Sweet Home Alabama

Rebecca A. Bearden
Geological Survey of Alabama


ALABAMA
TENNESSEE
TENNESSEE RIVER
MISSISSIPPI
GEORGIA
BLACK WARRIOR RIVER
COOSA RIVER
CAHABA R.
TALLAPOOSA R.
TOMBIGBEE RIVER
ALABAMA RIVER
CONECUH RIVER
PEA R.
FLORIDA
Gulf of Mexico
GREAT SEAL

Before We Begin— A Quick Overview of the Past

A Timetable of Alabama Geological History

	Time Period		When Began (in millions of years)	Significant Events in Alabama's Geologic History
Cenozoic Era	Quaternary	Holocene	11,700 years	our present epoch of Earth history
		Pleistocene	2.6	the "Ice Age"; Alabama ecosystems unlike today—northern tree species, megafauna
	Tertiary Period	Pliocene	5.3	Alabama landscape undergoes slight uplift, deep erosion of uplands
		Miocene	23	
		Oligocene	34	Earth's climate becomes unstable; fossil pollen studies show deciduous trees start to dominate Alabama forests
	Epochs →	Eocene	56	Alabama climate warm and wet, forests still contain many tropical tree species: lignite coal forms in Gulf coastal marshes
		Paleocene	66	
Mesozoic Era	Cretaceous		145	sea levels very high, warm oceans cover most of Alabama; "Selma chalk" forms offshore; dinosaurs roam tropical jungles
	Jurassic		201	opening of the Gulf of Mexico; Alabama climate still hot and dry; rich oil deposits form along edge of young, expanding Gulf
	Triassic		252	supercontinent of Pangaea begins to rift apart; Alabama moves north of the equator; state's climate and landscape desert-like
Paleozoic Era	Permian		299	probable peak of Appalachian Mtn. formation, Alabama locked within dry interior of Pangaea, no rocks from this time known from the state
	Carbon-iferous	Pennsylvanian	323	"Coal Age" forests; Pangaea forms
		Mississippian	359	widespread limestones deposited
	Devonian		419	sometimes called the "age of fishes," but land plants and animals also diversify and move further from the water's edge
	Silurian		443	Birmingham's Red Mountain iron ores form; terrestrial (land) environments first invaded by plants and animals
	Ordovician		485	tropical seas cover most of the state; Alabama rocks show mountain-building, volcanic activity was nearby to the east
	Cambrian Period		541 million years ago	Alabama on passive margin of ancient North American continent Laurentia; earliest fossils appear in Alabama rocks
"Precambrian"	"Precambrian" (represents about 87% of the Earth's history)			first multicellular organisms appear in the fossil record
	Proterozoic Eon		2.5 billion	Grenville mountain-building episode; deep crust beneath Alabama added
				first "free" oxygen accumulates in the Earth's atmosphere
	Archaean Eon		3.8 billion	earliest fossilized bacteria appear in the geologic record
			4 billion	age of Earth's oldest known rocks

J. Lacefield

Alabama's Geological History

"worlds stacked upon worlds"

2.

1. (oldest)

3.

7. (recent)

"roots" of Grenville Mtns. > 1 billion years old

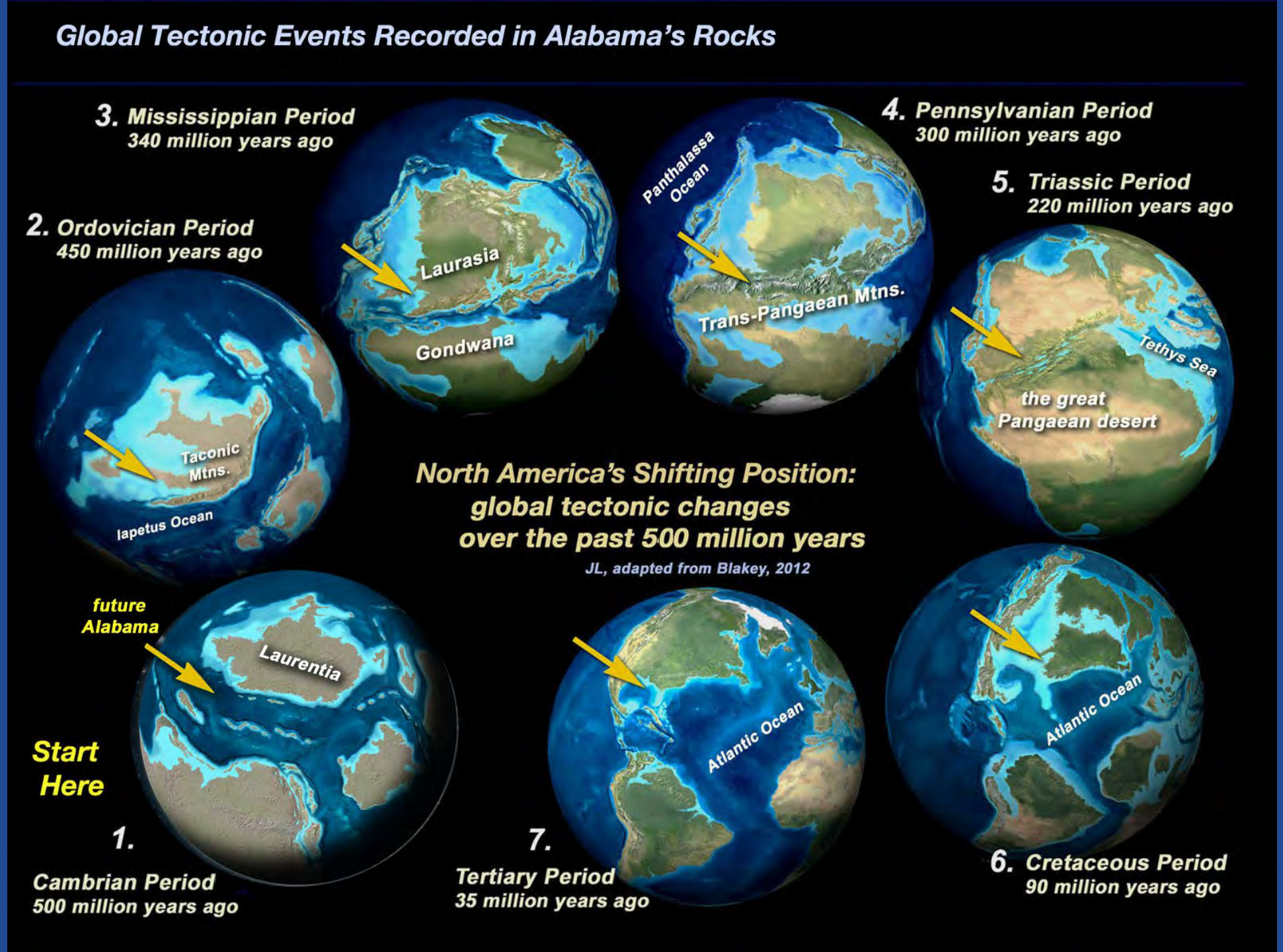
6.

map source: Geological Survey of Alabama

the land's evolution through geologic time

5.

The land of Alabama has undergone great changes in landscape, climate, and life over the millennia.

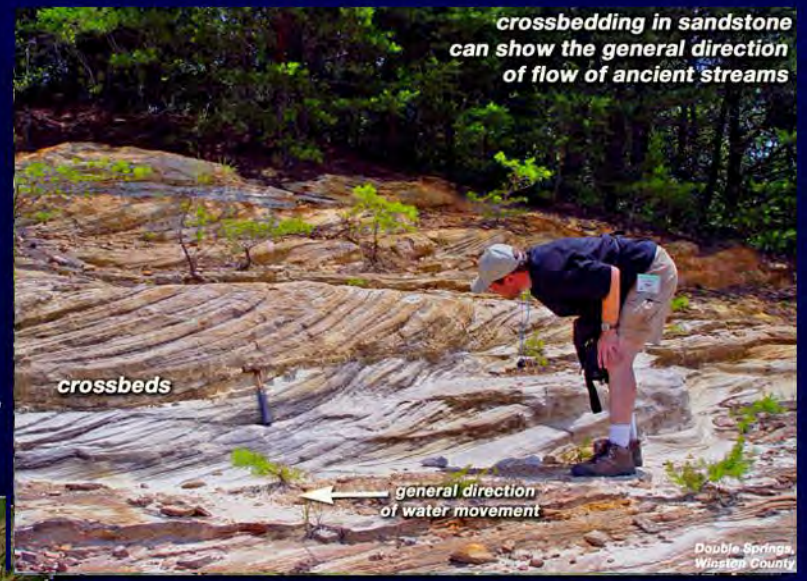

Global Tectonic Events Recorded in Alabama's Rocks
3. Mississippian Period
340 million years ago
Laurasia
Gondwana
4. Pennsylvanian Period
300 million years ago
Panthalassa Ocean
Trans-Pangaean Mtns.
5. Triassic Period
220 million years ago
Tethys Sea
the great Pangaean desert
2. Ordovician Period
450 million years ago
Taconic Mtns.
Iapetus Ocean
North America's Shifting Position:
global tectonic changes
over the past 500 million years
JL, adapted from Blakey, 2012
future Alabama
Laurentia
Start Here
1.
Cambrian Period
500 million years ago
7.
Tertiary Period
35 million years ago
Atlantic Ocean
Atlantic Ocean
6. Cretaceous Period
90 million years ago

Alabama's Earliest Rivers: A Soggy, Tropical Landscape During the Great "Coal Age"- the Pennsylvanian Period

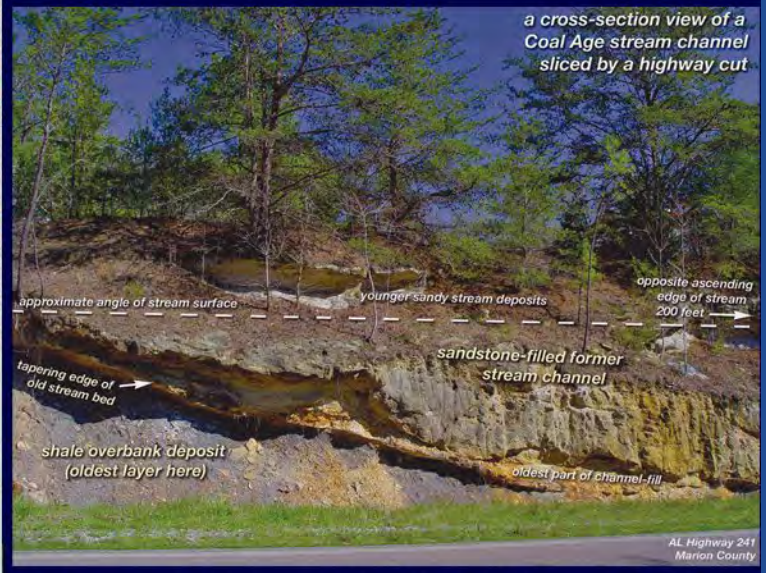
Study of the sedimentary rocks deposited during this period show spectacular changes were taking place to the landscape here.

The Earth's crust was being compressed and deformed by powerful tectonic forces originating from a southeasterly direction.

An enormous volume of new sediment from the erosion of rising mountains to the southeast was swept into the Black Warrior Basin. This event marks the birth of the Southern Appalachian Mountains.

