

Riparian Forest Buffers in the Developed Landscape



Seminar by:

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Management
Radnor, PA
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RIPARIAN FOREST BUFFERS



Function and Design
for Protection and Enhancement
of Water Resources

An Agroforestry Practice

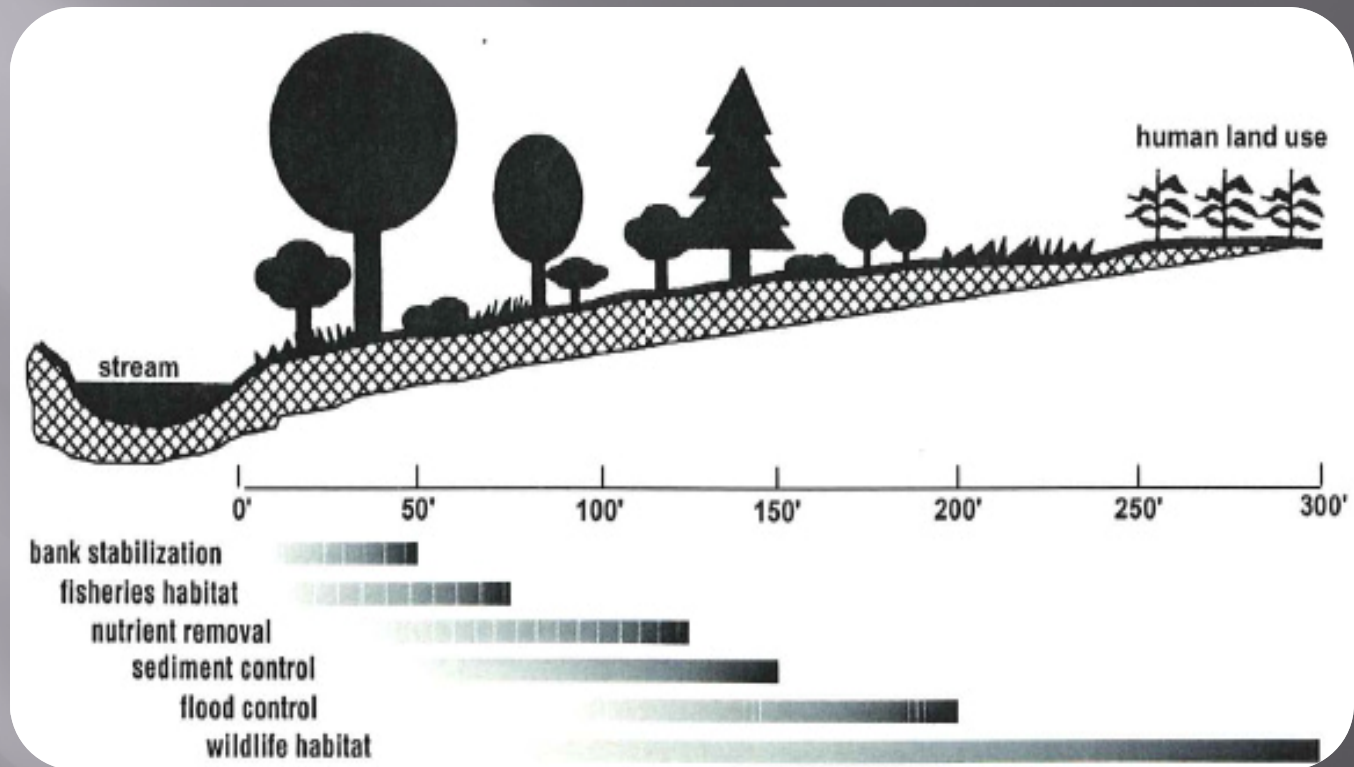
U.S. Forest Service (1991)

THE STREAMSIDE FOREST BUFFER



CROPLAND	ZONE 3 RUNOFF CONTROL	ZONE 2 MANAGED FOREST	ZONE 1 UNDISTURBED FOREST	STREAM BOTTOM	ZONE 1 UNDISTURBED FOREST	ZONE 2 MANAGED FOREST	ZONE 3 RUNOFF CONTROL	PASTURE
Sediment, fertilizer and pesticides are carefully managed.	Concentrated flows are converted to dispersed flows by water bars or spreaders, facilitating ground contact and infiltration.	Filtration, deposition, plant uptake, anaerobic denitrification and other natural processes remove sediment and nutrients from runoff and subsurface flows.	Maturing trees provide detritus to the stream and help maintain lower water temperature vital to fish habitat.	Debris dams hold detritus for processing by aquatic fauna and provide cover and cooling shade for fish and other stream dwellers.	Tree removal is generally not permitted in this zone.	Periodic harvesting is necessary in Zone 2 to remove nutrients sequestered in tree stems and branches and to maintain nutrient uptake through vigorous tree growth.	Controlled grazing or haying can be permitted in Zone 3 under certain conditions.	Watering facilities and livestock are kept out of the Riparian Zone insofar as practicable.

U.S. Forest Service (1991)— One Design Fits All



Dosskey et al. (1997). Agroforestry Note #4.

