Amphibians, Reptiles, and Turtles Along the Missouri / Kansas Border

ASSESSING OUR BORDERS: KANSAS HERPETOLOGICAL SOCIETY ANNUAL MEETING, HAYS, 2019

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Summary

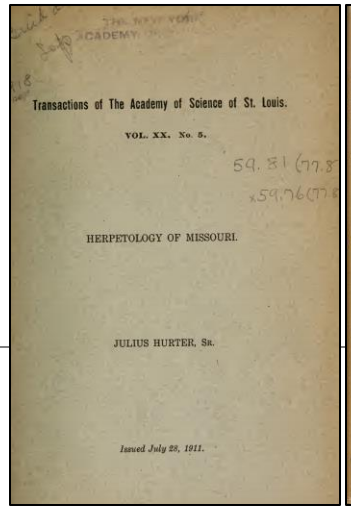
- Herpetology in Missouri
- The Missouri / Kansas Border
- Species Maps
- Discussion

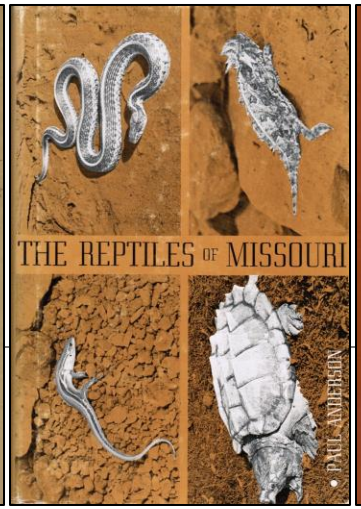
Herpetology in Missouri

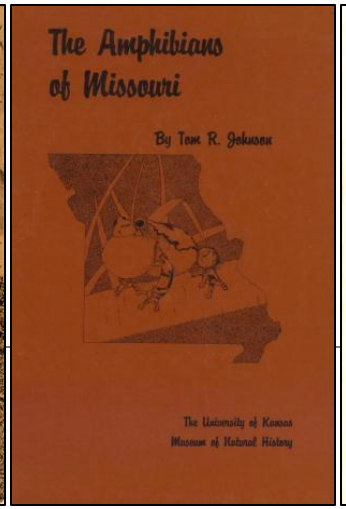
Early Collections

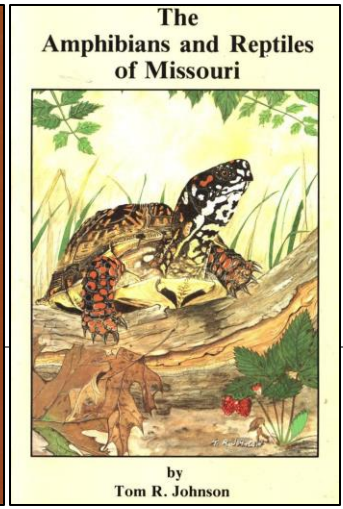
- *Coluber constrictor* is the first known collection at an unknown location in 1856.
- By 1880, only 4 additional records exist for the state, 2 each in the Saint Louis and Kansas City areas.
- **Julius Hurter**, a Swiss engineer living in Saint Louis, developed an interest in amphibians and reptiles by the late 1800s.
  - 812 records
  - Active from 1844 to 1916
- By 1900, more than 300 records are in the National Museum, the majority from Julius Hurter and his collecting partners from around the state.
- **Paul Anderson**, an amateur collector but competent and respected naturalist, started accumulating a vast number of specimens and field notes in the 1920s.
  - 3,716 records
  - Active from 1928 to 1964

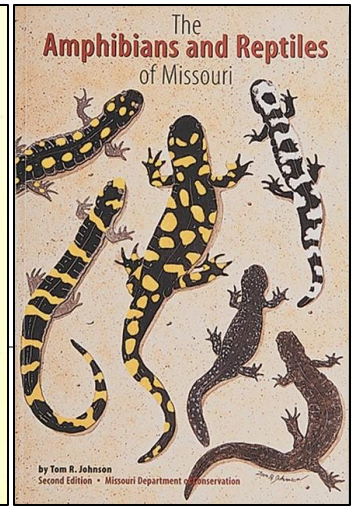
Milestones





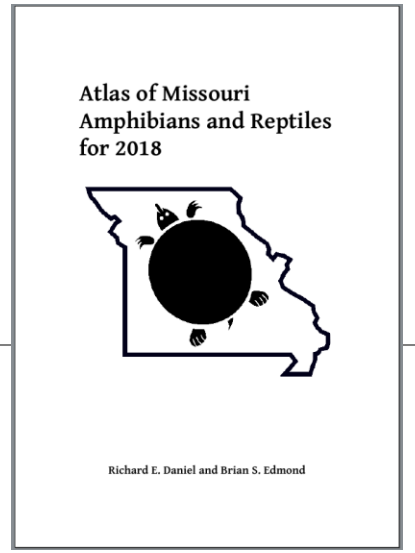


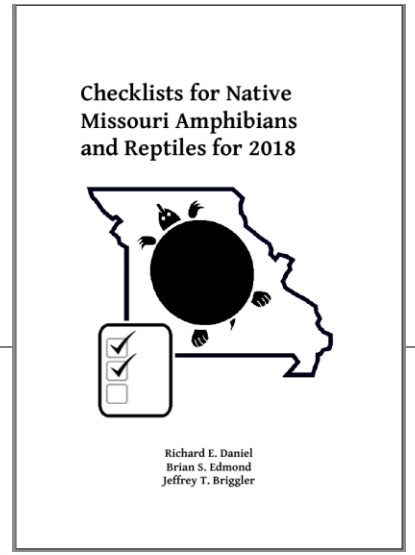




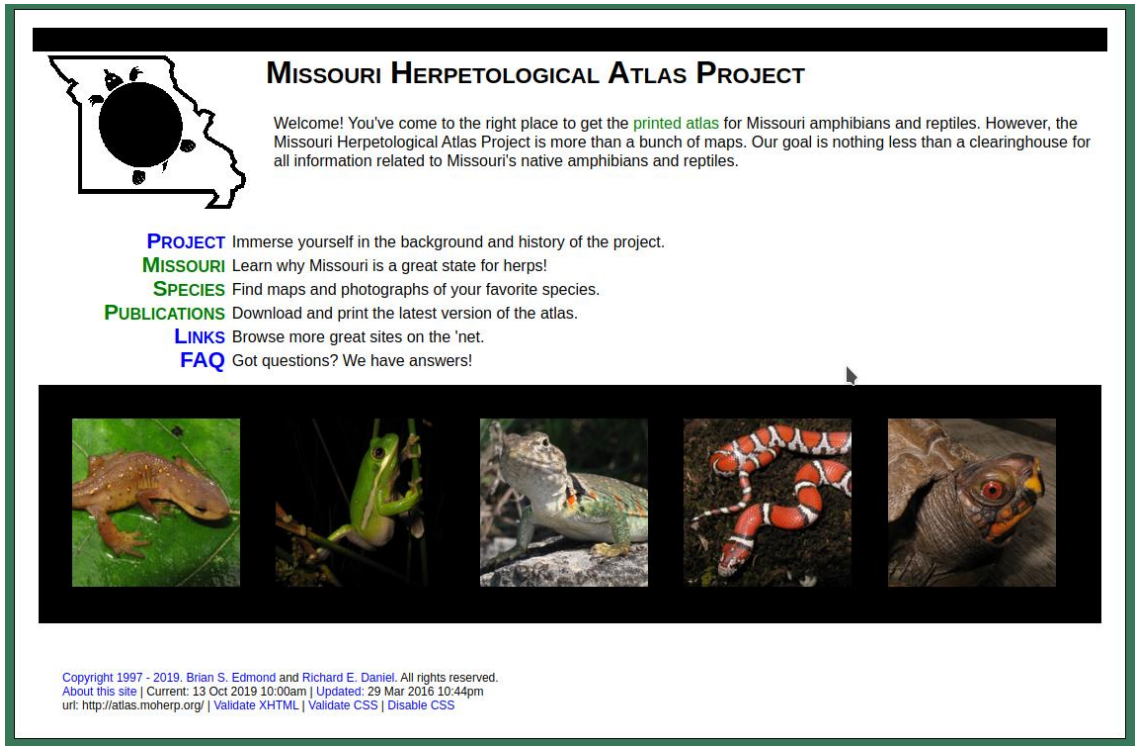
- Publication of *Herpetology of Missouri* (Hurter) in 1911 is the first comprehensive publication.
- Publication of the *Reptiles of Missouri* (Anderson) in 1965.
- Publication of the *Amphibians of Missouri* (Johnson) in 1977.
- Publication of the first edition of the *Amphibians and Reptiles of Missouri* (Johnson) in 1987.
- First meeting of the Missouri Herpetological Association is held at Reis Biological Field Station in 1988, essentially kicking off the **Modern Period** of Missouri Herpetology.
- Publication of an updated edition of the *Amphibians and Reptiles of Missouri* (Johnson) in 2000.
- A rumored third edition of Johnson's book is in the works.

