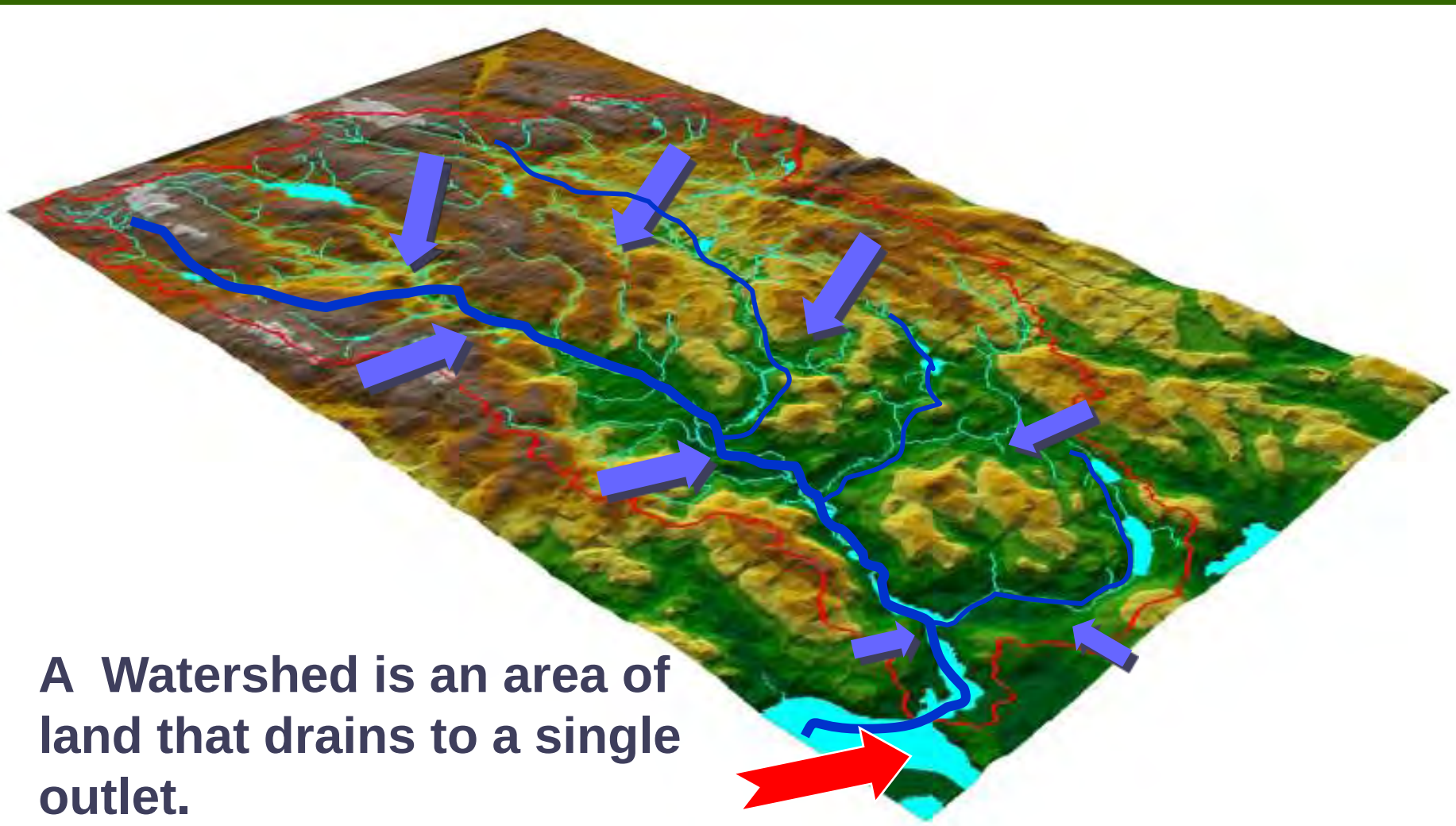
- **Headwater streams are orders 1 – 3**
- **Mid-sized rivers are orders 4 – 6**
- **Large rivers are orders 7 – 12**

About 85% of all stream miles in the U.S. are first to third order streams … close to 3 million miles.

The Mississippi River is approx. 12th order at its mouth.

Land Use – Water Quality & Quantity

Eve Brantley
Alabama Cooperative Extension System, Water Program
Auburn University, Dept. of Agronomy & Soils



A Watershed is an area of land that drains to a single outlet.

Center for Watershed Protection

Rain

Stormwater


AMERICAN

Stormwater Runoff

Point Source Pollution

- Traditional focus of water quality protection
- Direct discharges from factories, industrial complexes, or wastewater treatment plants
- Point source discharges have largely been addressed since passage of the Clean Water Act

Nonpoint Source Pollution

- New focus of water quality protection
- Stormwater runoff carries variety of pollutants to streams, rivers, and bays
- Nonpoint source pollution (or polluted runoff) comes from many sources - We all play a role in minimizing its impacts

Major Pollutant Categories

- Nutrients
- Pathogens
- Sediment
- Toxic Contaminants
- Debris
- Thermal Stress

The Pollutants in Polluted Runoff

➔ Nutrients

Pathogens
Sediment
Toxic Contaminants
Debris
Thermal Stress

Nutrients **such as nitrogen and phosphorus are substances needed for plant growth, but elevated levels can cause a health hazard in drinking water** ***and*** **stimulate excessive aquatic plant growth, which can ultimately lower dissolved oxygen levels.**

Sources: animal waste, fertilizers, septic systems

The Pollutants in Polluted Runoff

Nutrients

➔ Pathogens

Sediment
Toxic Contaminants
Debris
Thermal Stress

Pathogens **are disease-causing bacteria and viruses associated with the presence of fecal matter that cause shellfish bed and beach closures.**

Sources: failing septic systems, animal waste, marine sanitation devices

The Pollutants in Polluted Runoff

Nutrients
Pathogens

→ Sediment

Toxic Contaminants
Debris
Thermal Stress

Sediment **is eroded soil or sand which smothers aquatic habitat, carries pollutants, and reduces water clarity.**

Sources: road sand, construction sites, agricultural fields, disturbed areas

Photo courtesy of Weeks Bay Watershed Project

The Pollutants in Polluted Runoff

Nutrients
Pathogens
Sediment

➔ Toxic Contaminants

Debris
Thermal Stress

Toxic contaminants **are compounds like heavy metals and pesticides that can threaten the health of both aquatic and human life, and are often resistant to breakdown.**

Sources: industrial, commercial, household and agricultural chemicals; auto emissions

The Pollutants in Polluted Runoff

Nutrients
Pathogens
Sediment
Toxic Contaminants

➔ Debris

Thermal Stress

***Debris* includes plastics and other trash that threaten aquatic life and detract from recreational and aesthetic values.**

Sources: illegal dumping, street litter, beach litter, boating waste

Photo courtesy of Weeks Bay Watershed Project

The Pollutants in Polluted Runoff

Nutrients
Pathogens
Sediment
Toxic Contaminants
Debris

➔Thermal Stress

Thermal stress **is an elevation in water temperature that can harm native species while helping nonnative species to spread.**

Sources: runoff from heat-absorbing impervious surfaces, removal of streamside vegetation, shallow water impoundments, decreased base flow


LAND USE
WATER QUALITY

Land Use / Land Cover

- Land use is a key factor to current and future water quality and quantity
- Different land uses have different levels of impact on water quality

Current and Past Legacies

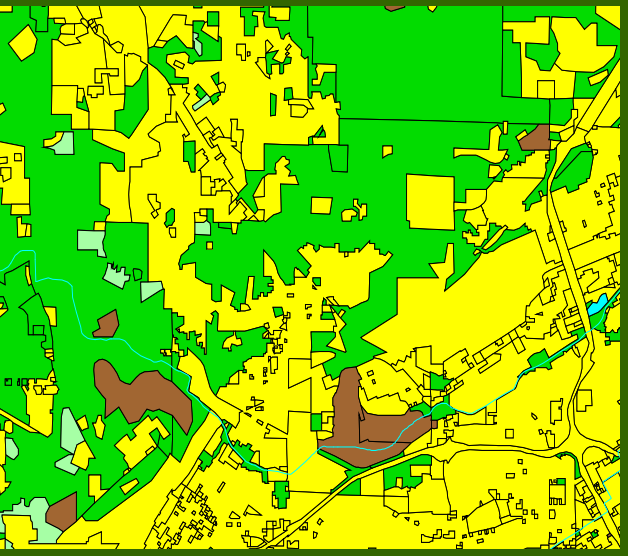
Arthur Rothstein, WPA

Arthur Rothstein, WPA

Land Cover vs. Land Use

USE = what is practiced, permitted, or planned (example --> Recreational)

COVER = what is physically on the ground. (example --> Forested)