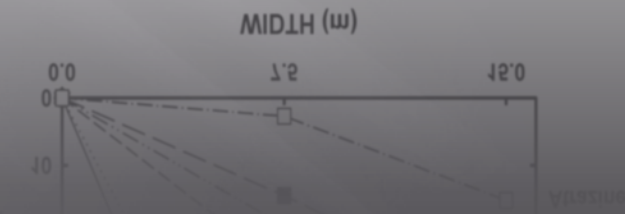
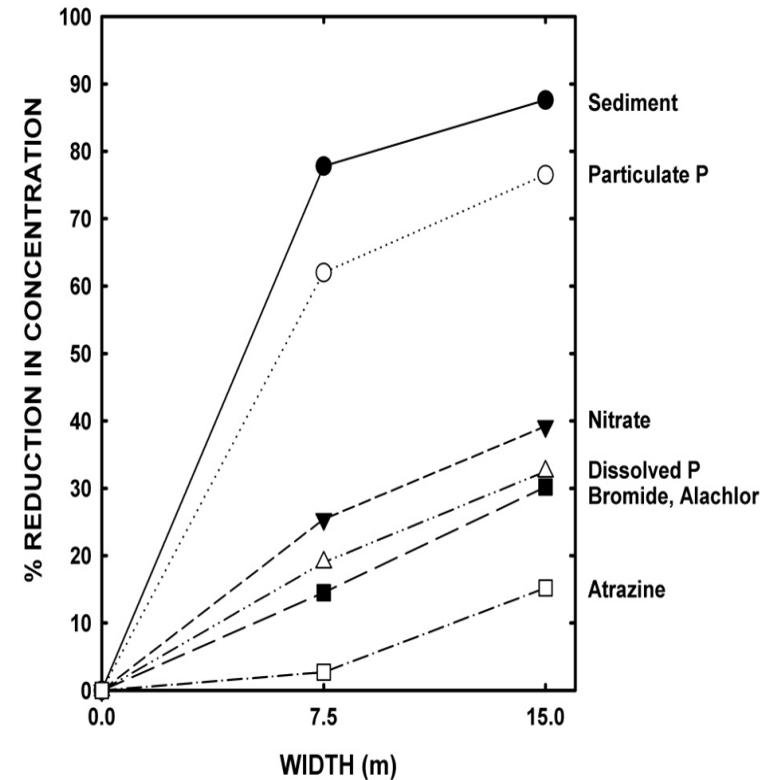
Water Quality Variables

Buffer

- Site conditions
- Pollutant type
- Design

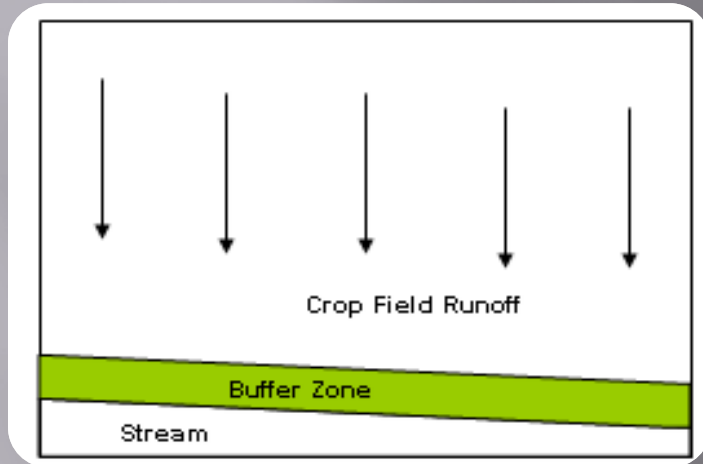
Upland

- Load
- Pathway



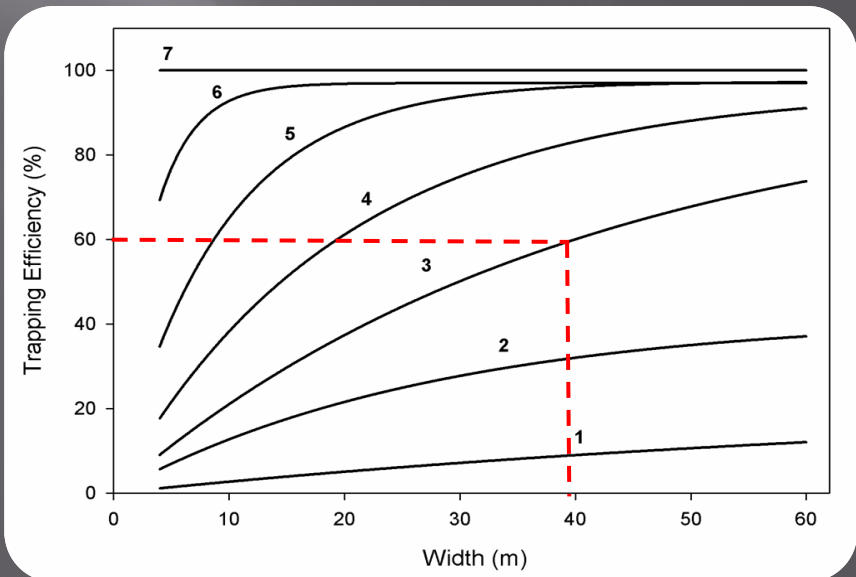
Dosskey et al. (1999)
J. Environ. Qual. 28:1479-1489