Missouri Herpetological Atlas Project (MOHAP)





- The Missouri Herpetological Atlas Project (MOHAP) was initiated in 1997 and summarizes all *collections* for Missouri herpetofauna (including photographs).
- A published atlas, checklist, and accompanying online maps are released about every year.
- https://atlas.moherp.org/



Missouri Species By The Numbers

	Number of species	Number of records
Salamanders	19	6,342
Frogs / Toads	25	6,672
Lizards*	13	3,524
Snakes	43	14,869
Turtles	18	3,314

* Includes two introduced species of lizards:
  - Mediterranean Gecko (*Hemidactylus turcicus*)
  - Italian Wall Lizard (*Podarcis siculus*)

All Localities Map

- This represents more than **9,000** localities.

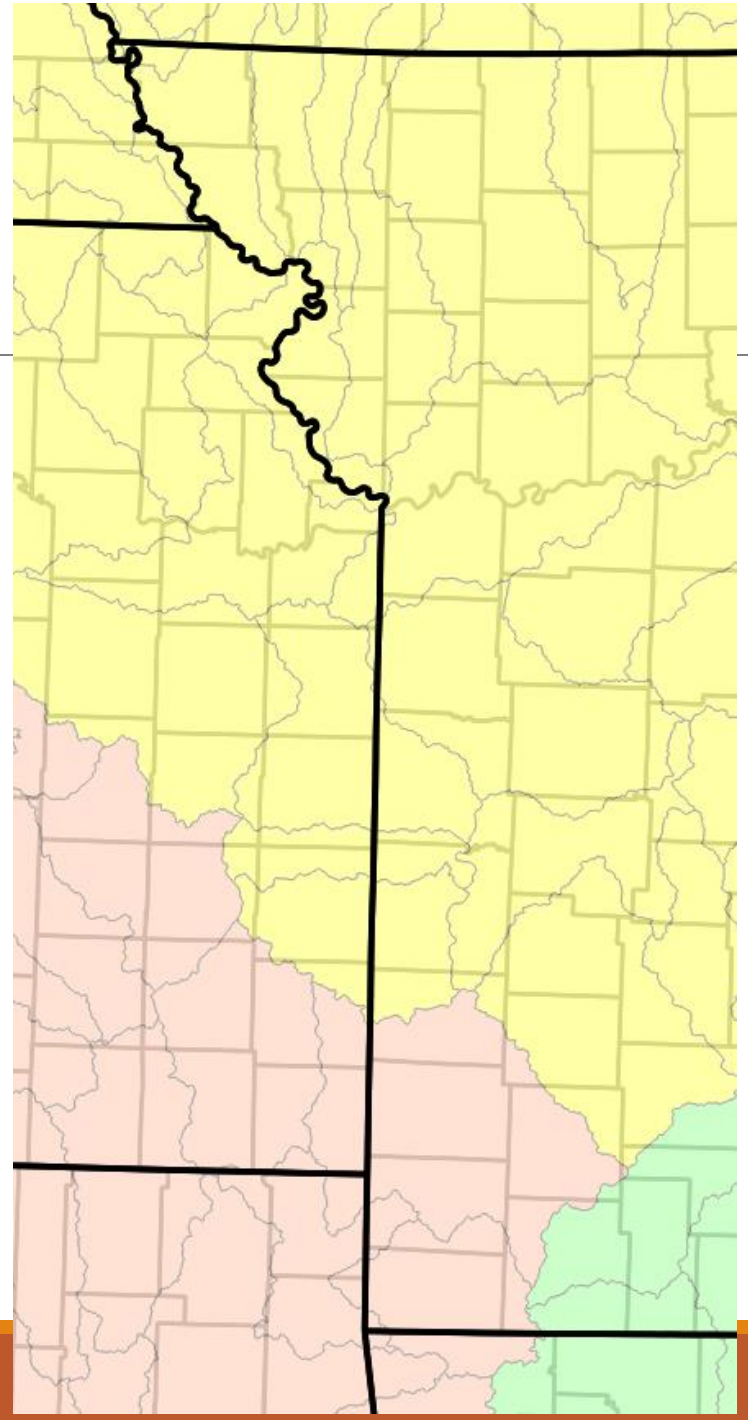
The Missouri / Kansas Border

Border Description

- The Missouri River forms the boundary between Missouri and Kansas for about 160 miles in the northern part of both states. This continues to the north in Missouri to form the entire boundary between Missouri and Nebraska.
- A political boundary forms the southern boundary between the states for about 148 miles. This continues to the south in Missouri to form the entire boundary between Missouri and Oklahoma.

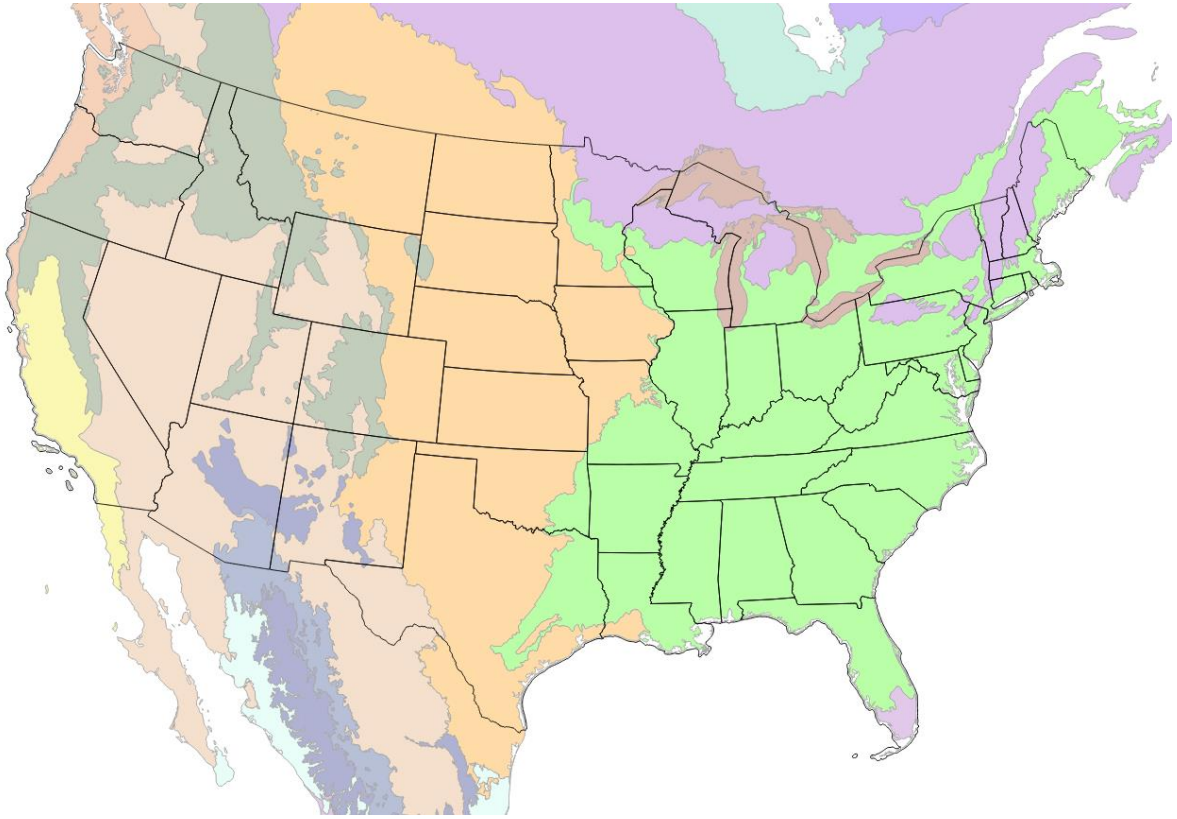
Major Watersheds

- Missouri River (yellow)
- Arkansas River (orange)
- White River (green)
- Watershed boundaries obviously matter for aquatic animals but might also be important for animals dependent upon forested habitat and cannot easily cross drier prairie ridges.



