

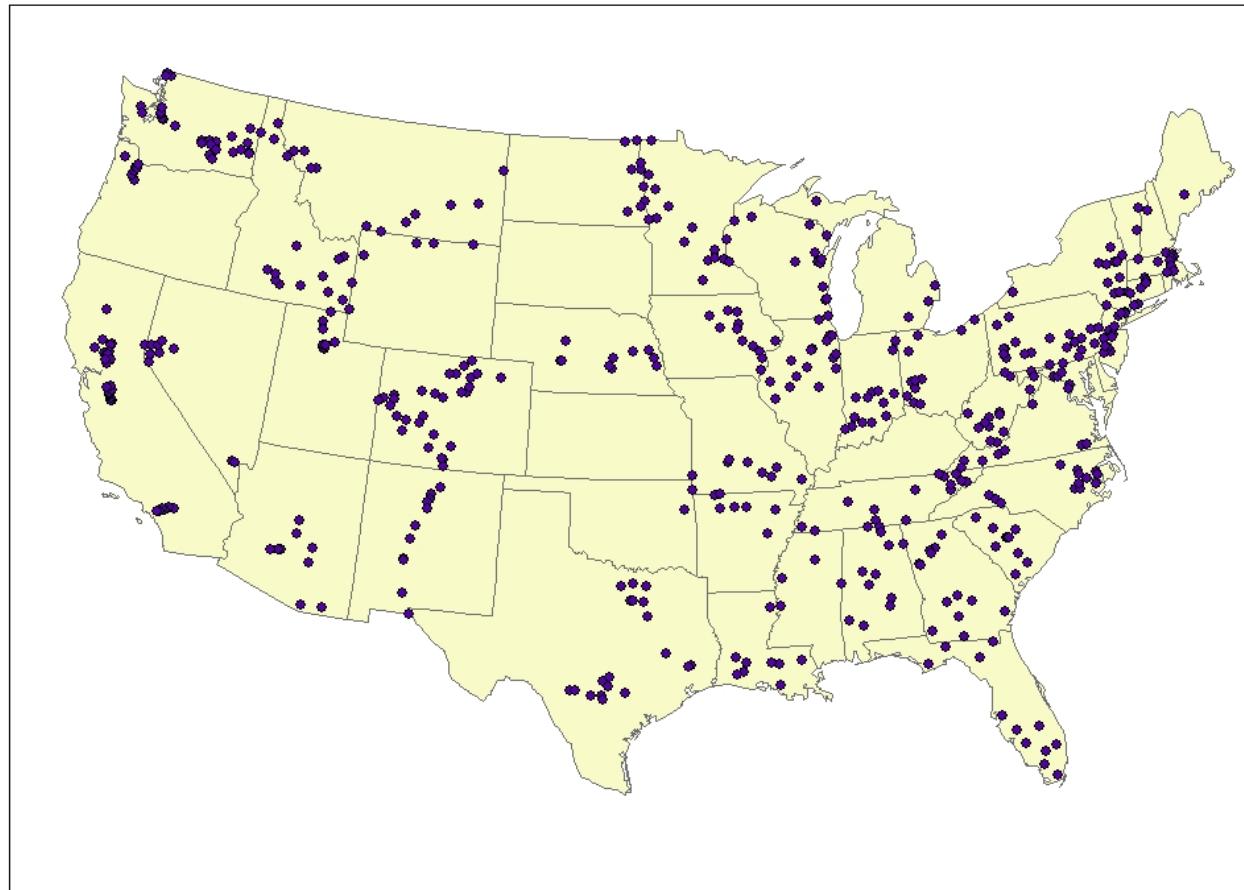
Hydrologic-landscape regions: An approach to watershed classification

David Wolock
USGS, Lawrence

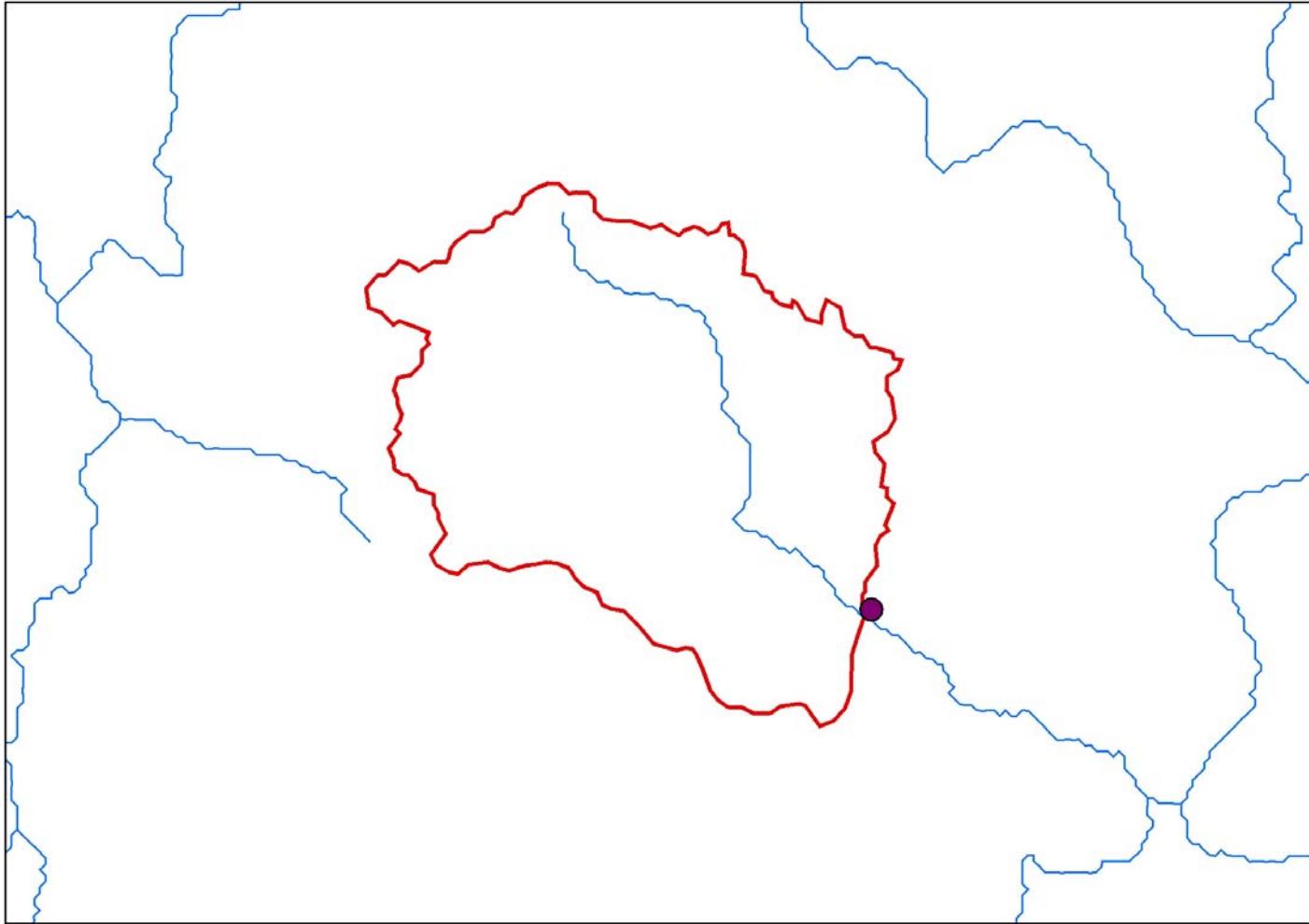
The USGS collects and analyzes information about natural resources