Uniform Runoff – Width

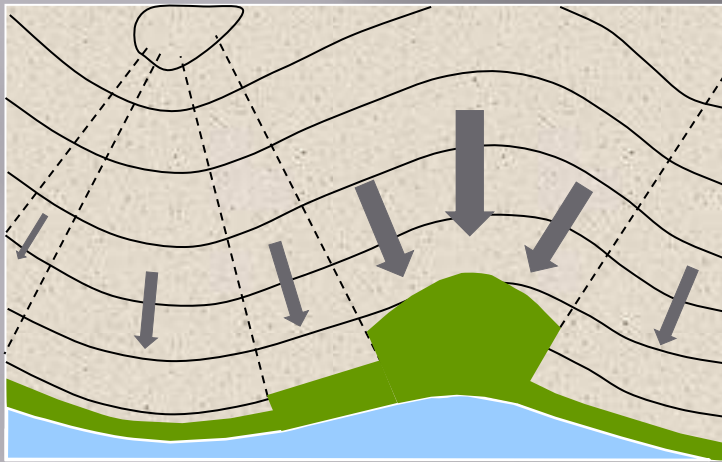


Design Variables

- Soil
- Slope
- C-factor (tillage, residue)
- Pollutant
- Field length

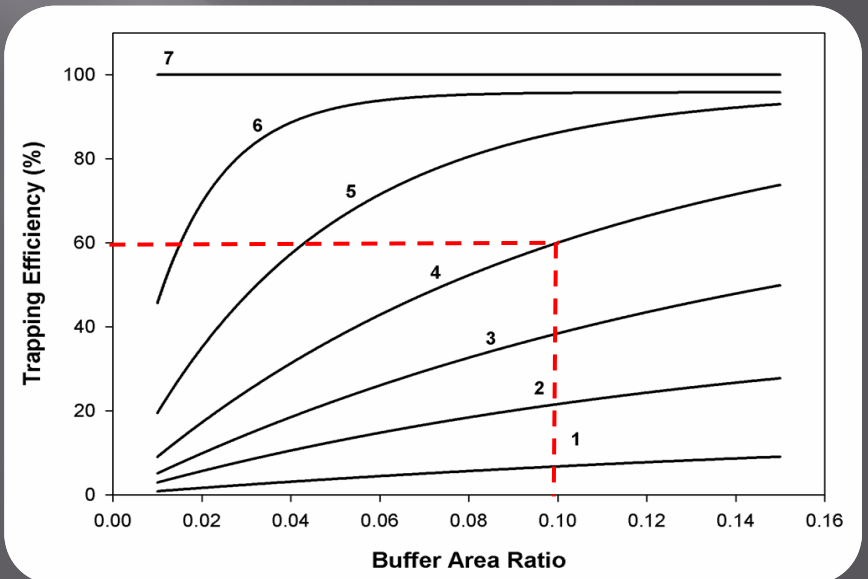


Non-Uniform Runoff – Area

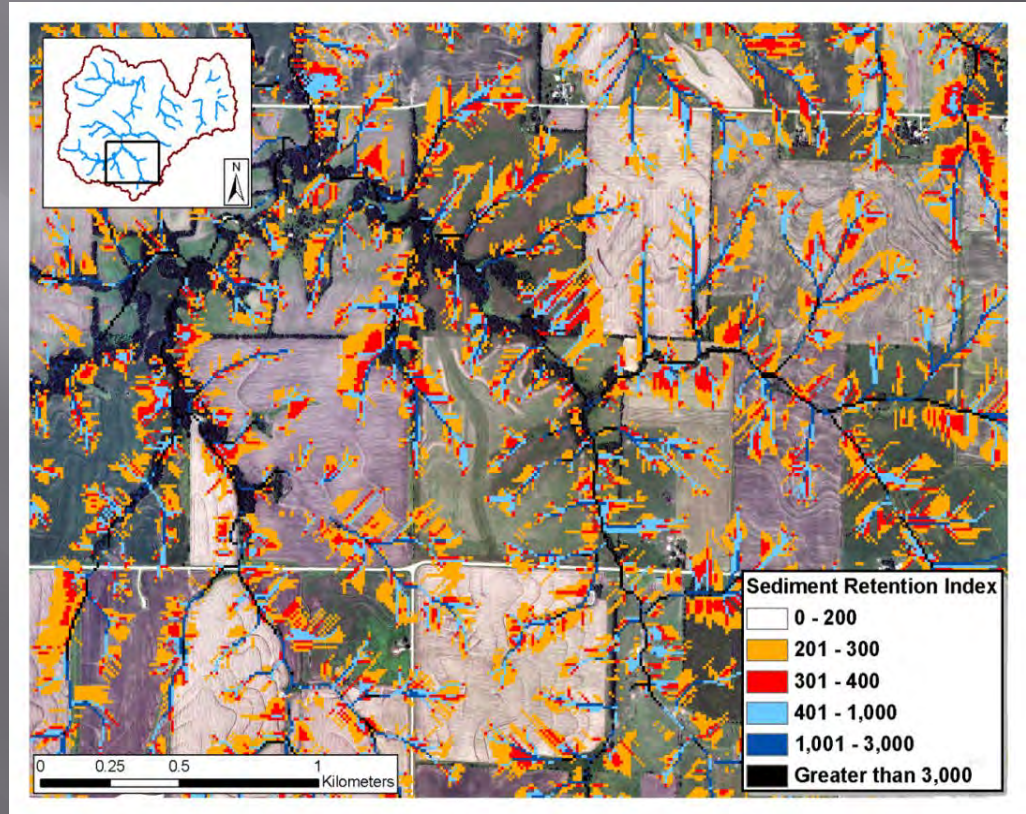
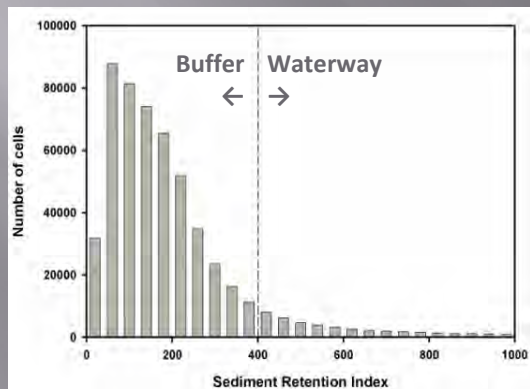
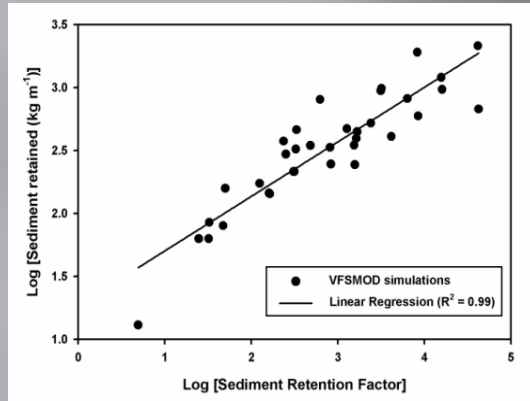