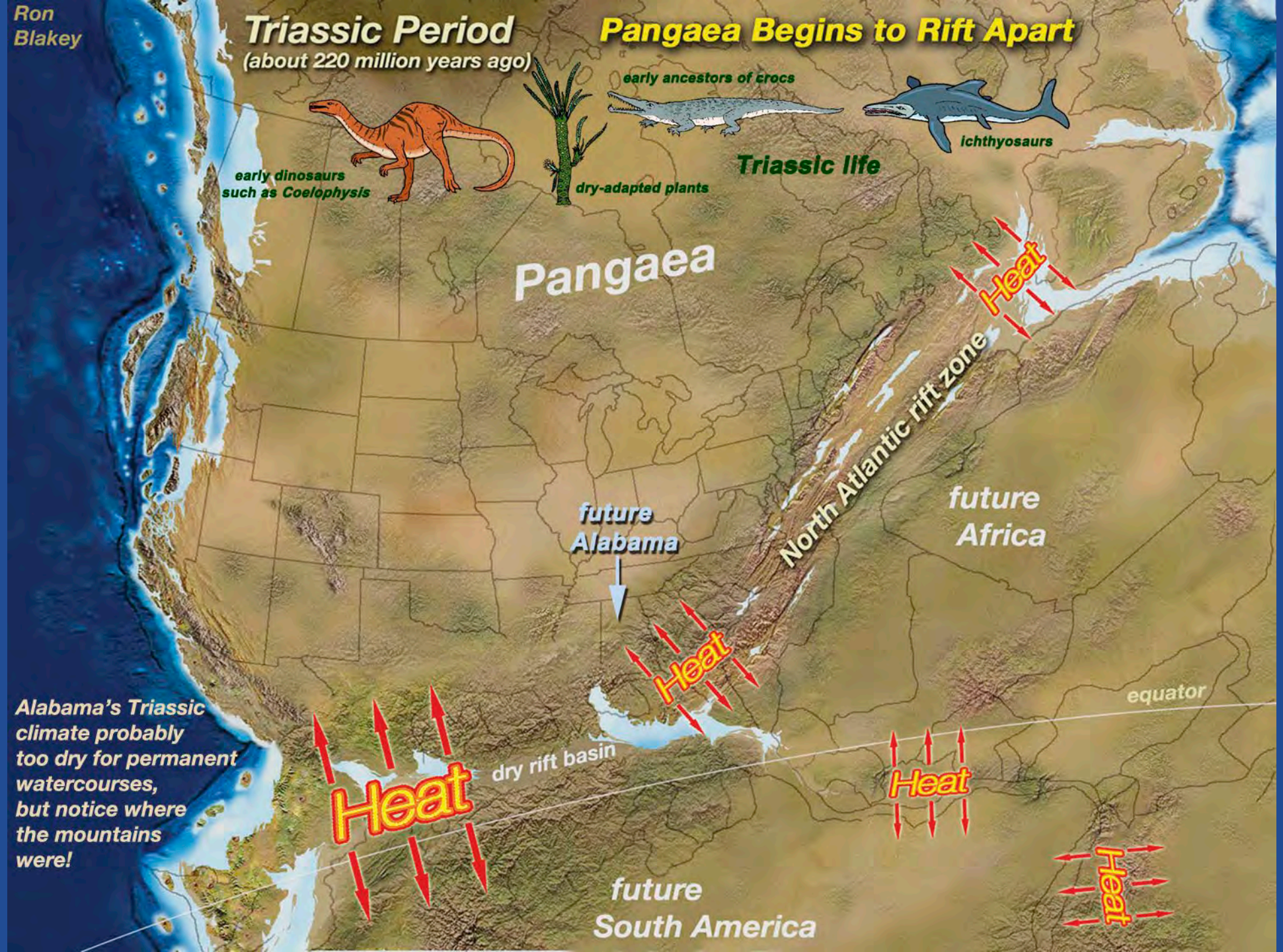


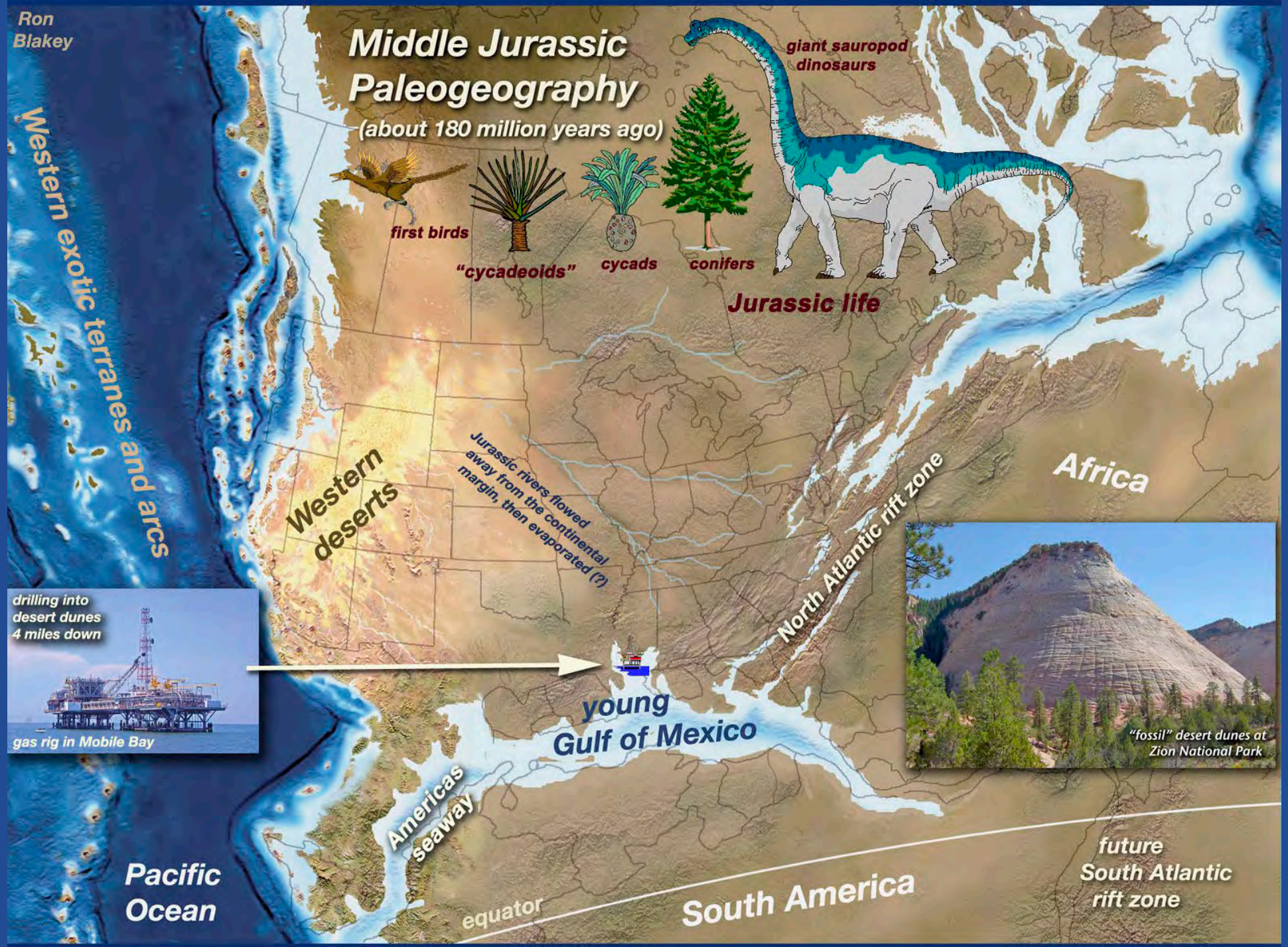
The direction of ancient stream flow offers a source of clues to the shape of the Coal Age landscape.



A large part of present-day North Alabama is built on the thick river-deposited sediment from this time.

In a very exaggerated way, here is what was going on in Alabama during the Pennsylvanian Period.....


Ron Blakey
Triassic Period
(about 220 million years ago)
Pangaea Begins to Rift Apart
early ancestors of crocs
ichthyosaurs
Triassic life
early dinosaurs such as Coelophysis
dry-adapted plants
Pangaea
Heat
North Atlantic rift zone
future Alabama
future Africa
Heat
equator
Alabama's Triassic climate probably too dry for permanent watercourses, but notice where the mountains were!
Heat
dry rift basin
Heat
Heat
future South America


Ron Blakey
Middle Jurassic Paleogeography
(about 180 million years ago)
giant sauropod dinosaurs
first birds
"cycadeoids"
cycads
conifers
Jurassic life
Western exotic terranes and arcs
Western deserts
Jurassic rivers flowed away from the continental margin, then evaporated (?)
North Atlantic rift zone
Africa
drilling into desert dunes 4 miles down
gas rig in Mobile Bay
young Gulf of Mexico
"fossil" desert dunes at Zion National Park
Americas seaway
Pacific Ocean
equator
South America
future South Atlantic rift zone

Arctic Ocean

Greenland

tropical and semitropical forests

T. rex

Pacific Ocean

Western Interior Seaway

Hudson Seaway

Labrador Seaway

3.

"Laramidia" Western North America

Eastern North America "Appalachia"

Mississippi embayment

Atlantic Ocean

huge pterosaurs

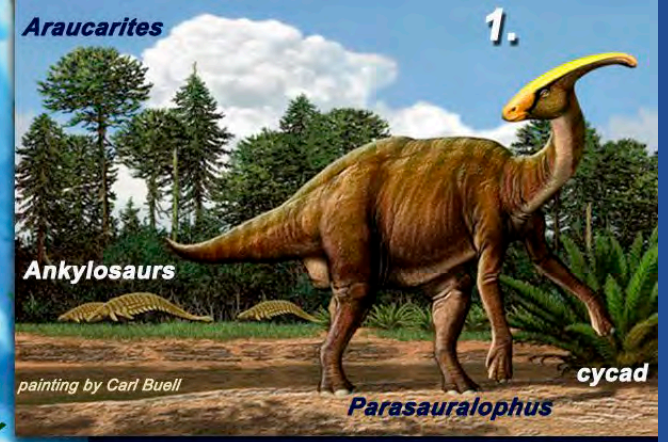
shallow continental shelf

Gulf of Mexico

ammonite

Late Cretaceous Paleogeography of North America

(about 75 million years ago)



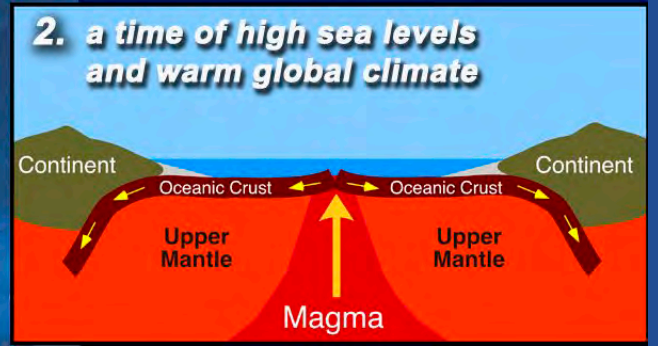
The Cretaceous Period:

