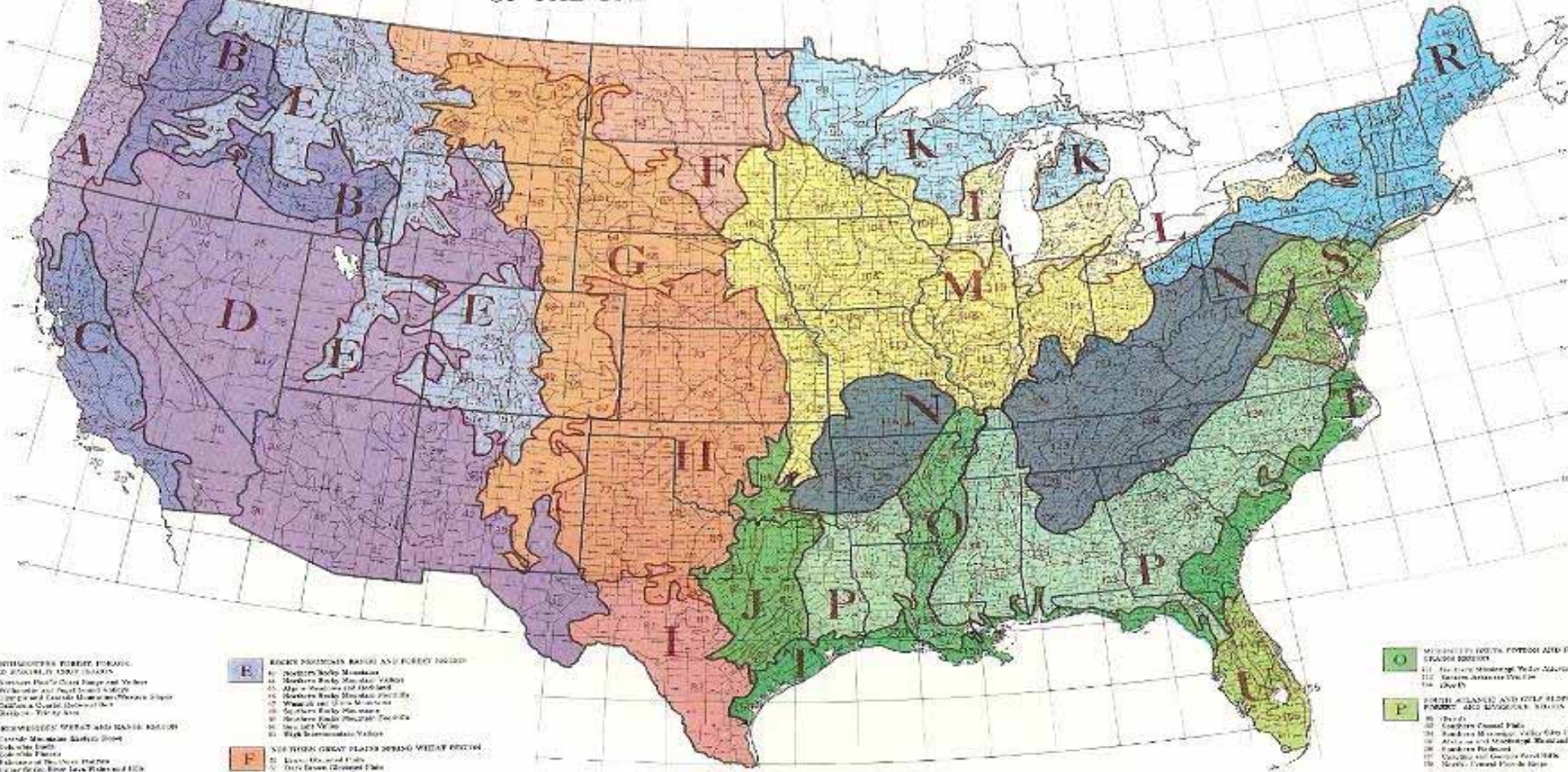
- Gather information
  - How were practices selected and targeted?
  - What practices worked and why?
- Analyze information
  - What are common problems/solutions?
  - How transferable are the lessons from one study to another?
- Provide recommendations
  - Feed information back to decision makers
  - Better management tools, resources

# Common Management Tools

- Ecoregion approach
  - Local/Regional Knowledge (NRCS, SWCD, Extension)
    - Major Land Resource Areas (MLRAs)
    - NRCS electronic Field Office Technical Guide (eFOTGs)

# Land Resource Regions and Major Land Resources Areas

LAND RESOURCE REGIONS AND MAJOR LAND RESOURCE AREAS  
OF THE UNITED STATES (exclusive of Alaska and Hawaii)



- A** NORTHWESTERN FOREST FORELAND AND FORELAND FORELAND
  1. Northwest Coast Range and Willamette
  2. Willamette and Coast Range
  3. Oregon Coast Range
  4. Oregon Coast Range
  5. Oregon Coast Range
- B** NORTHWESTERN FOREST FORELAND AND FORELAND FORELAND
  6. Cascade Mountains
  7. Cascade Mountains
  8. Cascade Mountains
  9. Cascade Mountains
  10. Cascade Mountains
- C** CALIFORNIA COASTAL FORELAND AND FORELAND FORELAND
  11. Central California Coast Range
  12. Central California Coast Range
  13. Central California Coast Range
  14. Central California Coast Range
  15. Central California Coast Range
- D** WESTERN RANGE AND FORELAND FORELAND
  16. Sierra Nevada
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  20. Sierra Nevada

- E** WESTERN GREAT PLAINS FORELAND FORELAND
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[MRLA Explorer](http://www.cei.psu.edu/mlra/)  
<http://www.cei.psu.edu/mlra/>

# Common Management Tools

- Ecoregion approach
  - Local/Regional Knowledge (NRCS, SWCD, Extension)
    - Major Land Resource Areas (MLRAs)
    - NRCS electronic Field Office Technical Guide (eFOTGs)
- Modeling tools for assessment/evaluation
  - RUSLE-2
  - SWAT, AnnAGNPS, GWLF, WEPP, CONCEPTS