Design Variables

- Soil
- Slope
- C-factor (tillage, residue)
- Pollutant



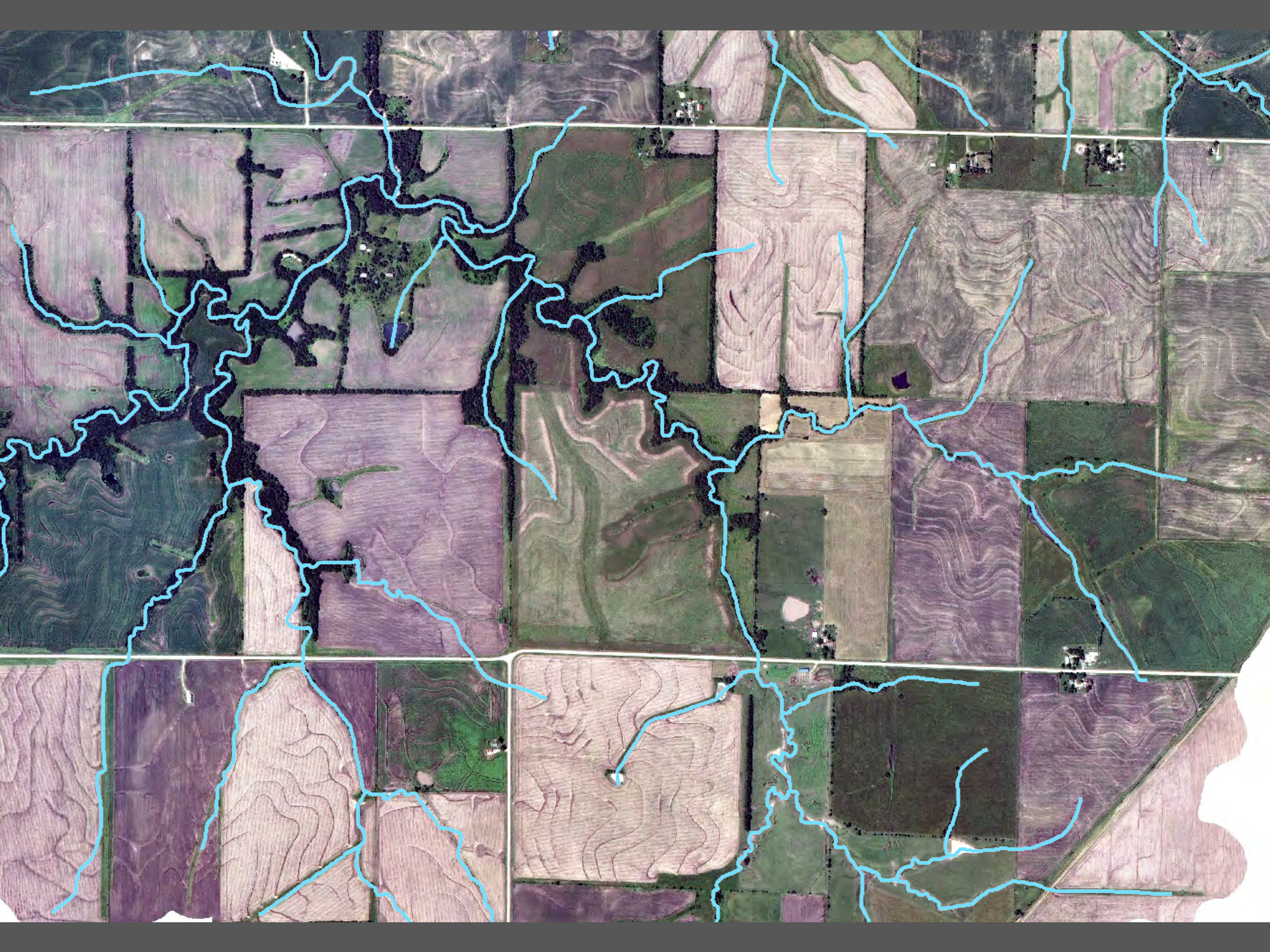
Better Locations

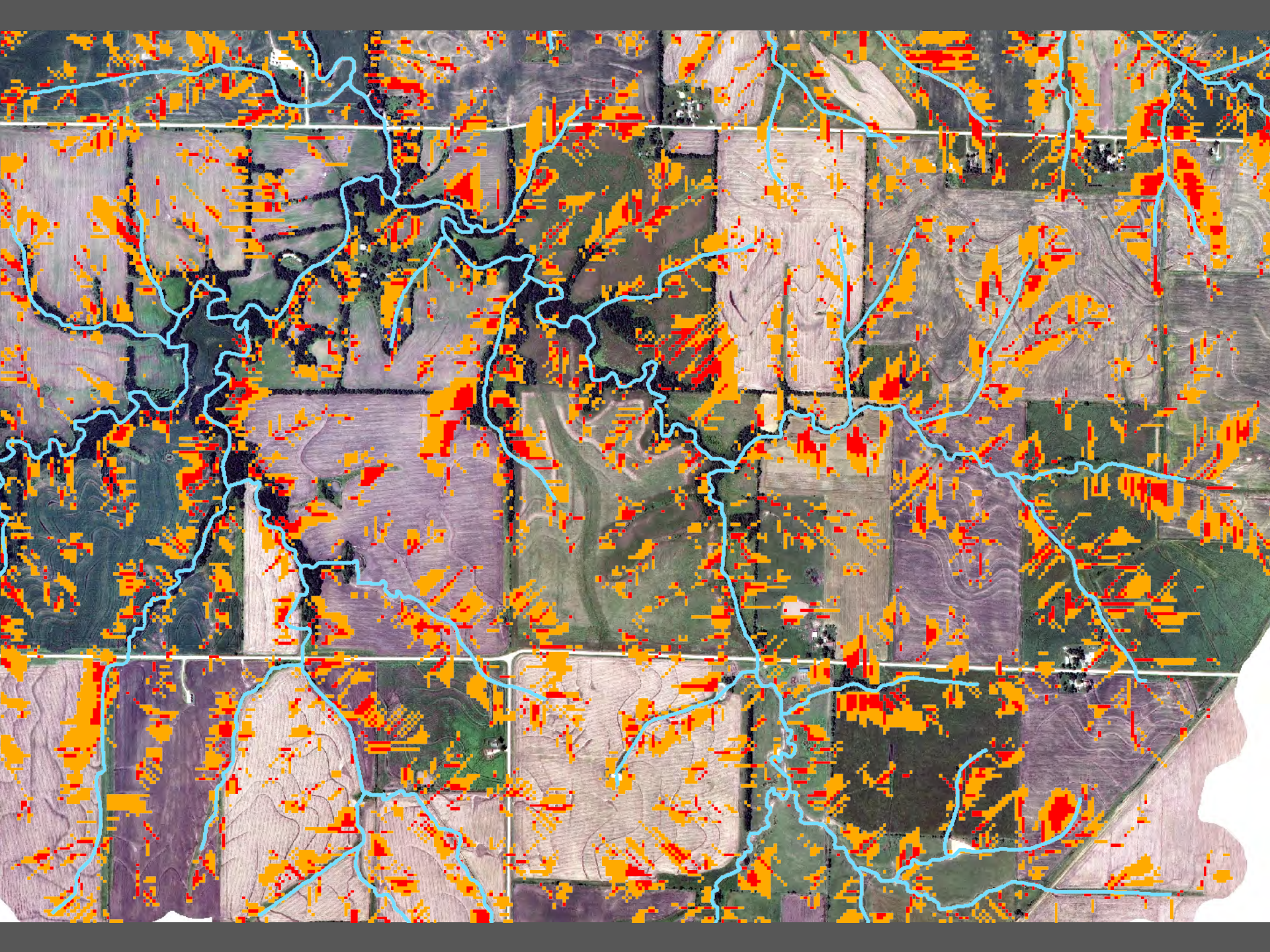