- Biology
- Geology
- Water
- Geography

National water-quality monitoring network

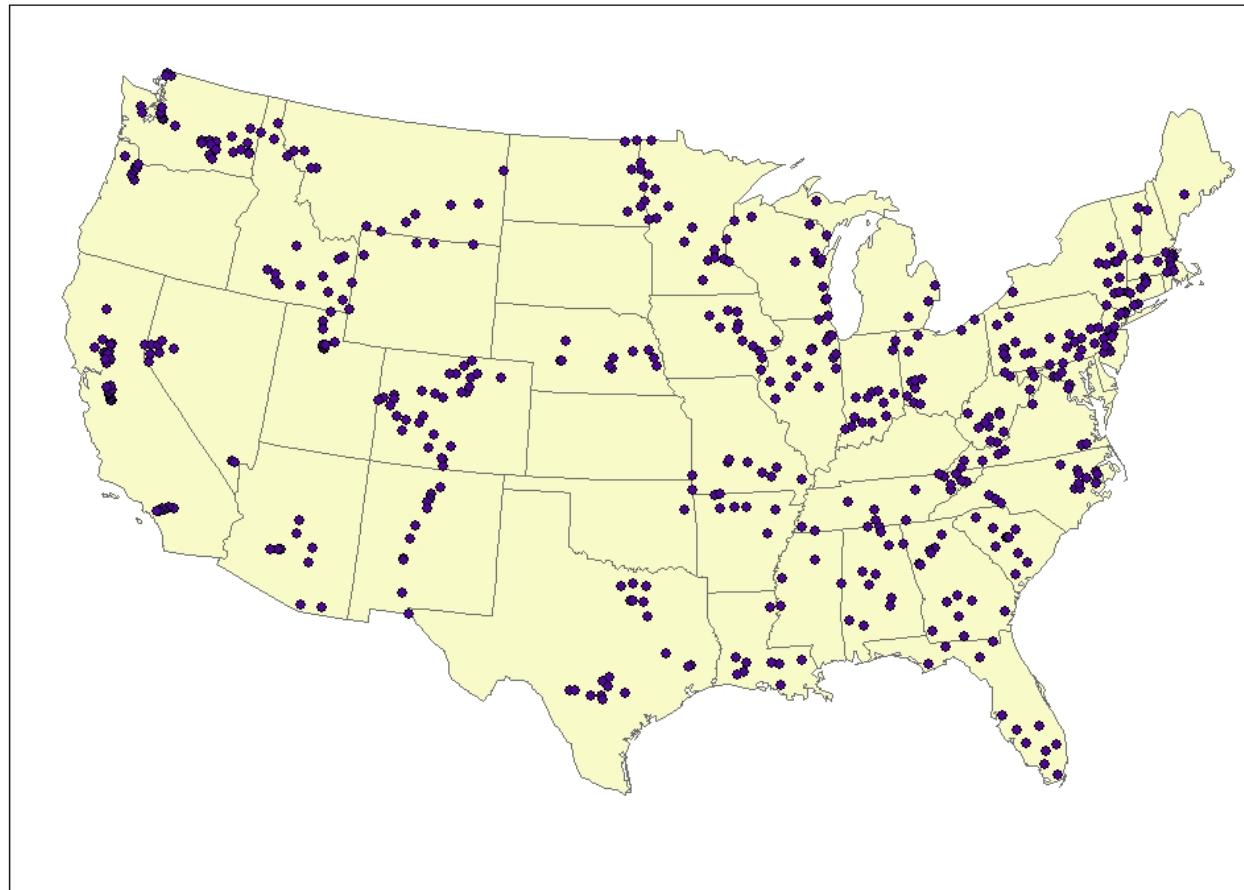


Understand how differences in hydrology affect relations between land use and water quality



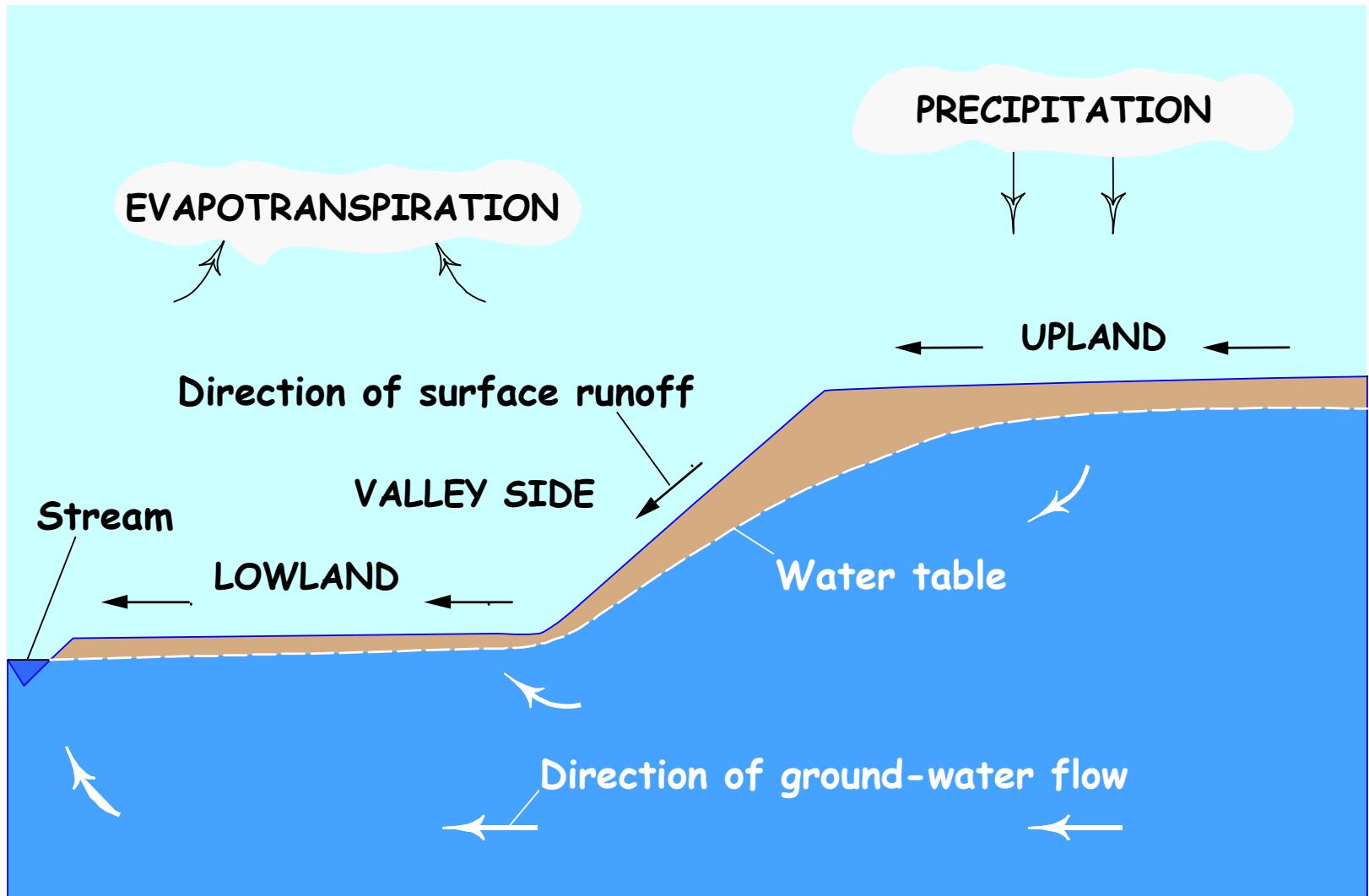
Need to characterize differences in watershed characteristics that affect hydrology

National water-quality monitoring network



Classify watersheds according to the most important factors affecting their hydrology

A generalized hydrologic landscape



Tom Winter, 2001, JAWRA

1. Delineate a set of small watersheds in the area of interest
2. Describe each watershed by its hydrologic landscape variables
 - Climate
 - Geology
 - Terrain
3. Group the watersheds according to similar hydrologic landscape variables