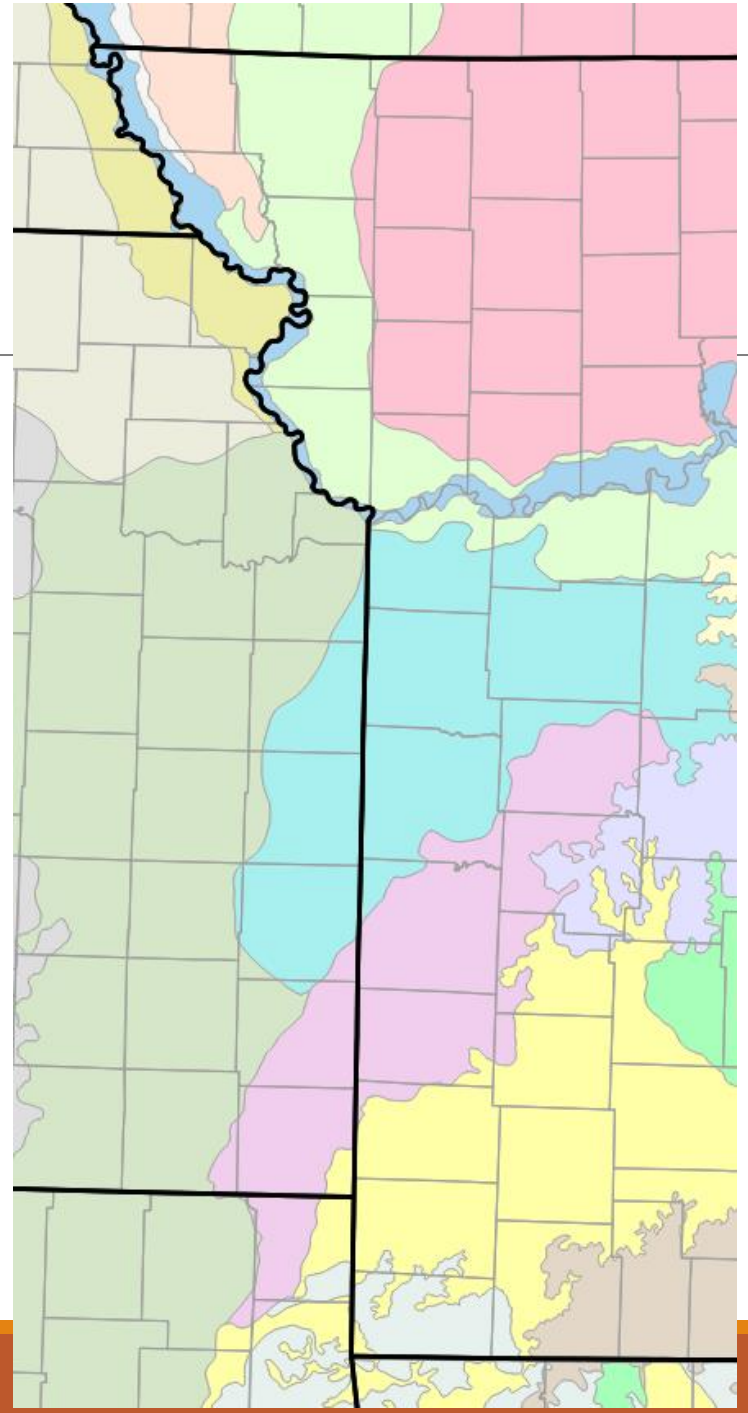
Ecoregions

- Ecoregions are generally and broadly similar landscapes with a shared geological and biological heritage.
- The EPA divides the United States into four (4) broad classifications of ecoregions, each more refined and nested within the previous level, labelled with Roman numerals.
- Shown is the Level I (the broadest) ecoregions for the lower US and adjacent Canada and Mexico.
- Level II subdivides Level I, Level III further subdivides Level II, and so on.
- https://www.epa.gov/eco-research/ecoregions



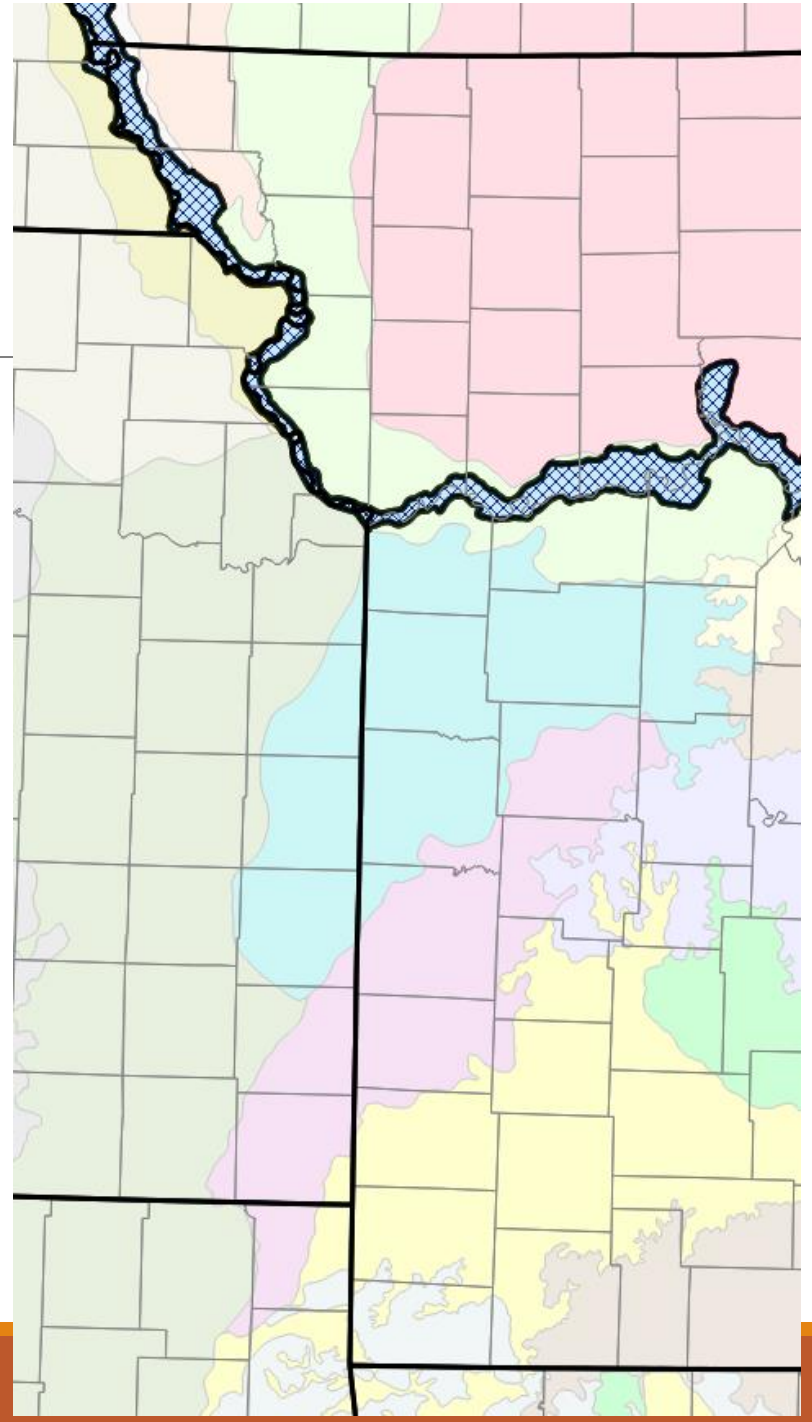
Ecoregion Level IV

- Continental US has **967** Level IV ecoregions
- Great Plains
  - Temperate Prairies
    - Western Corn Belt Plains
      - Missouri Alluvial Plain (narrow strip of blue right along Missouri River)
    - Central Irregular Plains
      - Wooded Osage Plains (blue)
      - Cherokee Plains (pink)
- Eastern Temperate Forest
  - Ozark / Ouachita / Appalachian Forests
    - Ozark Highlands
      - Springfield Plateau (yellow)
      - Elk / White River Hills (light gray and brown)



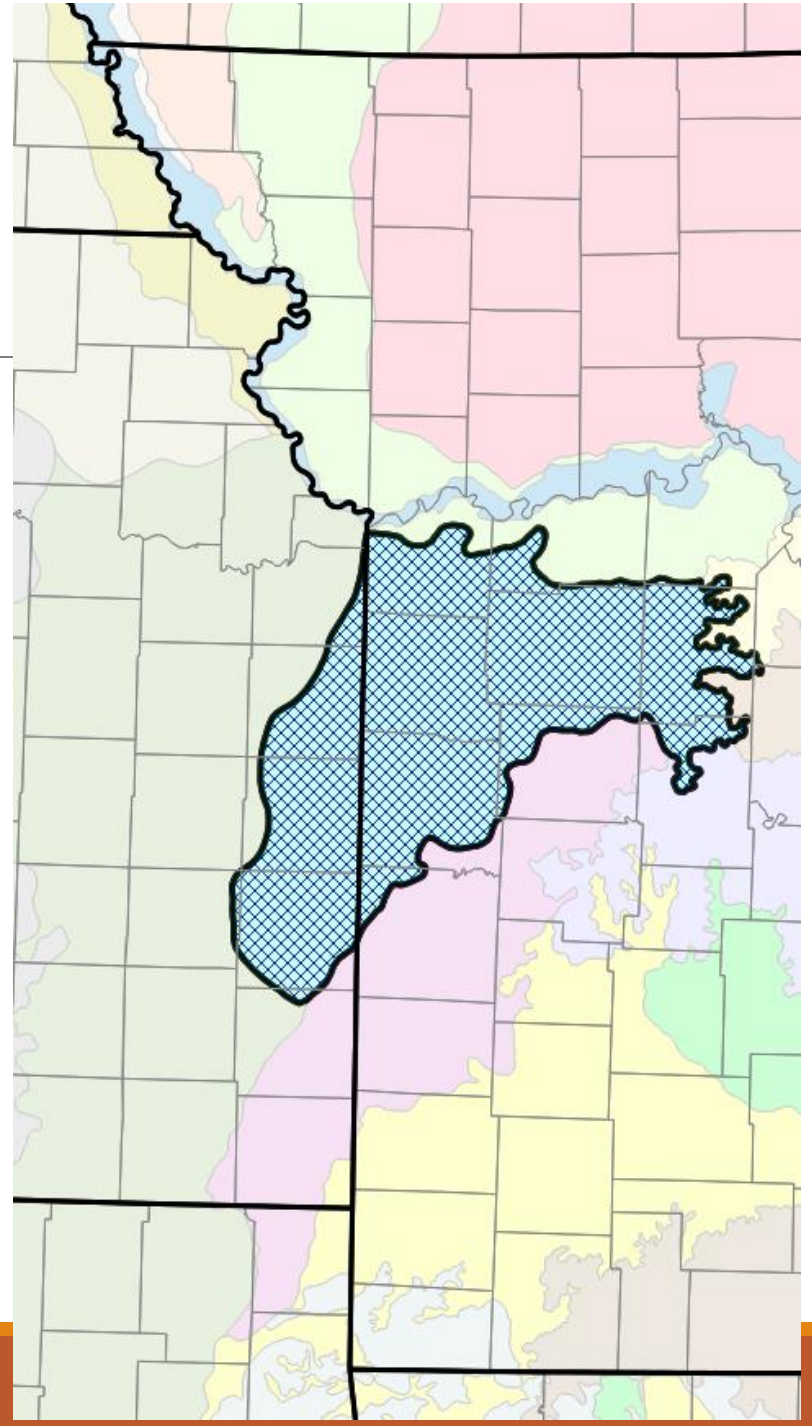
Missouri Alluvial Plain

- This is the alluvial plain and channel of the Missouri River along the entire length of the Missouri / Kansas border.
- It's a narrow strip of habitat but important for at least a few species of interest.