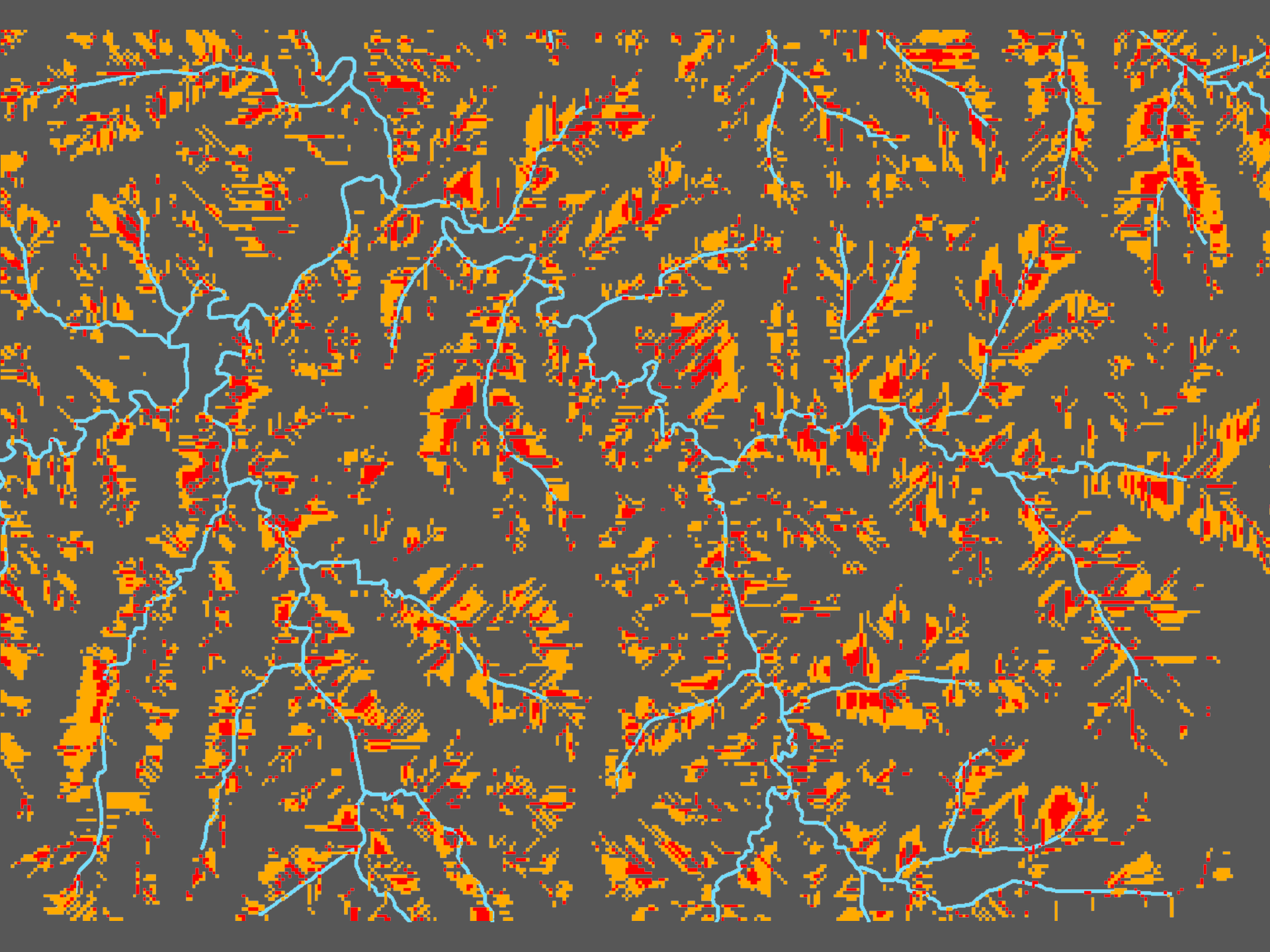
$$\text{Empirical (E)} = A \cdot R \cdot K \cdot (\text{LS}) \text{ D}_{50}$$
$$\text{Calibrated (SRI)} = 18.6 (\text{E})^{0.4333}$$