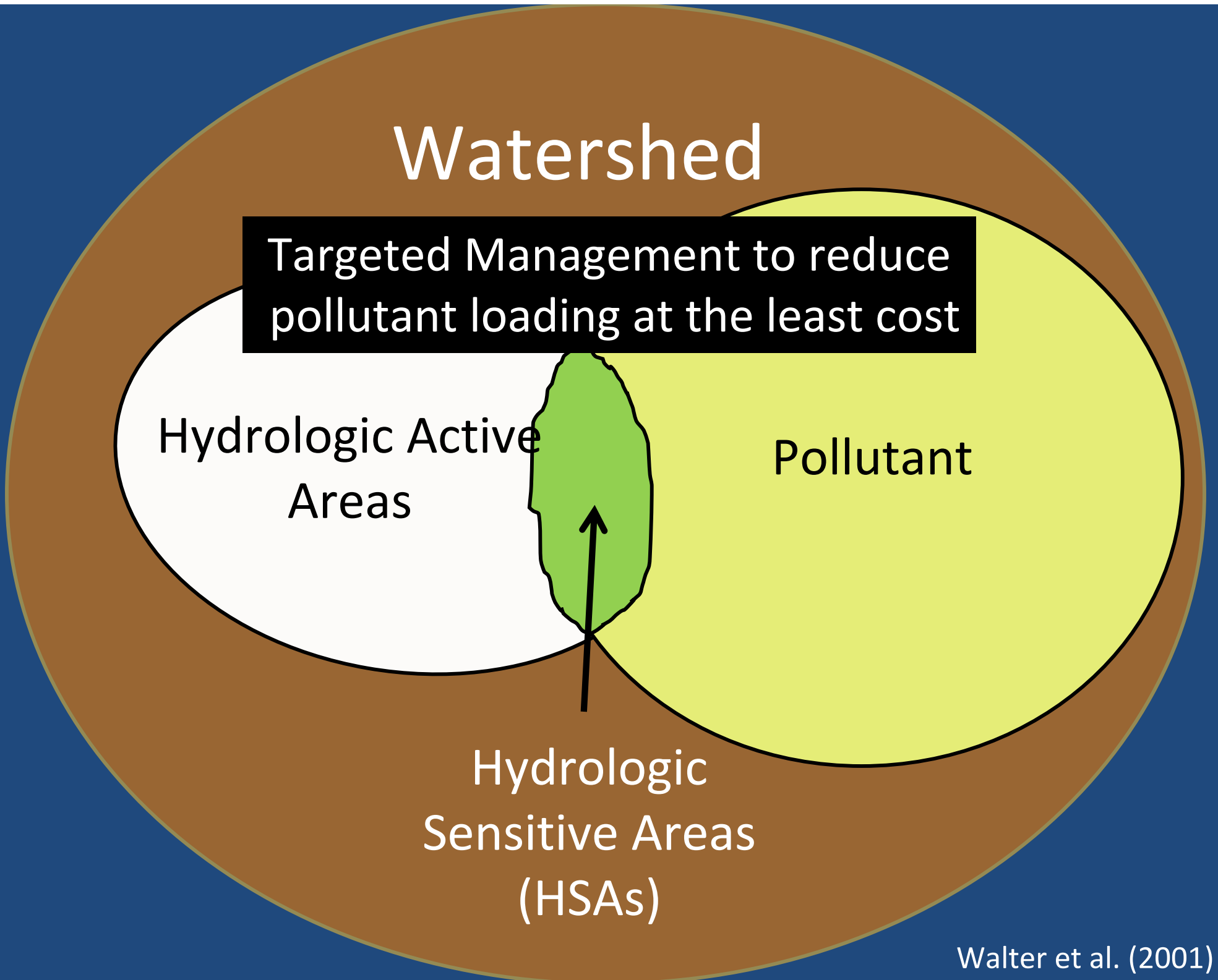
# Watershed

Targeted Management to reduce  
pollutant loading at the least cost

Hydrologic Active  
Areas

Pollutant

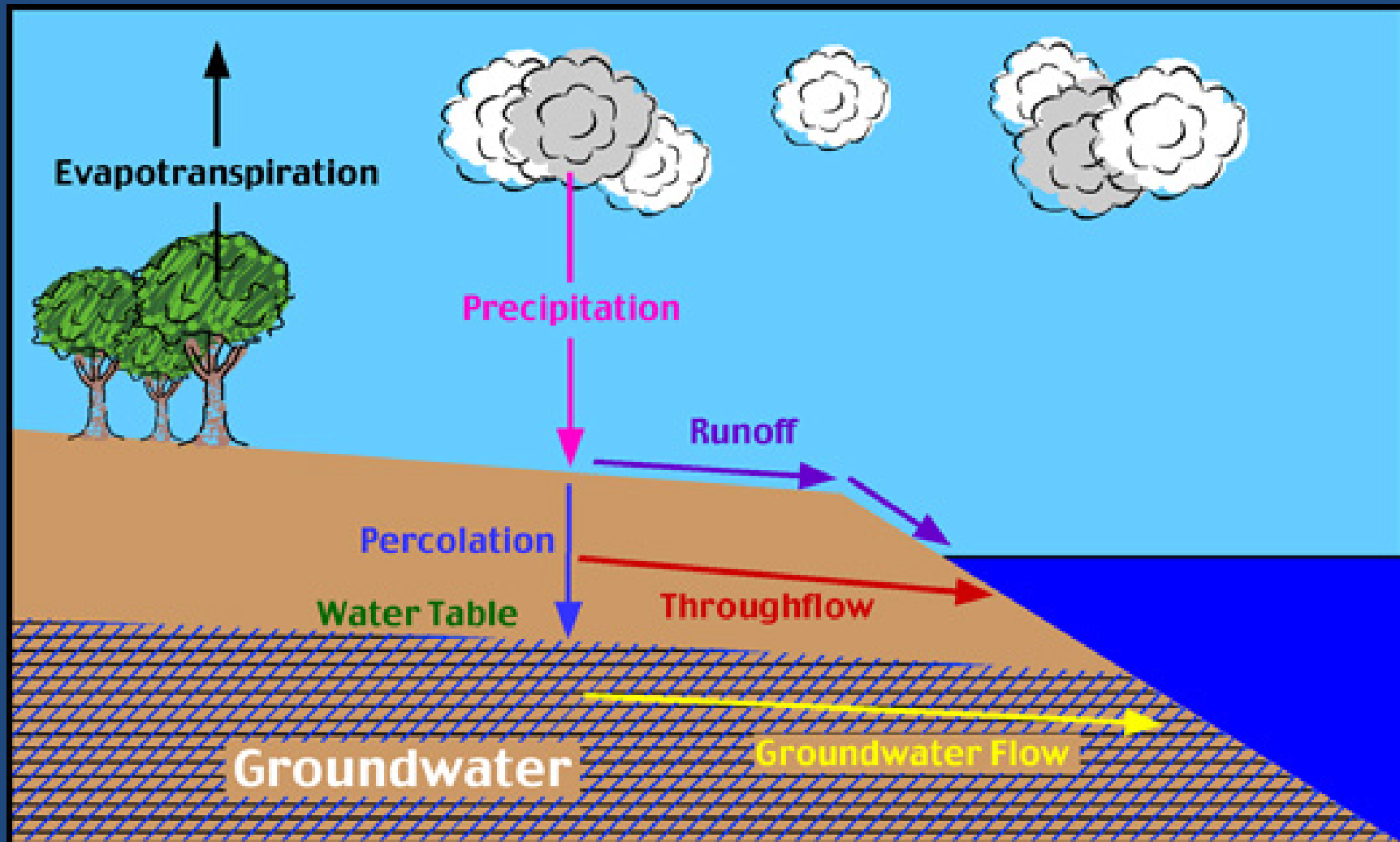
Hydrologic  
Sensitive Areas  
(HSAs)



# Misconceptions

- Buffer strips are always 75% effective
- What worked in Iowa will work in Idaho

# Pollutant Transport



# Importance of flow paths

- Nitrate
  - Ideal Conditions for denitrification
    - Shallow, saturated flow, carbon rich environments
  - Poor conditions
    - Deep, water flow below rooting depths
- Particulate Pollutants
  - Infiltration excess vs Saturation excess runoff
    - Surface vs subsurface controls

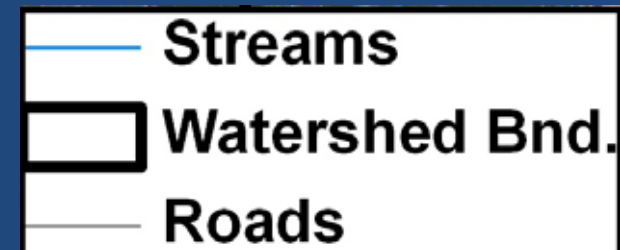
# Limitations of Current Tools

- Ecoregions
  - Good general recommendations, local knowledge
  - Limitations
    - Cannot identify specific HSAs in a watershed
- Modeling
  - Provides site specific evaluation and assessment
  - Limitations
    - Often difficult to use, takes too much time, not properly validated, not comprehensive

# Needs for Integration

- Properly validated models can identify
  - Where? How effective? Why?
  - Sensitivity analysis can reveal key factors/trends
- Ecoregions can be more specific
  - Provide specific information to target HSAs
  - Describe sensitive factors, trends, and limitations

# Paradise Creek Watershed (PCW) Analysis



# WEPP Model

- Hillslope-scale, multiple elements
- Large Climate, Soil, Management Database
- Process-based
  - Saturation-excess and Infiltration excess runoff
  - Subsurface lateral flow, percolation
  - Soil detachment, delivery, and deposition
  - Crop growth, residue decay, and soil structural changes with time
  - Snowmelt, Soil Freezing

# Paradise Creek Watershed Analysis

## Regional Physical Attributes

### Vegetation

- Winter Wheat
- Barley Pea

### Slope

- Flat (2%)
- Mid (15%)
- Steep (30%)