Elevation data



← 100 km →

Watersheds



200 km² watersheds

44,000 watersheds in 50 states

Factors used to define hydrologic landscape regions

- Climate

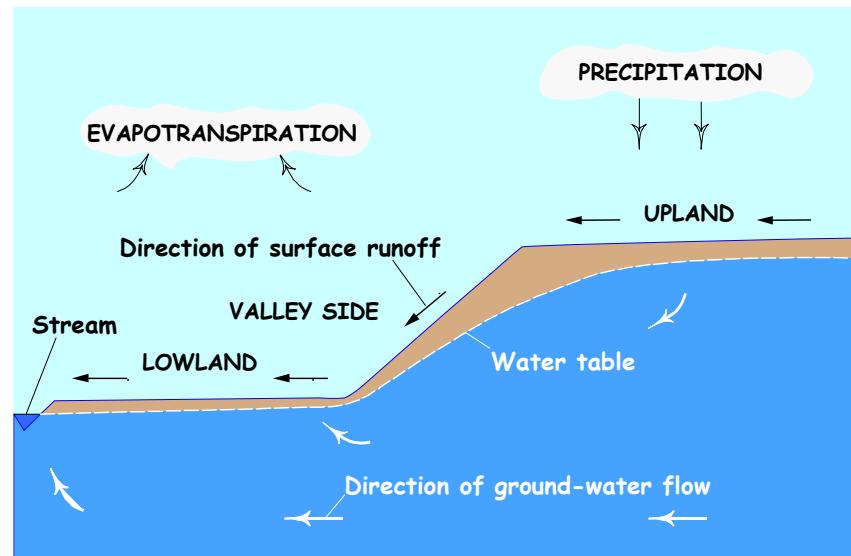
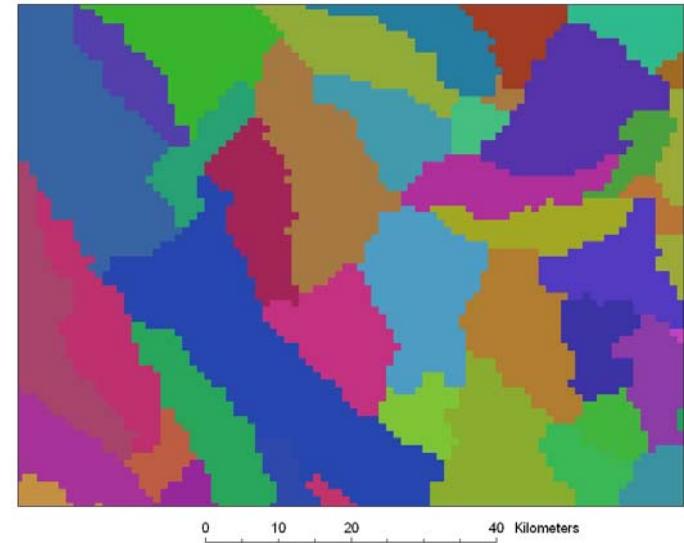
- Mean annual precipitation minus potential evapotranspiration

- Geology

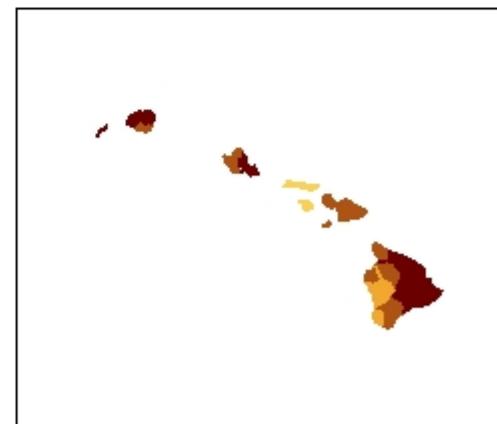
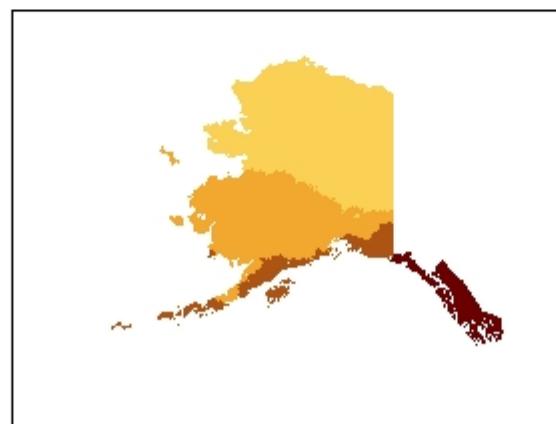
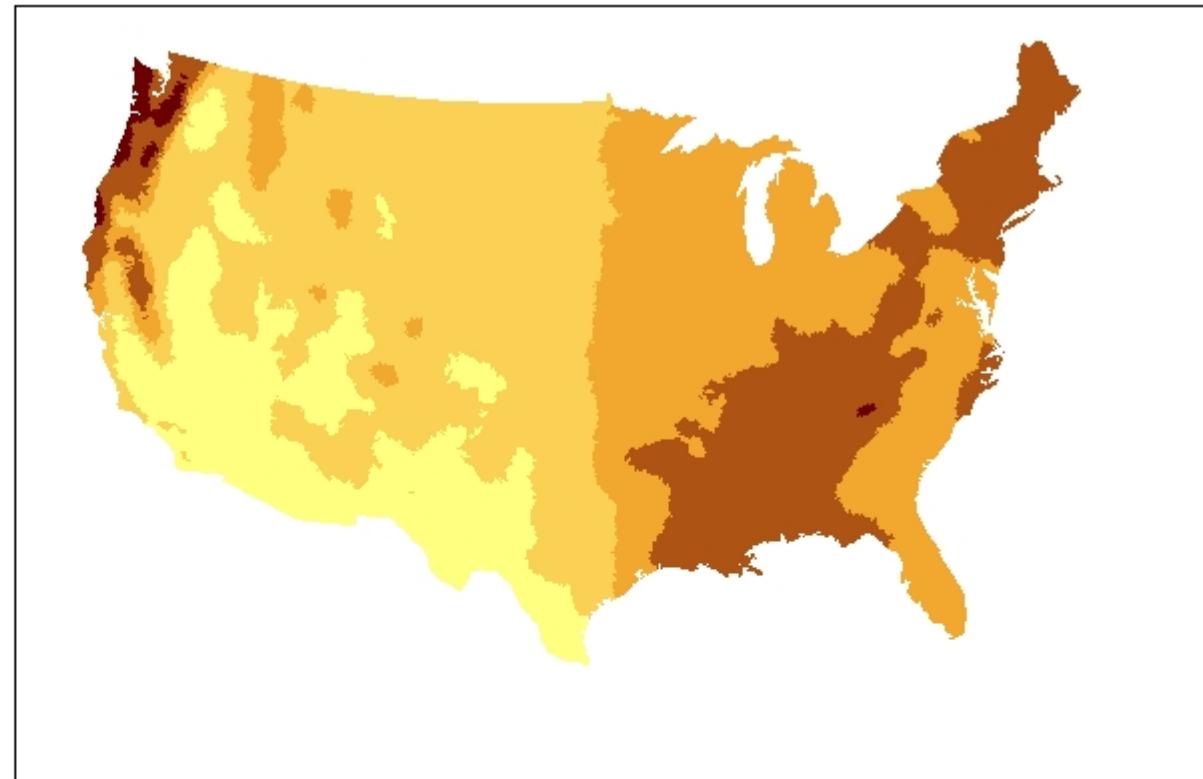
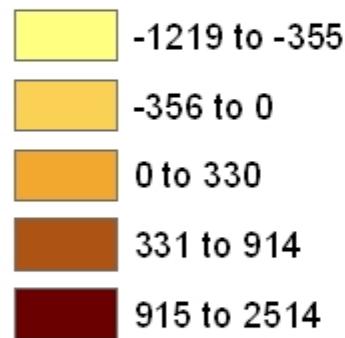
- Subsurface permeability class
 - Percent sand in soil