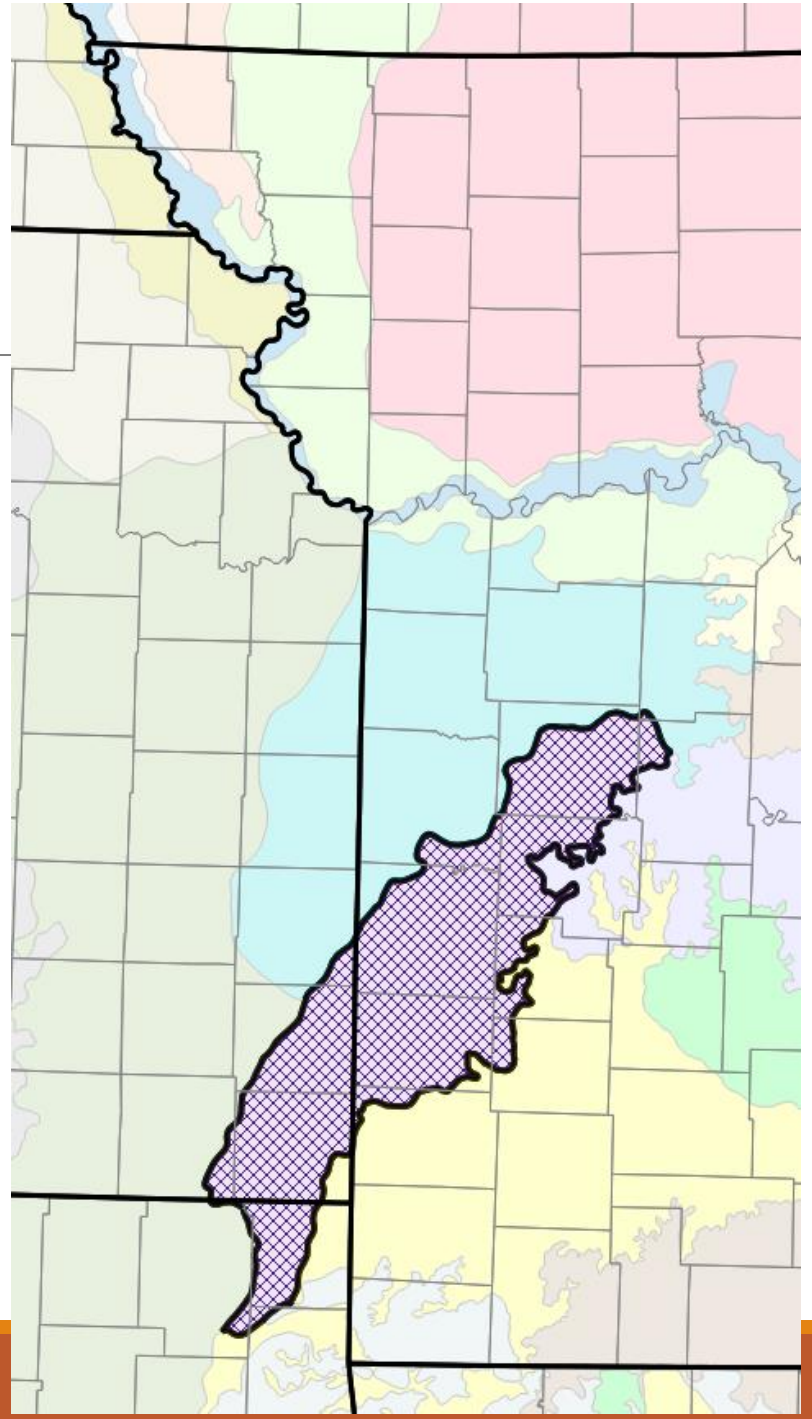
Wooded Osage Plains

- Composed of mostly thin limestone and shale with moderate relief (up to 150 feet).
- Historically more than 80% prairie, with timbered stream valleys and woodlands (savannahs) common on hillsides.



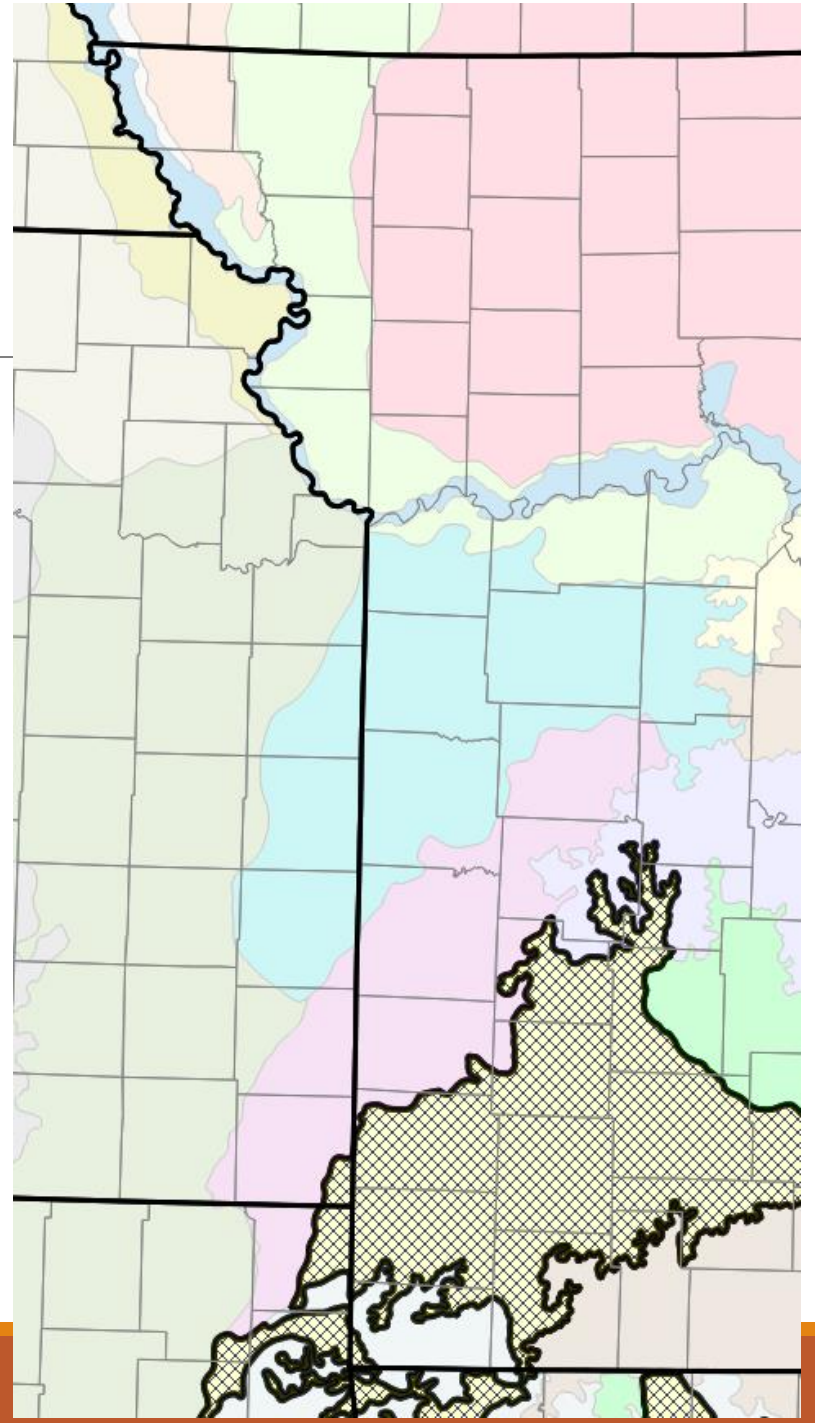
Cherokee Plains

- Composed of mostly sandstone and shale with very low local relief (usually less than 80 feet).
- Historically more than 80% prairie, with timbered stream valleys (although these are typically shallow).