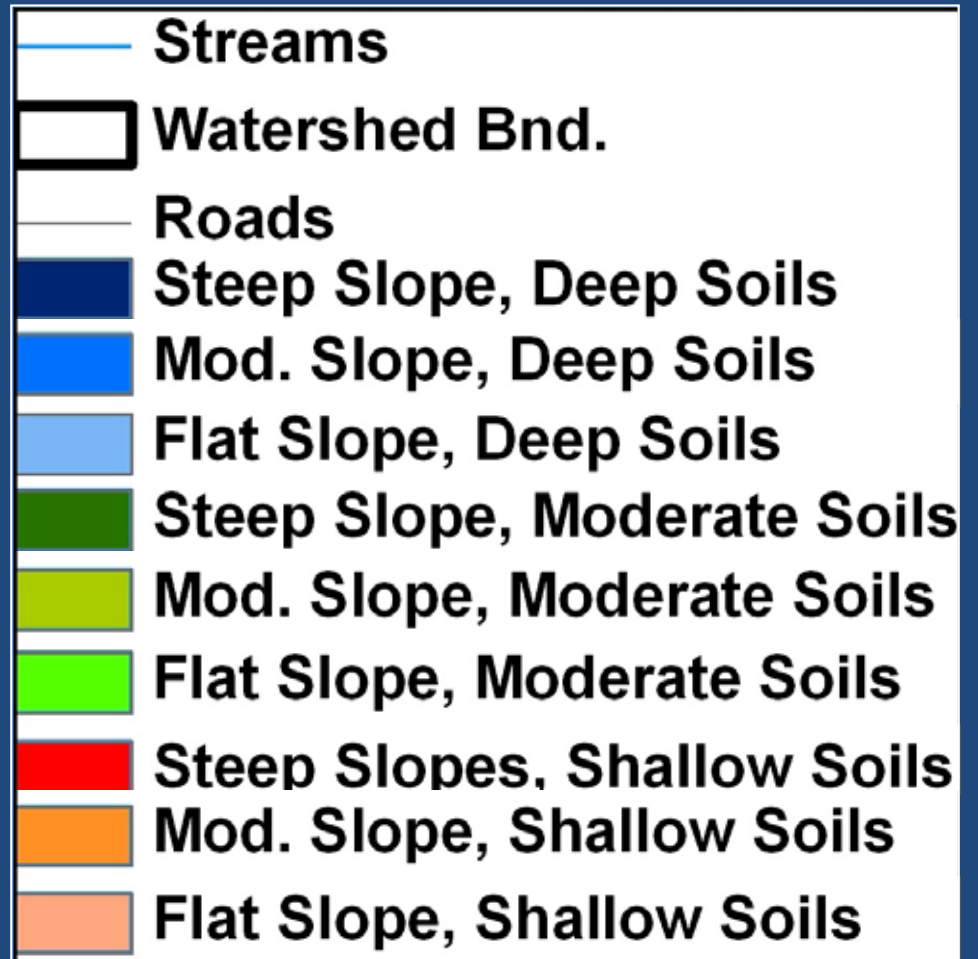
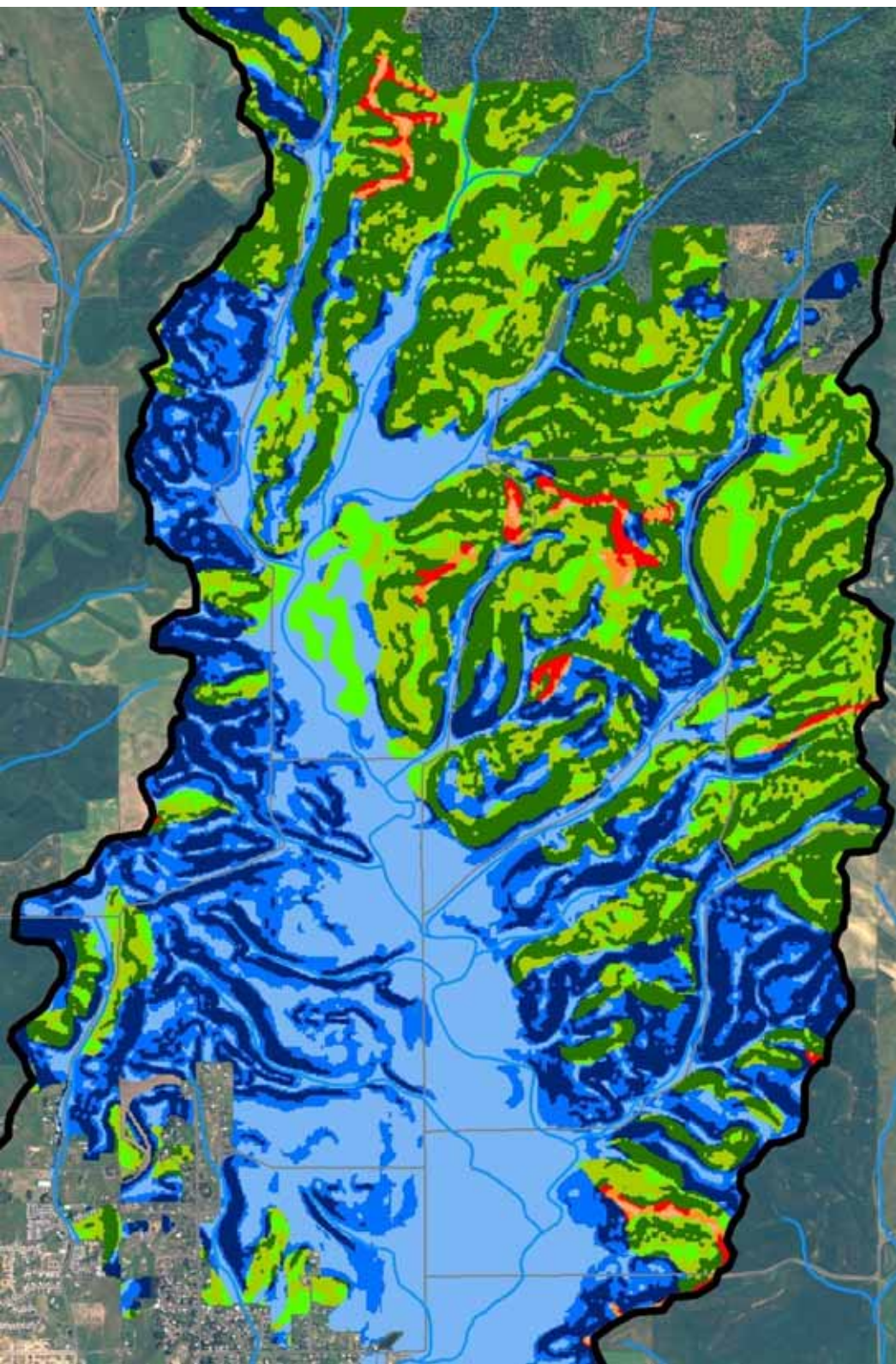
### Soil

- Palouse (>150 cm)
- Southwick (<97 cm)
- Garfield (>23 cm)

### Management

- Fallow
- Conv. Till
- Mulch Till
- No Till
- Grass
- Forest

# PCW COMBINED MAP



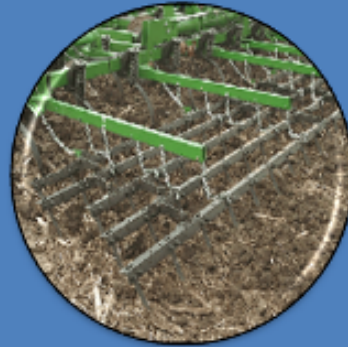
# Land Use Management Practices



Grass (CRP)