A "Greenhouse World" Marked by Great Biological and Geological Revolutions

* lasted for 70 million years

"creta-" = chalk

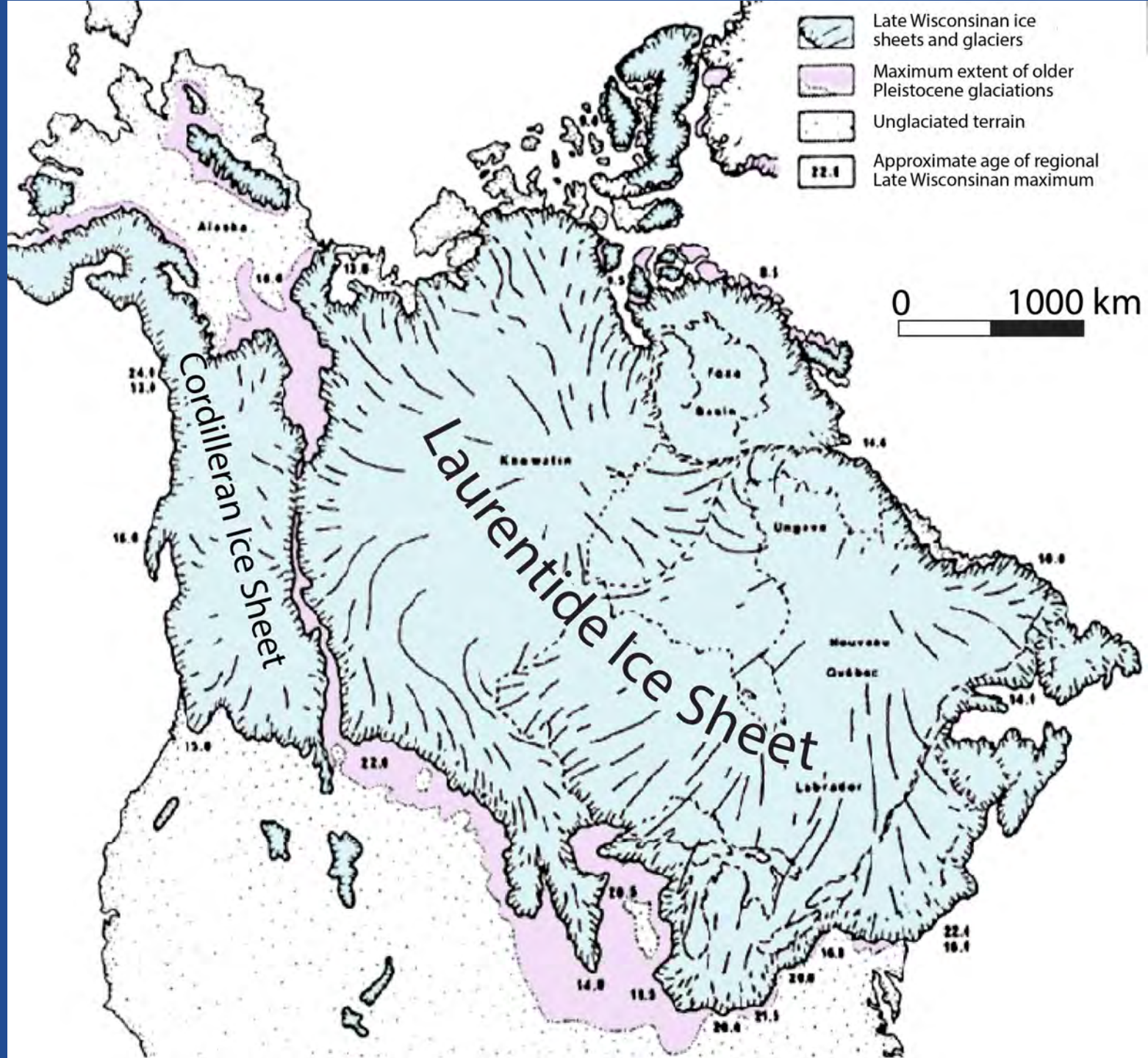
2. a time of high sea levels and warm global climate



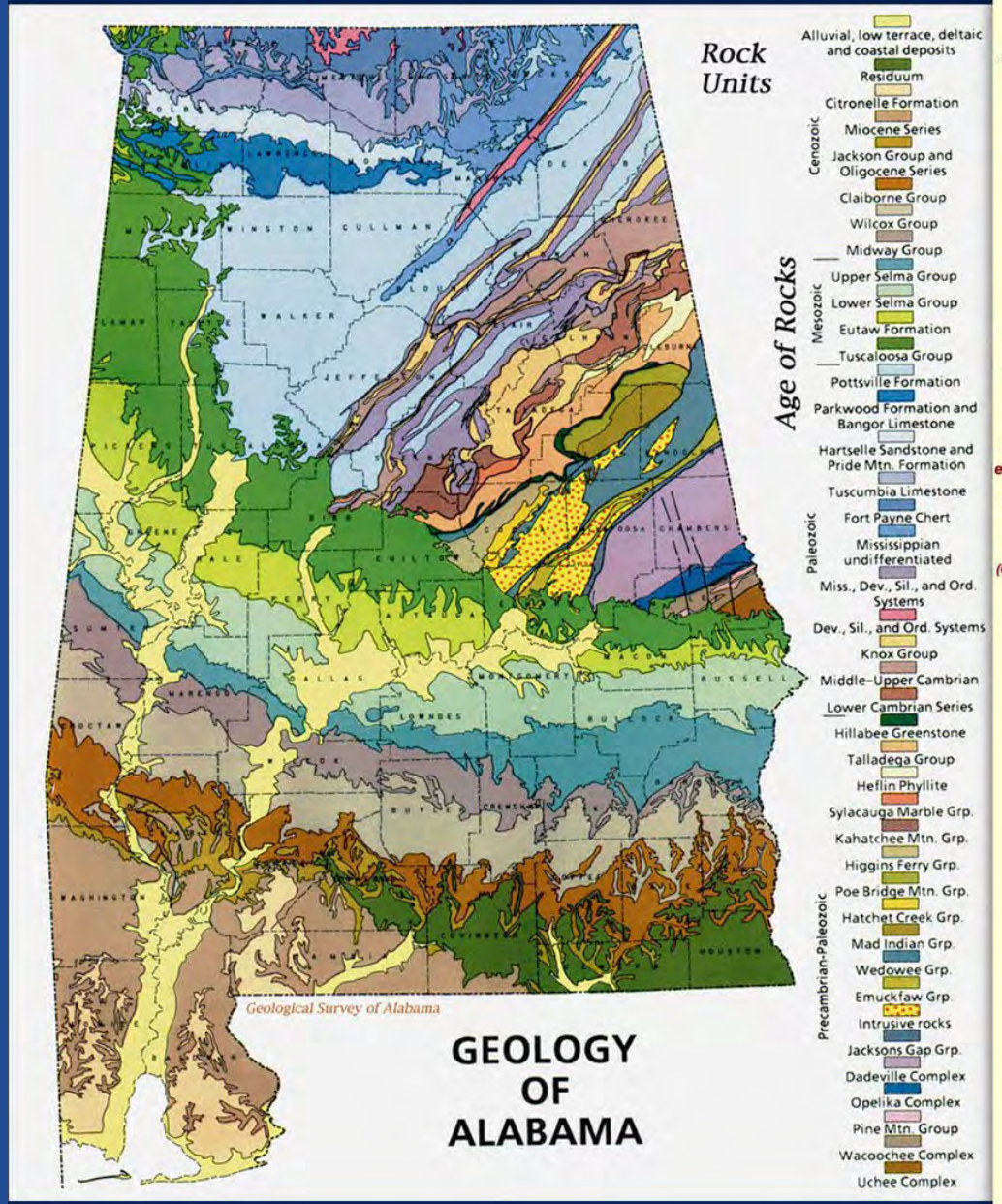
The Ice Age

The Pleistocene epoch from 2.5 million years ago to 11,700 years ago

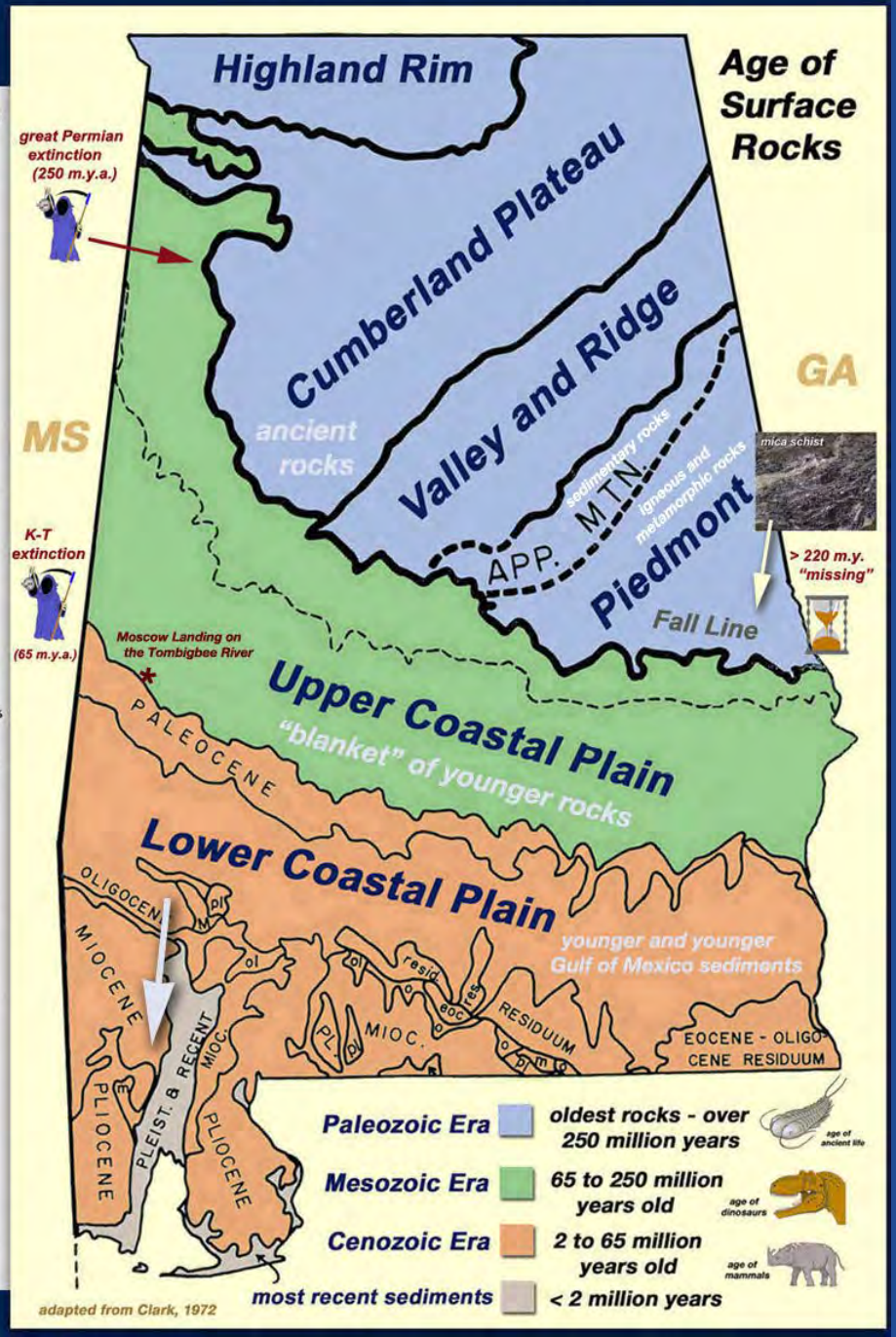
*** Alabama acted as refugia from arctic conditions allowing continuous evolution**



The diversity of surface rocks seen on the Alabama geologic map is reflected in the state's geographic divisions.