Land Cover Categories

Forested and Wetland

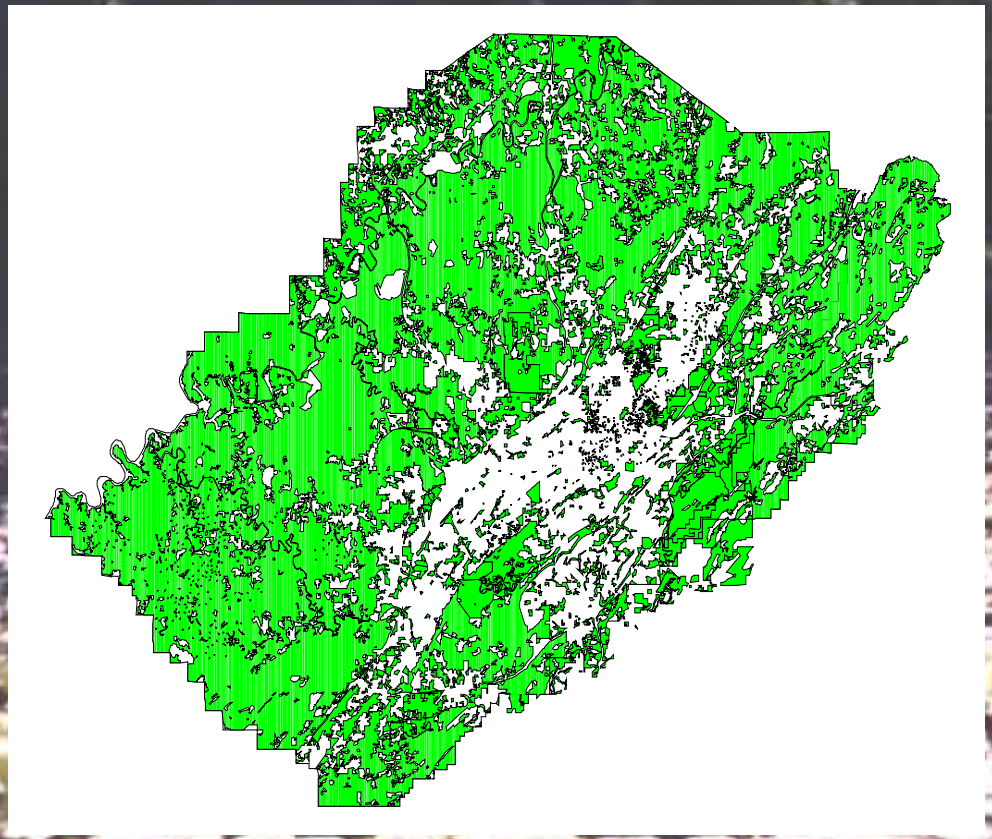
Open and Agriculture

Residential

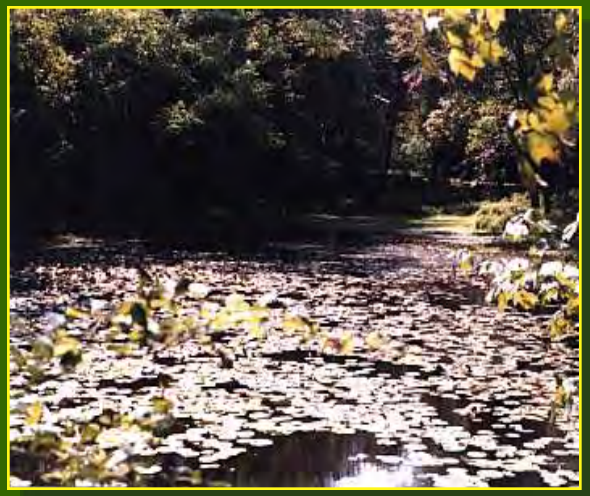
Commercial

Water

Forested and Wetlands



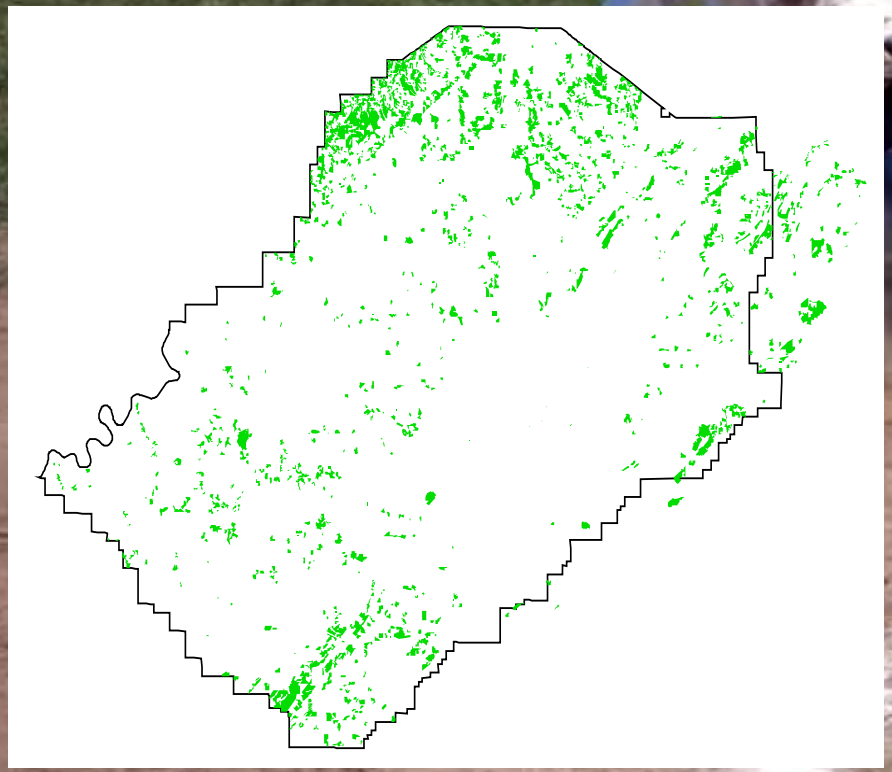
What to Look For:



Polluted runoff from
Forested & Wetland areas

Nutrients:	
Pathogens:	animal waste
Sediment:	erosion from logging operations
Toxic:	
Debris:	
Thermal:	removal of streamside vegetation

Open & Agricultural

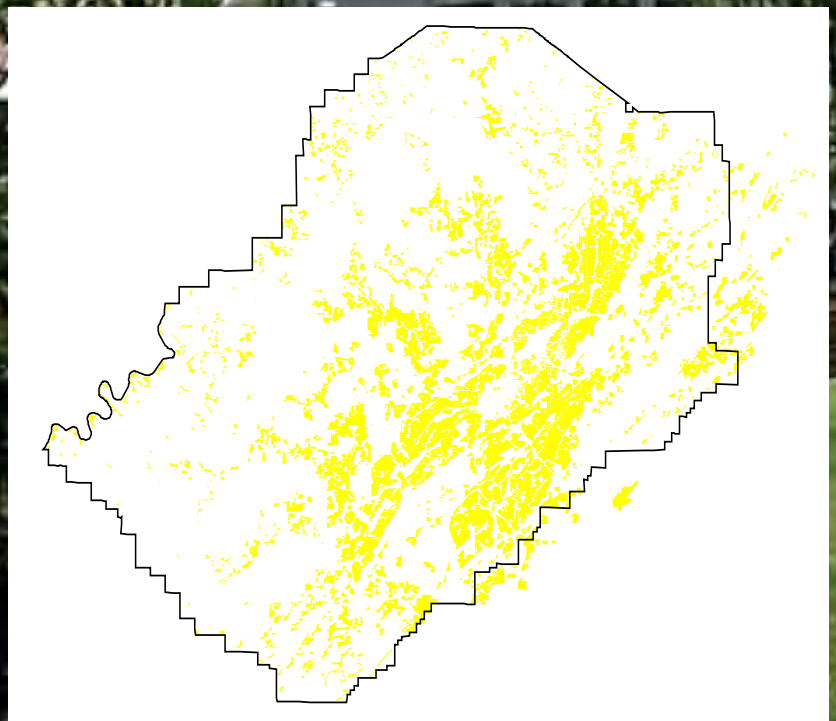


What to Look For:

Polluted runoff from Agriculture & Open Space areas

Nutrients:	fertilizer from farms, parks, golf courses
Pathogens:	domestic animal & wildlife waste
Sediment:	erosion from agricultural fields
Toxic:	pesticides from ag. lands & golf courses
Debris:	litter & illegal dumping
Thermal:	removal of streamside vegetation, shallow water impoundments

Residential



What to Look For:

Polluted runoff from Residential areas

Nutrients: lawn fertilizers & septic system effluent

Pathogens: malfunctioning septic syst., pet waste

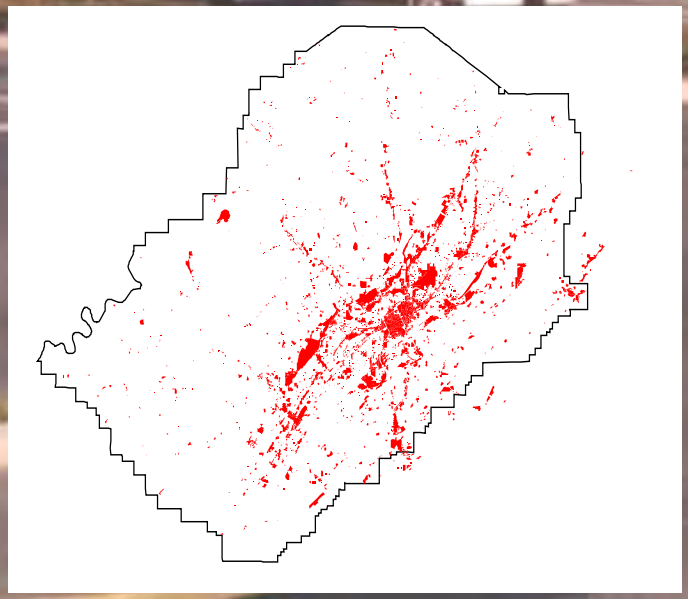
Sediment: construction, road sand, erosion from lawns & gardens

Toxic: household products, pesticides

Debris: litter & illegal dumping

Thermal: heated runoff, removal of streamside vegetation, impoundment's

Commercial & Industrial



What to Look For:

Polluted runoff from
Commercial & Industrial areas

Nutrients: acid rain and car exhaust

Pathogens: malfunctioning or overloaded septic systems & lagoons

Sediment: construction, road sand, roadside erosion

Toxic: auto emissions, industrial pollutants

Debris: litter & illegal dumping

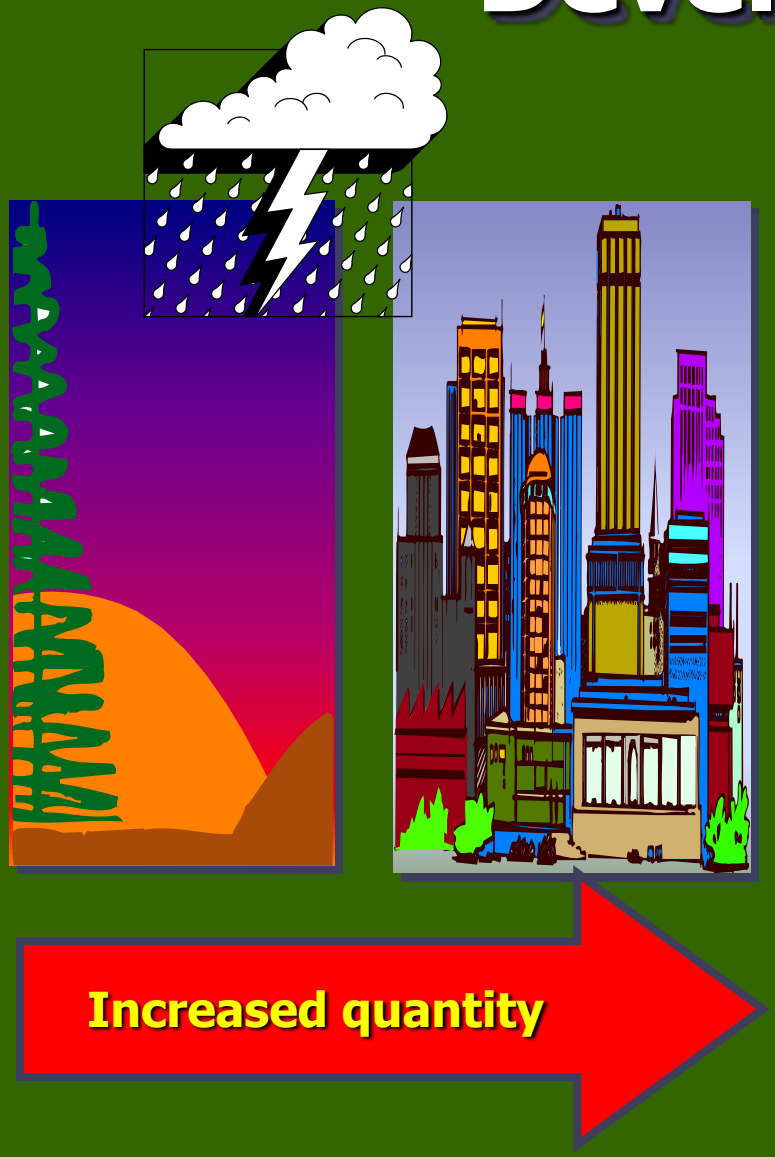
Thermal: heated runoff, removal of streamside vegetation, impoundment's

INTENSITY OF LAND USE

POTENTIAL WATER QUALITY PROBLEMS

AMOUNT OF IMPERVIOUS SURFACE

Development Impacts on Water Quality

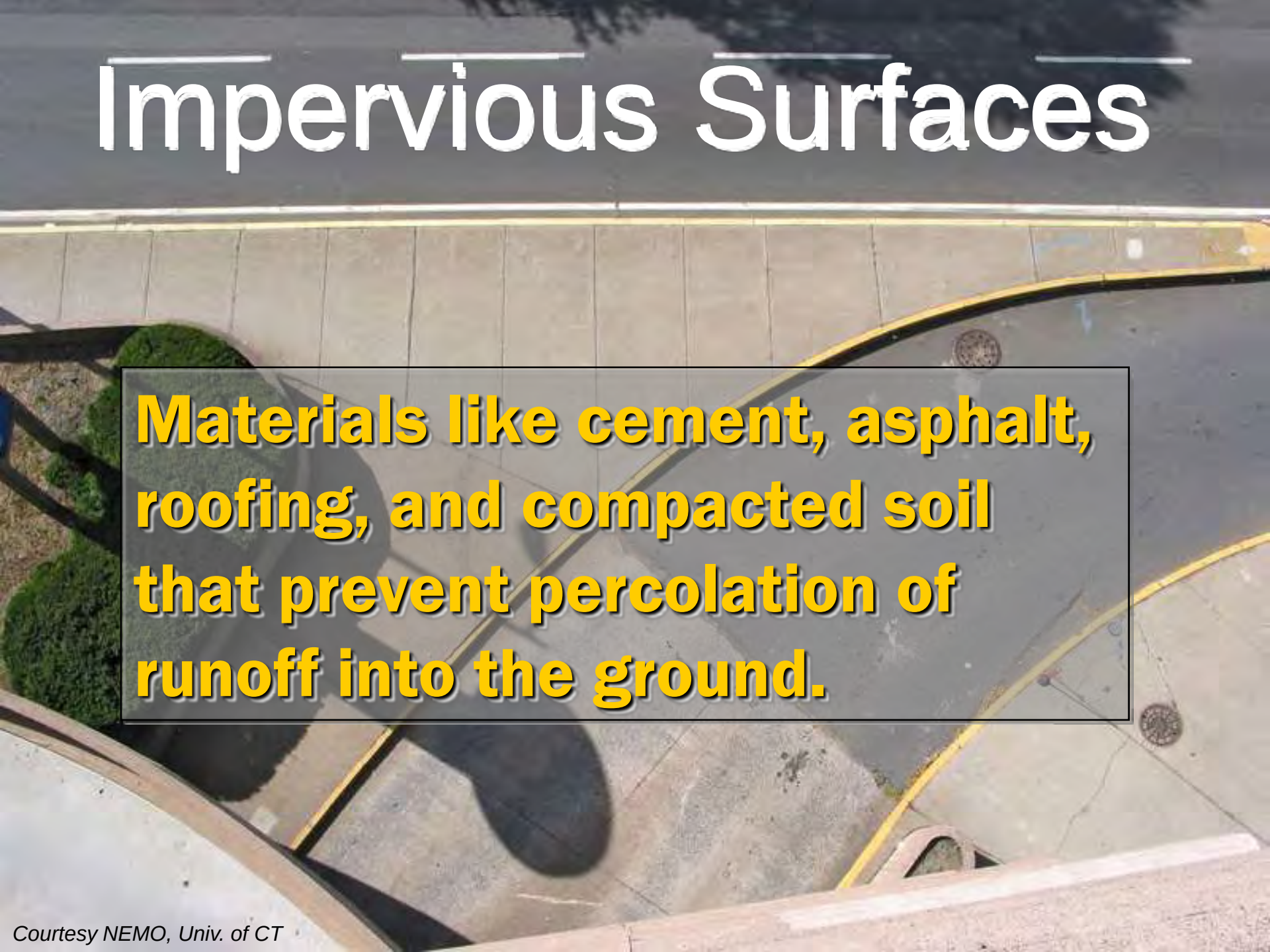


Decreased ground water levels

Decreased quality

- Nutrients
- Pathogens
- Sediment
- Toxic Contaminants
- Debris
- Thermal Stress