No-Till Drill



Mulch Till



Conventional  
Till



Fallow



# Sediment Yield PCW (tons/acre)

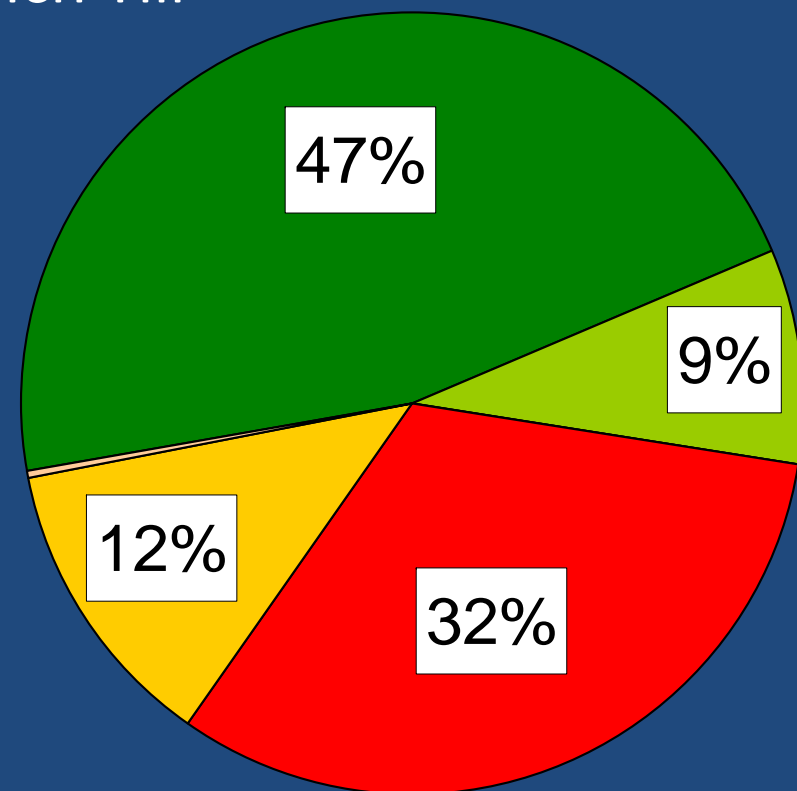
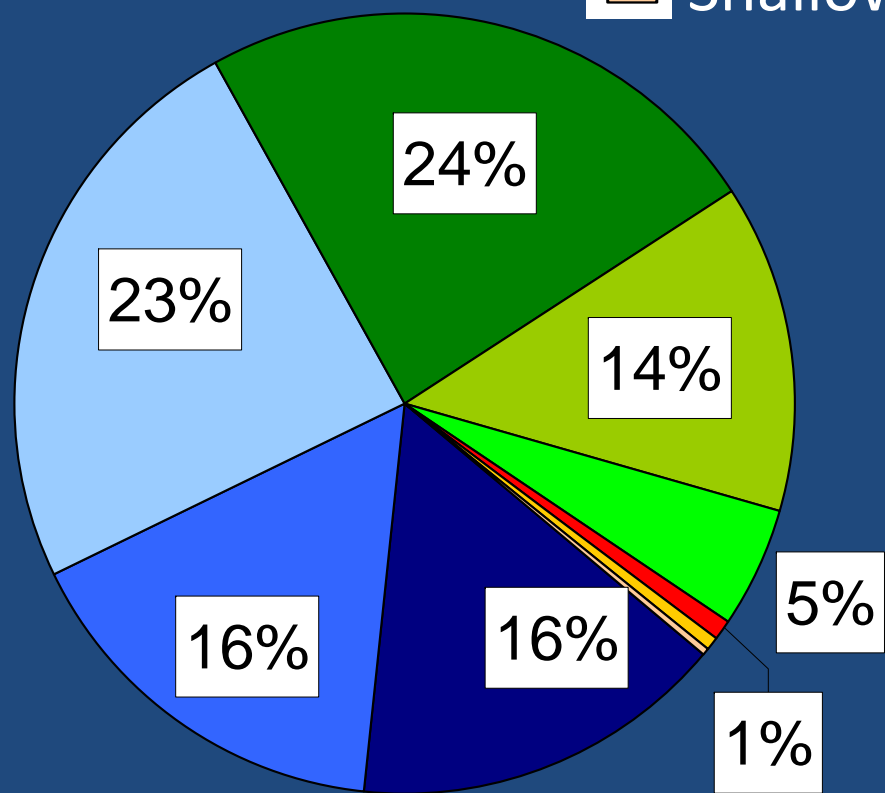
		<b>Management</b>					
<b>Soil</b>	<b>Slope</b>	Fallow	Conv. Till	Mulch Till	No Till	Forest	Grass
Deep	Steep	51.9	18.6	0.0	0.0	0.0	0.0
	Mid	28.3	8.4	0.0	0.0	0.0	0.0
	Flat	1.6	0.6	0.0	0.0	0.0	0.0
Mid	Steep	86.8	35.9	1.5	0.3	0.0	0.0
	Mid	47.7	16.6	0.5	0.1	0.0	0.0
	Flat	2.8	1.0	0.0	0.0	0.0	0.0
Shallow	Steep	209.6	126.8	30.7	4.7	1.3	1.2
	Mid	126.3	66.5	15.8	2.5	0.5	0.5
	Flat	5.8	2.3	0.6	0.3	0.3	0.2

Values in pink > 5 tons/acre

# Watershed Area

Deep	Steep	Mulch Till
Deep	Mod.	Mulch Till
Deep	Flat	Mulch Till
Mod.	Steep	Mulch Till
Mod.	Mod.	Mulch Till
Mod.	Flat	Mulch Till
Shallow	Steep	Mulch Till
Shallow	Mod.	Mulch Till
Shallow	Flat	Mulch Till