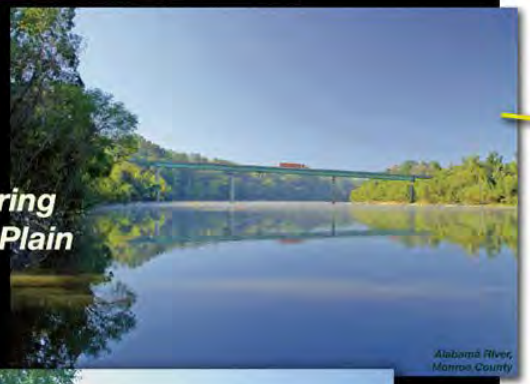
Geology Underlies Geography



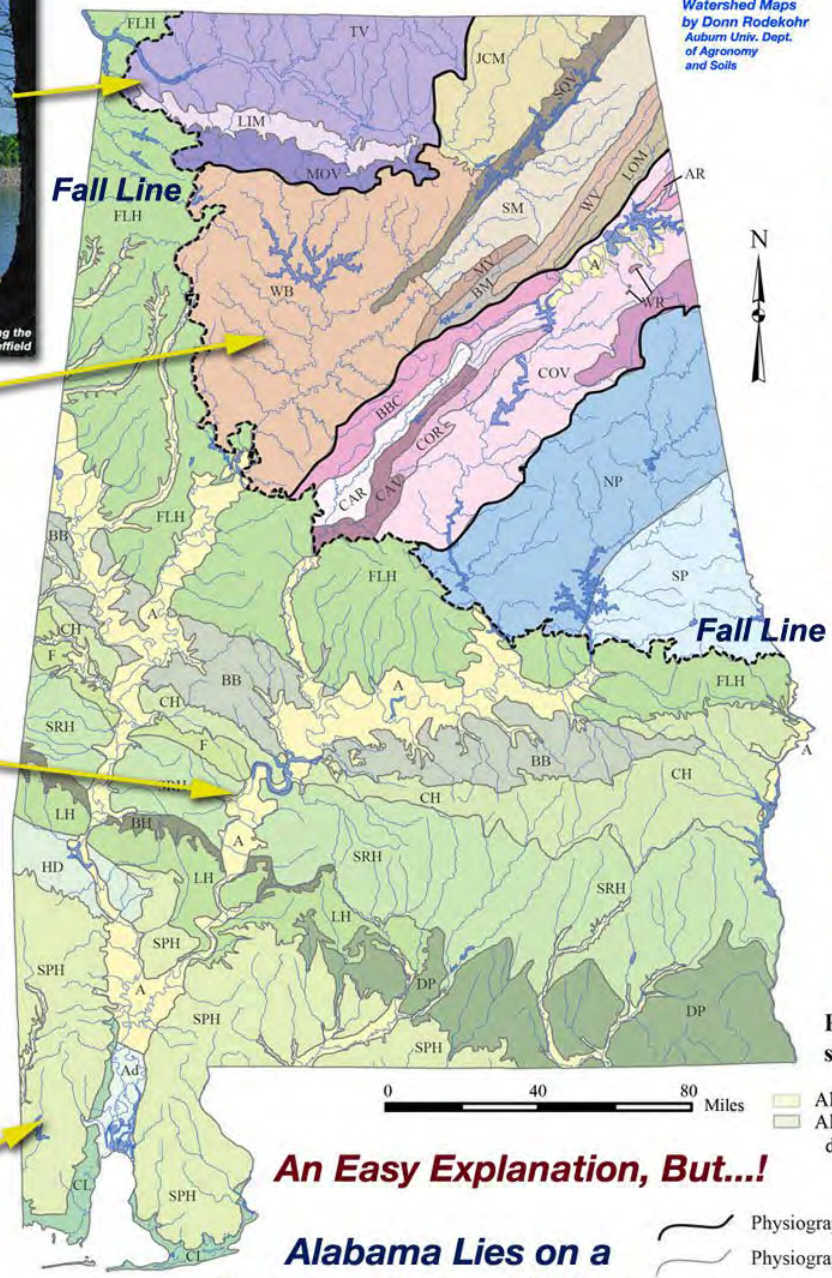
limestone valleys

hard rock uplands

large, meandering Coastal Plain rivers



sandy creeks



Highland Rim (HR)
- Tennessee Valley (TV)
- Little Mountain (LIM)
- Moulton Valley (MOV)

Cumberland Plateau (CP)
- Jackson County Mountains (JCM)
- Sequatchie Valley (SQV)
- Sand Mountain (SM)
- Wills Valley (WV)
- Lookout Mountain (LOM)
- Warrior Basin (WB)
- Murphrees Valley (MV)
- Blount Mountain (BM)

Alabama Valley and Ridge (AVR)
- Armuchee Ridges (AR)
- Birmingham-Big Canoe Valley (BBC)
- Cahaba Ridges (CAR)
- Cahaba Valley (CAV)
- Coosa Ridges (COR)
- Coosa Valley (COV)
- Weisner Ridges (WR)

Piedmont Upland (PU)
- Northern Piedmont Upland (NP)
- Southern Piedmont Upland (SP)

East Gulf Coastal Plain (EGCP)
- Fall Line Hills (FLH)
- Black Belt (BB)
- Chunnenuggee Hills (CH)
- Southern Red Hills (SRH)
  - Flatwoods Subdistrict (F)
  - Buhrstone Hills Subdistrict (BH)
- Lime Hills (LH)
  - Hatchetigbee Dome Subdistrict (HD)
- Southern Pine Hills (SPH)
- Dougherty Plain (DP)
- Coastal Lowlands (CL)

- Alluvial (A)
- Alluvial deltaic Plain (A

Physiographic sections

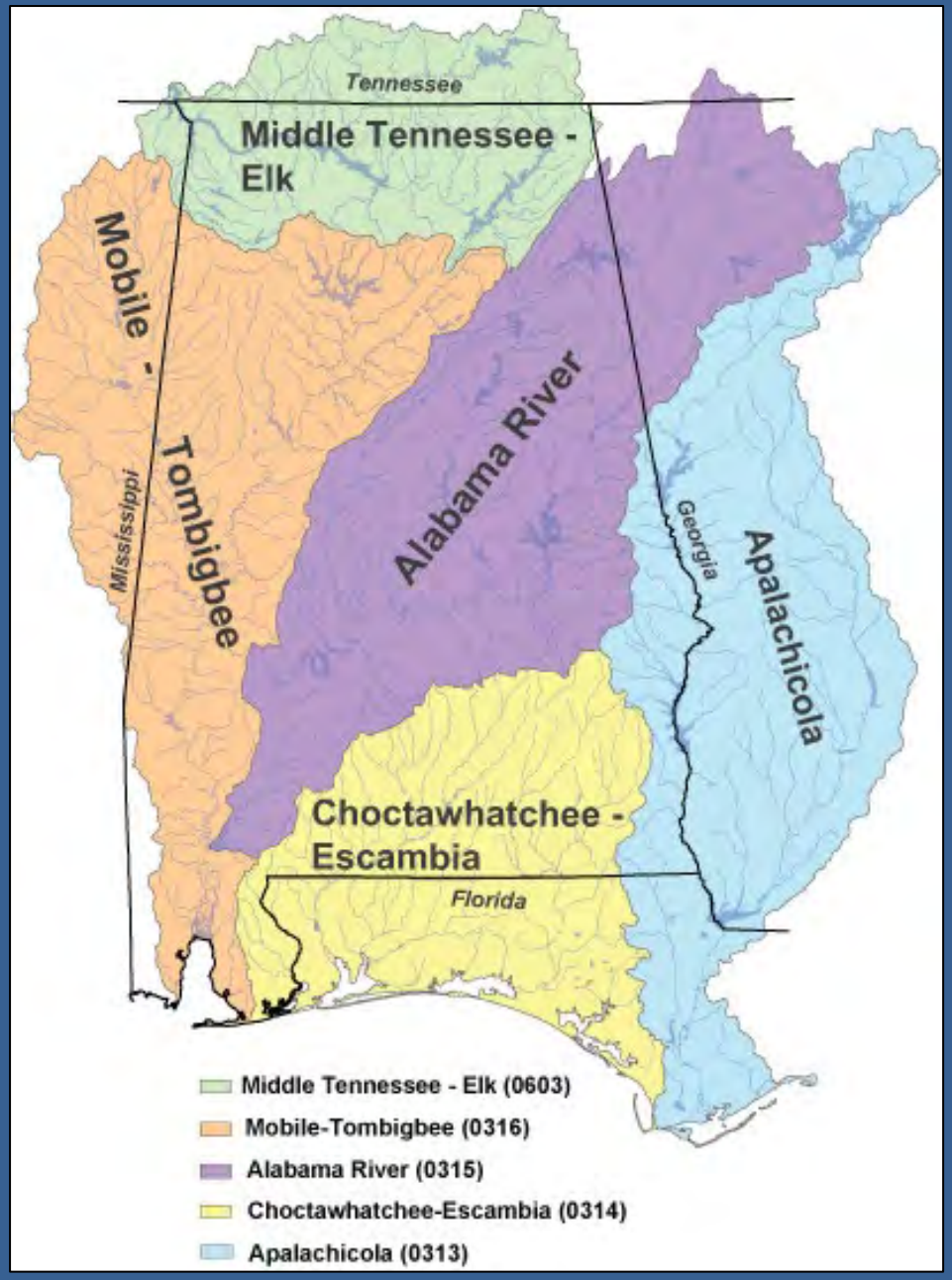
An Easy Explanation, But...!

Alabama Lies on a Geographical as Well as Geological "Sweet Spot"

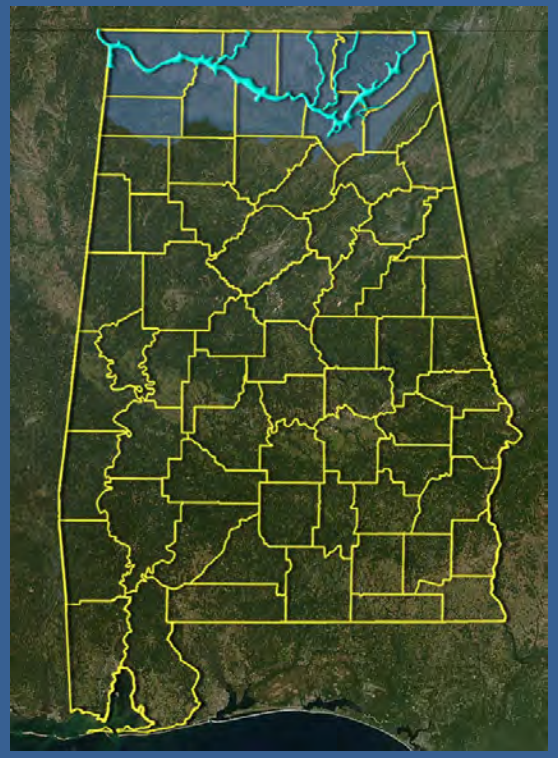
- Physiographic section line
- Physiographic district line
- Fall Line
- Streams


Coastal Plain
Appalachian uplands
fewer habitats
Fall Line (metaphorically speaking)
The basic ecological concept is simple: A heterogeneous environment offers many more opportunities for life to gain a foothold (i.e. more niches).
Fall Line
richer in habitats
Alabama's richness in aquatic life is a direct product of its geological diversity.

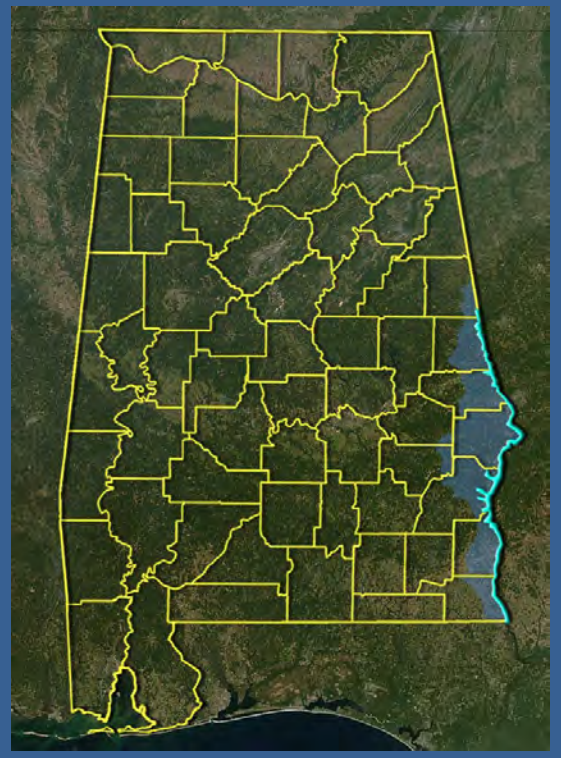
- 64 types of terrestrial ecosystems
- 25 forests and woodlands
- 11 wetlands
- 7 glades and prairies
- More than 132,000 miles of rivers and streams
- Several dozen marine ecosystems



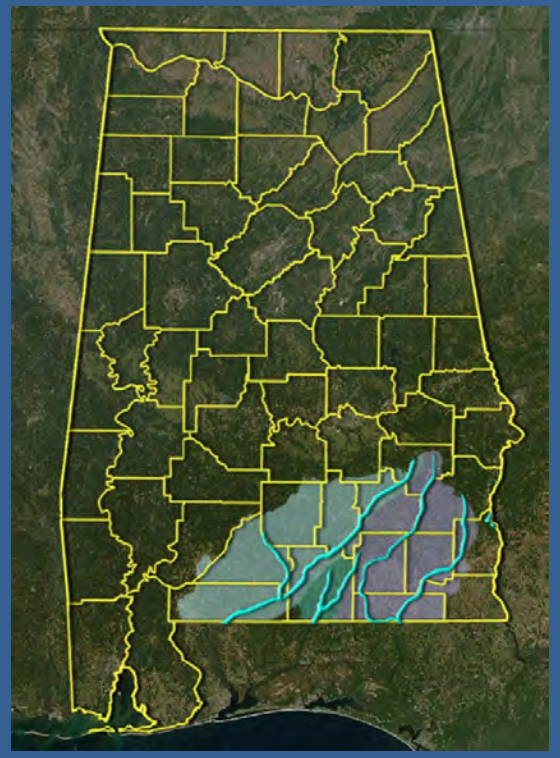
10% of freshwater in the US begins and/or flows through Alabama