Impervious Surfaces



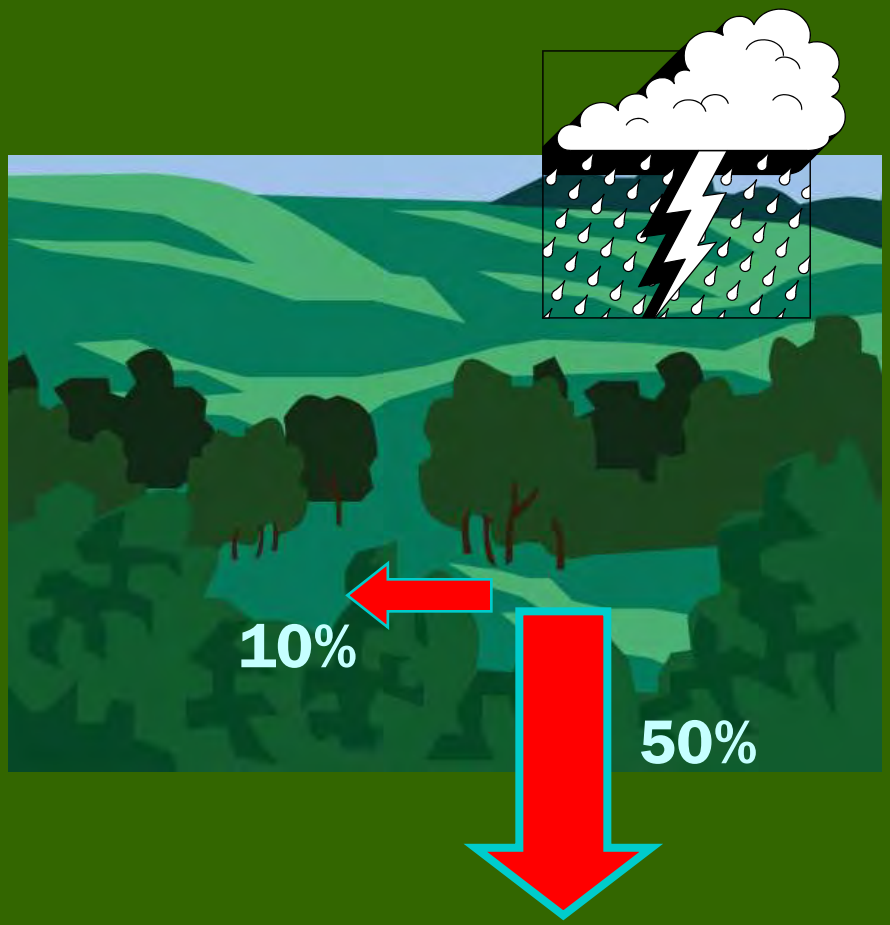
Materials like cement, asphalt, roofing, and compacted soil that prevent percolation of runoff into the ground.