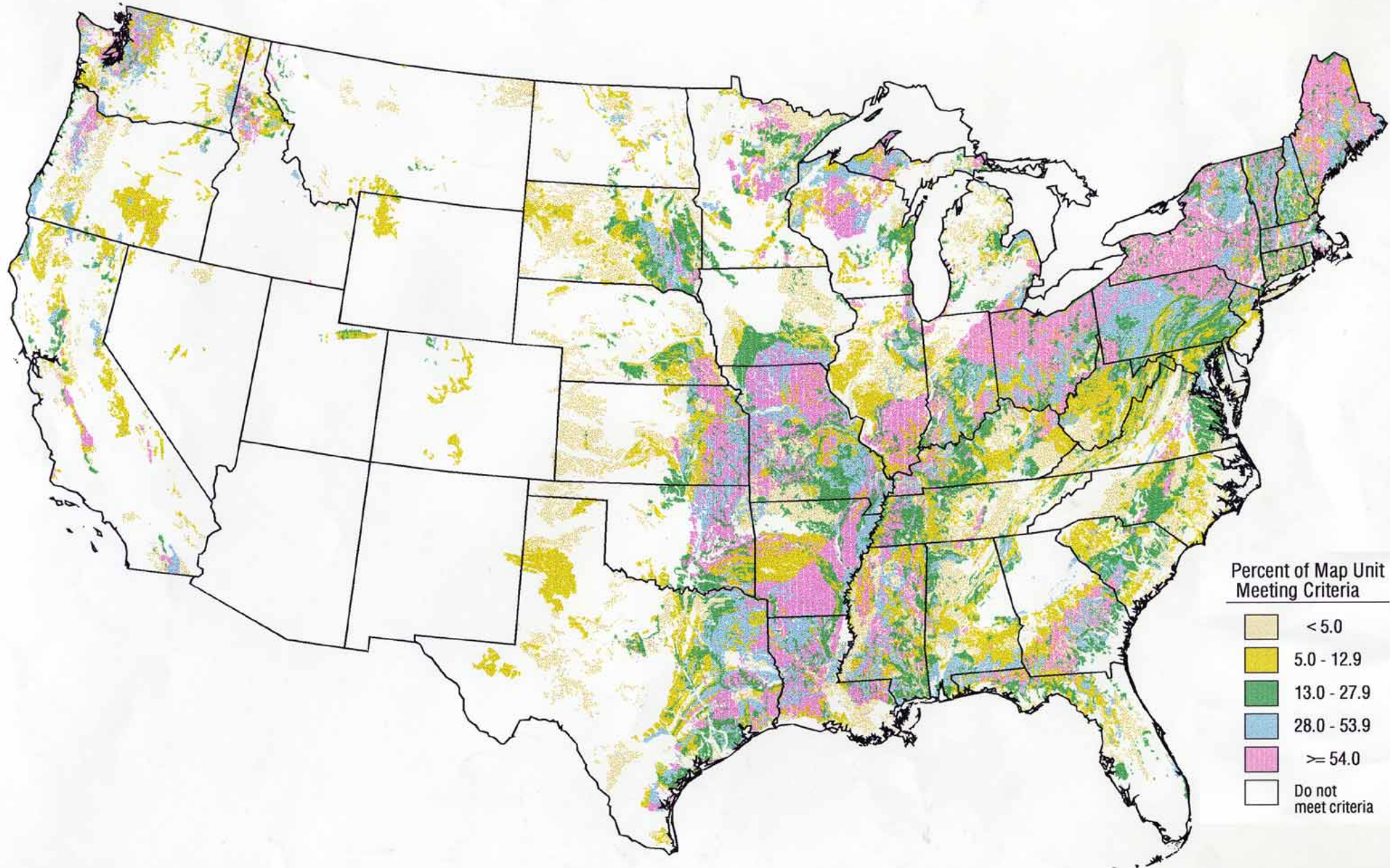
# Sediment Yield



# Regional Analysis

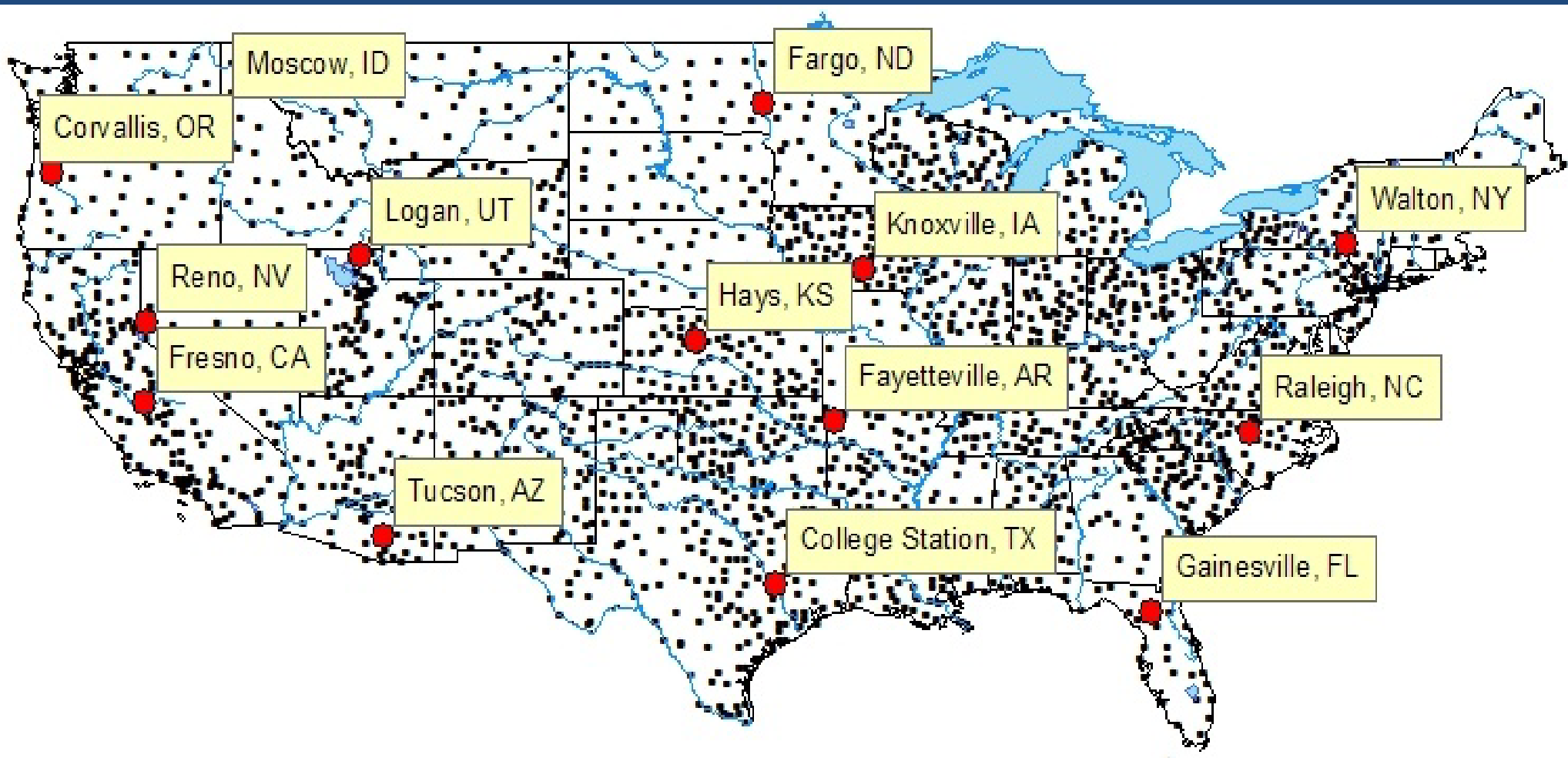
- What attributes can be used to target HSAs?
- How sensitive are these factors?
- How transferable are these relationships to other regions?

# Perched Water Tables (STATSGO)

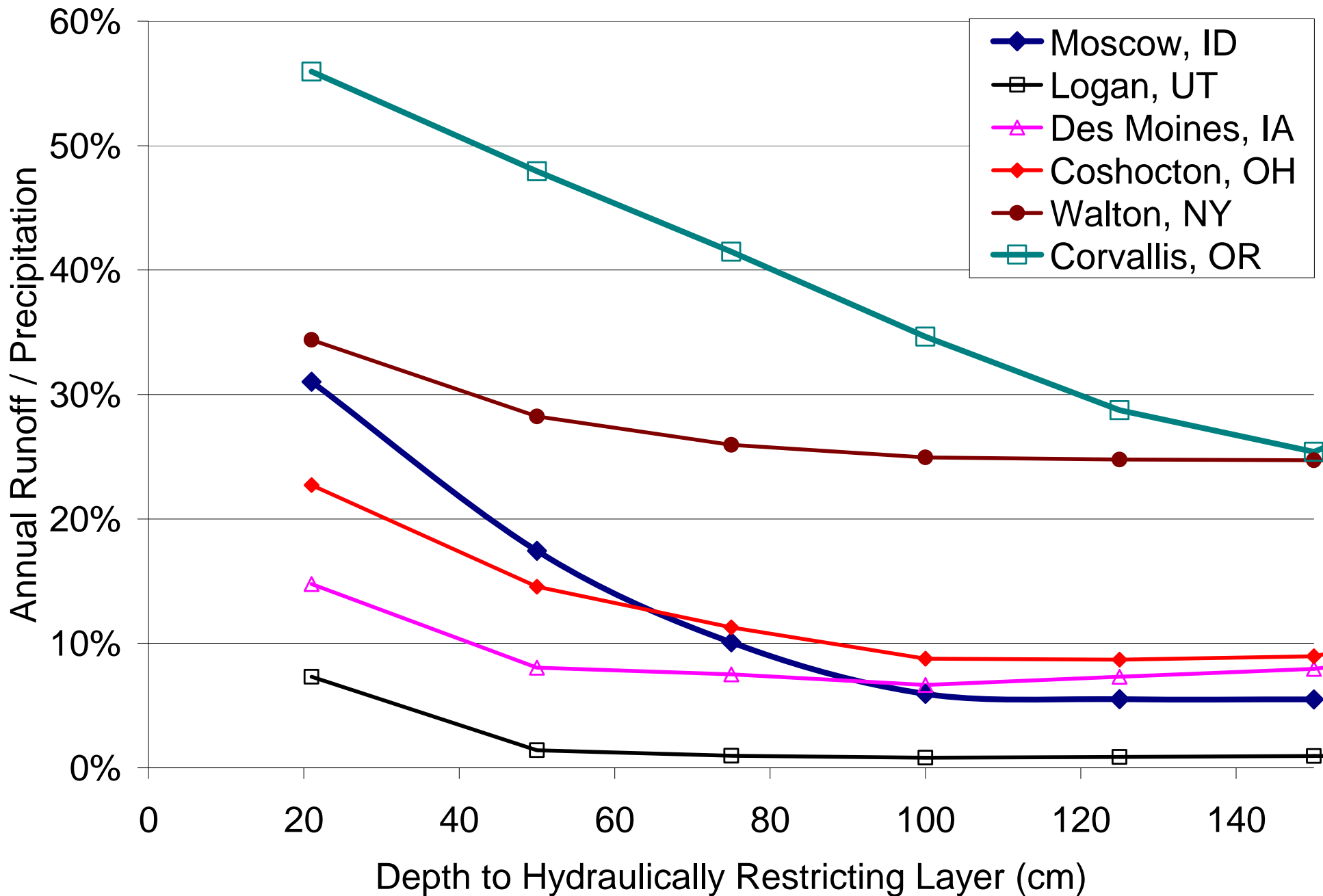


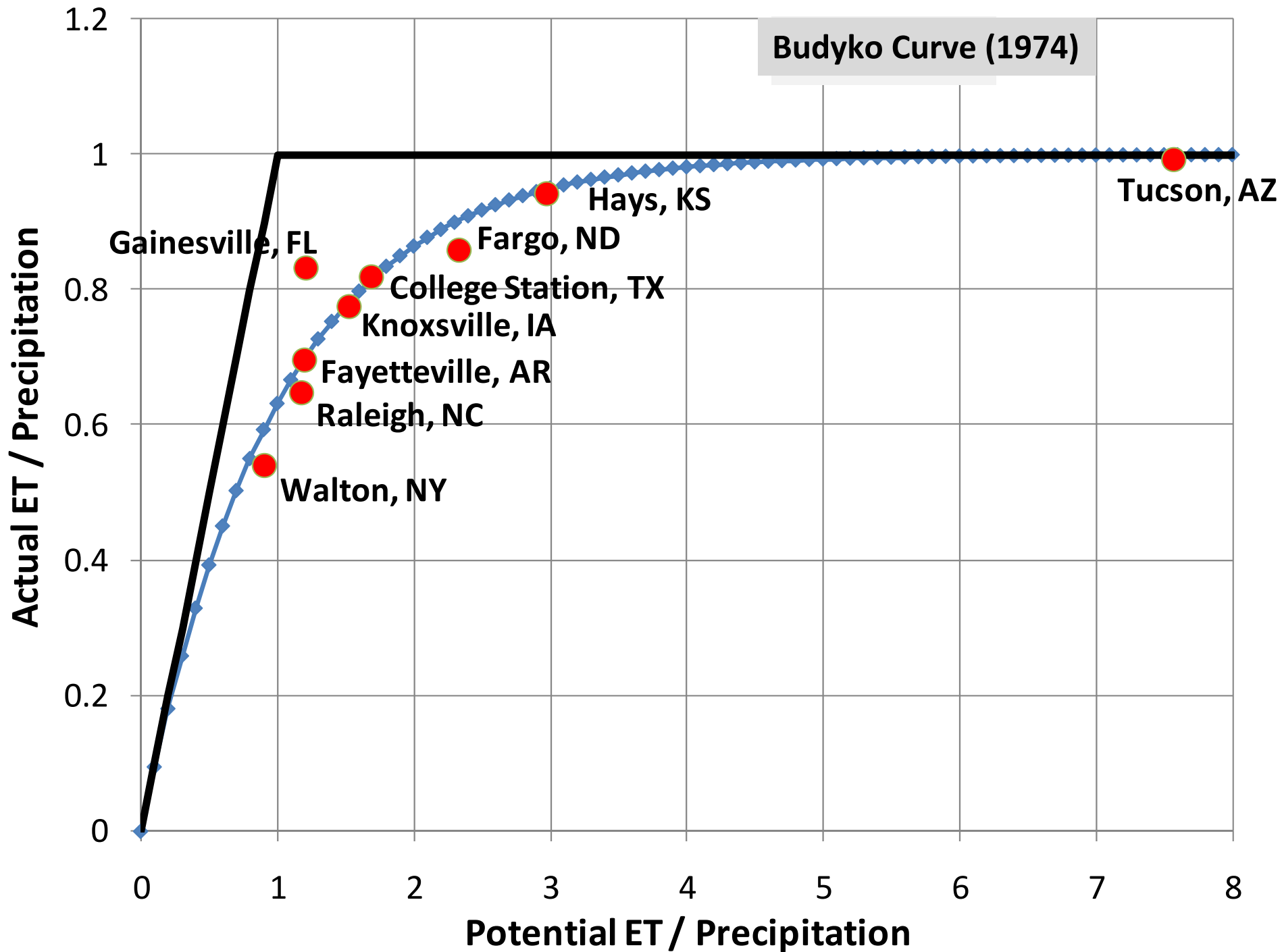
McDaniel et al (2008)