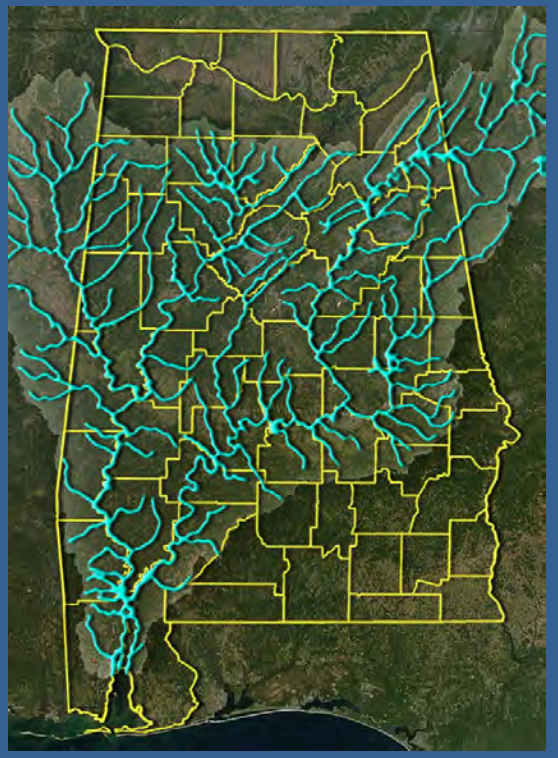
Tennessee



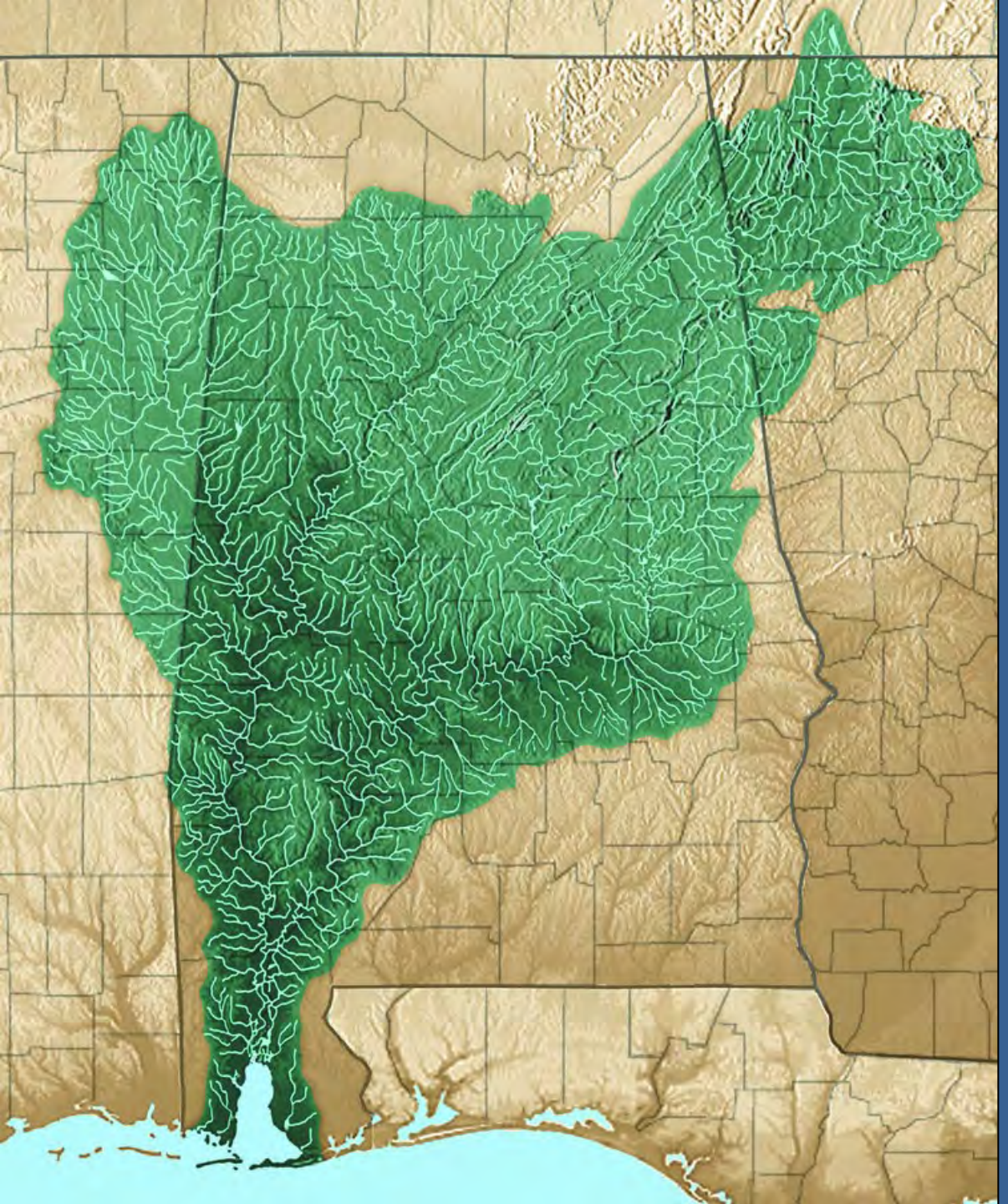
Apalachicola



Choctawhatchee-
Escambia



Alabama &
Mobile-Tombigbee



The Greater Mobile Basin

Alabama River and Mobile-Tombigbee River Basin

Drains parts of Tennessee, Georgia, Mississippi

65% of land area for the state of Alabama

6th largest basin in the US based on size

4th largest basin in the US based on discharge

Mobile-Tensaw River Delta

The most biodiverse watershed in the United States and in some cases, the world!

AMERICA'S AMAZON

Alabama the Beautiful

14 river basins form the waterways of Alabama.

51 miles of shoreline in Alabama.

10% of the freshwater resources in the continental United States flow through or originate in Alabama.

Largemouth Bass
Alabama's State Fish

Flathead Minnow

Banded Pygmy Sunfish

Southeastern Blue Sunfish

Spotted Bass

Redbreast Sunfish

Redeye Bass

There are more than **132,000** miles of rivers and streams in Alabama.

5 marine turtle species or **83%** of U.S. species

200 marine fish species or **18%** of U.S. species

Red Snapper

Golden Shiner

Orangespotted Sunfish

Hawksbill Turtle

Gulf Sturgeon

Brown Bullhead

That's enough to circle the Earth 5 times!

5x

97 freshwater crayfish species

or **24%** of North American species

312 freshwater fish species

or **35%** of North American species

202 freshwater snail species

or **29%** of North American species

31 freshwater turtle species

or **63%** of North American species

186 freshwater mussel species

or **61%** of North American species

Native to Alabama

Alabama Ranks #1 in the U.S. for freshwater crayfish, fish, snail, turtle, and mussel species!

FRESHWATER FISH DIVERSITY*

Rank	State	Species
1	Alabama	339
2	Tennessee	313
3	Georgia	290
4	Kentucky	262
5	Mississippi	242

*Includes introduced, exotic, diadromous, and select brackish species

99 ENDANGERED AQUATIC SPECIES

70% of the species in Alabama that are federally listed as endangered or threatened are aquatic.

ALABAMA AQUATIC SPECIES AT RISK*

Fauna Type	Species
Freshwater Crayfish	44
Freshwater Mussel	103
Freshwater Fish	63
Freshwater Snail	52
Freshwater Turtle	6
Marine Turtle	5

*Greatest Conservation Need (GCN) list per the 2015 Alabama State Wildlife Action Plan.

Suggested Reading List:

CONTRIBUTORS:

AUBURN Water Resources Center | Legacy | ADEM | NOAA FISHERIES

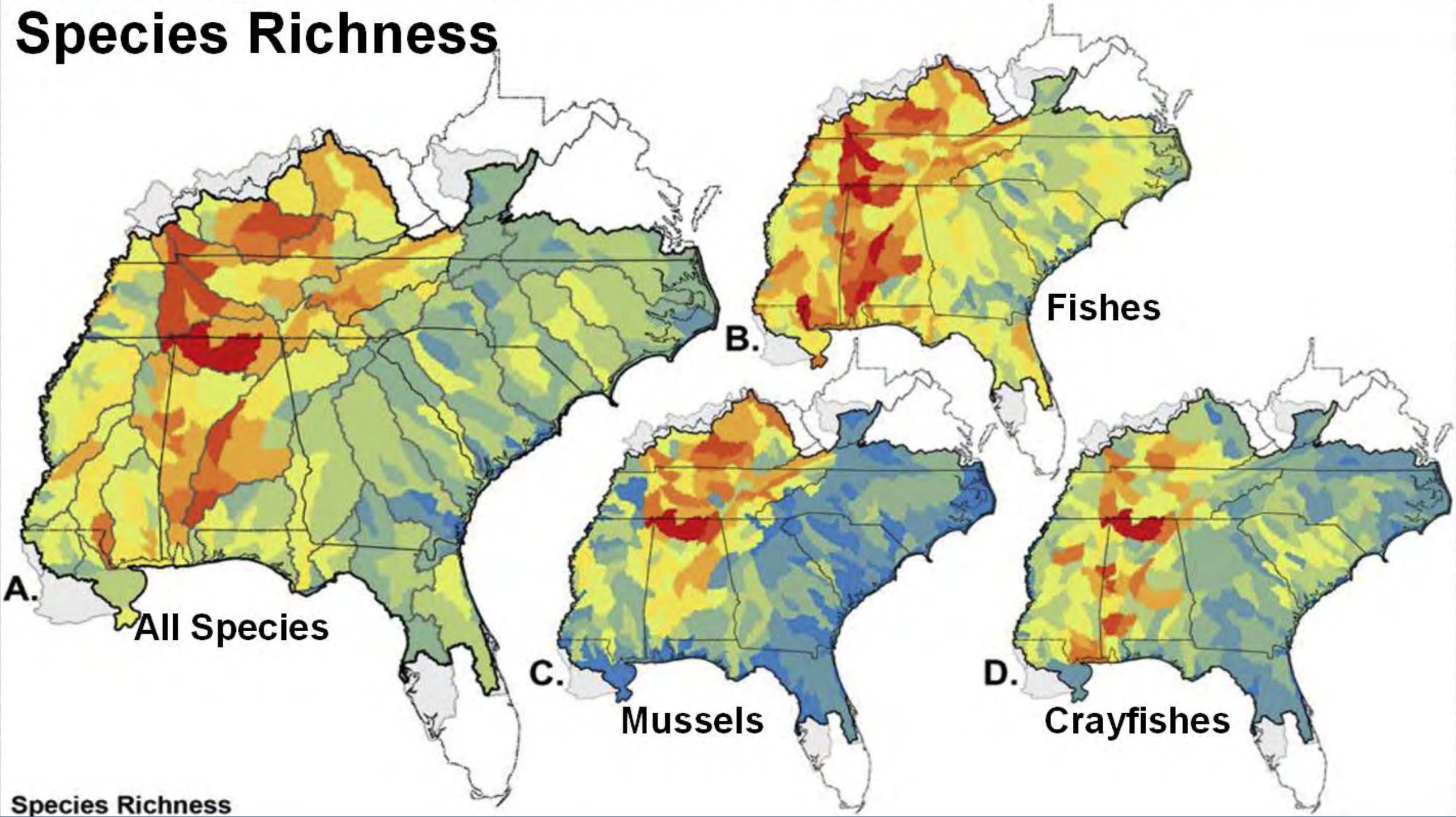
GET INVOLVED

Get certified as a volunteer water monitor.

ALABAMA WATER WATCH

Alabama Water Watch is a program in the Auburn University Water Resources Center which receives support from the Alabama Agricultural Experiment Station and the Alabama Cooperative Extension System.