- Terrain

- Slope
 - Percentage and location of flatland in watershed

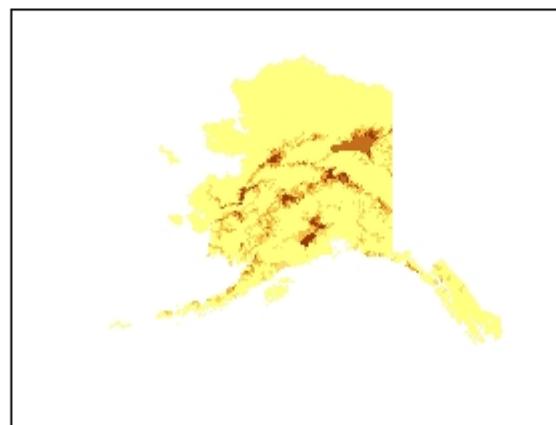
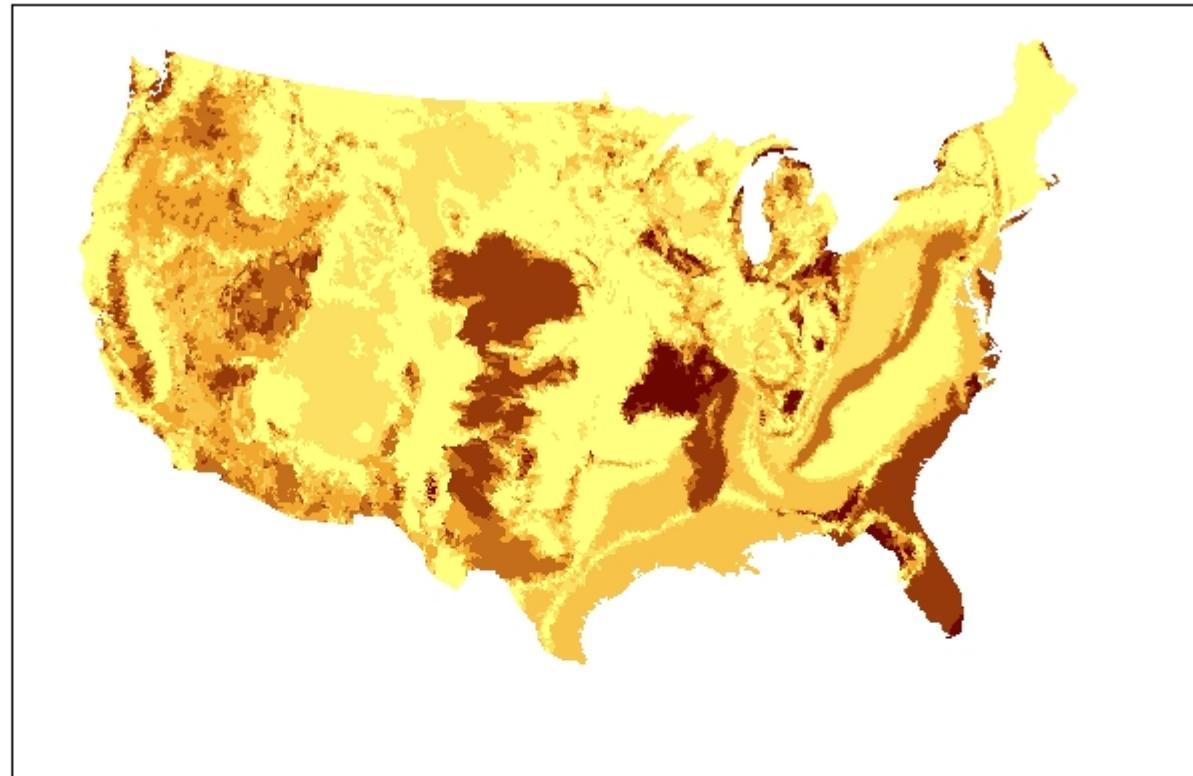
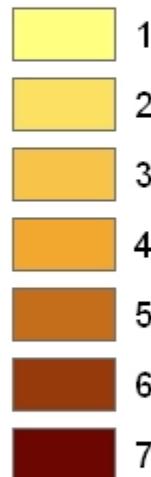


Precipitation minus potential evapotranspiration (mm/year)

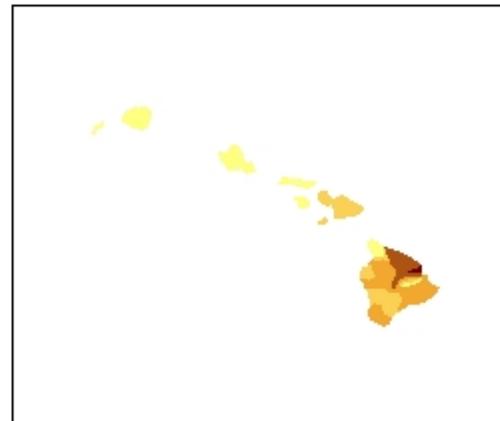
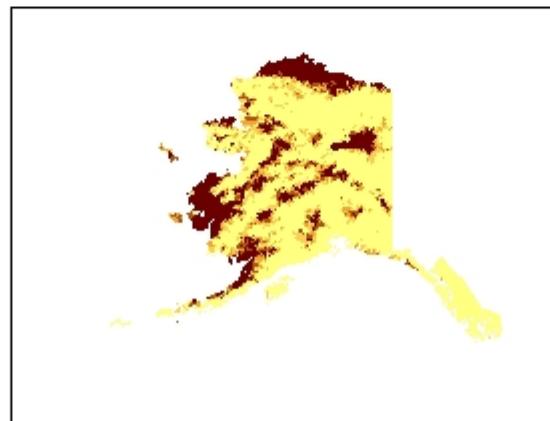
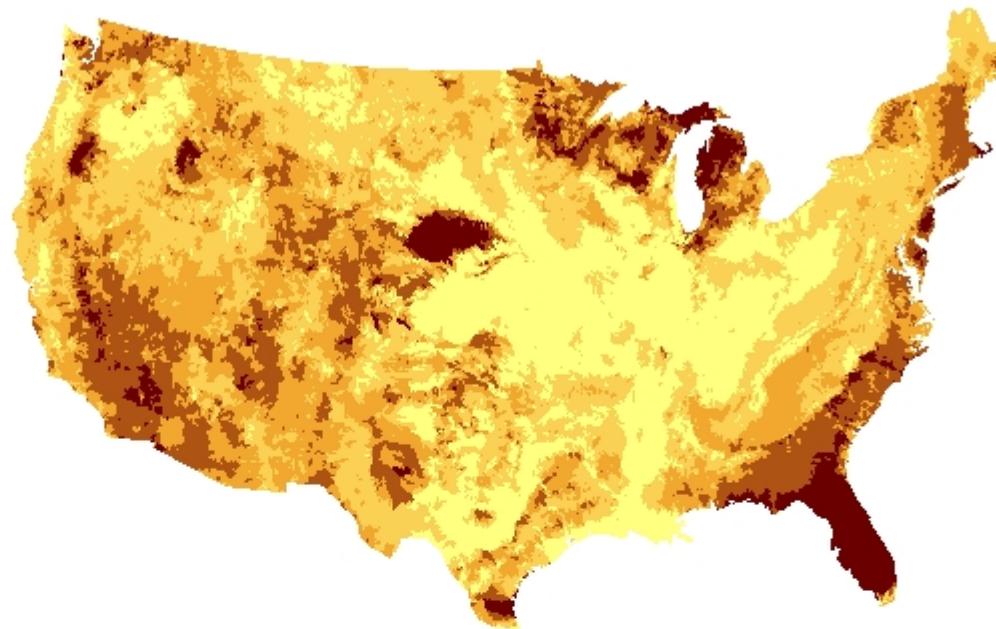
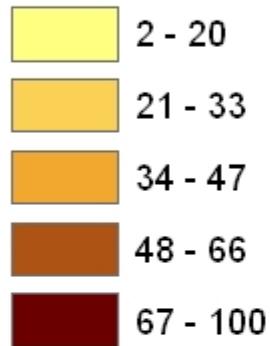