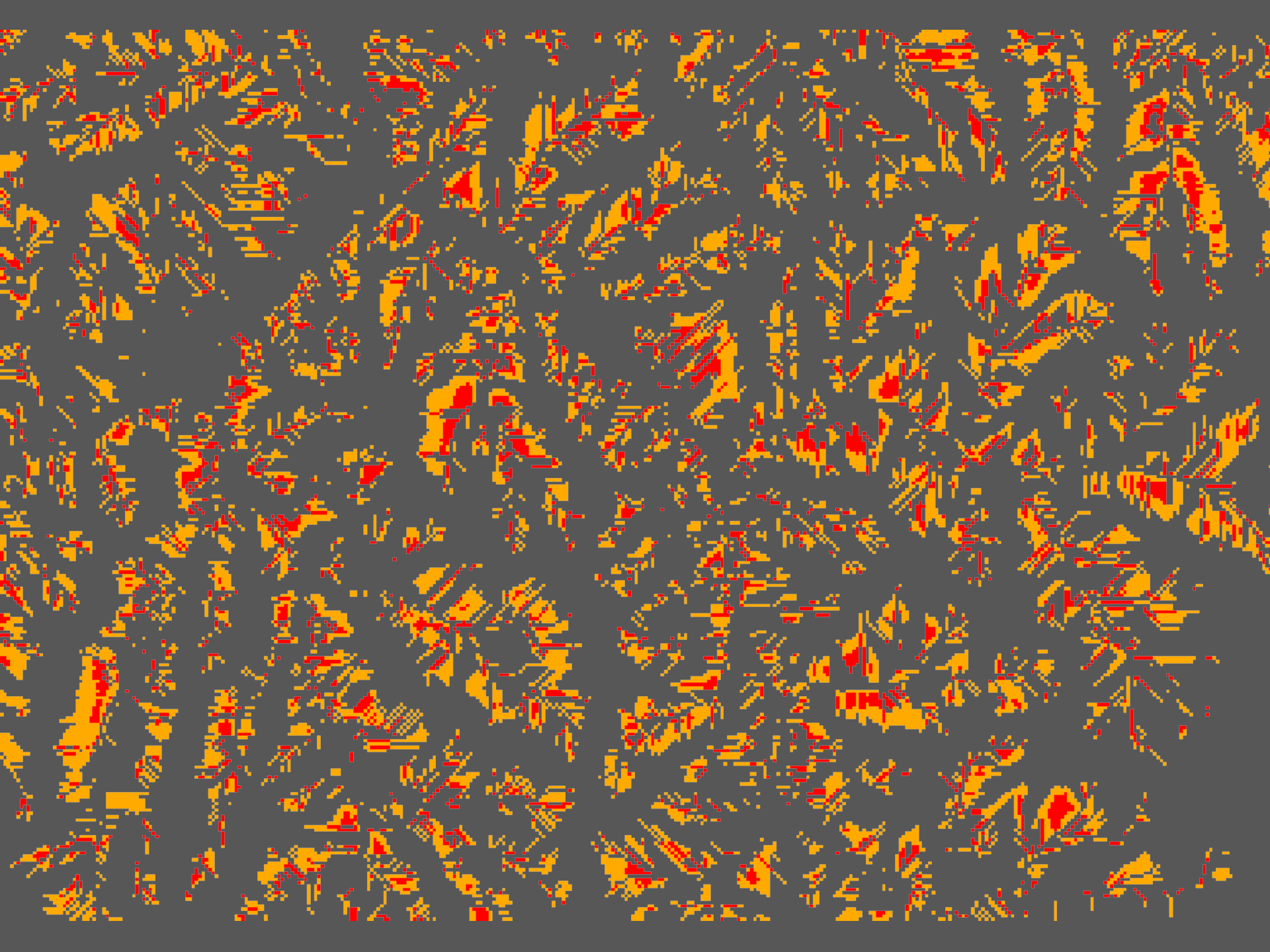
Dosskey et al. (2011) JSWC 66:362-372

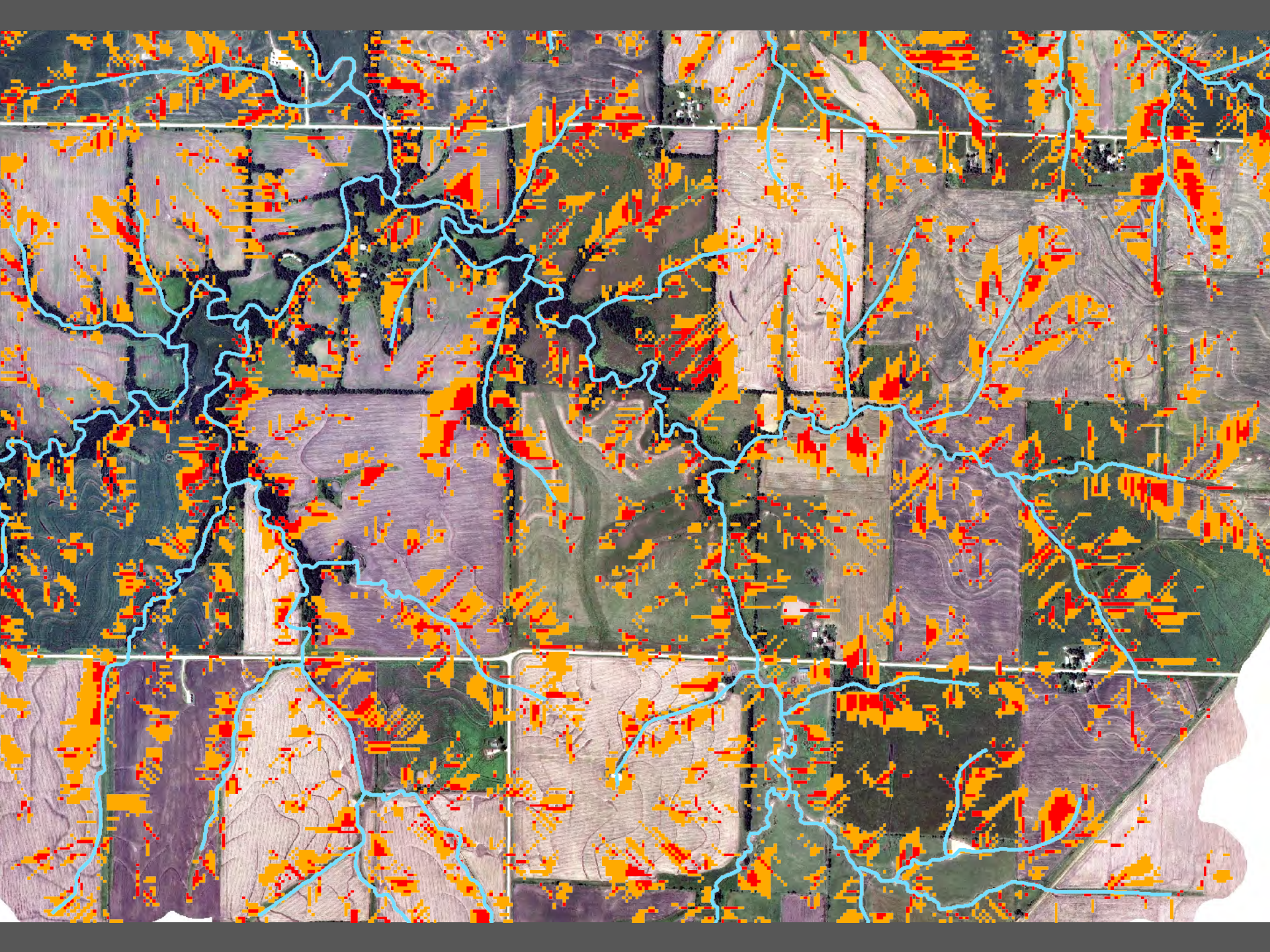