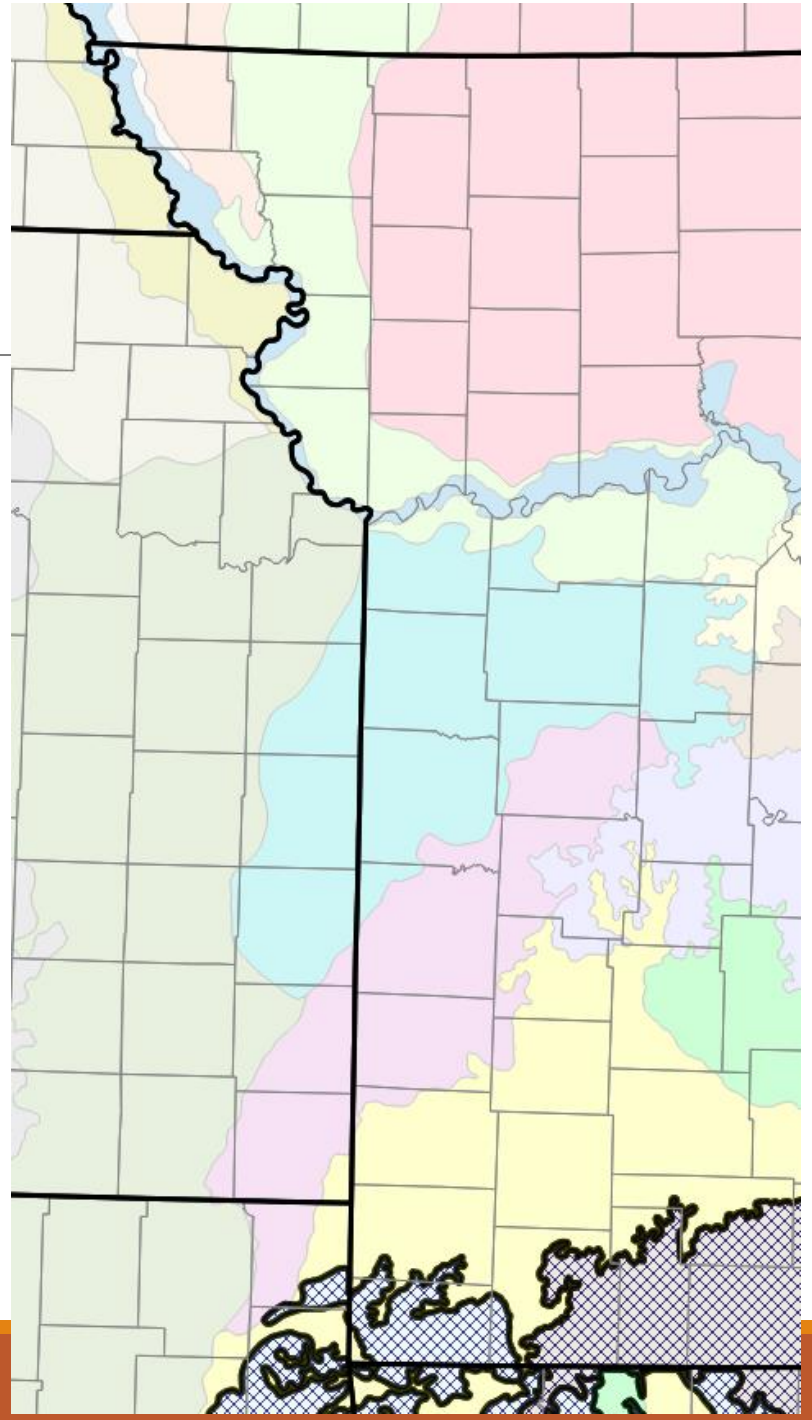
Springfield Plateau

- Transition zone between the more wooded Ozarks to the east and the prairie regions to the east, with historical land cover more than 50% prairie.
- A true plain or plateau with up to 150 feet of local relief, mostly from stream valleys.
- Significant karst features dominate due to the limestone substrate.
- Topographically, there is no clear transition between the Cherokee Plains and the Springfield Plateau.
- This is your "Gentleman's Ozarks".

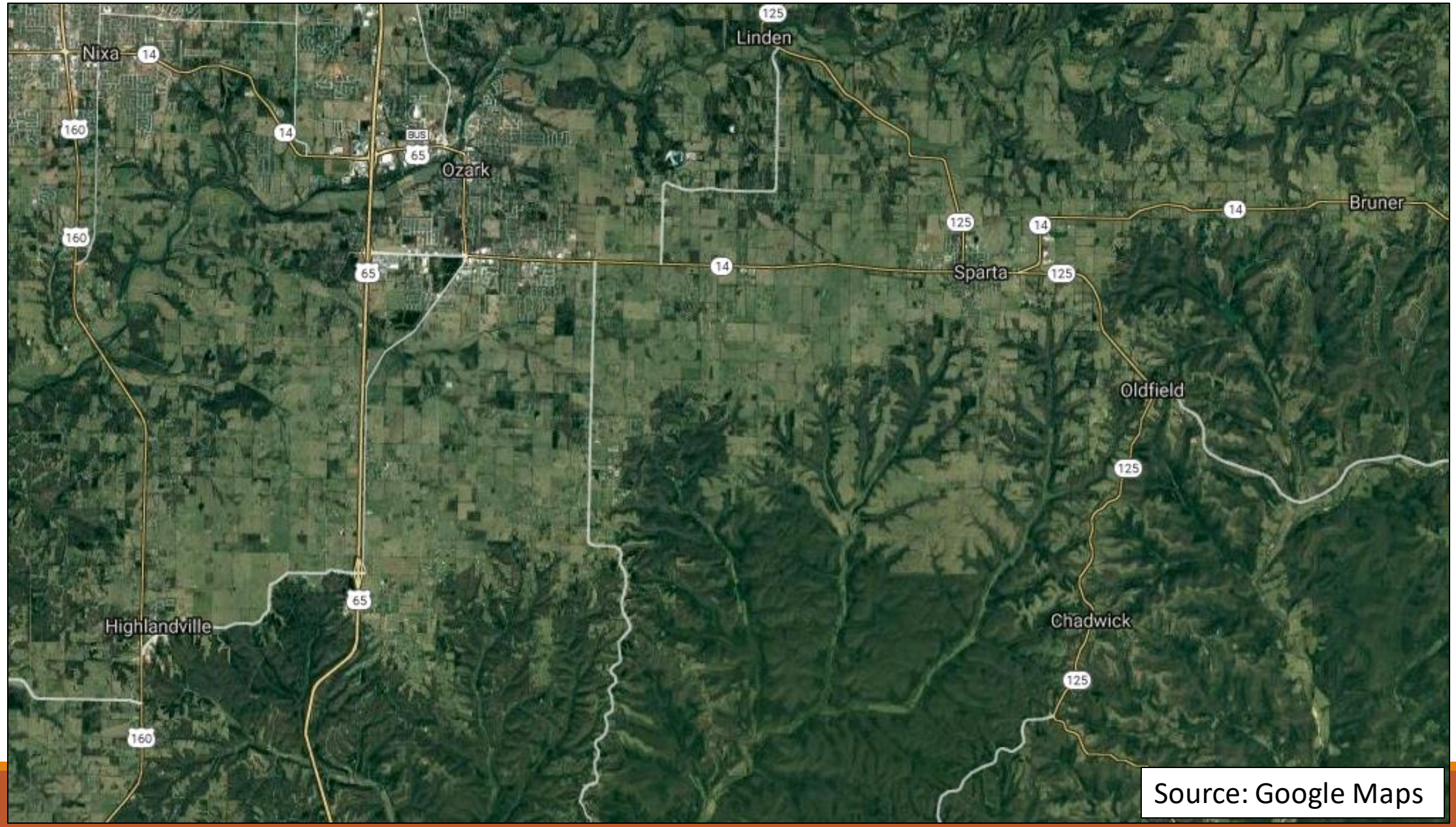


Elk / White River Hills

- Mostly forest and open woodland with moderate (up to 250 feet) to high (up to 600 feet) local relief.
- Mostly limestone and dolomite with steep, narrow stream valleys and significant karst features with frequent glades (or limestone / dolomite prairies).
- The transition between this area and the Springfield Plateau is very obvious on the landscape. Topography, land use, and existing vegetation between these two regions can easily be spotted on satellite maps.
- This is your "Hillbilly Ozarks".