Subsurface permeability class

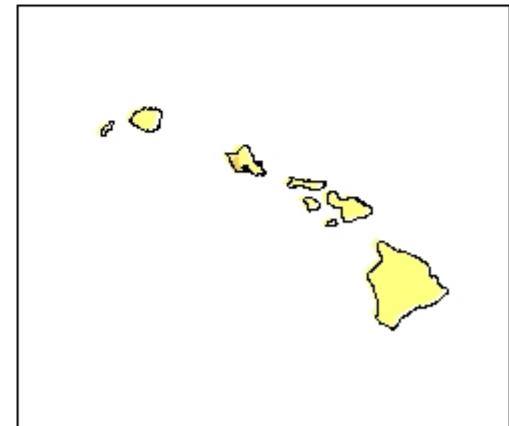
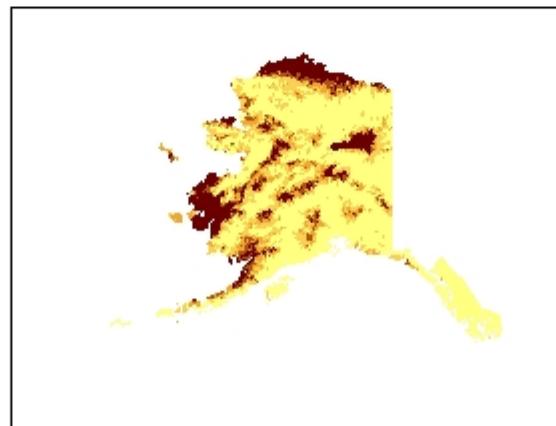
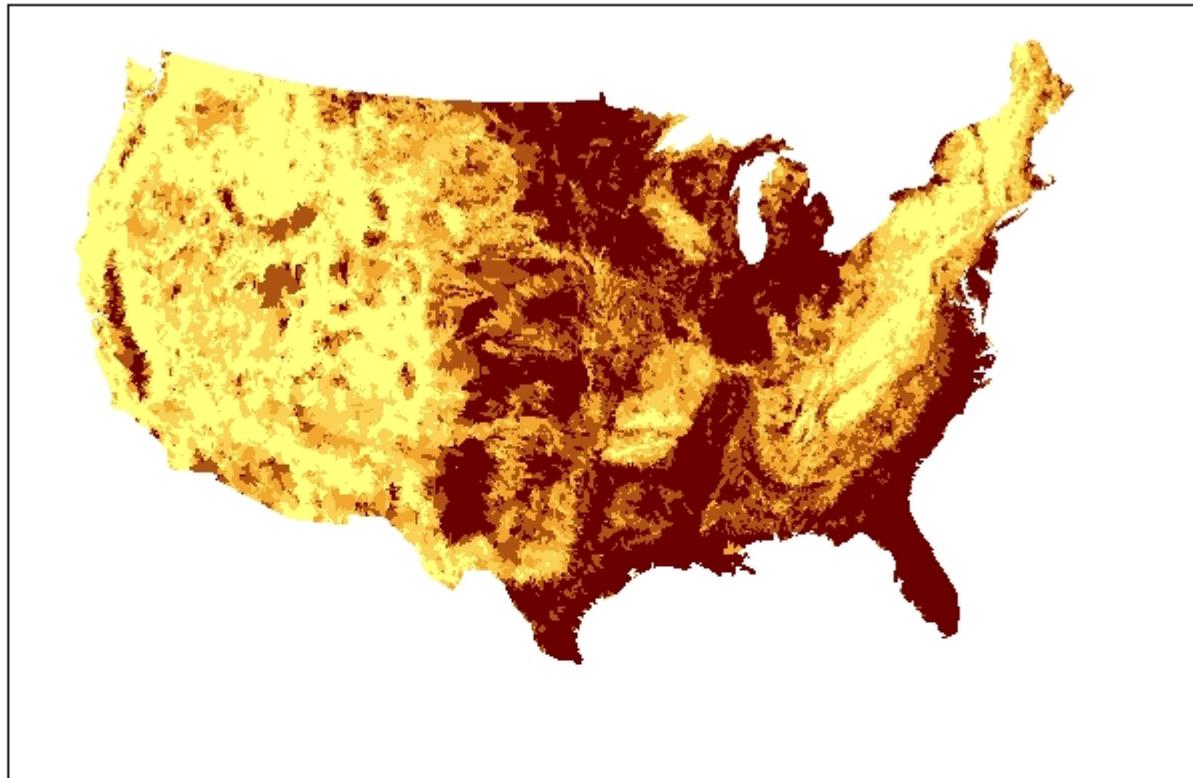
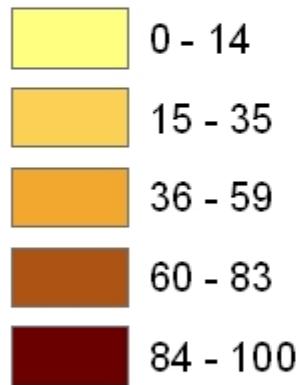
1 is lowest,
7 is highest



Percent sand



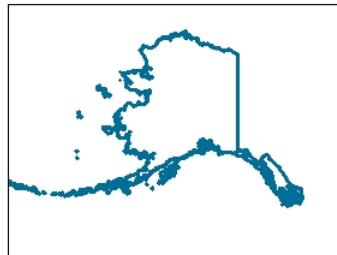
Flatland in watershed (%)