Species Richness

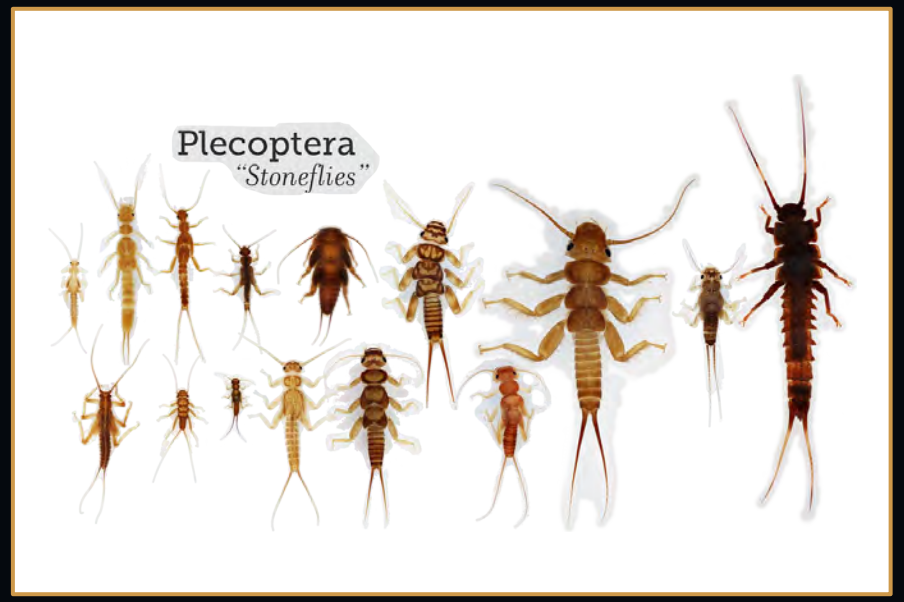


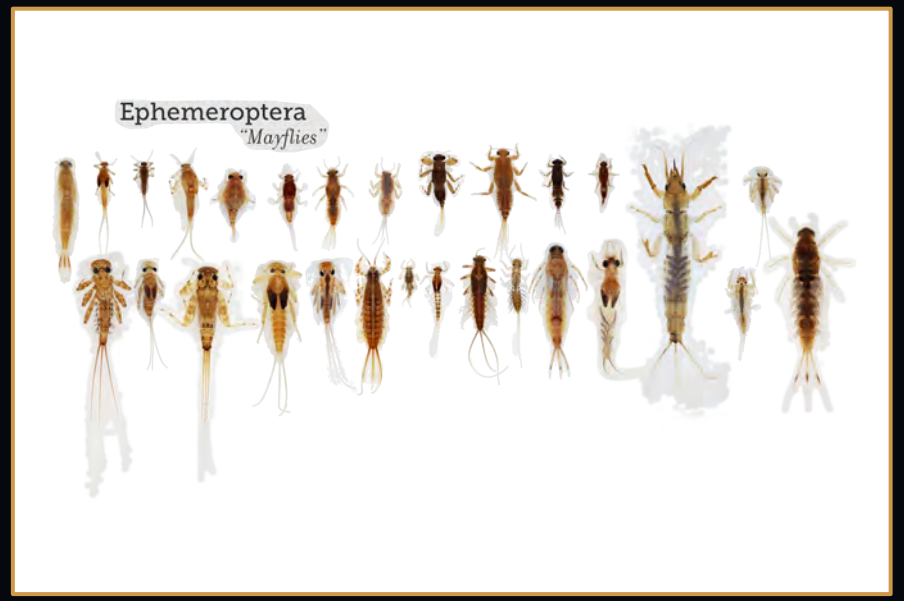
Over 3,000 Species

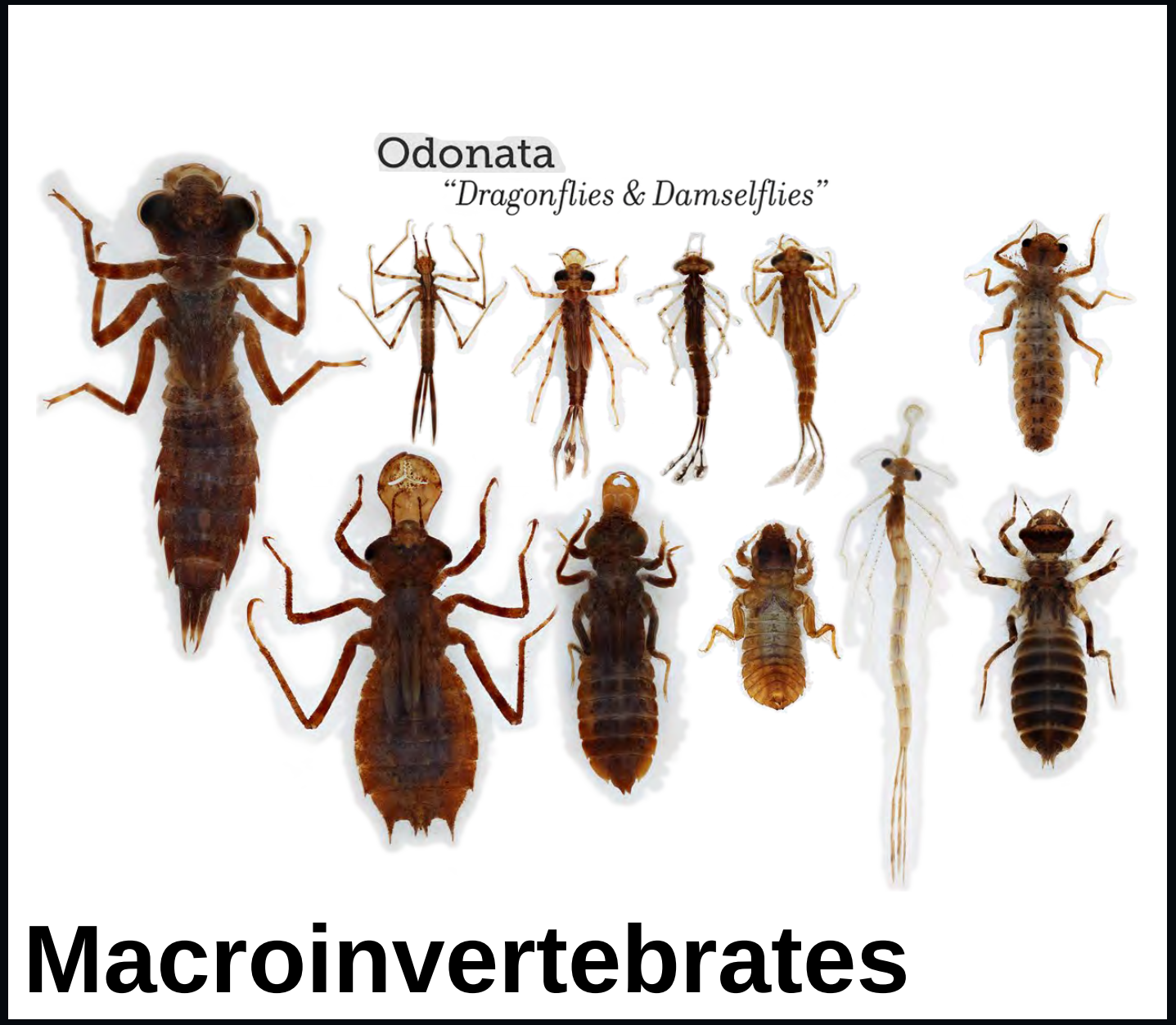
62 Species

- 22 species of rodents
- 16 species of bats
- 11 species of carnivores
- 6 species of insectivores
- 4 species of rabbits
- 1 ungulate
- 1 opossum
- 1 armadillo

420 Species







Macroinvertebrates






100 species

200 marine fish species

339 freshwater fish species

539 species

312 endemic freshwater fish species

73 species

30 species of frogs

43 species of salamanders


Leptoxis foremani - Interrupted Rocks
Oostanaula River, Georgia
Alabama Aquatic Biodiversity Center
Alabama Department of Conservation and Natura

203 species

31 species

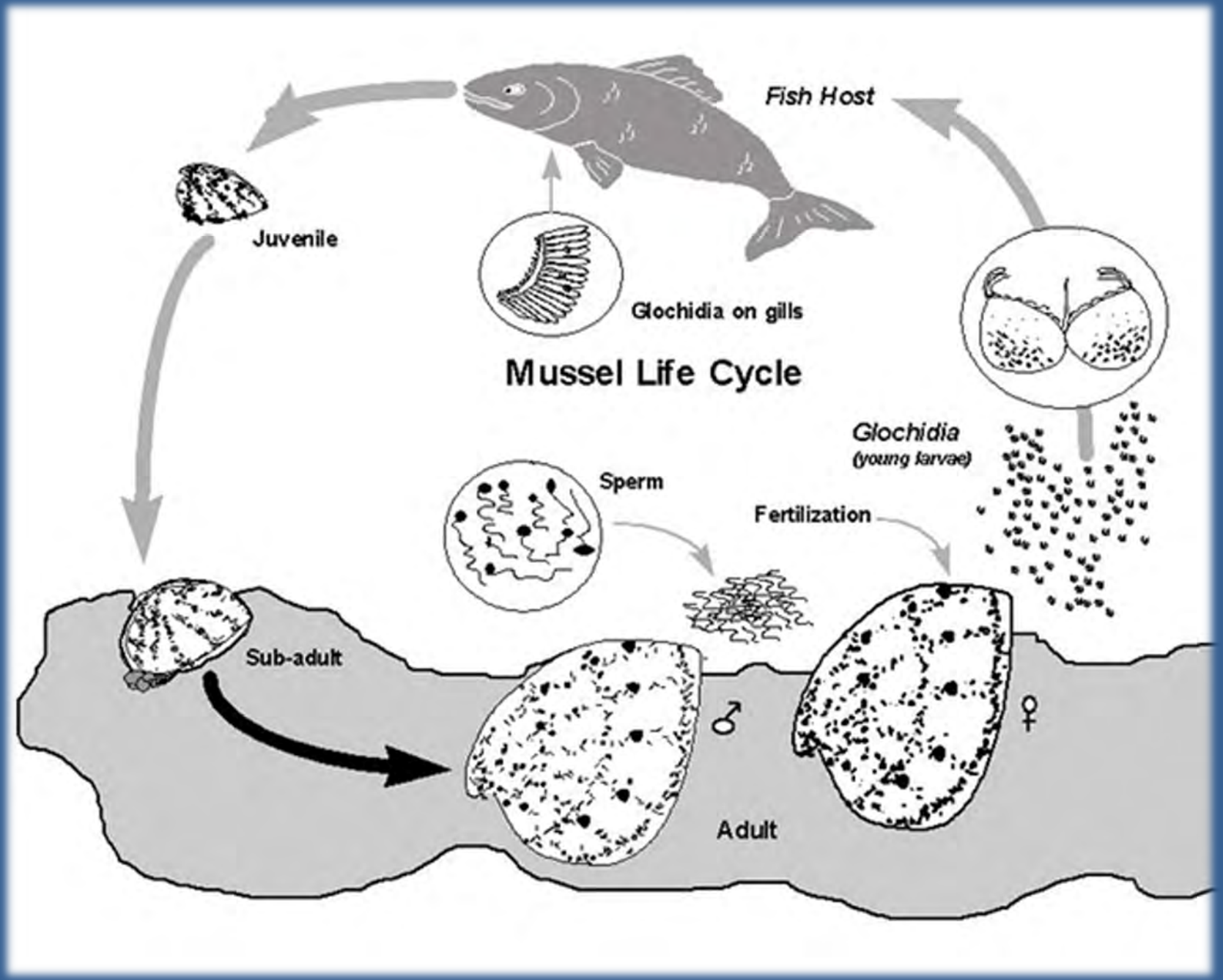
Other species of reptiles:

Lizards = 12

Snakes = 49

Alligator = 1 (but do we really want more?)