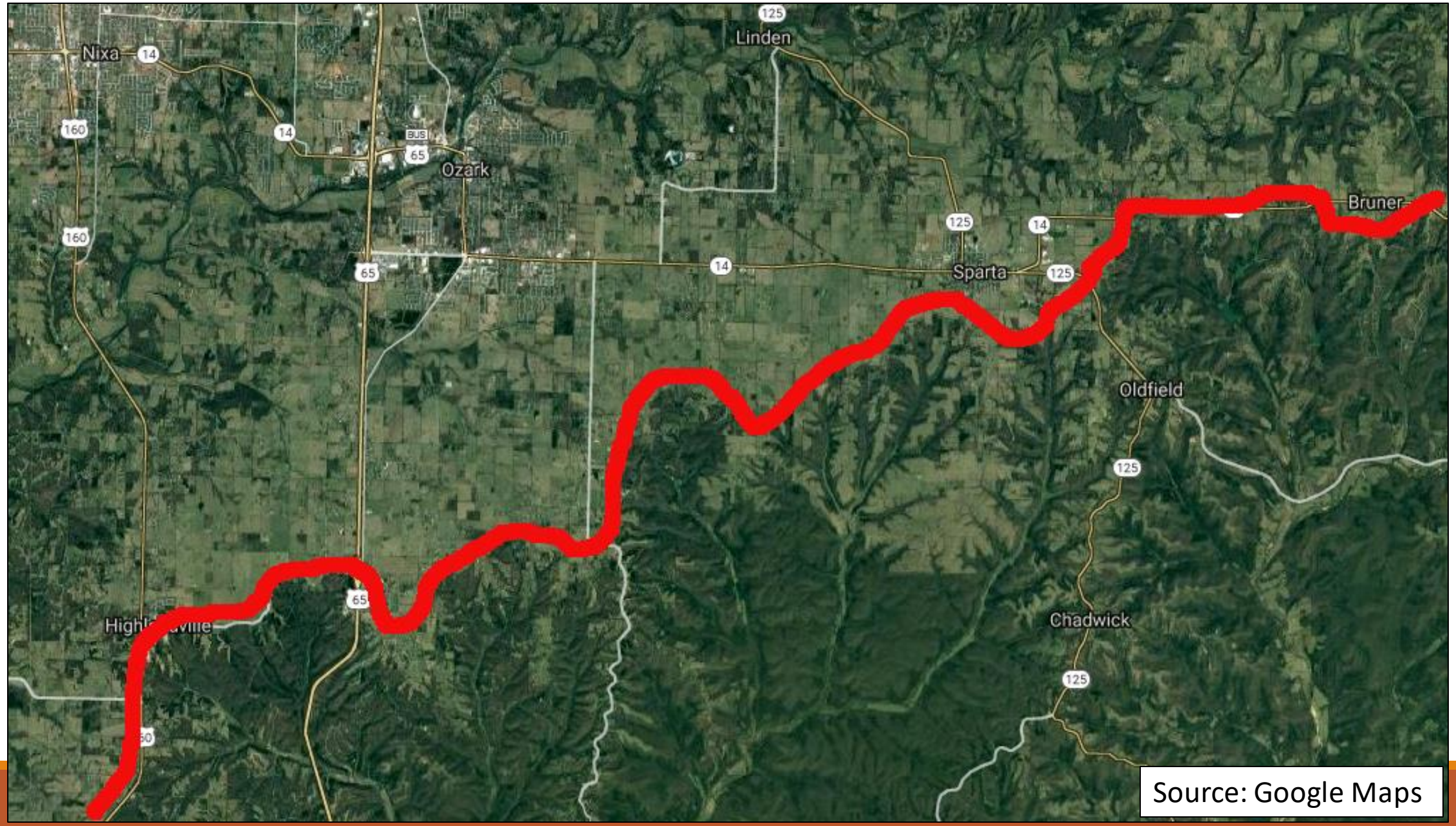


Springfield Plateau / Elk / White River Hills Border



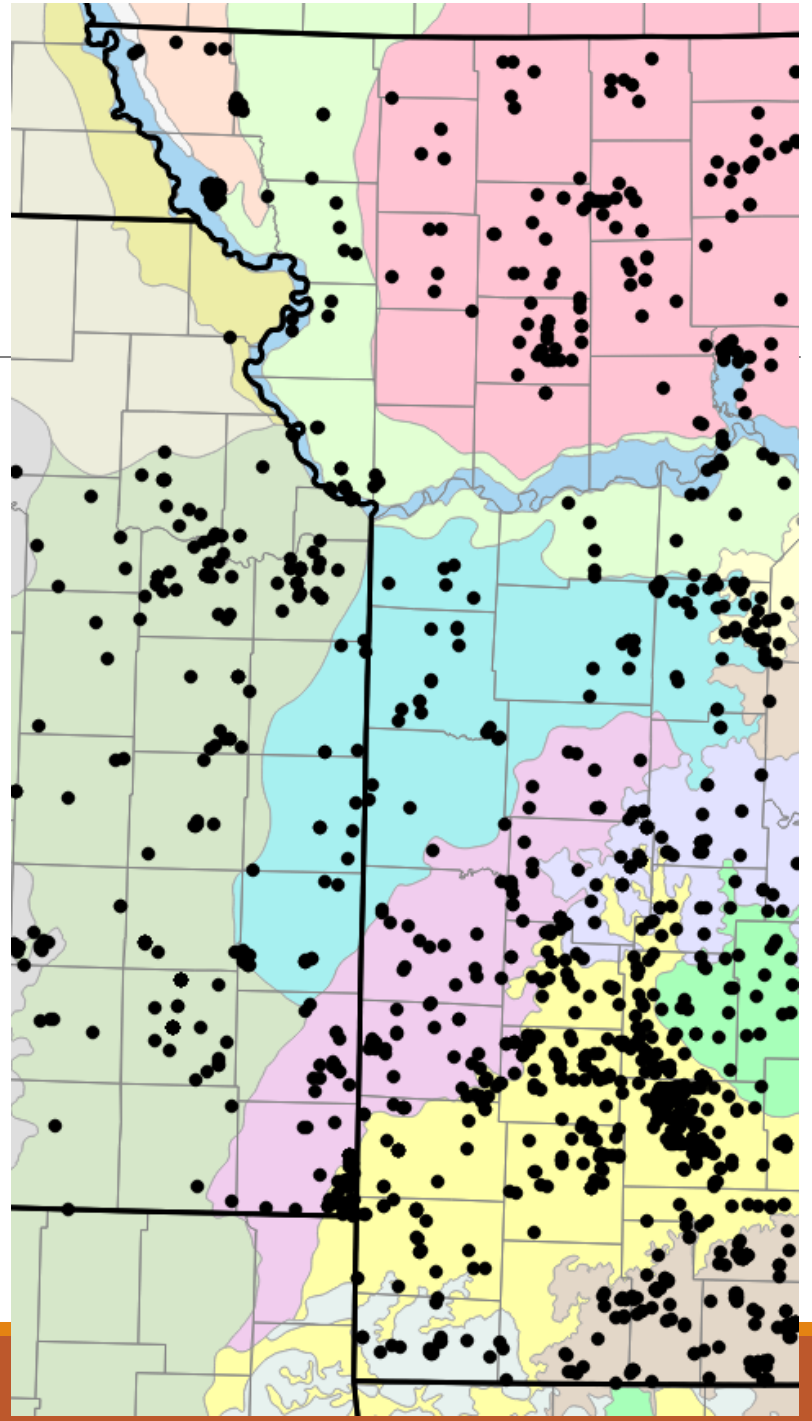
Source: Google Maps

Springfield Plateau / Elk / White River Hills Border



Collections After 2006

- The Kansas Herpetological Society (KHS) hosted a border symposium in 2006.
- Note the paucity of collections in the western tier of counties in Missouri, particularly in the plains region.
- Note the lack of recent collections in northeast Kansas.
- Previous presentation can be found at:
  - https://atlas.moherp.org/pubs/