Group the 44,000 watersheds according to similar hydrologic landscape variables



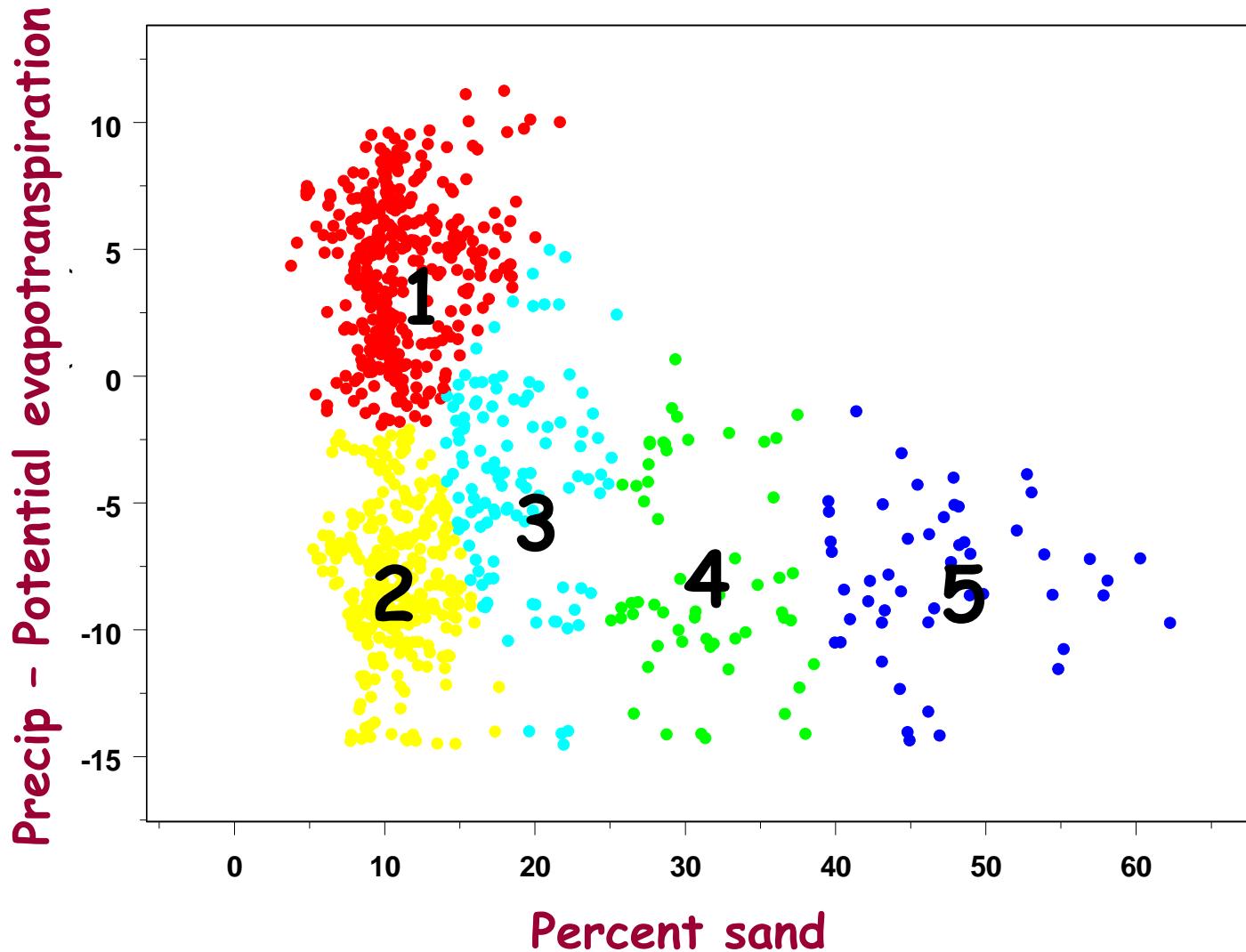
- Climate
- Geology
- Terrain

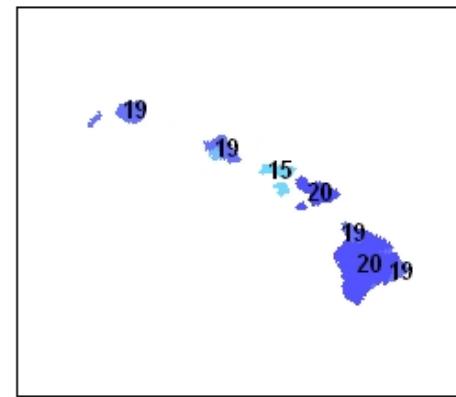
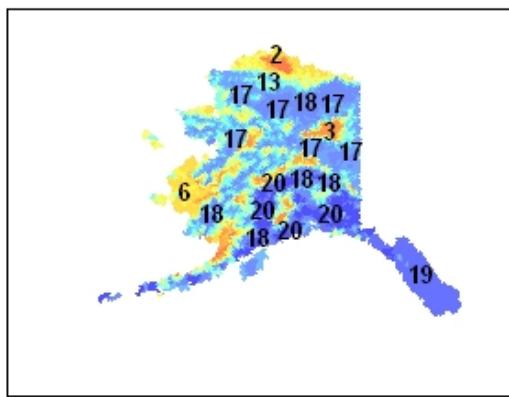
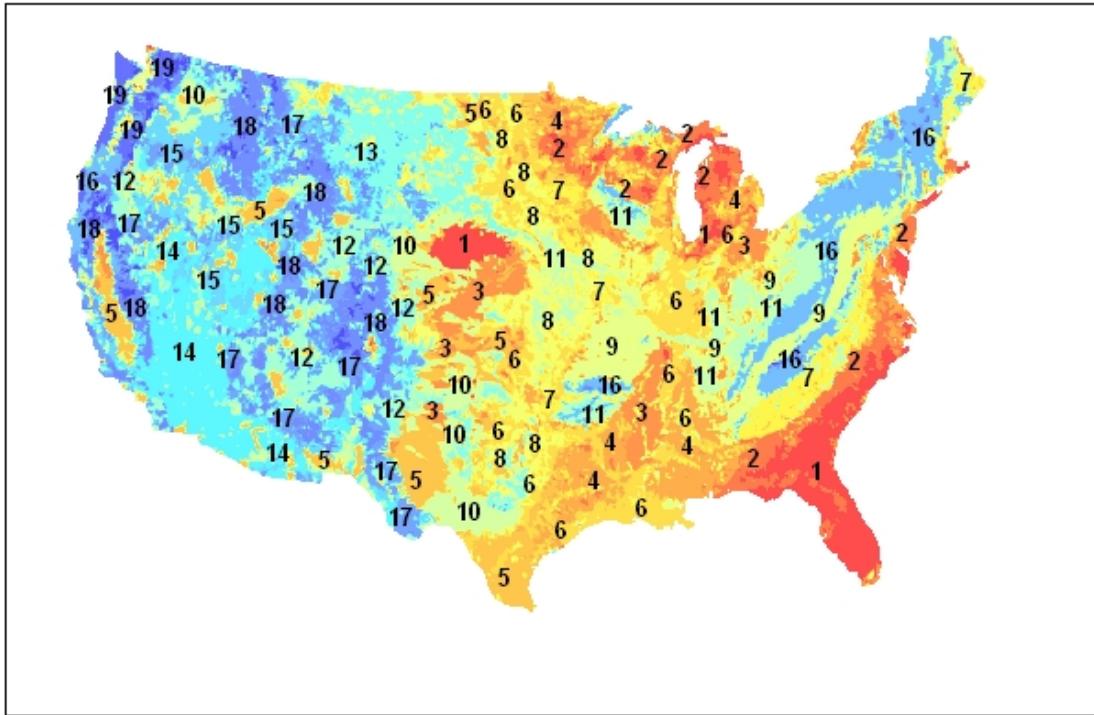


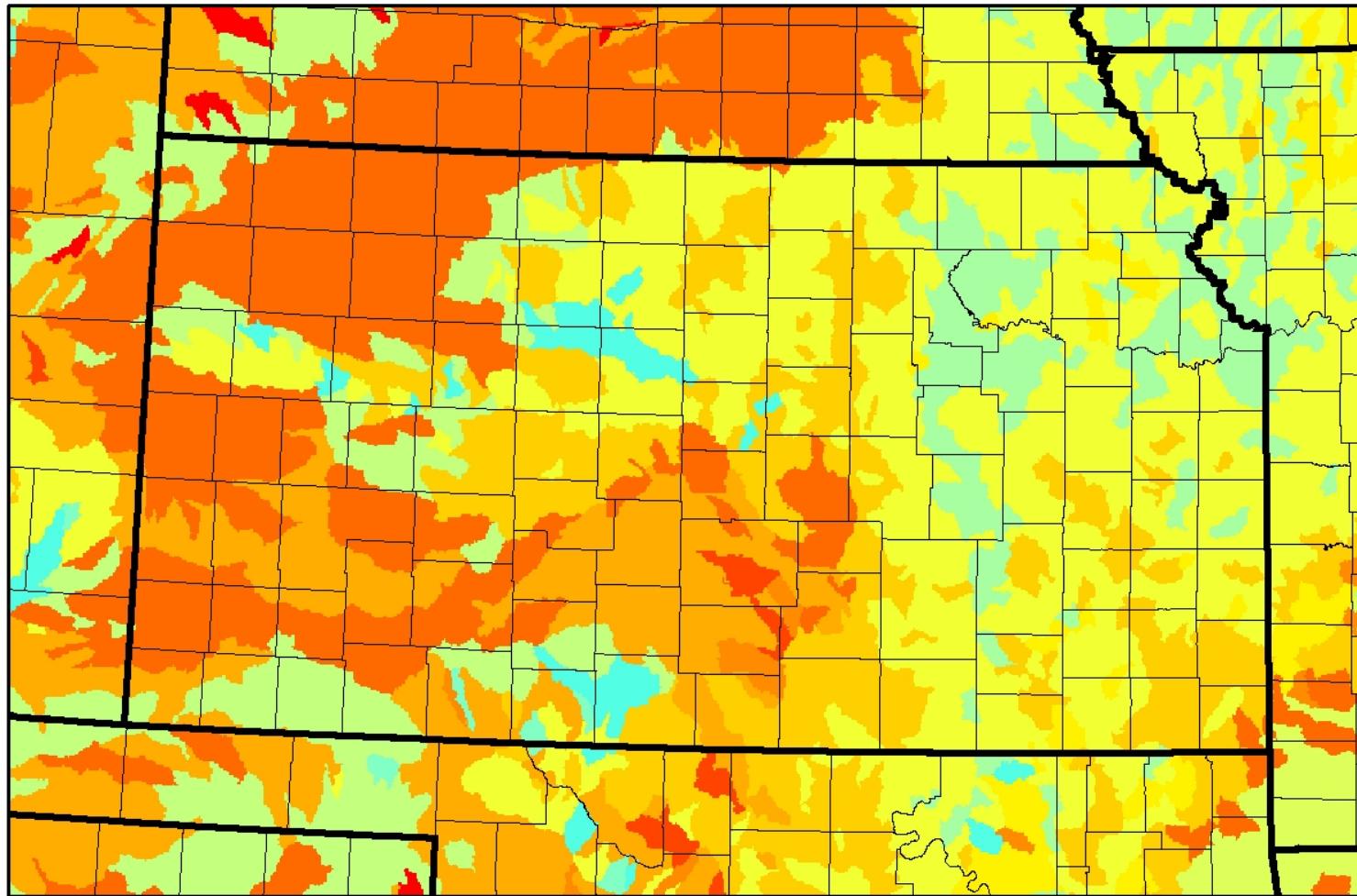
Cluster analysis

Nearest neighbor chain algorithm (Murtagh, 1985)

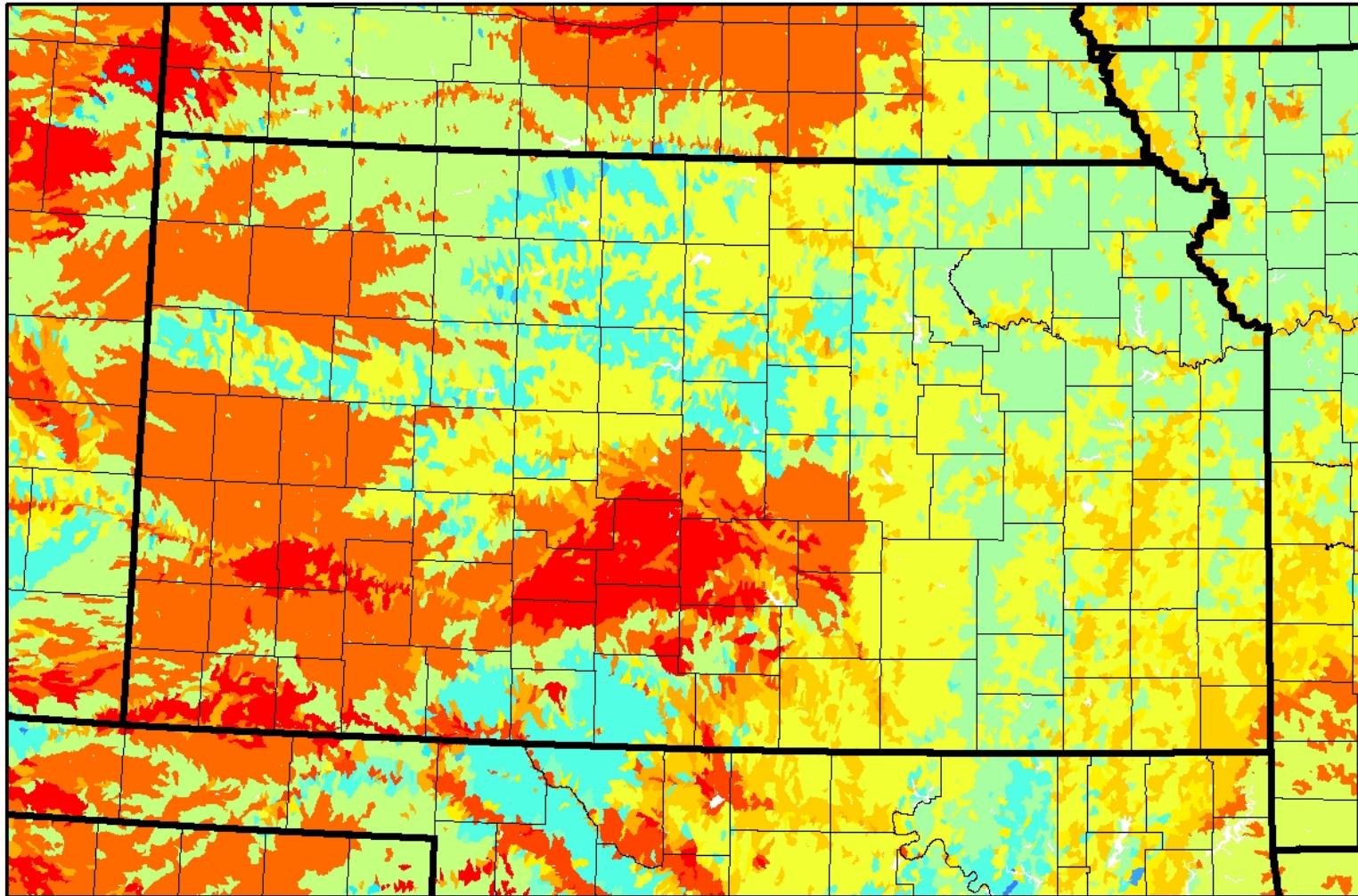
Cluster analysis groups similar watersheds