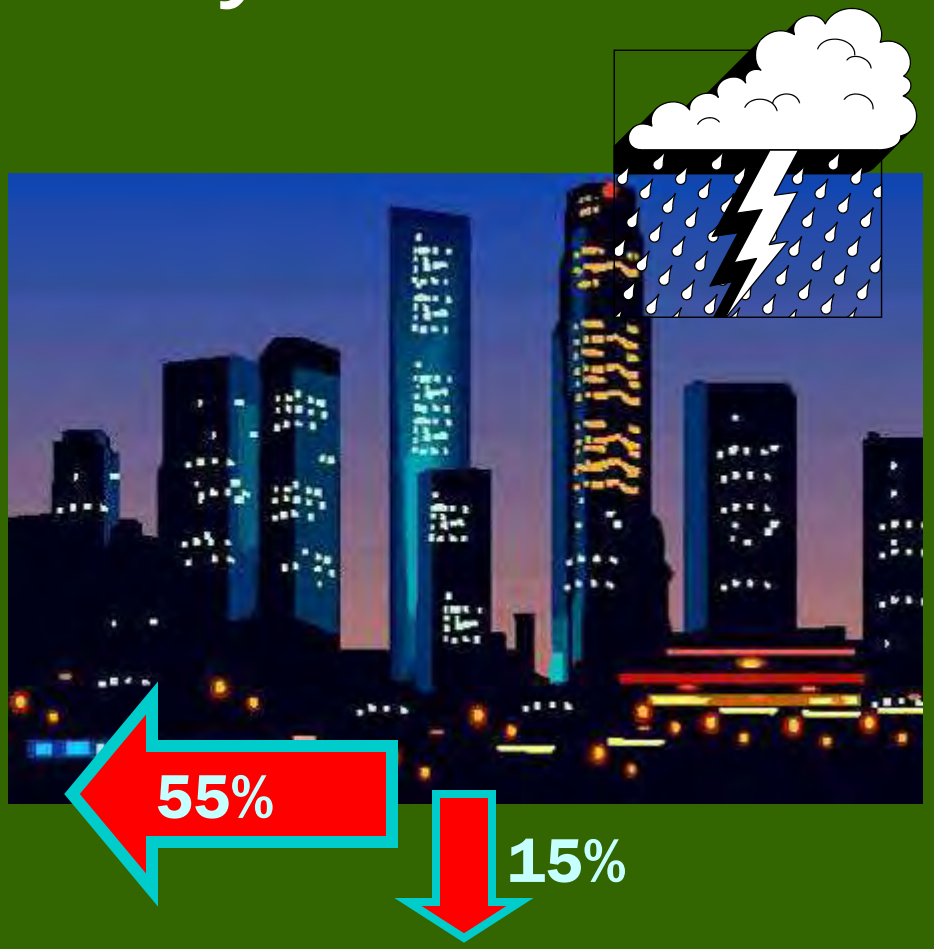
Courtesy NEMO, Univ. of CT

Impervious Surfaces Across the Landscape

Dr. Mimi Fearn

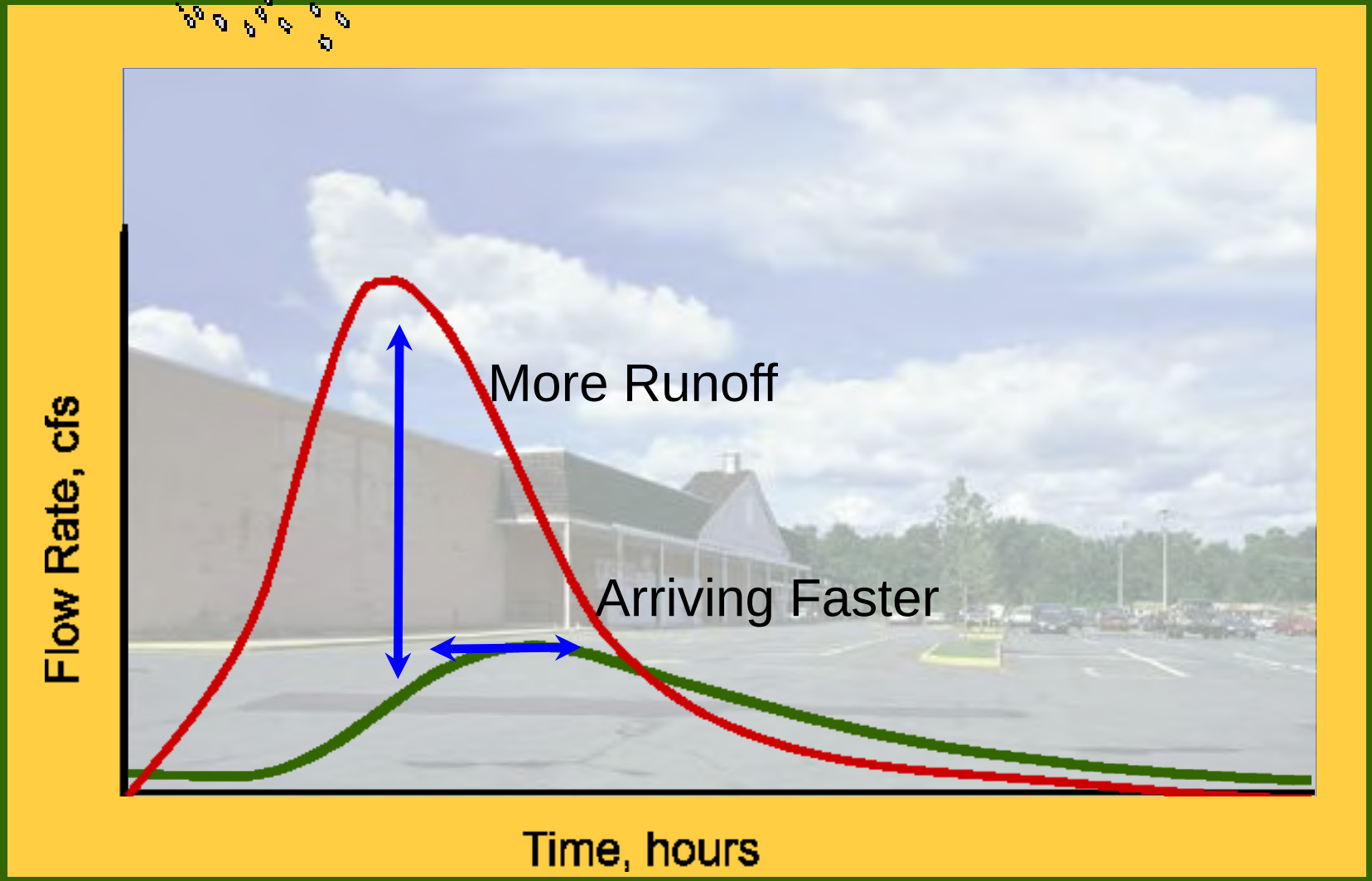
Development Impacts on the Water Cycle



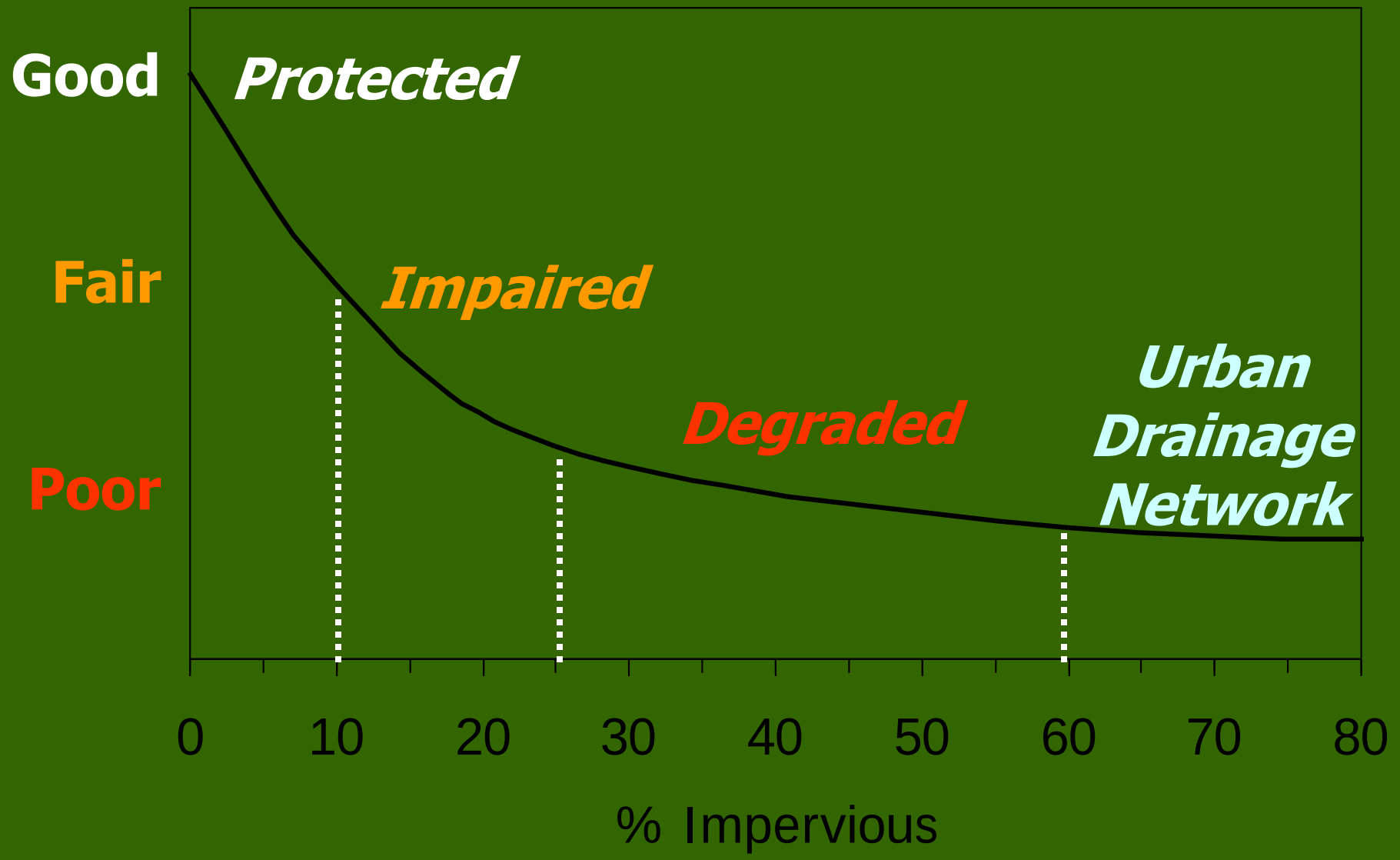


Courtesy NEMO, Univ. of CT

The Science of Stormwater…



*Stream Condition Related to Impervious Surface



From Schueler, 2002

Trivia Question …

How much of the U.S. is paved?

a) Maryland
b) Alabama
c) Ohio
d) Wyoming

112,610 square kilometers – slightly larger than the area covered by wetlands in the lower 48 states – C. Elvidge, EOS, June 2004, NOAA Geophysical Data Center

Growing Pains

- US population is growing at a rate of 3 million people per year
- 10,000 miles of roads are constructed annually

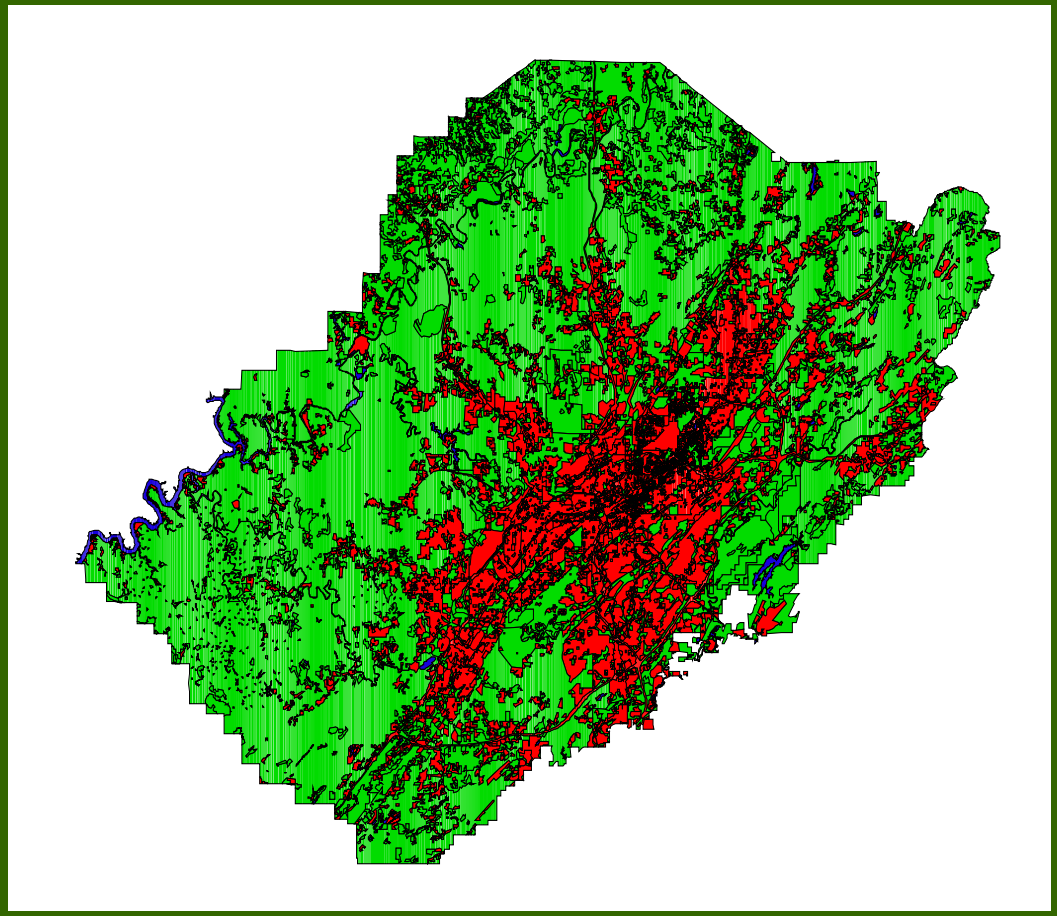
St. Clair County, Friends of Rural AL

What about our area?

- Southeast is one of the most rapidly growing areas in the United States
- In 2006, more than half of the population growth in the USA occurred in southern states.