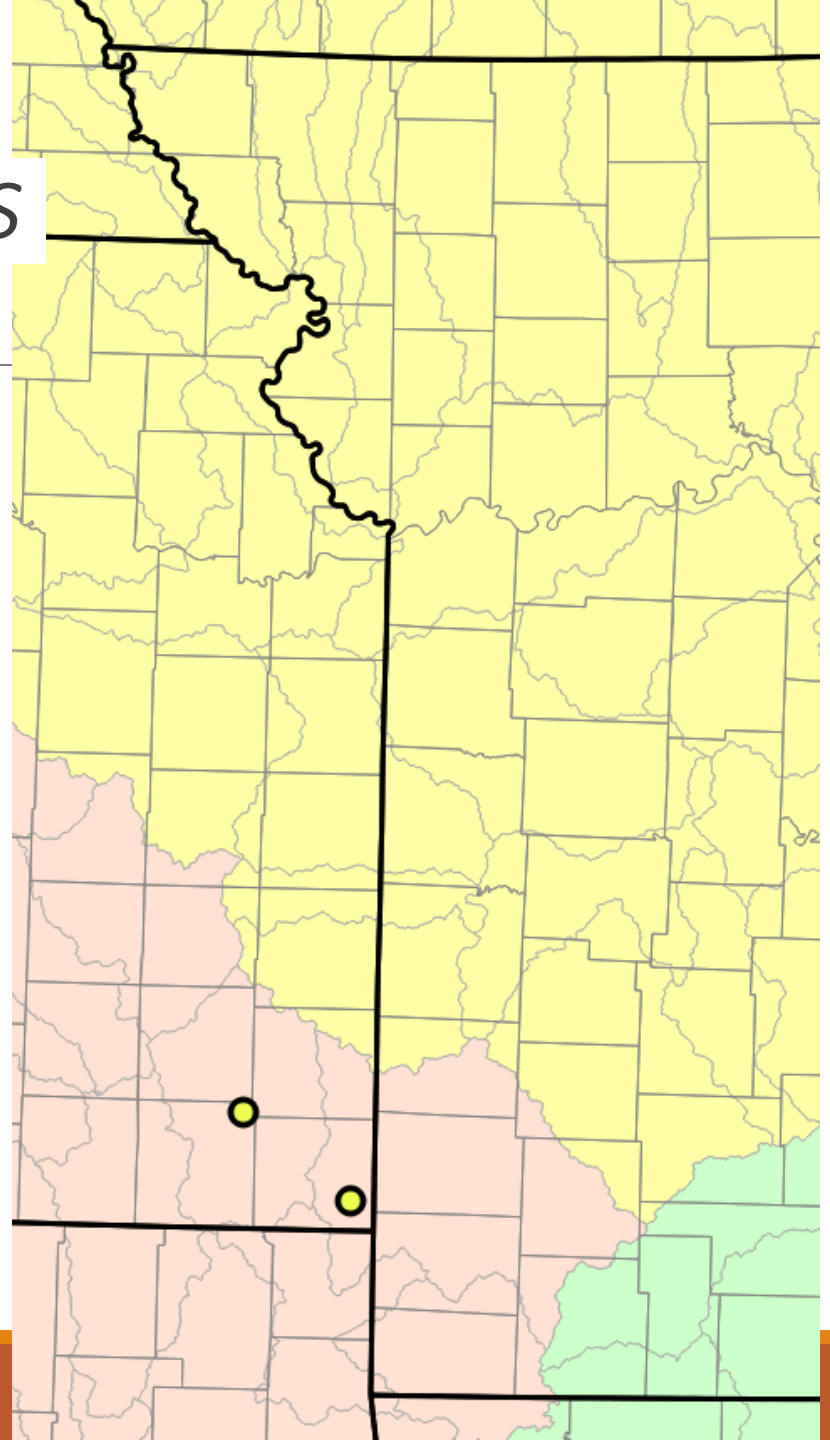
Species Maps

Species Maps

- Two locality dot styles:
  - Solid black – Records from 1988 and after
  - Yellow with black outline – Records prior to 1988 or unknown
- Two background map styles:
  - Species presumed to have distributions more closely follow drainages
  - Species presumed to have distributions more closely following terrestrial habitats

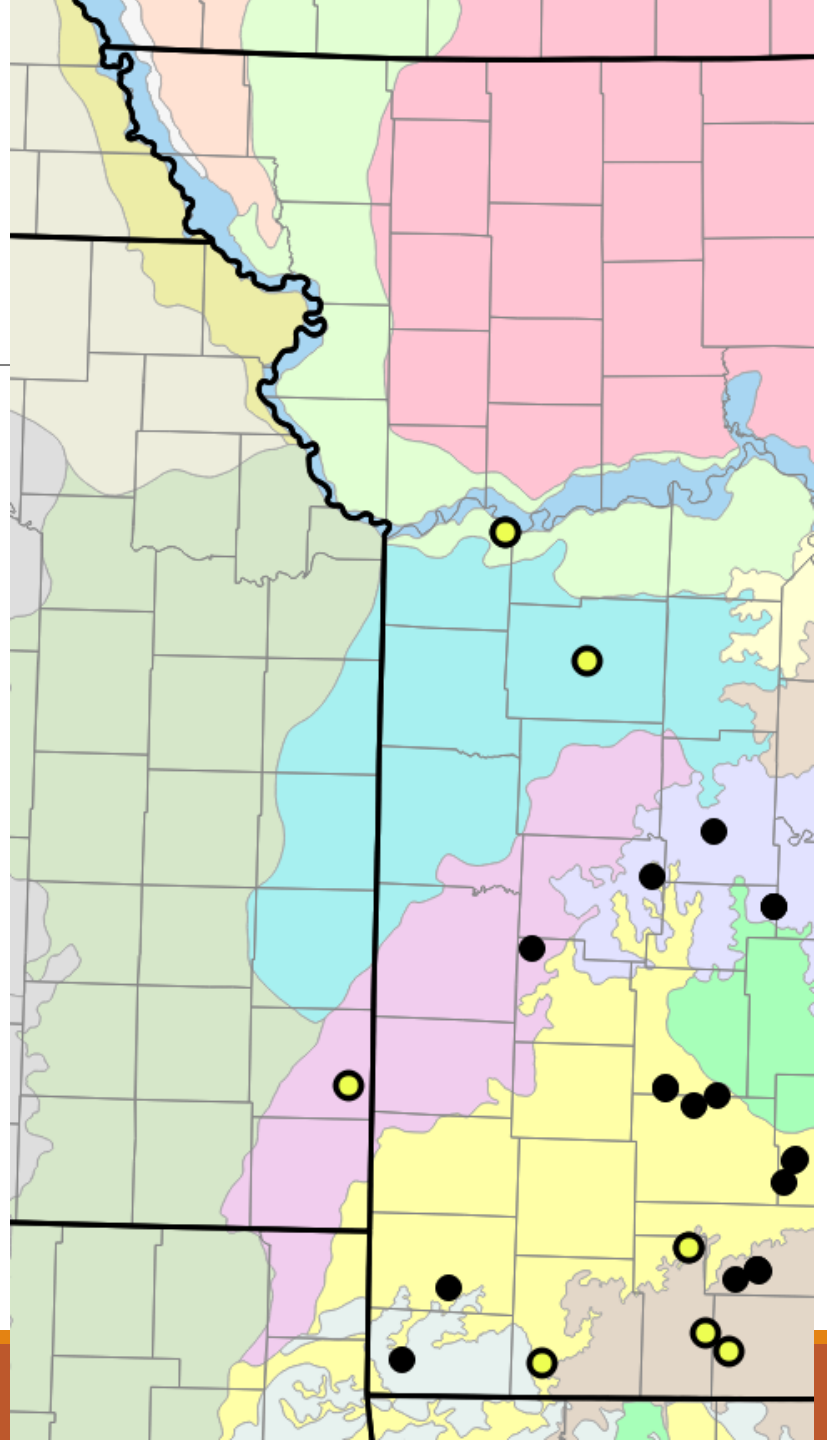
Cryptobranchus alleganiensis (Hellbender)

- Found in medium to large spring-fed rivers.
- They seem to be associated with large springs or found in rivers that are heavily spring-fed.
- Look for them in fast-flowing water below large, permanent springs.
- **Assessment: Unlikely**



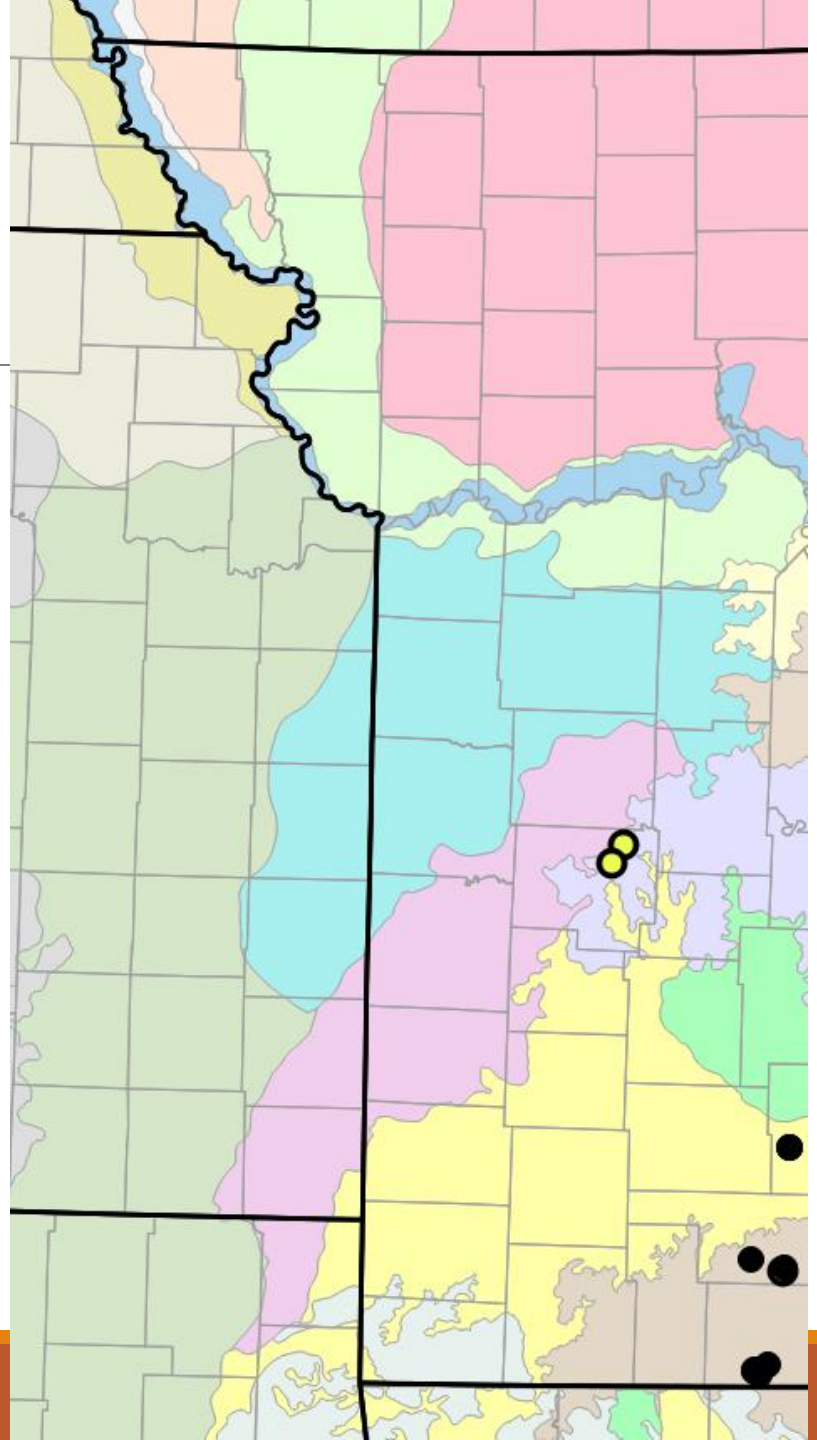
Ambystoma maculatum
(Spotted Salamander)