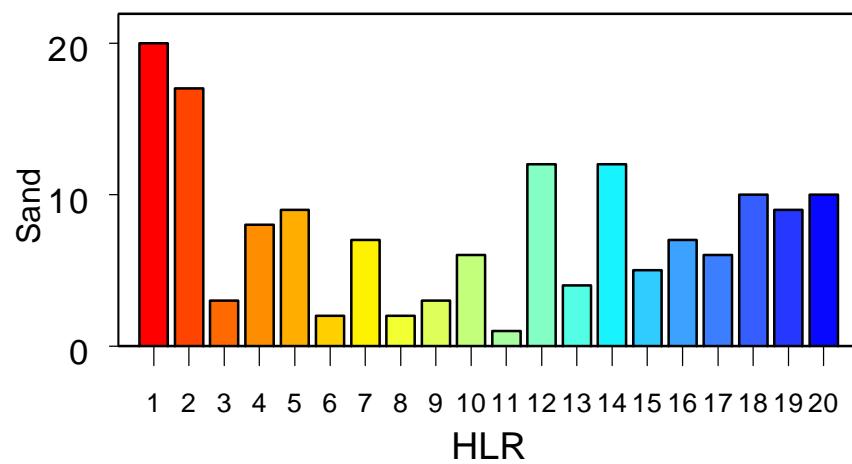
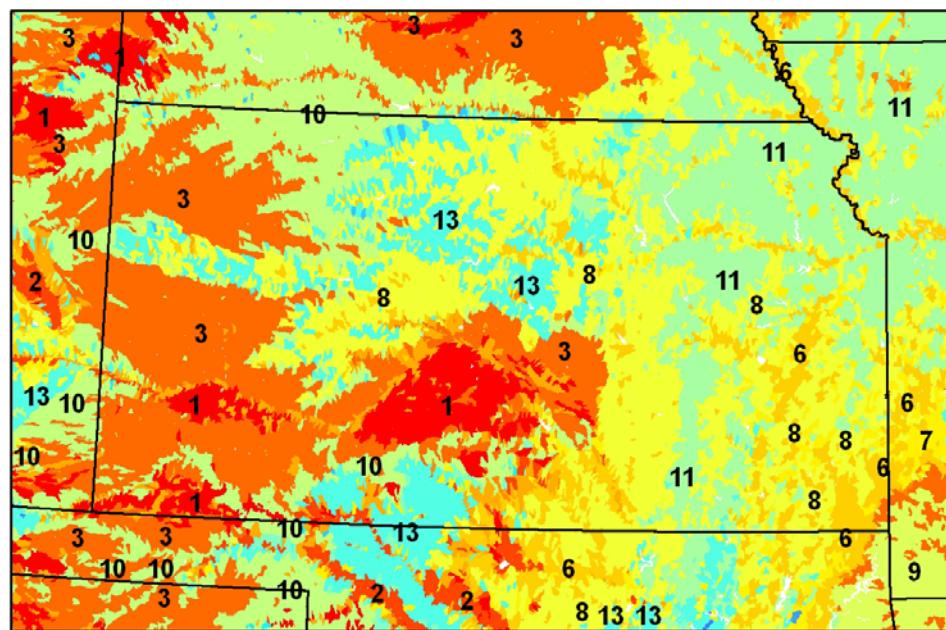
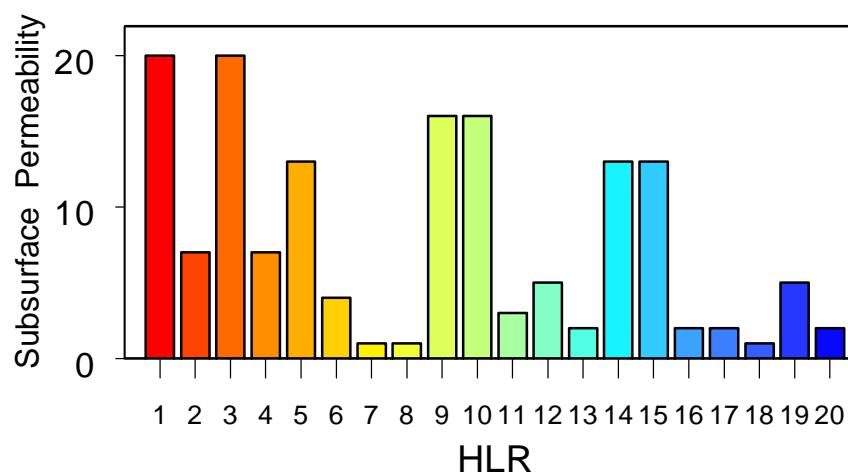
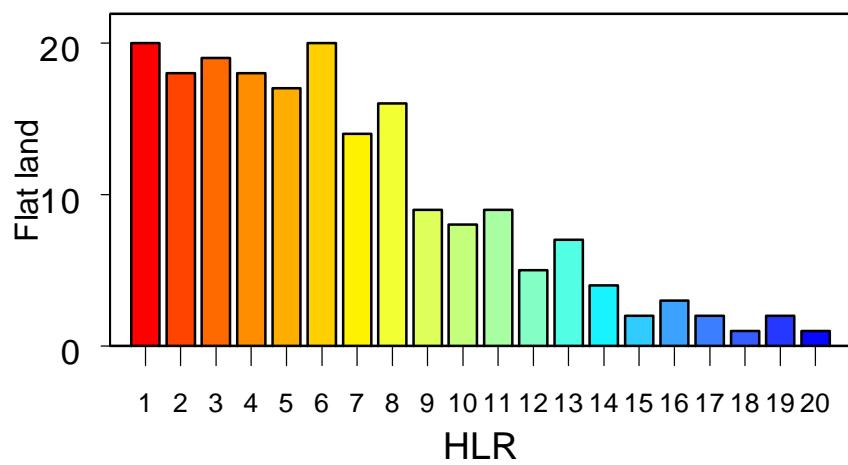
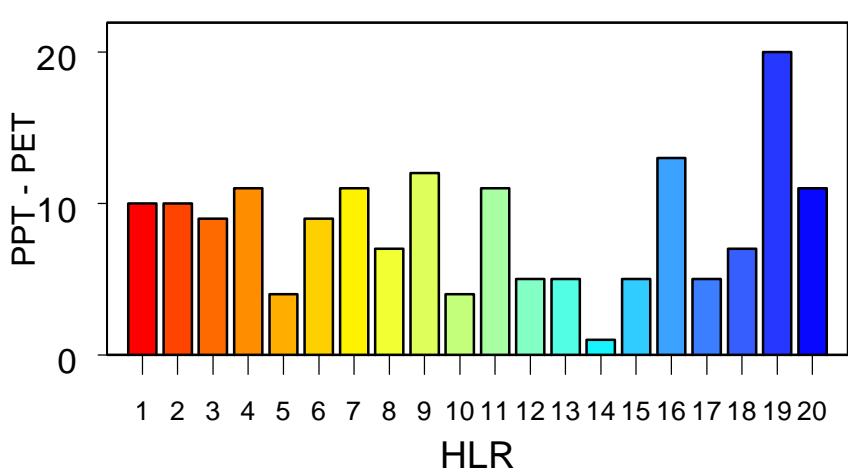