186 species


Fish Host
Juvenile
Glochidia on gills
Mussel Life Cycle
Glochidia
(young larvae)
Sperm
Fertilization
Sub-adult
♂
♀
Adult

Wake Up Call

Greatest single mass extinction event in North American history

40 freshwater species lost

2nd in the nation for number of taxa lost to extinction

4th in number of at-risk taxa

What’s At Risk

Alabama Aquatic Species at Risk

• Crayfish	44
• Mussels	103
• Freshwater Fish	63
• Freshwater Snails	52
• Aquatic Turtles	6
• Marine Turtles	5

70% of federally listed endangered or threatened species in Alabama are aquatic

Alabama Rivers and Streams Network

Biologists, engineers, ecologists, foresters, and others from Alabama and Mississippi unite for a weeklong effort to conduct fish surveys on the Buttahatchee River


U.S. Fish & Wildlife Service
U.S. Forest Service
NRCS Natural Resources Conservation Service
U.S. Department of Transportation
Federal Highway Administration
National Park Service
EPA United States Environmental Protection Agency
USGS science for a changing world
US Army Corps of Engineers
Geological Survey of Alabama
Founded 1848
ADEM Alabama Department of Environmental Management
Alabama Wildlife & Freshwater Fisheries
Alabama Department of Transportation
Alabama Forestry Commission
Georgia Department of Natural Resources
Wildlife Mississippi
Alabama Soil & Water Conservation Committee
Mississippi Wildlife, Fisheries, & Parks
National Fish and Wildlife Foundation 40 Years NFWF
UWA The University of West Alabama
NC State University
Tennessee Aquarium
Smithsonian Institution
Cawaco RC&D Council
The Nature Conservancy
Saving the last great places on earth
Michigan
Troy University
University of North Alabama
UWF University of West Florida
USA
Dauphin Island Sea Lab Alabama
Sustainable Forestry Initiative Alabama
SFI-01116
the Westervelt Company
Weyerhaeuser
Alabama Power A Southern Company
TVA
PowerSouth Energy Cooperative
Volkert
Trutta Environmental Solutions
NAFO National Alliance of Forest Owners
Forest Investment Associates
Tennessee River Basin Network
Cahaba River Society
NCASI
Manulife
American Forest Foundation
We grow stewardship every day.
RMS Resource Management Service, LLC
freshwater LAND TRUST
Alabama Rivers Alliance
Water Is Life
Riverkeeper


MINERAL SPRINGS
SIMPLY ARTESIAN


TROY
UNIVERSITY


The
Westervelt
COMPANY


WOODS to WATER
RaMP PROGRAM
W2W

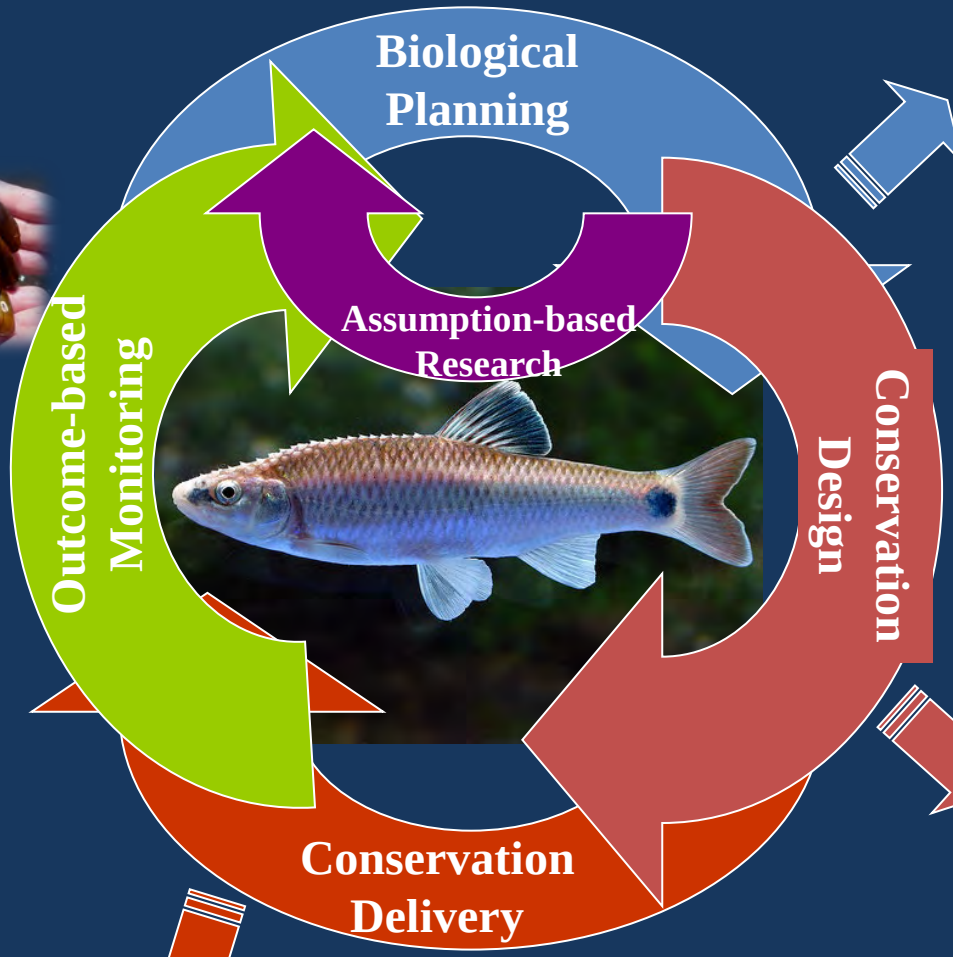

ALABAMA
HISTORICAL
COMMISSION
STATE HISTORIC PRESERVATION OFFICE
ahc


BIG CANOE

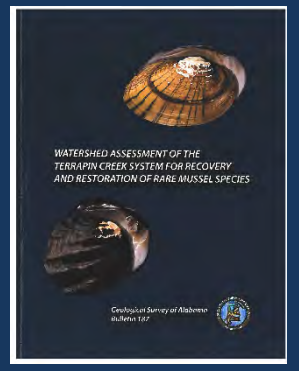

The Nature Conservancy
RESEARCH, APPLIED
TECHNOLOGY
EDUCATION AND SERVICE

Strategic Habitat Conservation in Alabama

Monitoring



- Establishing baseline conditions
- Alabama Aquatic Biodiversity Center
- Propagation & Reintroduction Plan
- Established Priority Species List



Working toward developing a landscape model that is protective of:

- habitat quality
- hydrology – environmental flows
- water quality
- biotic integrity – e.g., IBI

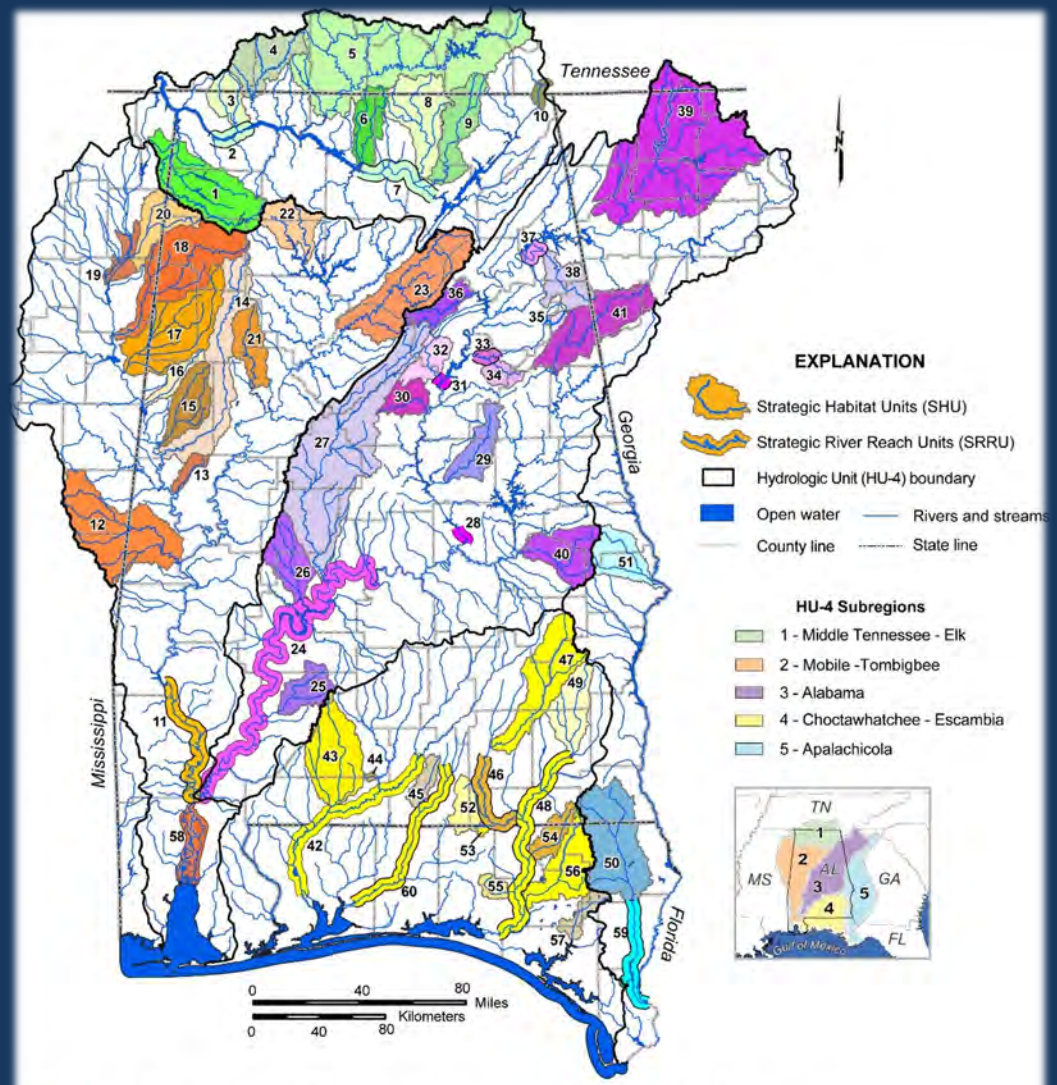
- PFW
- County-level planning
- Reintroductions
- CAWACO RC&D

Strategic Habitat Conservation in Alabama

- ✓ Why is this fish worth it?
- ✓ Where does this fish live?
- ✓ What does this fish need?
- ✓ What problems does this fish have?
- ✓ How can the problems be solved?
- ✓ How can we avoid future problems?

BIOLOGISTS need **ENGINEERS**
who need **GEOLOGISTS**
who need **FORESTERS**
who need **HYDROLOGISTS**
who need **GEOGRAPHERS**
who need **FARMERS**
who need **CHEMISTS**
who need **CITY PLANNERS**
who need **STORMWATER MANAGERS**

And we ALL need **ATTORNEYS** and **ACCOUNTANTS!**



Unit	Name
1	Bear Creek
2	Tennessee River at Wilson Dam
3	Cypress Creek
4	Shoal Creek
5	Elk River
6	Limestone Creek
7	Tennessee River at Guntersville Dam
8	Flint River
9	Paint Rock River
10	Tennessee River at Nickajack Dam
11	Lower Tombigbee River
12	Sucarnoochee River
13	Trussels Creek
14	Sipsey River
15	Lubbub Creek
16	Coalfire Creek
17	Luxapallila Creek
18	Buttahatchee River
19	East Fork Tombigbee River
20	Bull Mountain Creek

Unit	Name
21	North River
22	Upper Sipsey Fork
23	Locust Fork
24	Lower Alabama River
25	Big Flat Creek
26	Bogue Chitto Creek
27	Cahaba River
28	Coosa River at Jordan Dam
29	Hatchet Creek
30	Yellowleaf Creek
31	Coosa River at Logan Martin Dam
32	Kelly Creek
33	Lower Choccolocco Creek
34	Cheaha Creek
35	Shoal Creek
36	Big Canoe Creek
37	Weiss Lake bypass (Old Coosa River)
38	Terrapin Creek
39	Oostanaula River
40	Upbapee Creek

Unit	Name
41	Upper Tallapoosa River
42	Conecuh- Escambia River
43	Murder Creek
44	Amos Mill Creek
45	Five Runs Creek
46	Lower Pea River
47	Upper Pea River
48	Lower Choctawhatchee River
49	West Fork Choctawhatchee River
50	Upper Chipola River
51	Uchee Creek
52	Flat Creek
53	Limestone Creek
54	Wrights Creek
55	Bruce Creek
56	Holmes Creek
57	Econfina Creek
58	Mobile - Tensaw River Delta
59	Lower Chipola River
60	Yellow River

THE ROAD MAP

- 60 SHUs
- 4 HUC 4 sub basins
  - Alabama River
  - Mobile-Tombigbee
  - Middle Tennessee
  - Choctawhatchee-Escambia
- Focused restoration and recovery efforts on highest priority areas that yield the greatest benefit

Network Mission Statement …to **study, manage, and develop our water resources** in a scientific and comprehensive way to minimize their degradation, maximize their availability for all users, and **restore and recover aquatic species**.