IMPERVIOUS SURFACE BUILDOUT ANALYSIS

EXISTING CONDITIONS



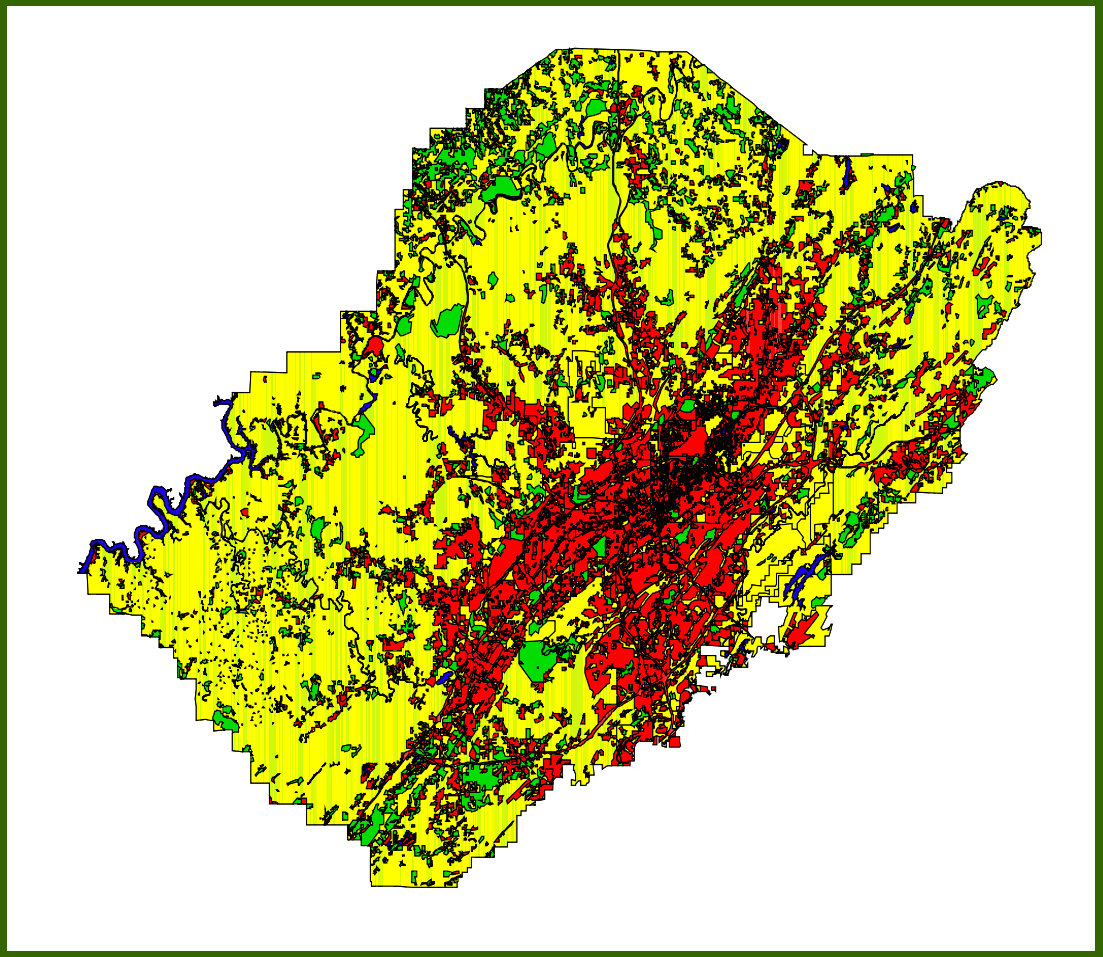
IMPERVIOUS SURFACE AREA

- IMPERVIOUS
- WATER
- PERVIOUS

ADEM

IMPERVIOUS SURFACE BUILDOUT ANALYSIS

Possible CONDITIONS based on current land use and zoning

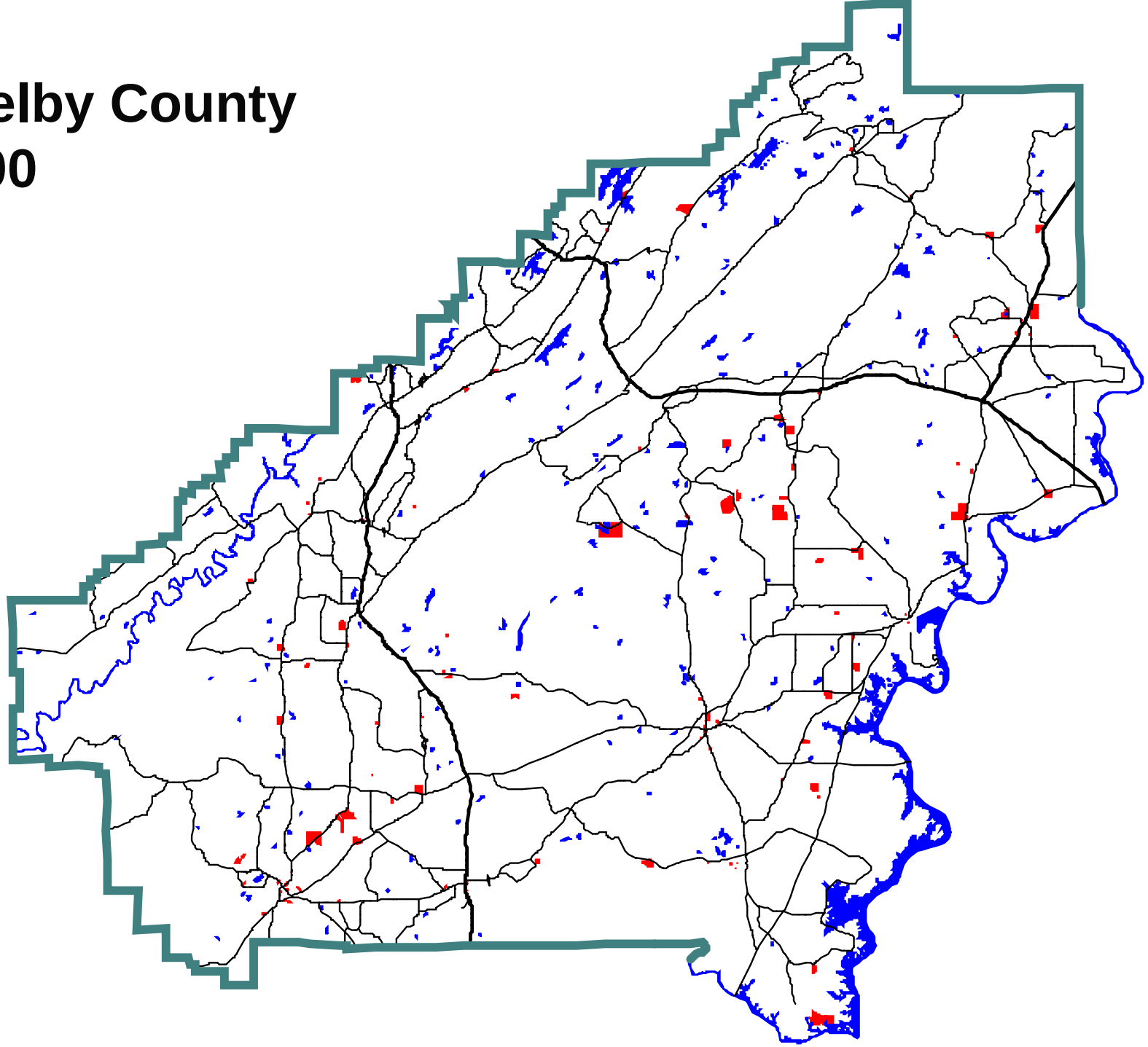


PROJECTED IMPERVIOUS

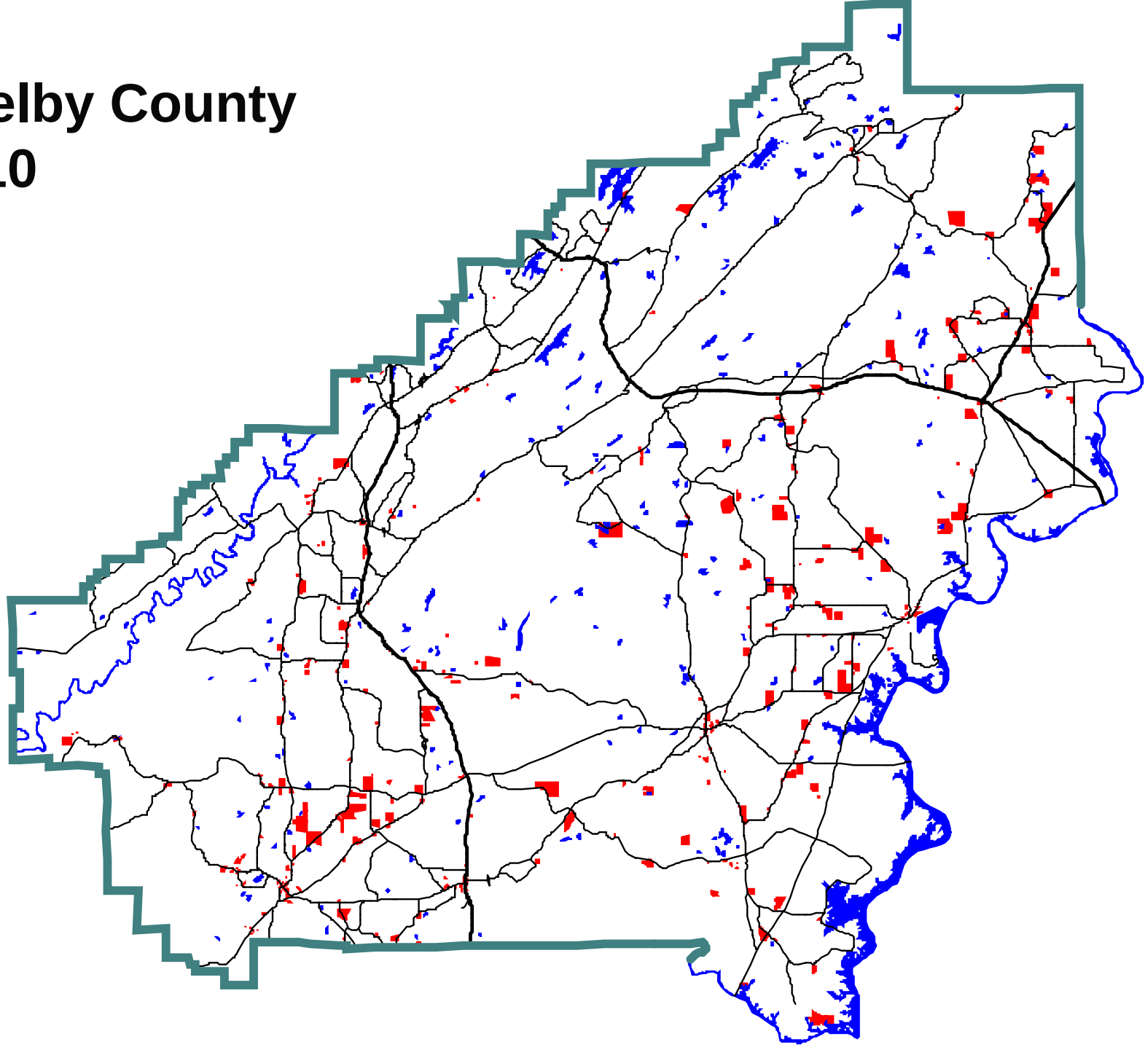
- EXISTING IMPERVIOUS
- PERVIOUS
- PROJECTED IMPERVIOUS

ADEM

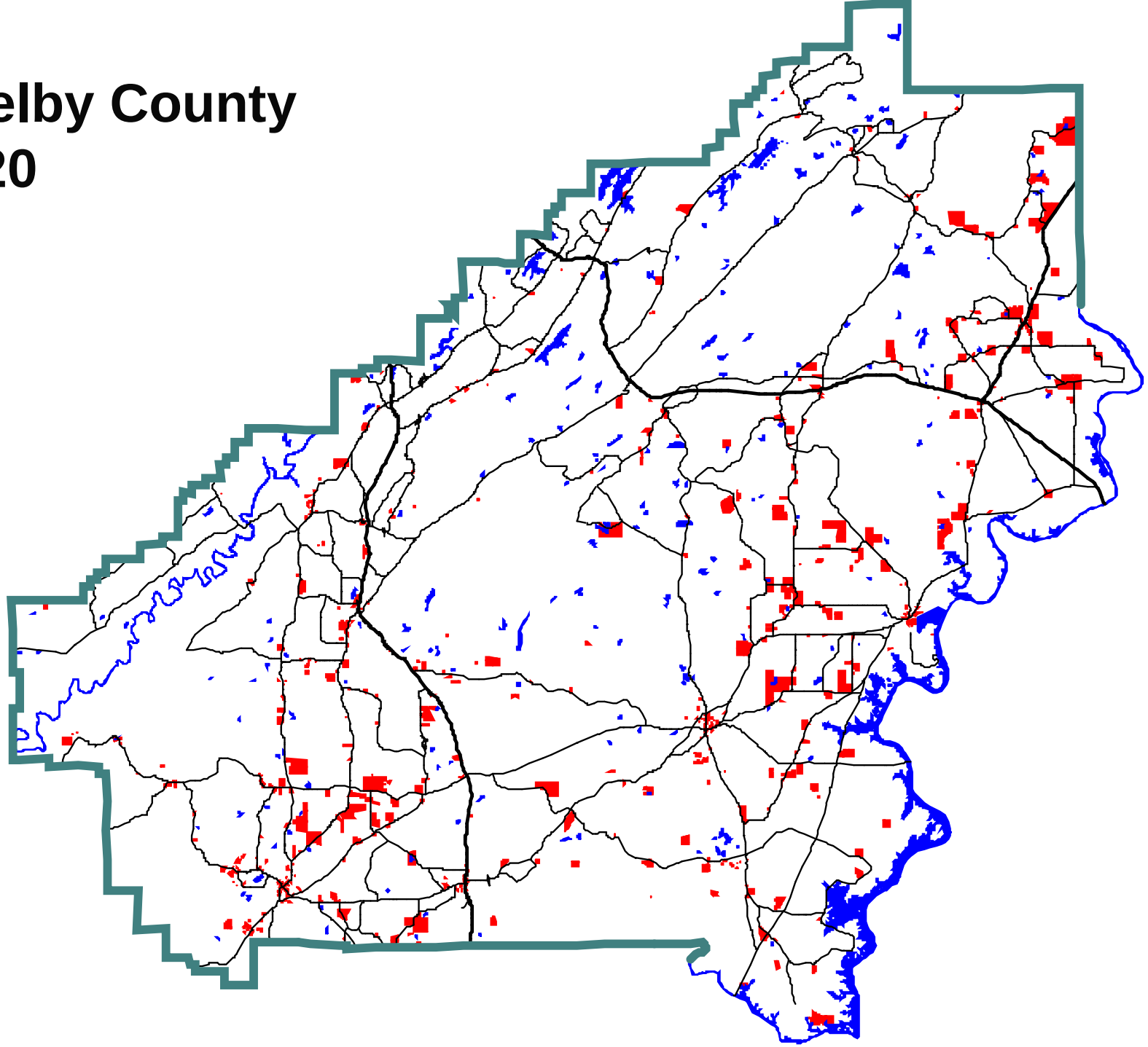
Shelby County
1900



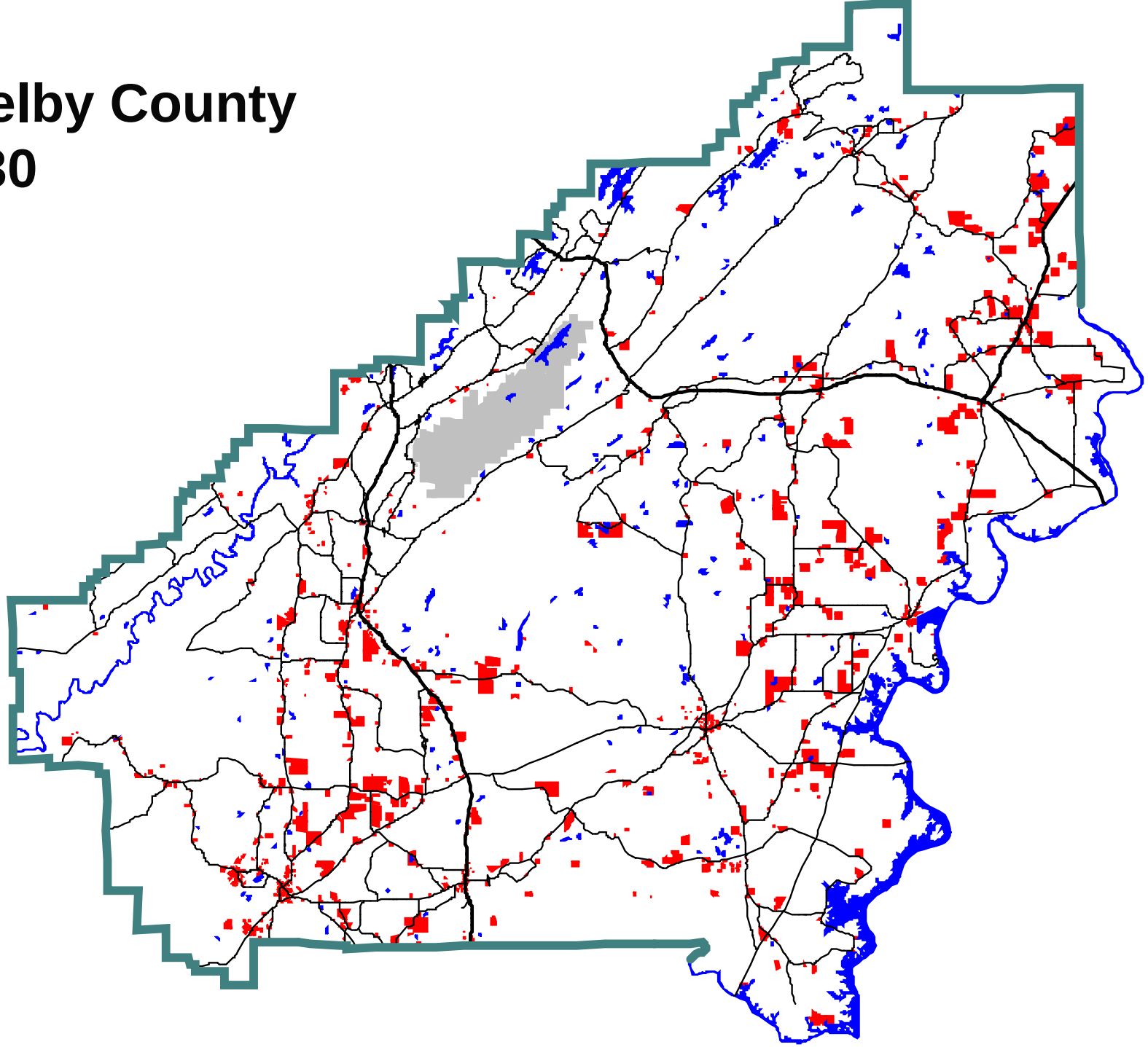
Shelby County
1910



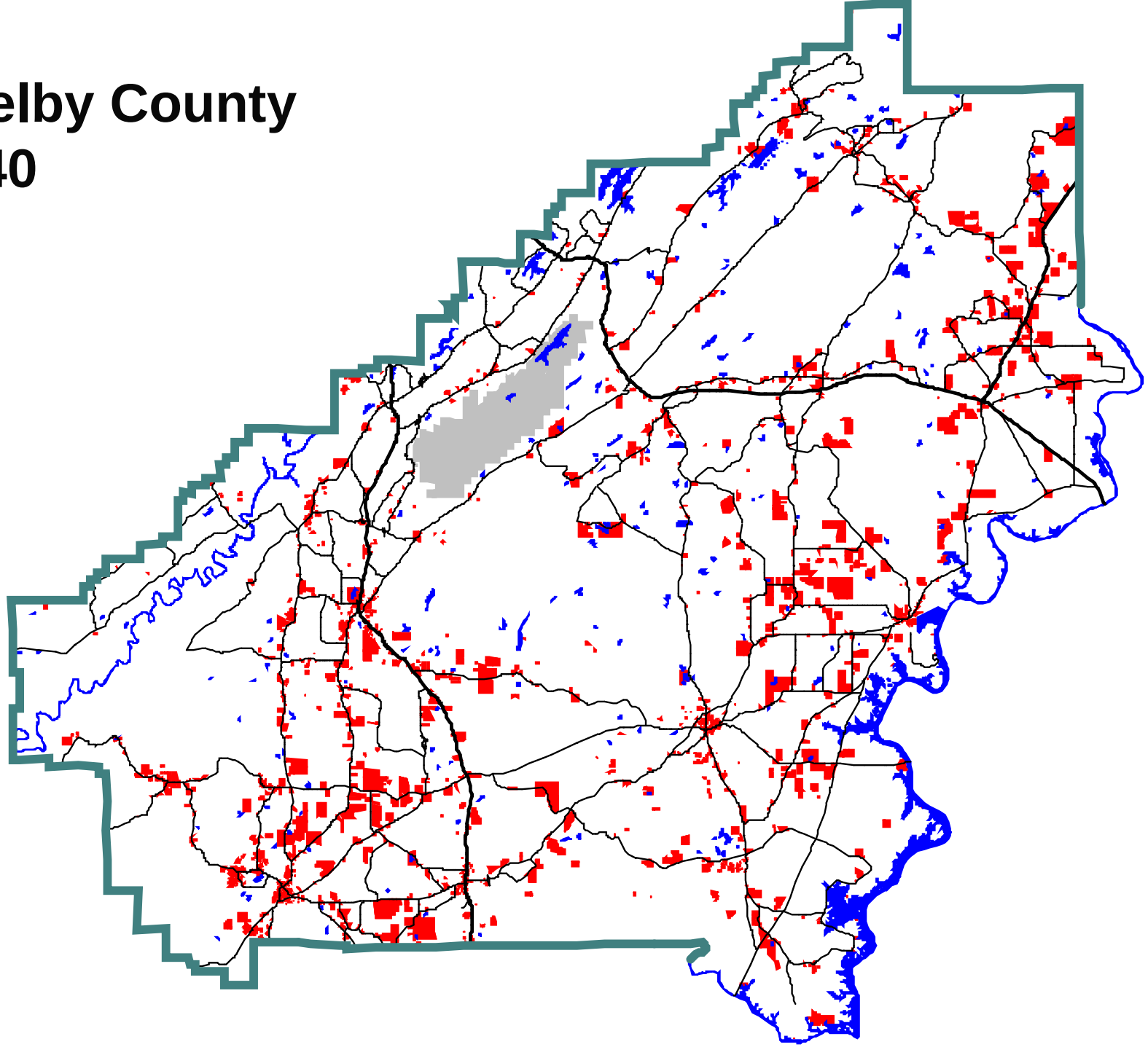
Shelby County
1920



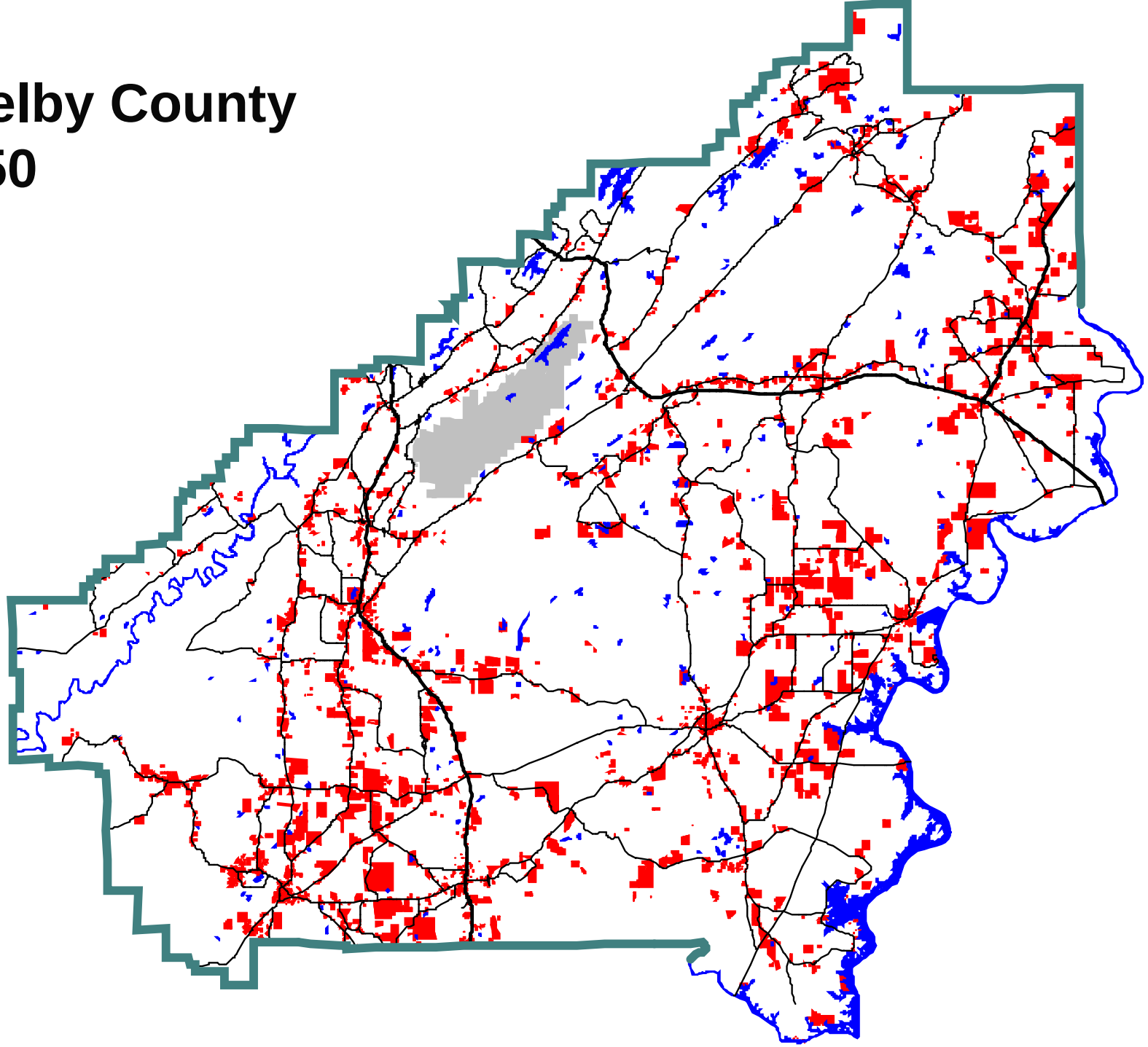
Shelby County
1930



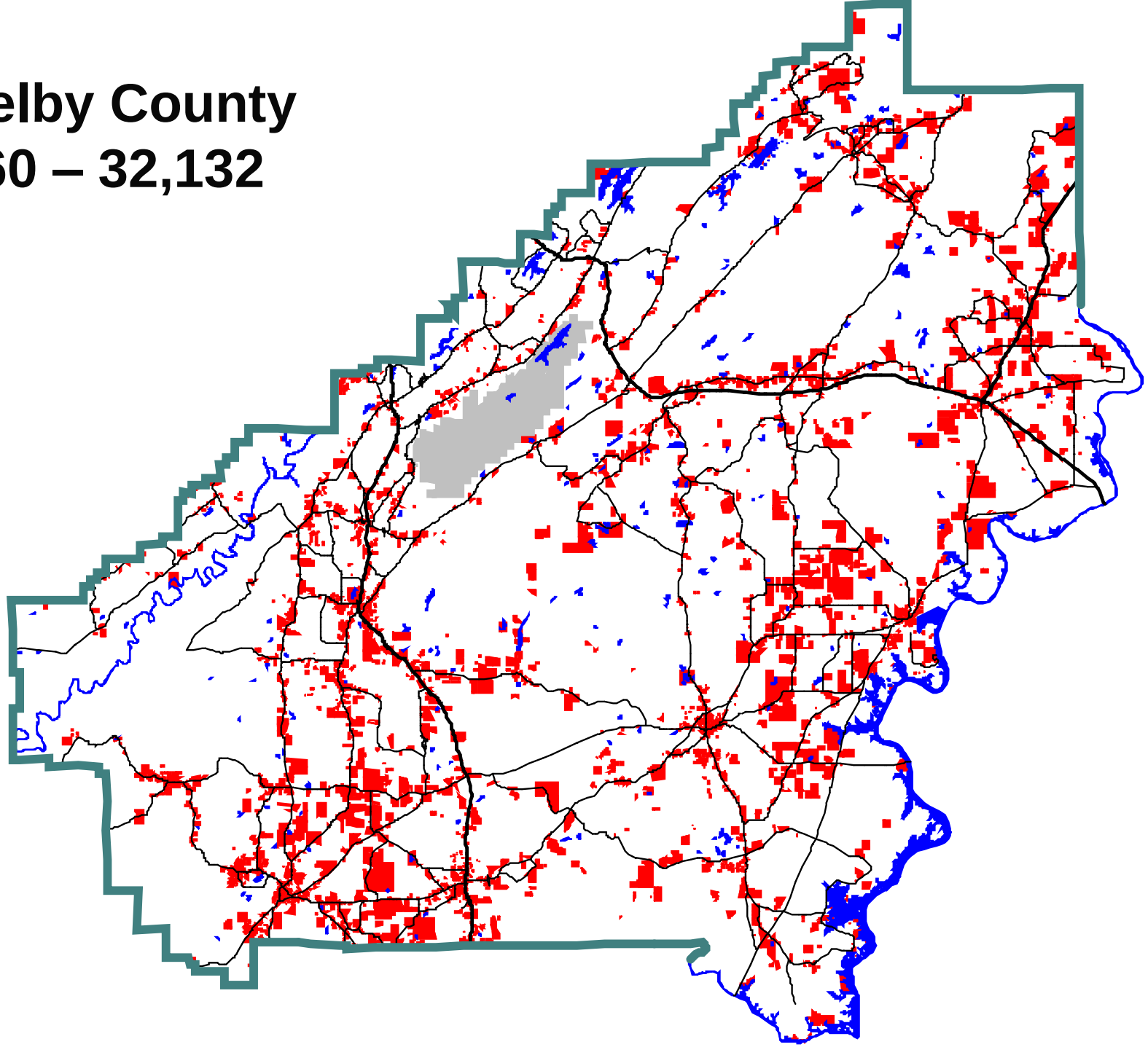
Shelby County
1940



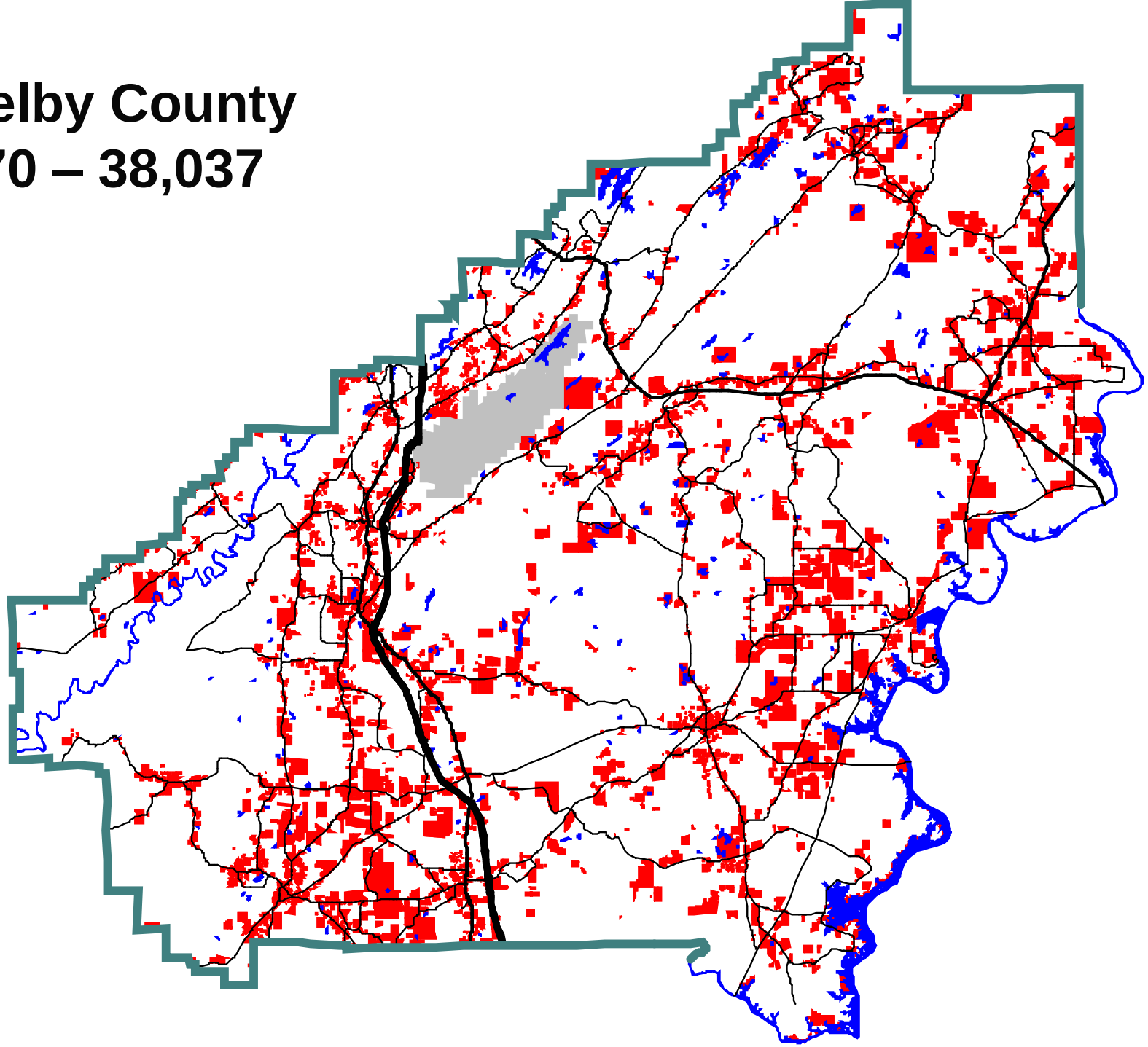
Shelby County
1950



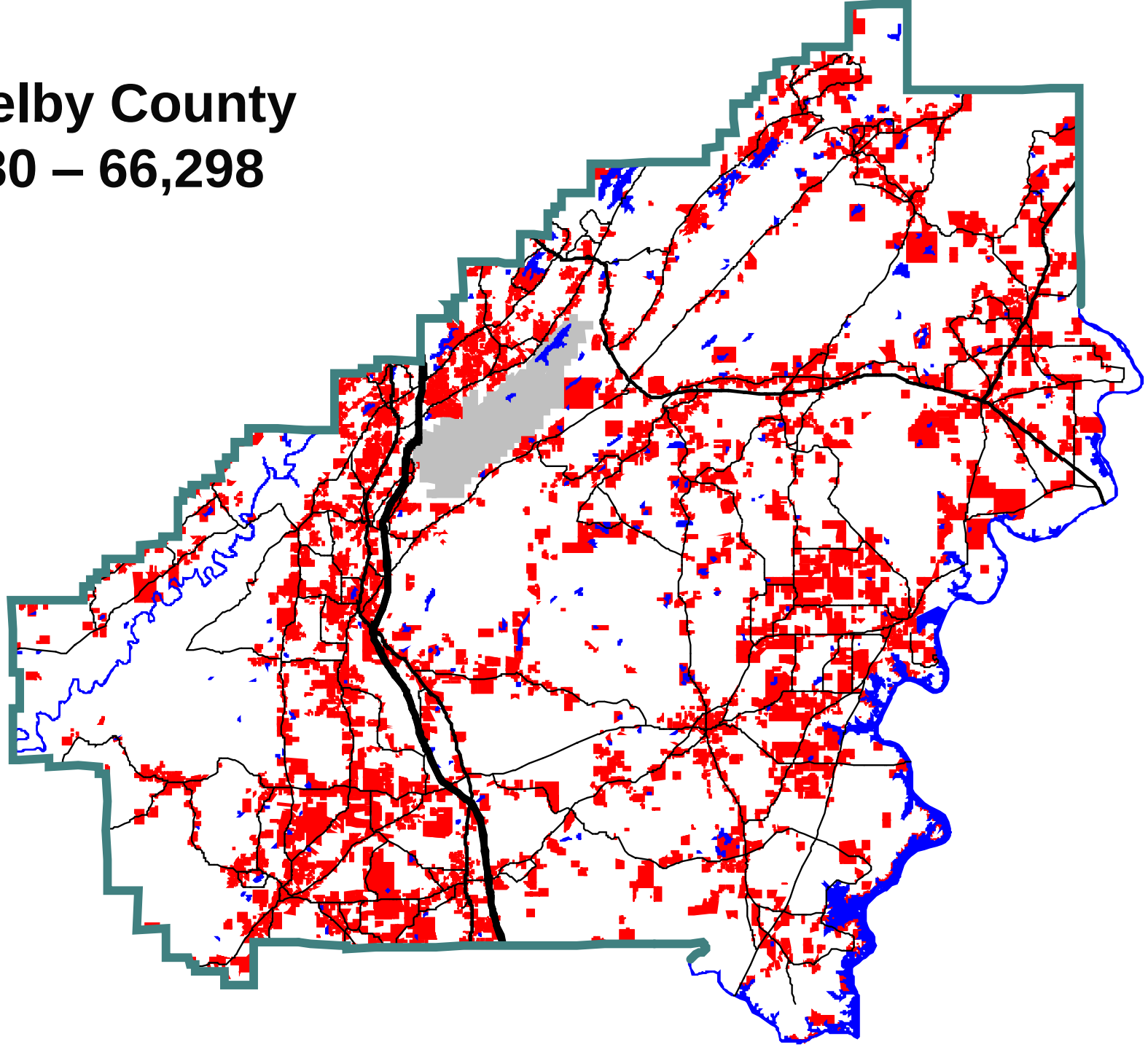
Shelby County
1960 – 32,132