200 km² watersheds



20 km² watersheds

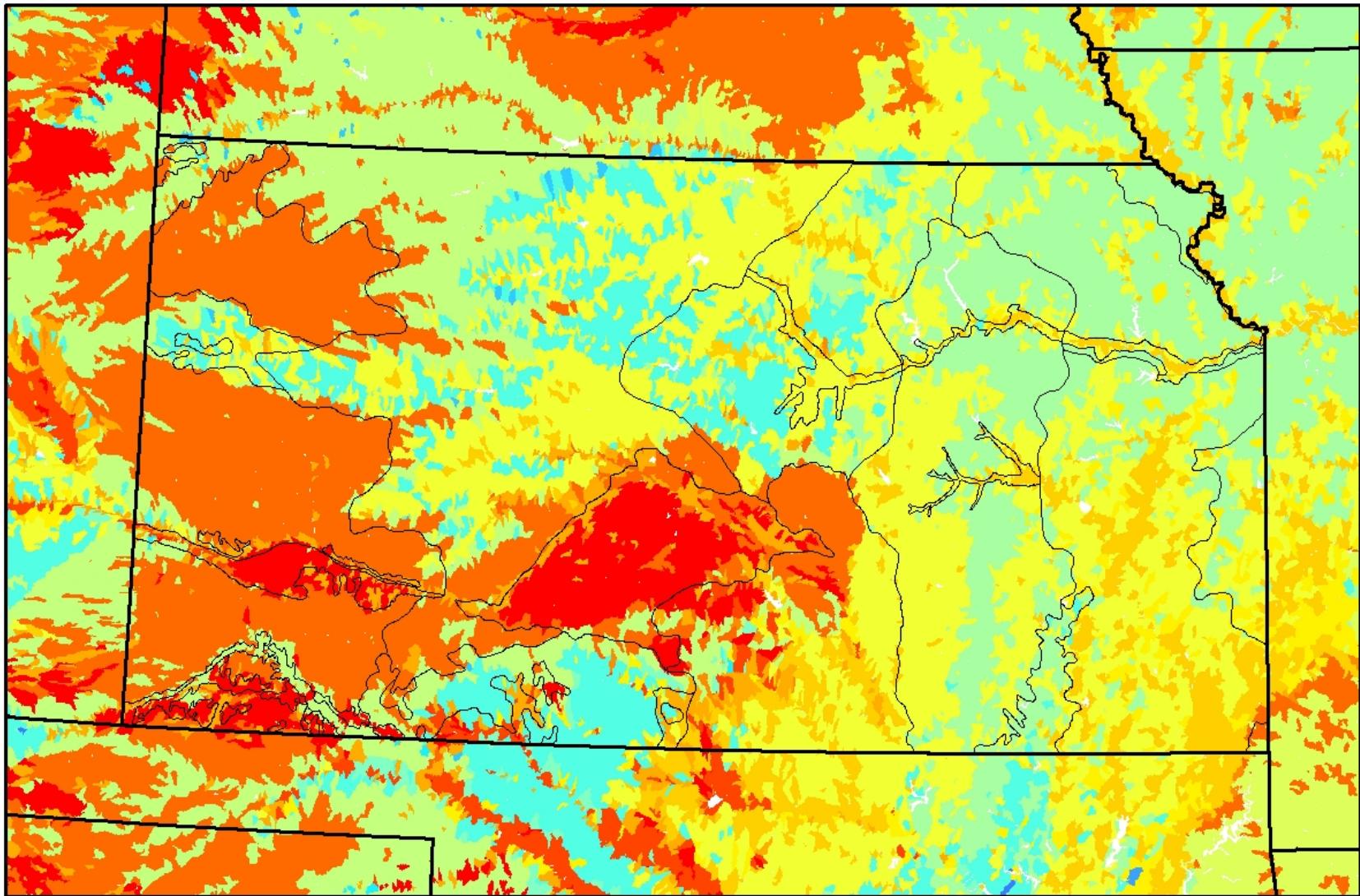


Ecoregions

- Terrain
- Climate
- Soils
- Land cover
- Vegetation

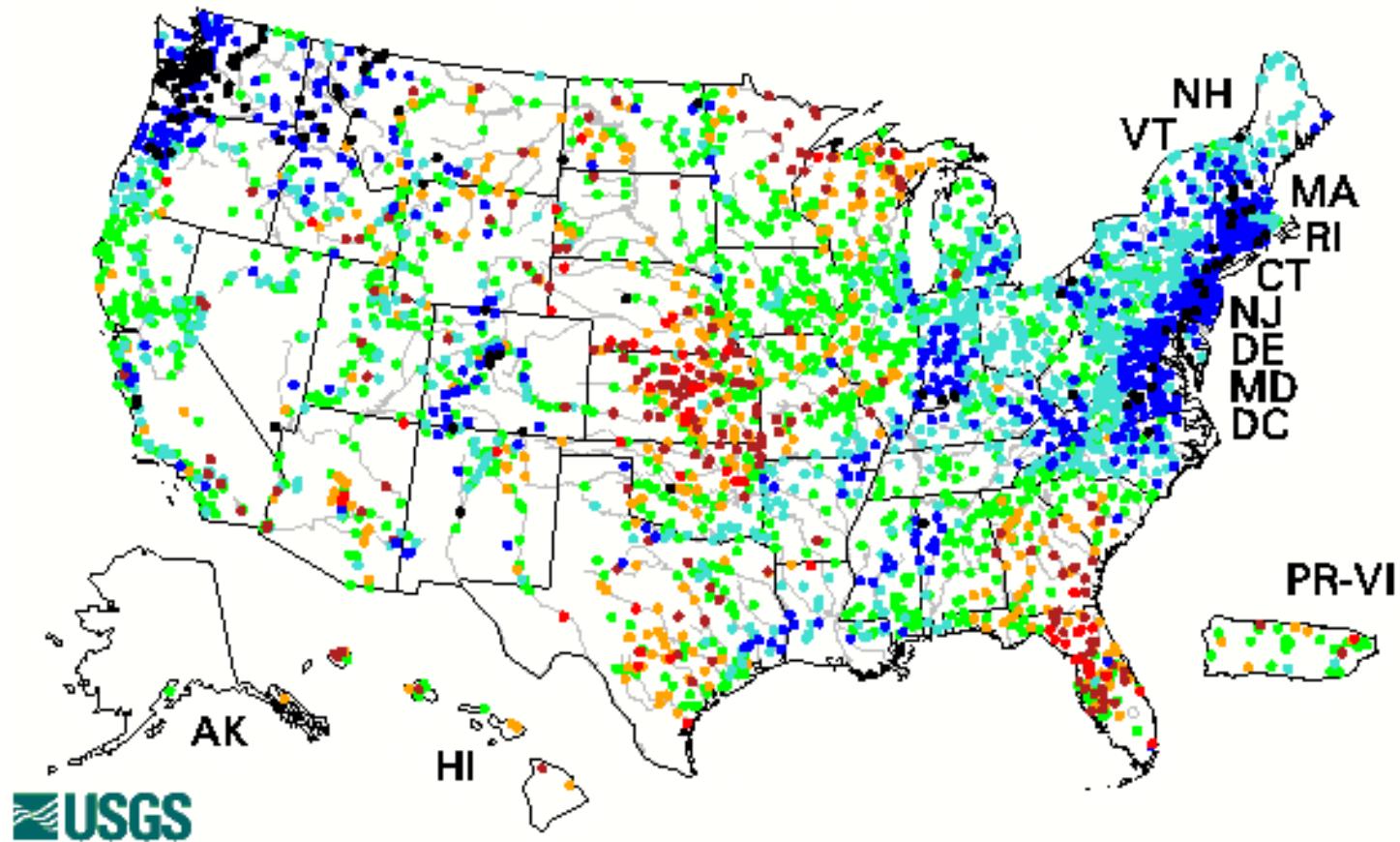
Omernik and Griffith, 1991, J. Soil & Water Conservation

Level IV ecoregions boundaries on HLRs



GIS is important throughout the USGS

Monday, November 13, 2006



<http://water.usgs.gov/>

More information on hydrologic landscape regions

GIS data:

<http://water.usgs.gov/lookup/getspatial?hlrus>

Journal articles:

Winter, 2001, JAWRA 37:335-349.

Wolock, Winter, and McMahon, 2004,
Environmental Management

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