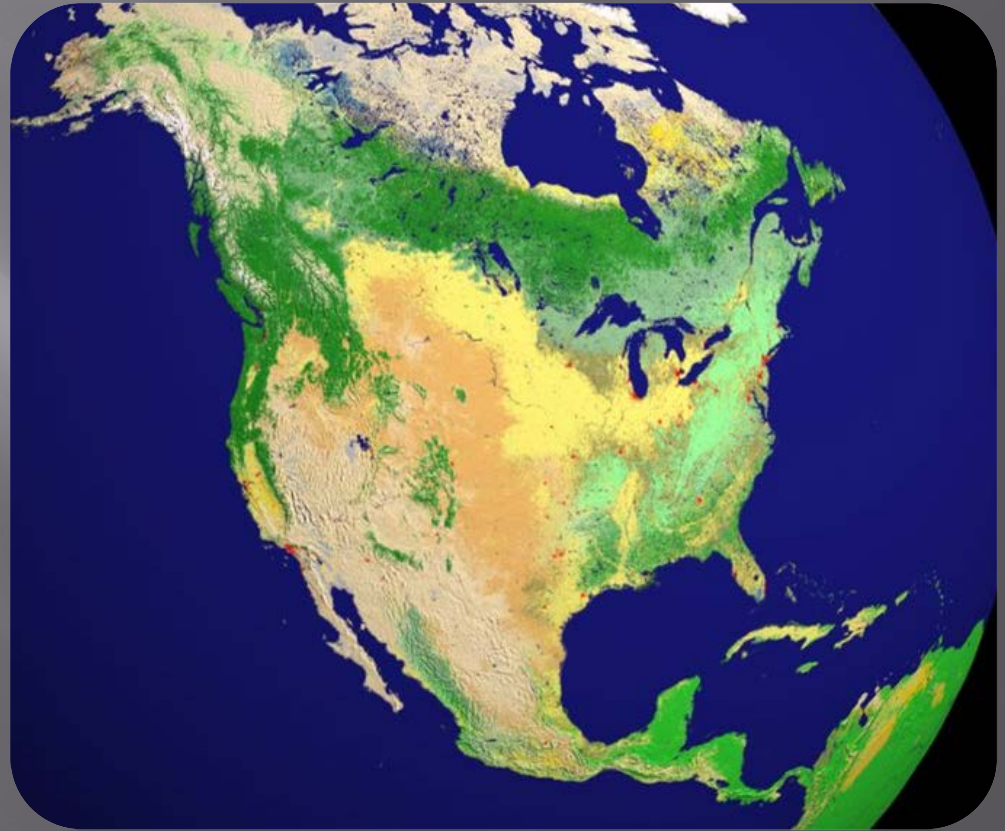






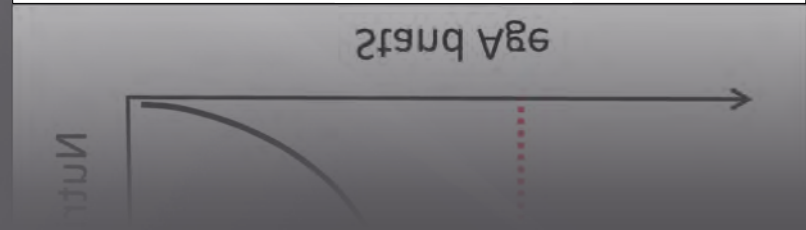
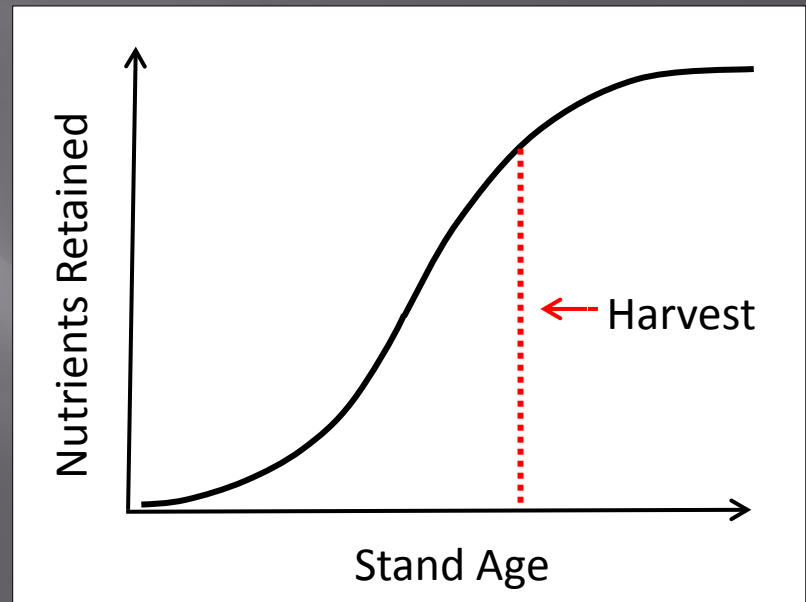
Tools for Other Regions