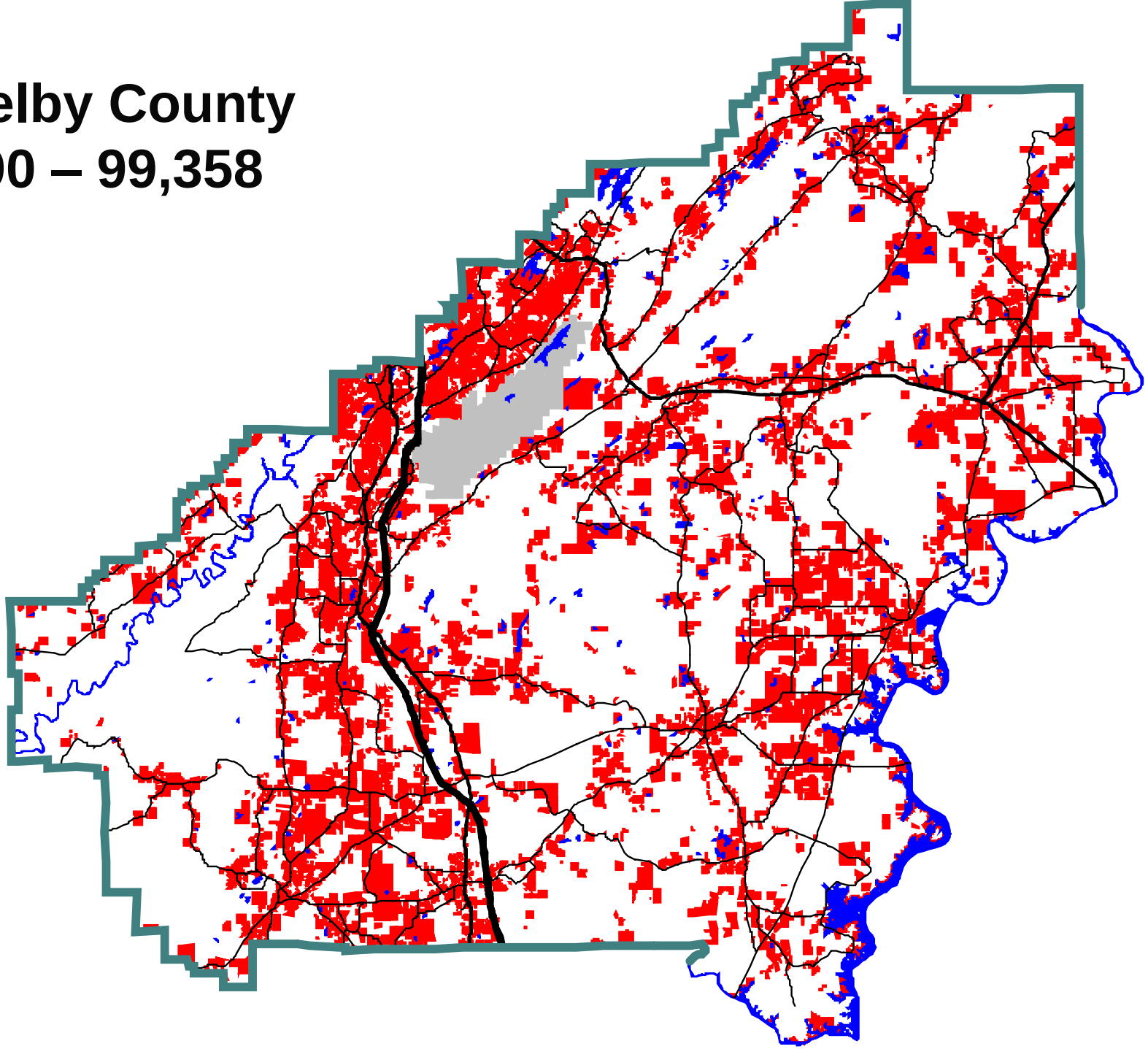
Shelby County
1970 – 38,037



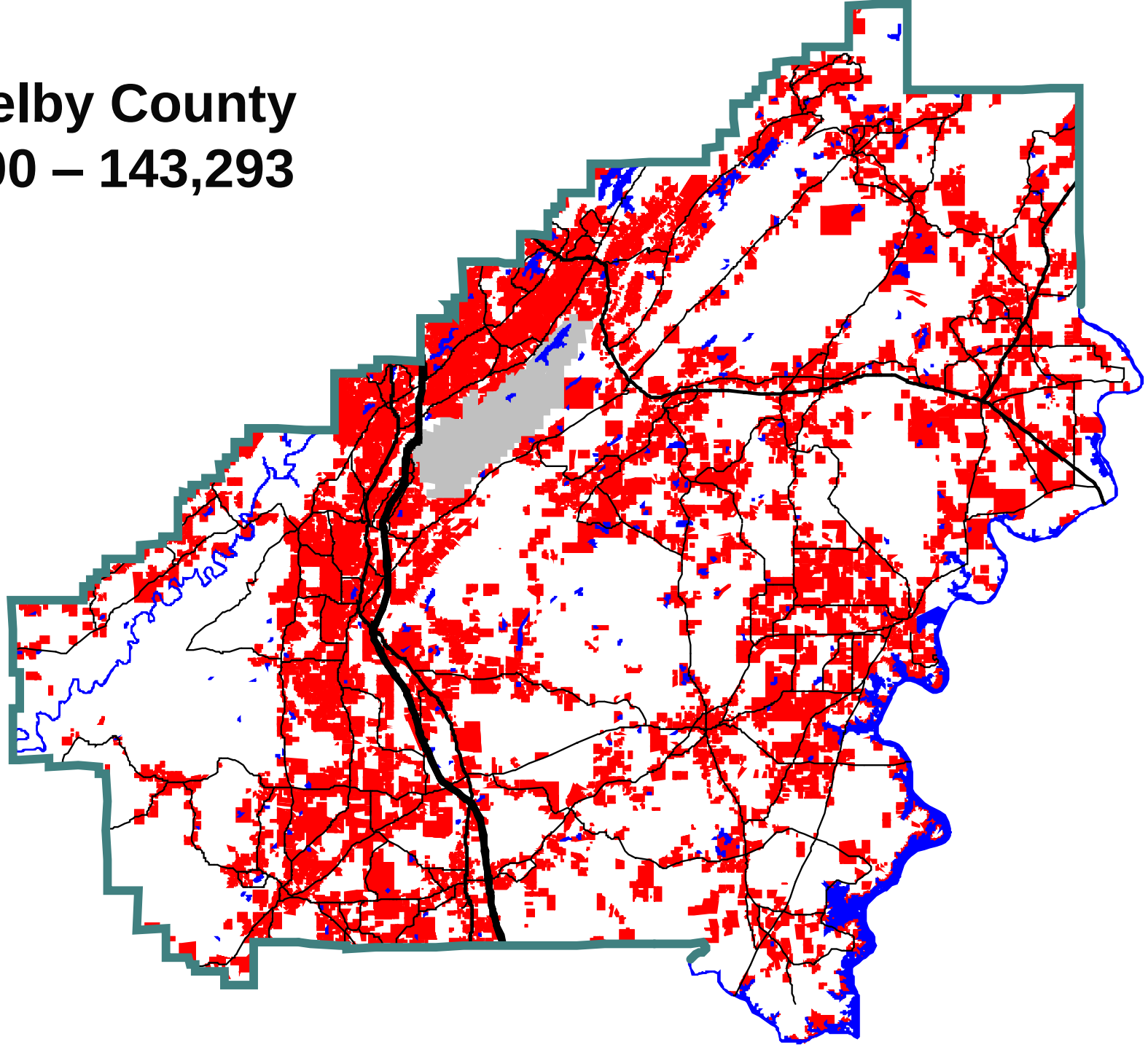
Shelby County
1980 – 66,298



Shelby County
1990 – 99,358



Shelby County
2000 – 143,293

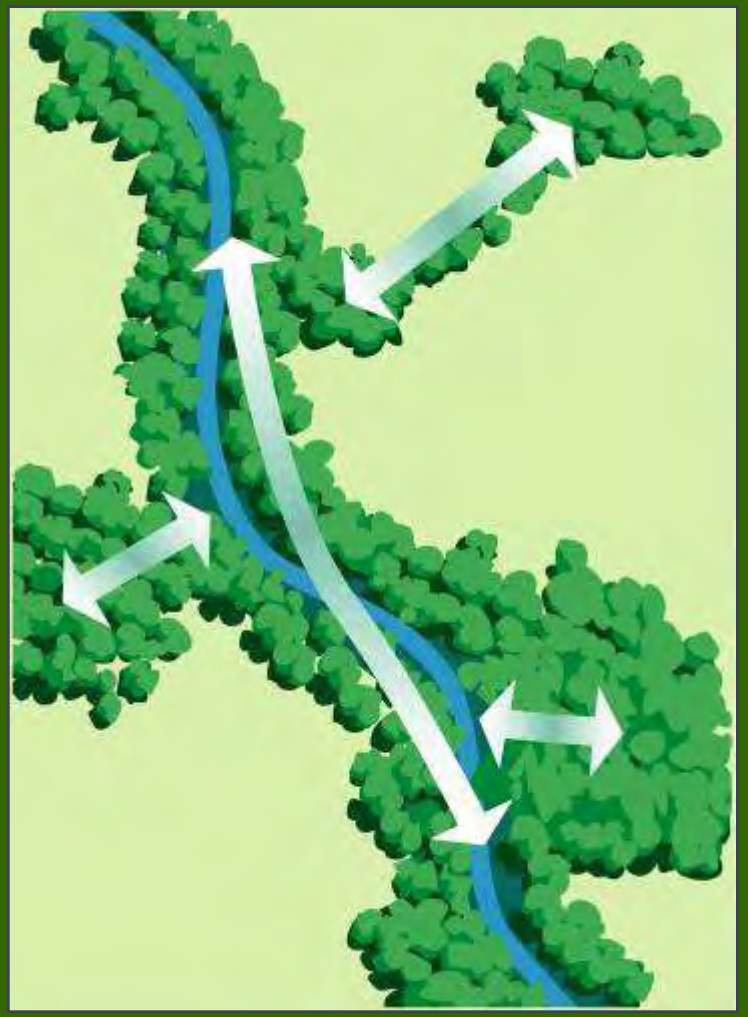


A Quick Quiz

What were the ‘unhealthy’ streams missing?

What were the ‘unhealthy’ streams missing?

- Vegetation!
- Natural Habitats
- Good Water Quality



Stream Corridor Restoration: Principles, Processes, and Practices, 10/98, by the Federal Interagency Stream Restoration Working Group (FISRWG)."

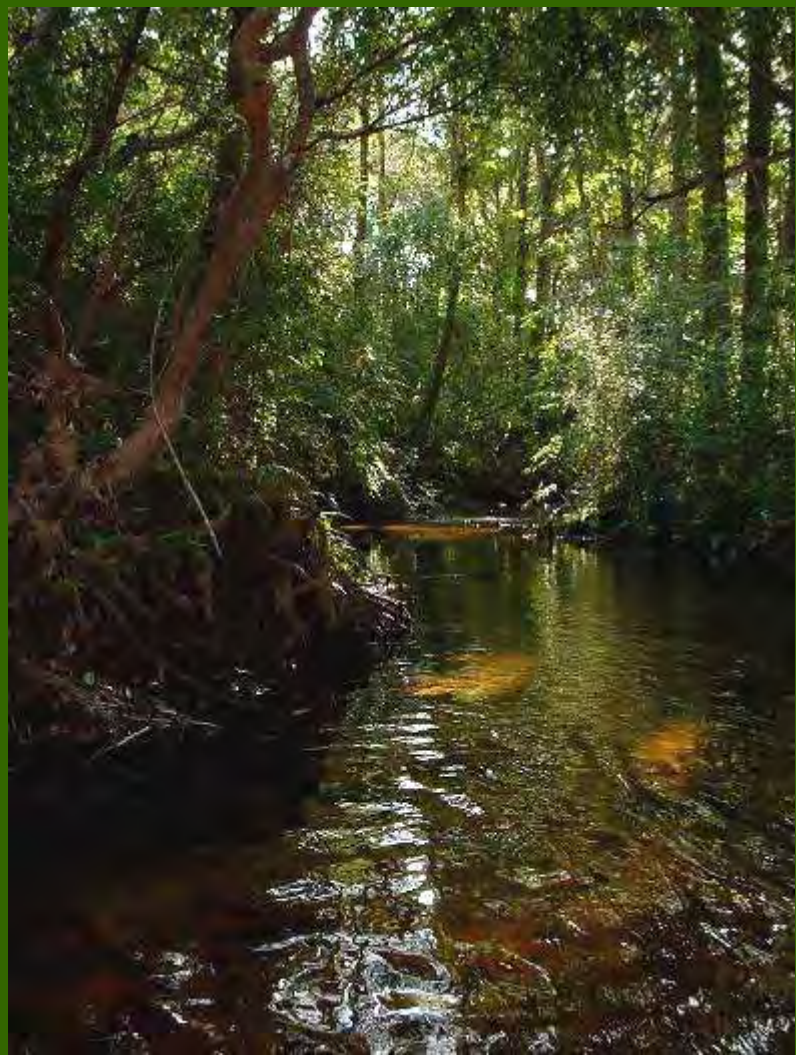
Streamside Forests (also known as riparian buffers)

- Trees, shrubs, herbs, and grasses are critical to the health of streams
- Buffers are the first line of defense against the impacts of polluted runoff
- natural vegetation buffers are especially critical in urban areas

Streamside Forests influence in-stream life