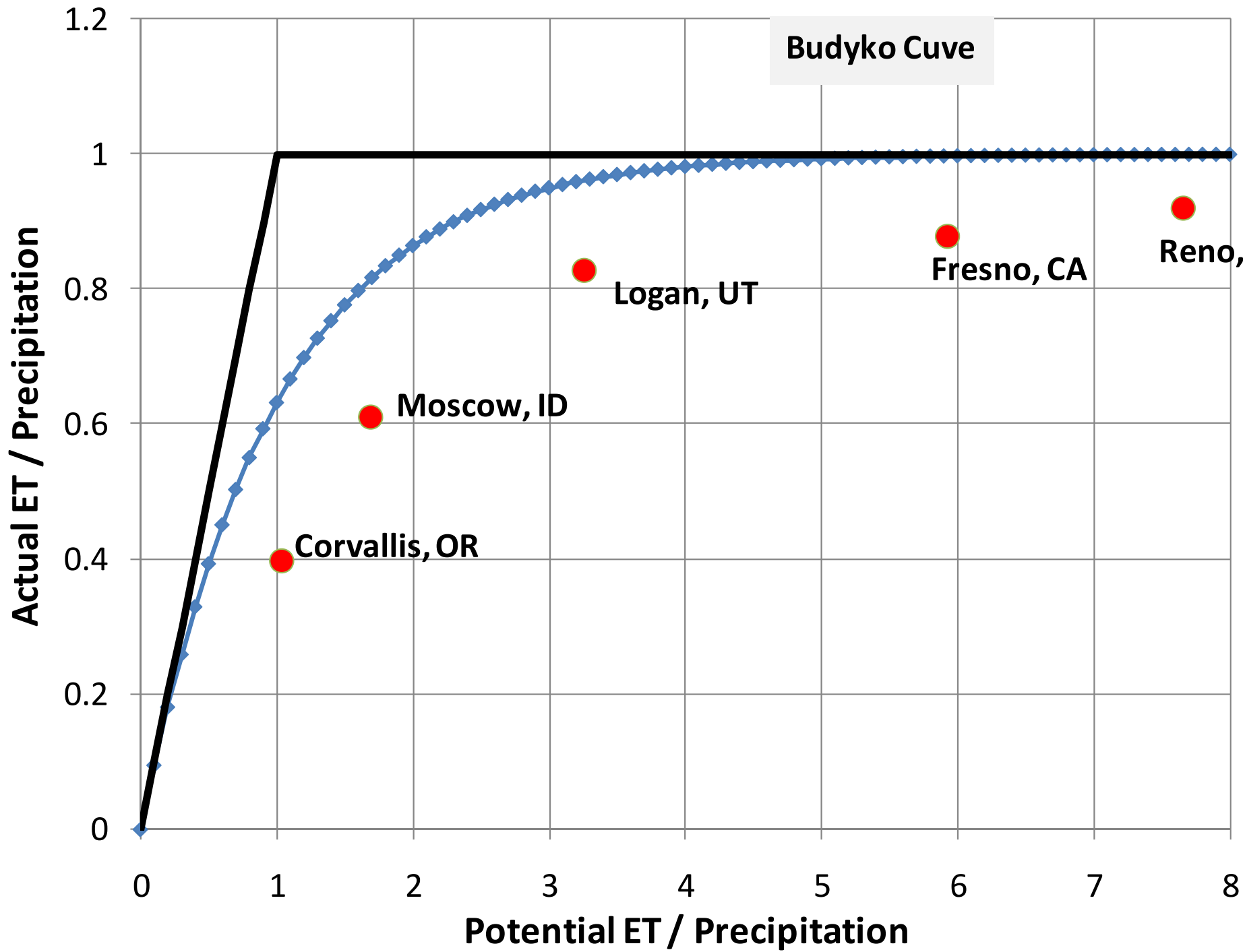
# WEPP Climate Database

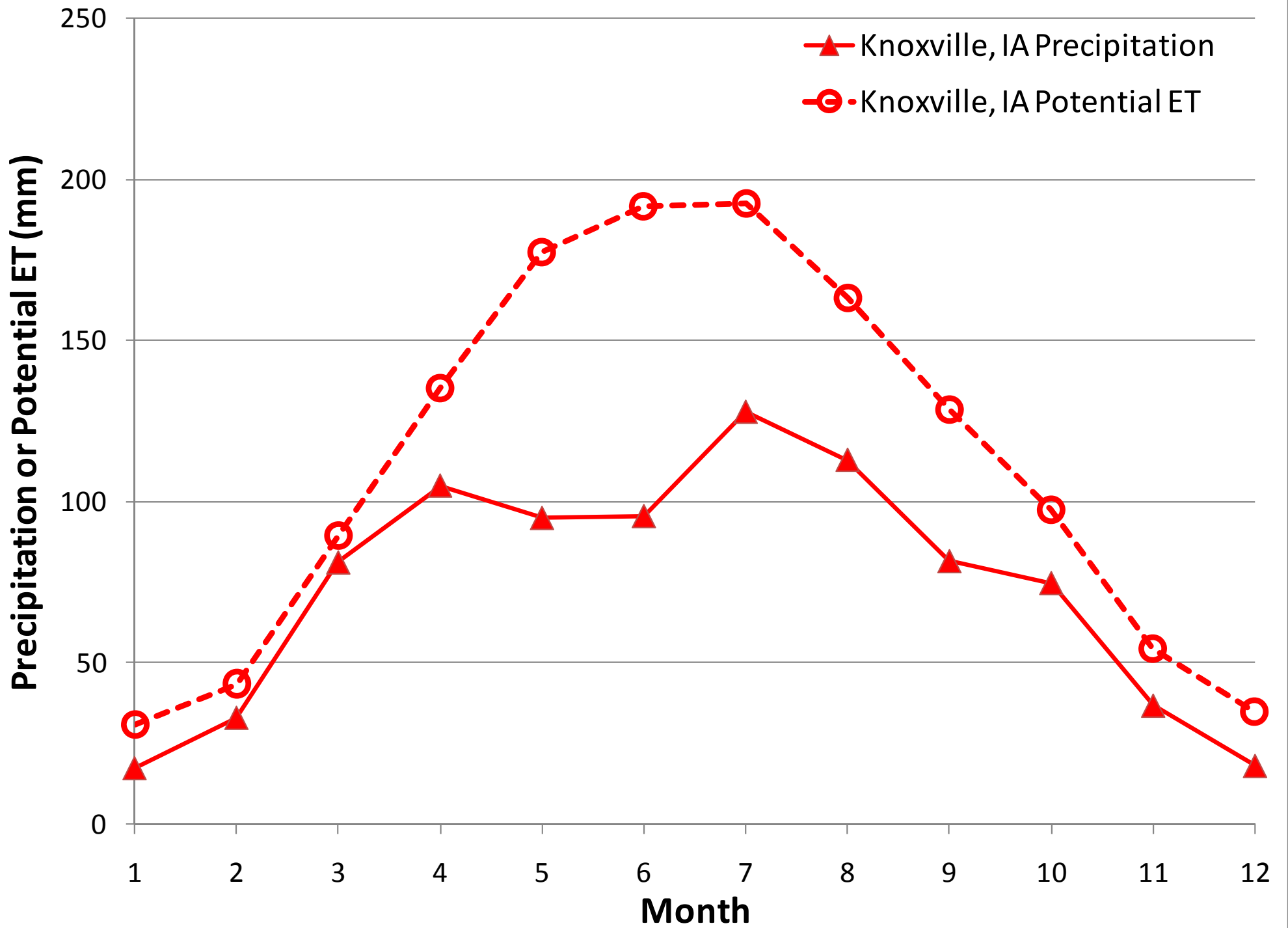


# Regional Sensitivity to Soil Depth

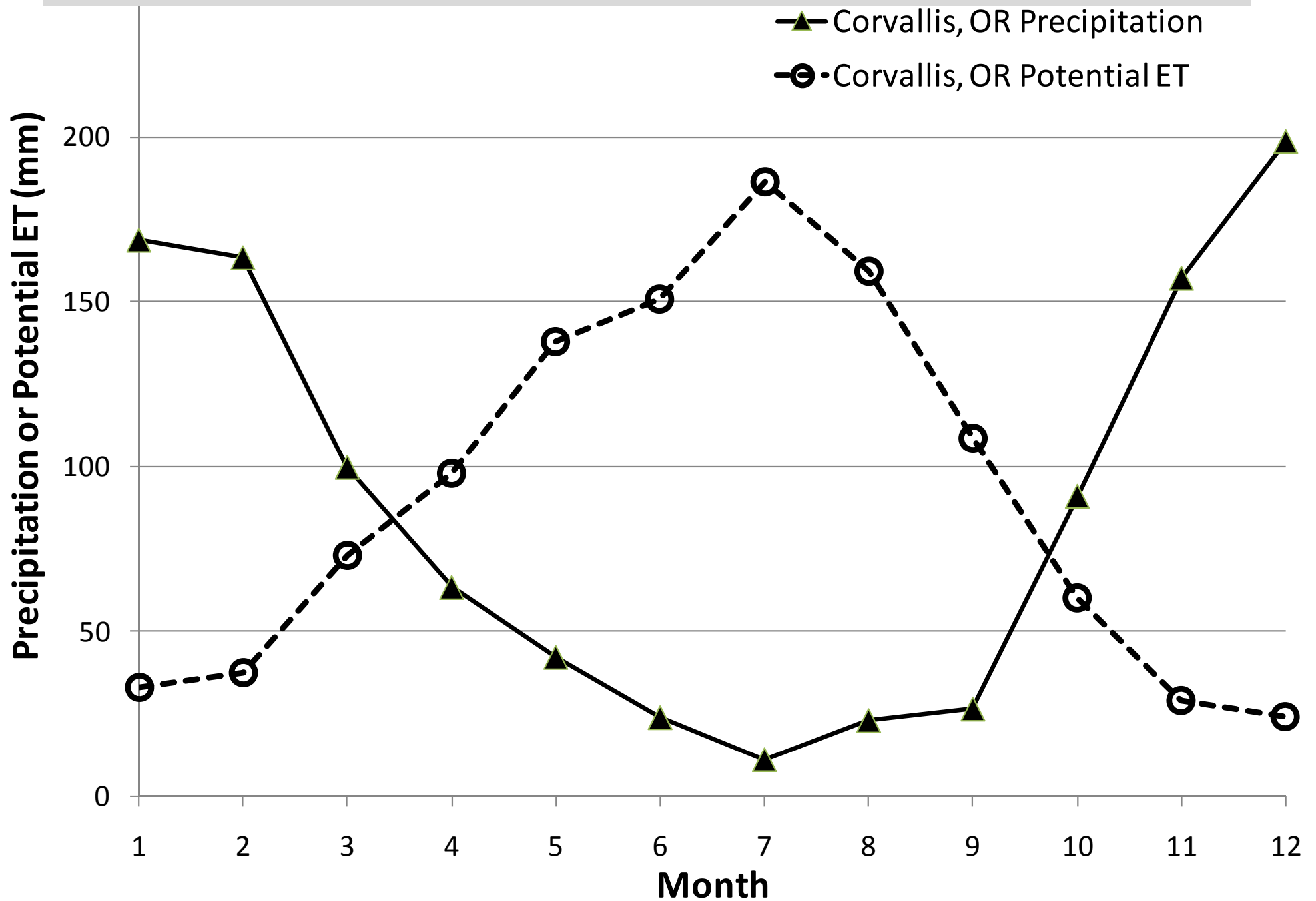


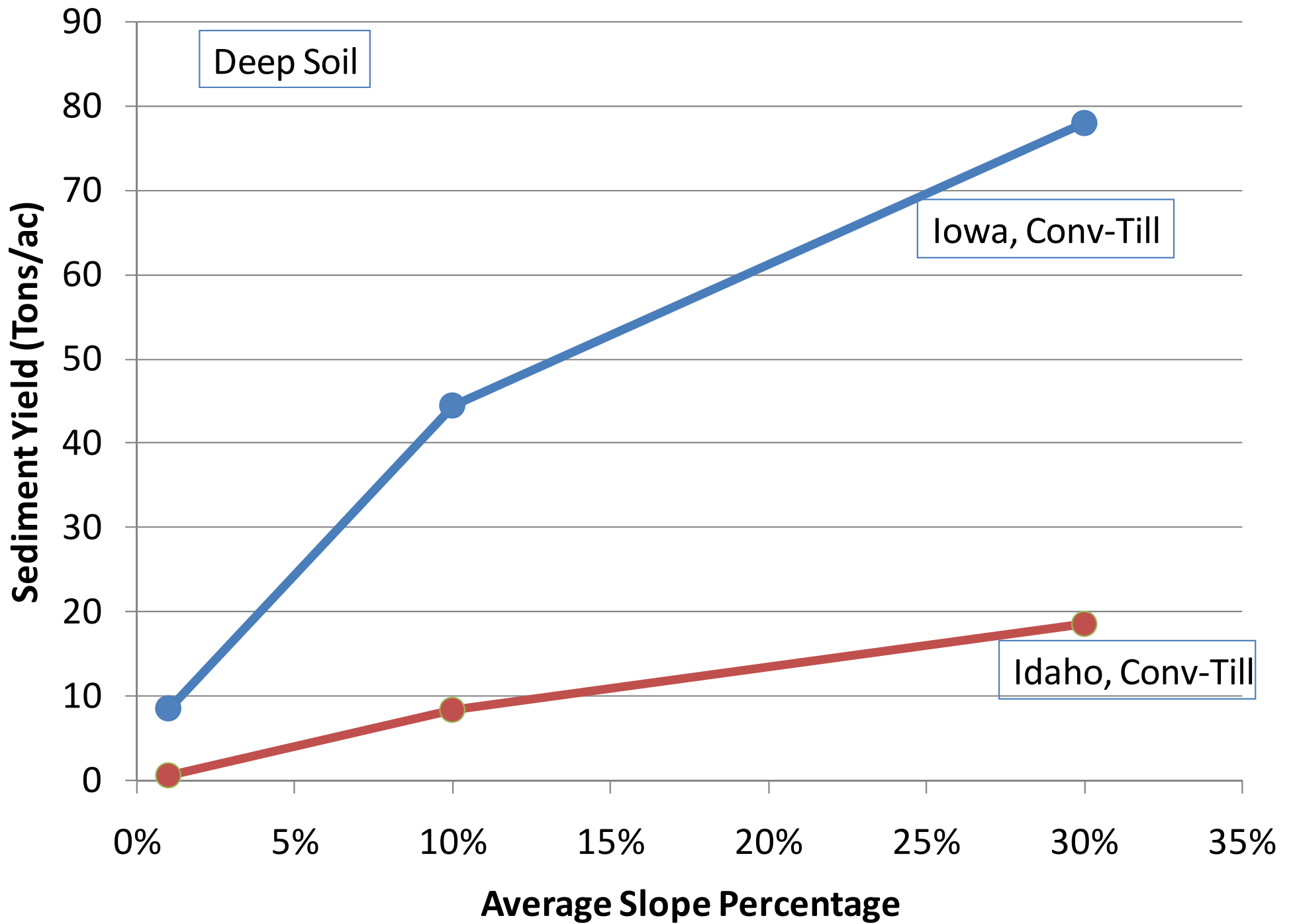




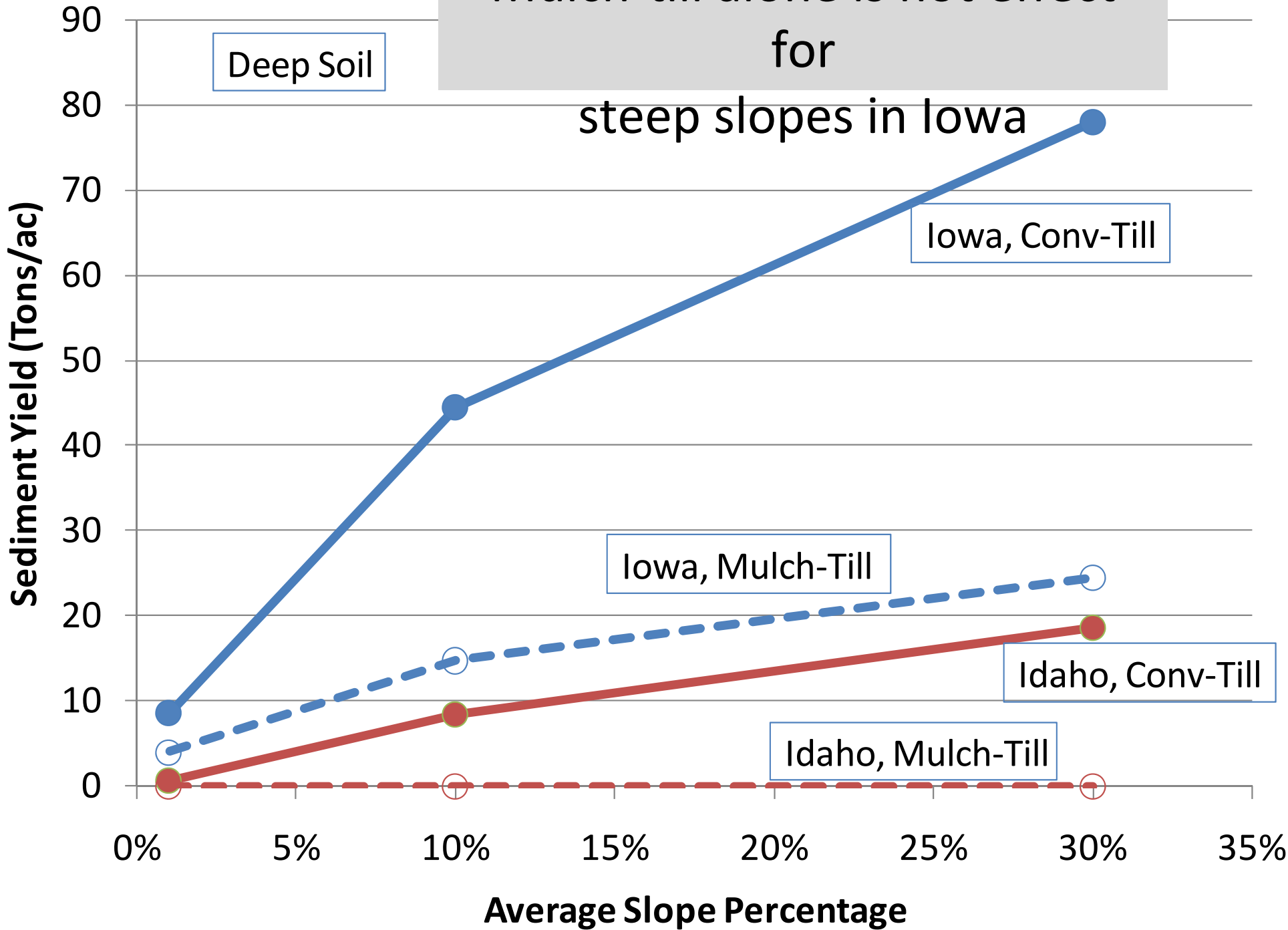


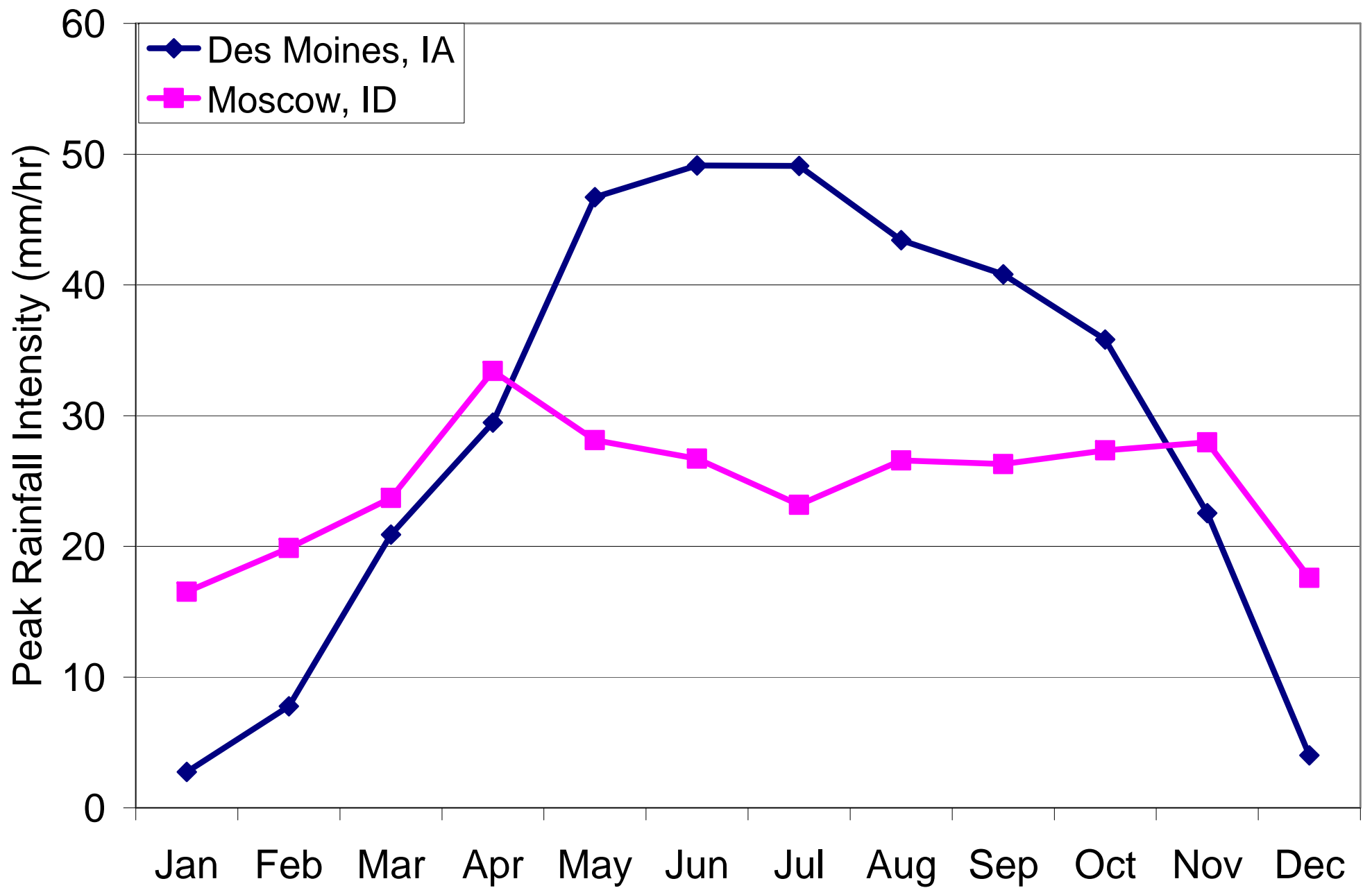
# Humid regions with wet winters and dry summers are more sensitive to restrictive soil layers





Mulch-till alone is not effect  
for  
steep slopes in Iowa





# Regional Description

- Low intensity rainfall, wet winters/ dry summers
- Restrictive soil horizons within 1 m are important for runoff generation
- Highest priority HSAs
  - Steep slopes with shallow soils (< 0.7 m)
    - Dominant runoff mechanism - saturation excess
    - Recommend No-till or CRP
- Mulch-till highly effective even on steep slopes
  - Gully erosion in convergent topography with shallow soils

# Future Direction

- Modeling and Tool Development needs:
  - Identify specific HSAs
  - Identify transport flow paths within HSAs
  - Quantify effectiveness by flow path
- Ecoregion Development
  - Examine spatial trends of effectiveness
  - Incorporate specific information
  - Incorporate social and economic data
  - Test the durability of regional trends
    - MRLAs or
    - Alternative Reclassification Techniques (Wolock et al. 2004)

An aerial photograph of rolling hills covered in agricultural fields. The fields are arranged in neat, curved rows, creating a rhythmic pattern across the landscape. The colors range from vibrant green to dark brown, suggesting different crops or stages of growth. The hills are gently sloping, and the overall scene is one of organized agriculture in a natural setting.

Thank You