- ✓ Overland runoff
- Saturated runoff
- Groundwater
- Snowmelt-frozen soil
- Glacial complex

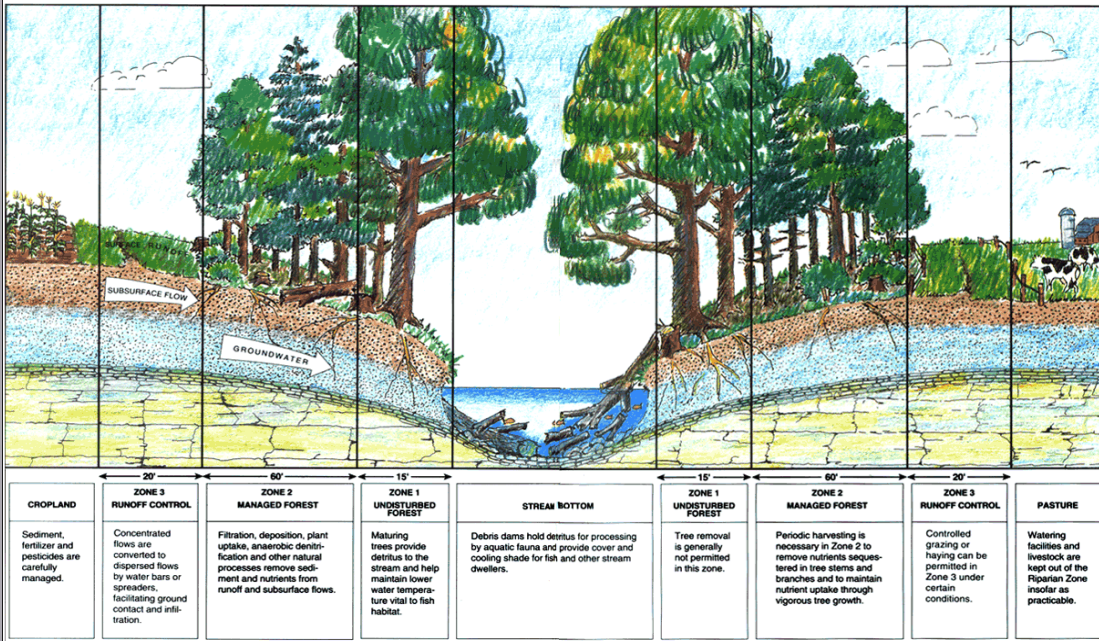


Biofuels

Hypothesis: Harvest enhances water quality

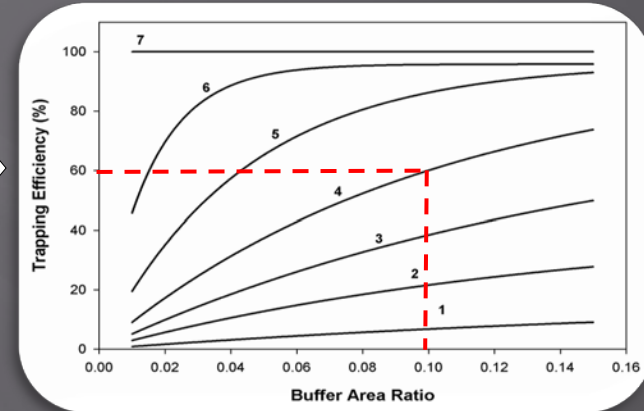


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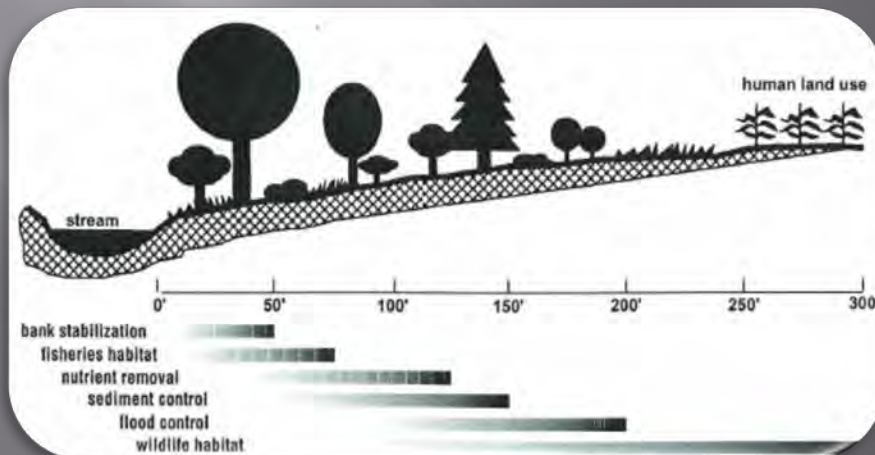


Design for Impact

Size



Multiple Benefits



Location