- Shading
- Temperature
- Food sources for aquatic animals
- Woody debris
- Bank stability
- Filtering nutrients and sediments

Shading-Temperature



Food sources for aquatic animals

Woody debris

Bank stability

Filtering nutrients and sediments

Invasive, Nonnative Plants

- Chinese privet
- Japanese Honeysuckle
- Japanese Climbing Fern
- Stilt Grass (Microstegium)
- Wisteria
- Cogon Grass

Invasive, Nonnative Plants

- Remove and replace with native vegetation
- Low habitat value
- May not be providing erosion control

Water Quantity

Water Quantity

Closely tied with water quality

Water Quantity

- Currently, water in Alabama is not in critically short supply – we are one of the few remaining regions of the nation with a surplus of water resources.

- Continued economic development through the expansion of industry and growth in population is expected to increase the demand on Alabama's water supplies.

Water resource protection in Alabama: the need for a paradigm change
Jones Law Review, Annual, 2003 Larry O'Neil Putt

In-stream flow

Water bodies need to maintain sufficient quantities of water to support various uses:

- Drinking water
- Recreation
- Irrigation and industrial withdrawals
- Support of aquatic life
- Pollution discharges
- Navigation
- Aesthetics / property value

In-stream flow

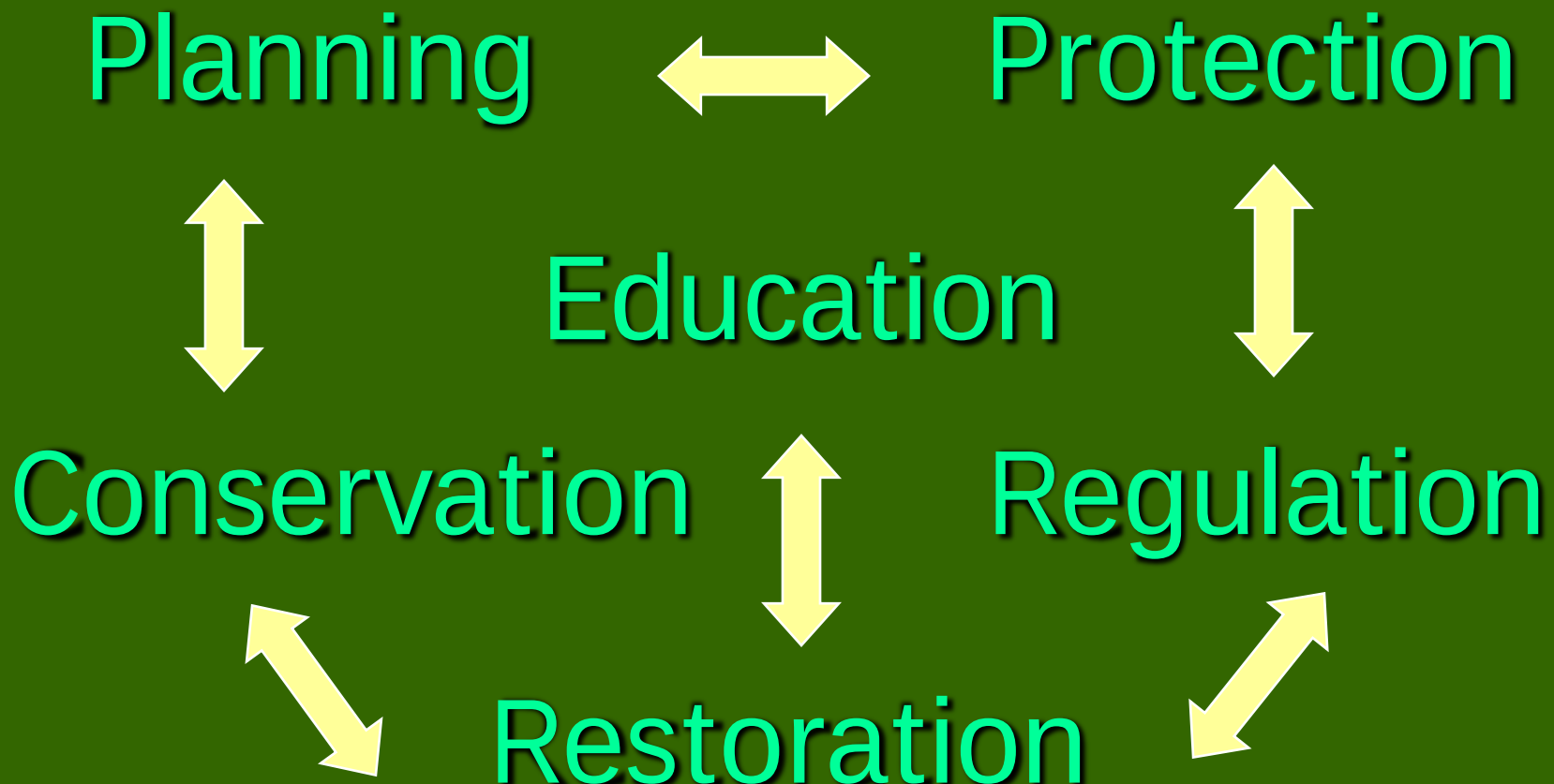
- Complicated questions arise
- How do we best mimic natural flow variations and consider the magnitude, frequency, and duration of flows in a river system?
  - How much water?
  - How often will it flow?
  - How long will it flow?

Consider

- Conservation
- Drought management plans
- Reduction of stormwater runoff in urban areas

So …
What's a person to do?

Working in Watersheds




Nathan Culpepper Photography


6:27PM