THE PROCESS

Assess

Restore

Recover

Monitor

PROBLEM: Sedimentation

SOLUTION: Streamside Management Zones

Problem:
Culvert = Fish Barrier

Solution:
Habitat Improvement

Slackwater Darter, Limestone Co, AL

SHU - Map

https://nwrcwebapps2.cr.usgs.gov/AL/Map

USGS science for a changing world

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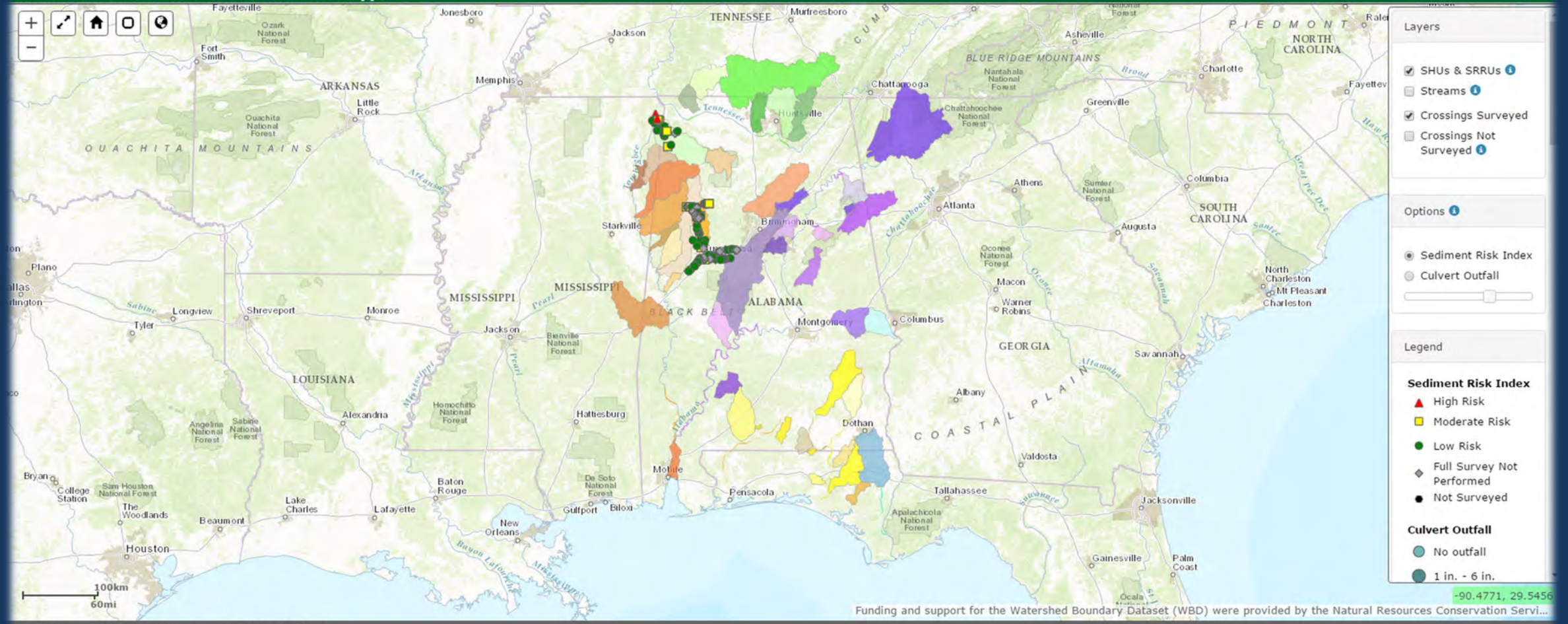
Alabama Rivers and Streams Network SHU Mapper



Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey
URL: https://nwrcwebapps2.cr.usgs.gov/AL/Map
Data Questions: Jennifer Grunewald, 251-441-6633
Application Questions: Craig Conzelmann, 337-266-8842
Page Last Modified: Friday, August 05, 2016

USA.gov

8:53 AM

Annual Meeting

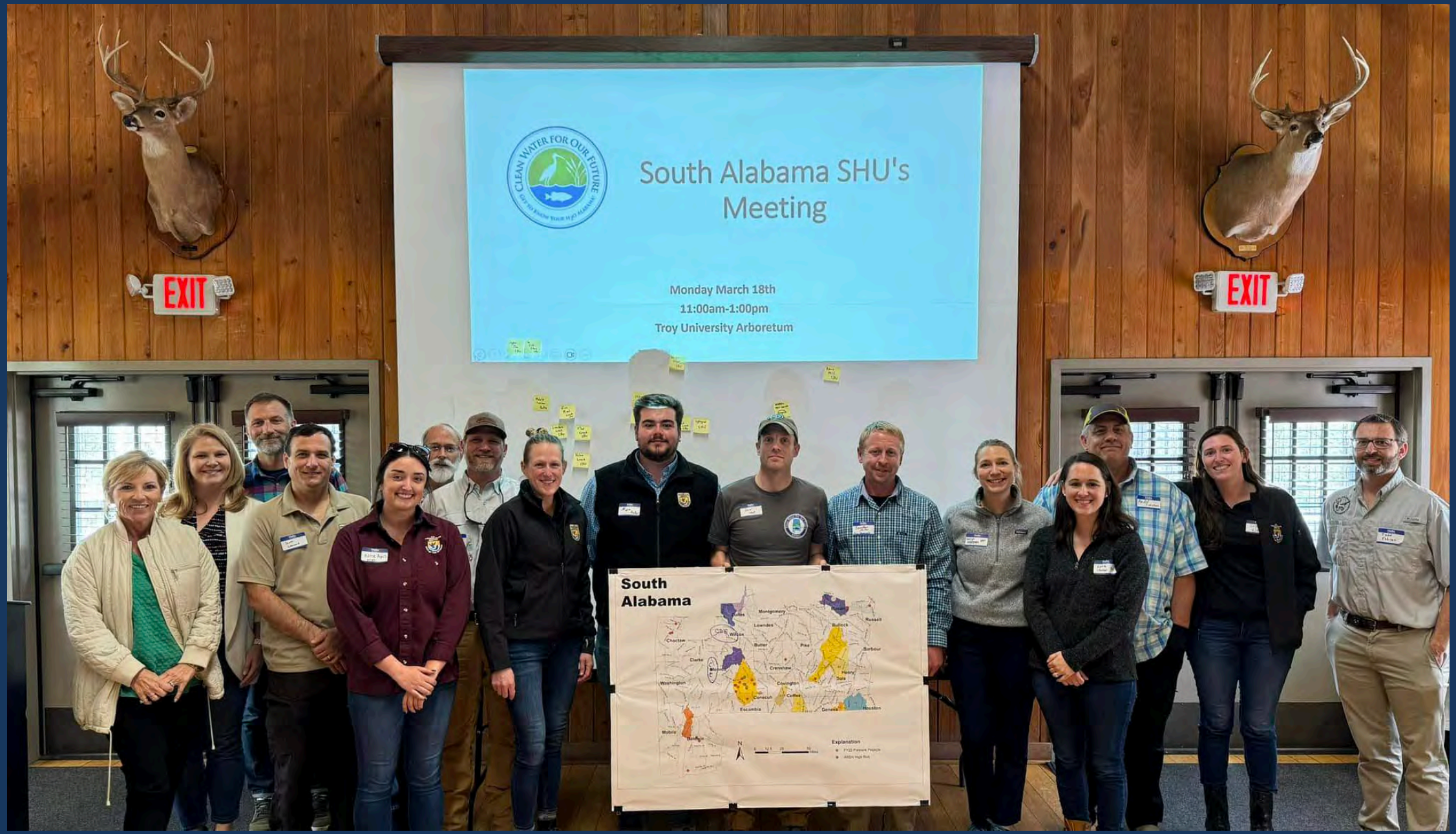
No egos
No president
Motivated Leadership
Dynamic engagement

$$$

How Can We Make Research Funds and Tax Dollars Go Farther

$$$

- Who's working where
- What worked
- What didn't work
- What needs to be done
- Who else can help


South Alabama SHU's Meeting
Monday March 18th
11:00am-1:00pm
Troy University Arboretum
EXIT
EXIT
South Alabama

THE ARSN Approach

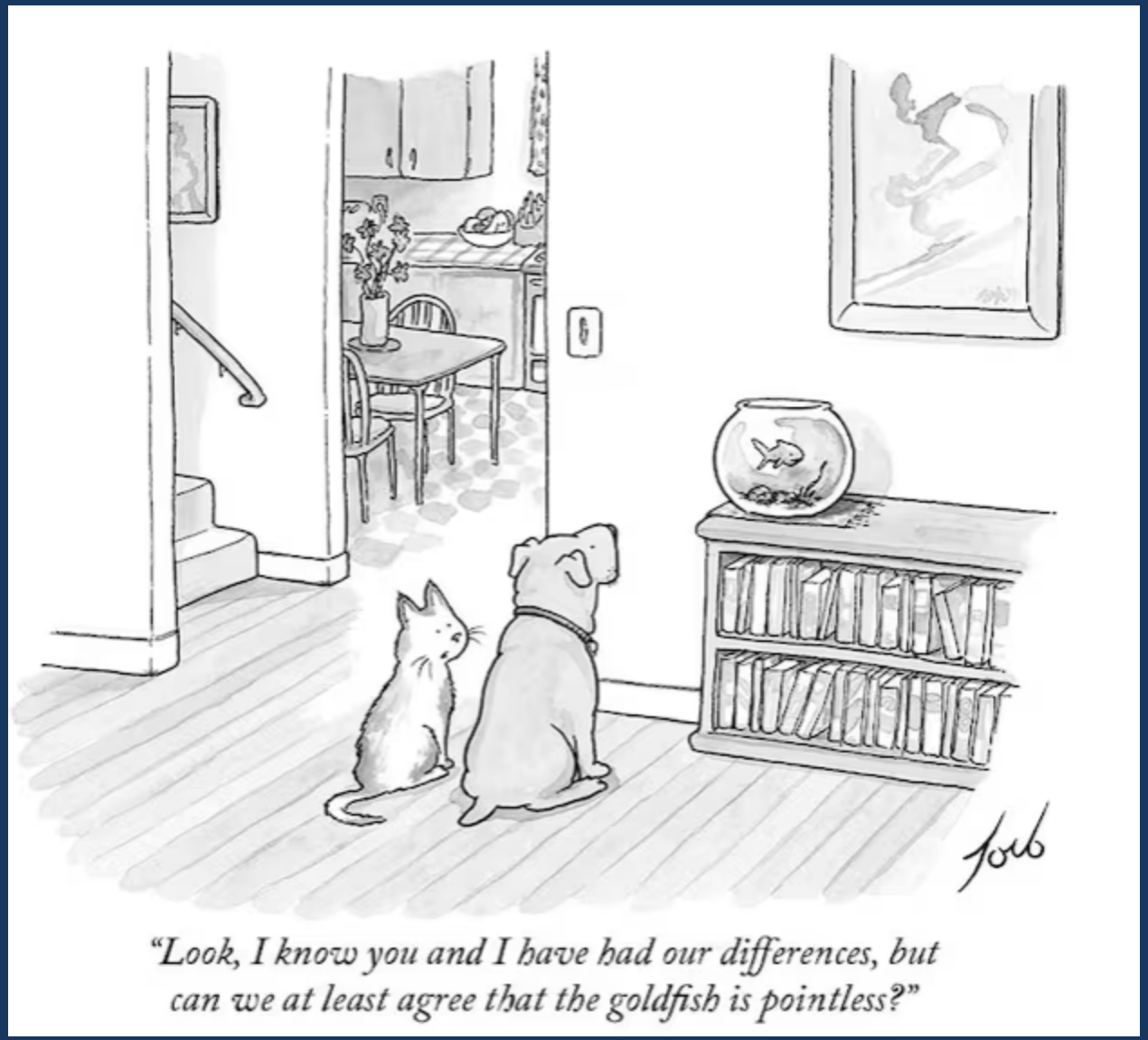
Why the process works

Working together in a non-adversarial manner (i.e., “Conservation without Conflict”) by growing relationships- based on trust, transparency, humility, and ALWAYS searching for common ground and solutions

"Water links us to our neighbor in a way more profound and complex than any other."

-John Thorson

Questions?



"Look, I know you and I have had our differences, but can we at least agree that the goldfish is pointless?"