- Peripheral in the Springfield Plateau, but usually in high numbers where found.
- Look in big timber (mature oak / hickory forests) that have at least some continuity with forests in the Springfield Plateau. Breeding takes place late Feb through March but most usually happens with a rainfall event in a single night. Breeding pools are fishless and can be quite small. Easily road cruised in the right habitat.
- Nearby records
  - Cedar Co MO – Brown, 2003 (photo)
  - Jackson Co MO – Anderson, 1938
  - Johnson Co MO – Hurter, unknown year
  - Crawford Co KS – Unknown year (note there is also a Crawford Co MO squarely within this species' range in Missouri)
- **Assessment: Possible**



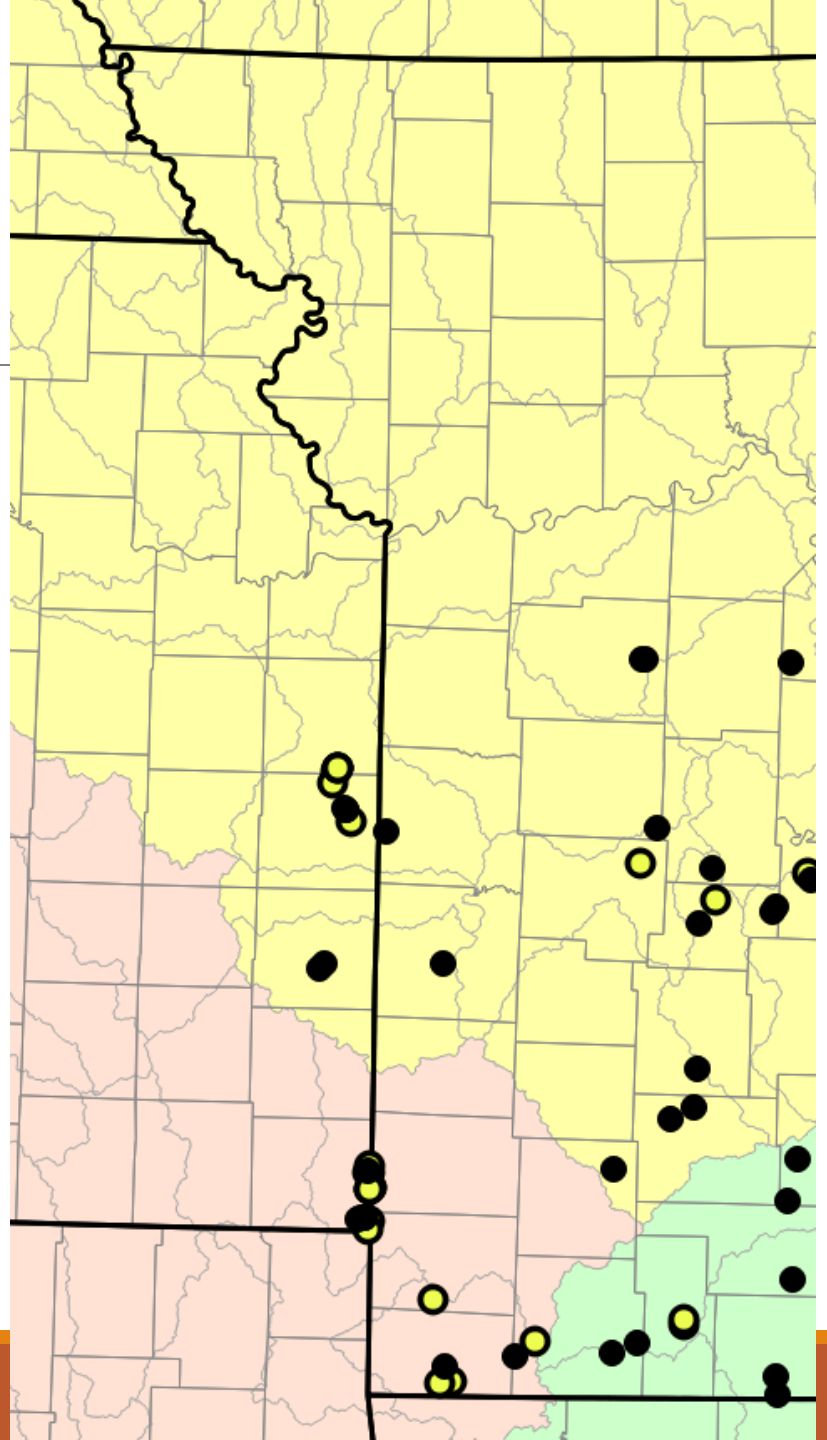
Ambystoma opacum (Marbled Salamander)

- Much less common than the Spotted Salamander in the western Ozarks.
- Similar habitat and breeding ponds to the Spotted Salamander but breeds in the early fall (September). Look for them near woodland ponds, even dry basins. The males will move to the ponds even before it rains and they are pretty easy to find by digging through nearby leaf litter or rolling logs. Not as easily road cruised as Spotted Salamanders.
- Nearby records
  - Saint Clair Co MO: Krager 1970 (actually a single record)
- **Assessment: Unlikely**



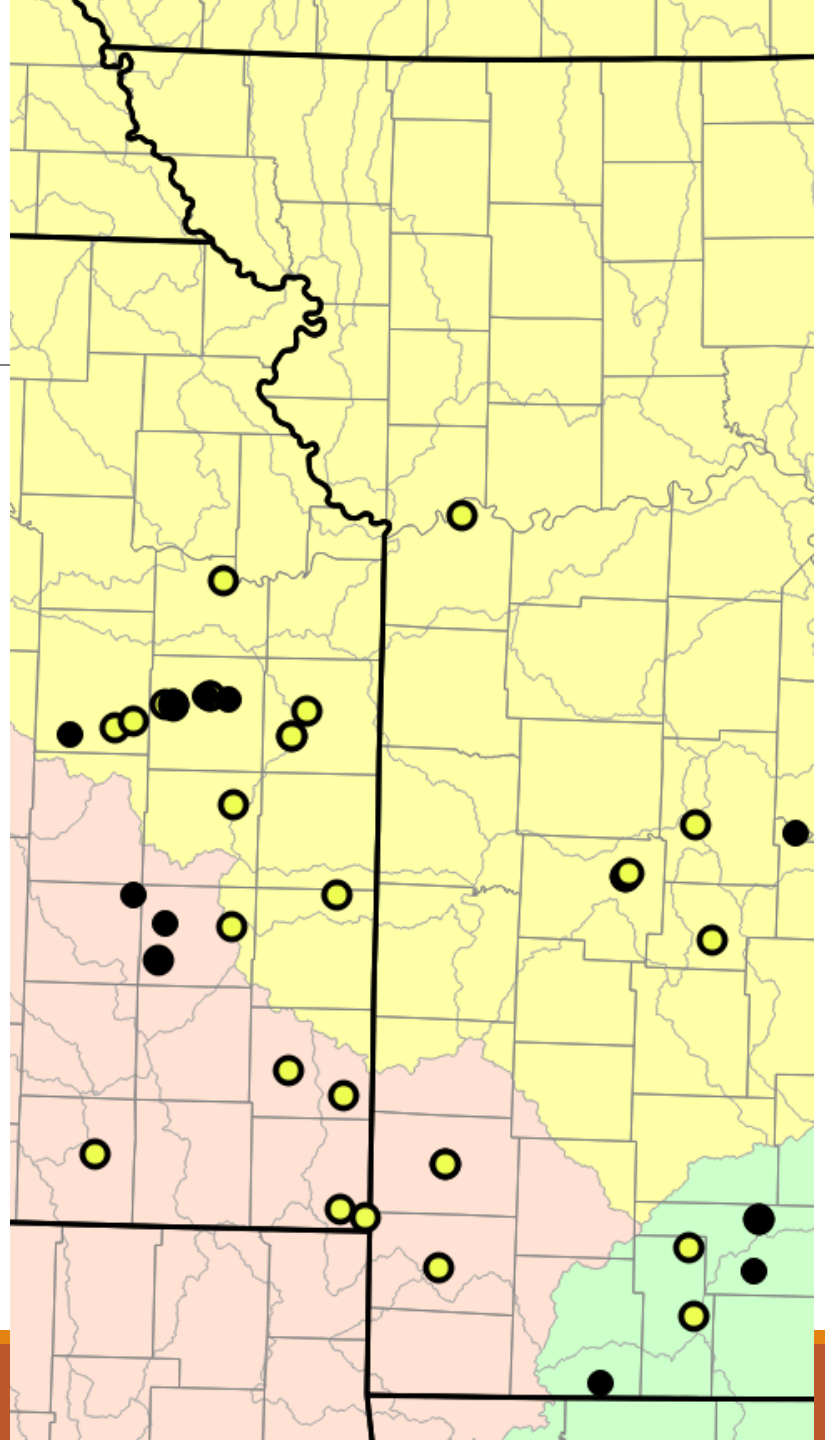
Notophthalmus viridescens (Central Newt)

- Found in scattered localities but probably more common than indicated.
- Likely will be found in more localities, especially in the indicated watersheds.
- Lack of Missouri records is most likely due to a lack of collecting effort.
- **Assessment: Likely**



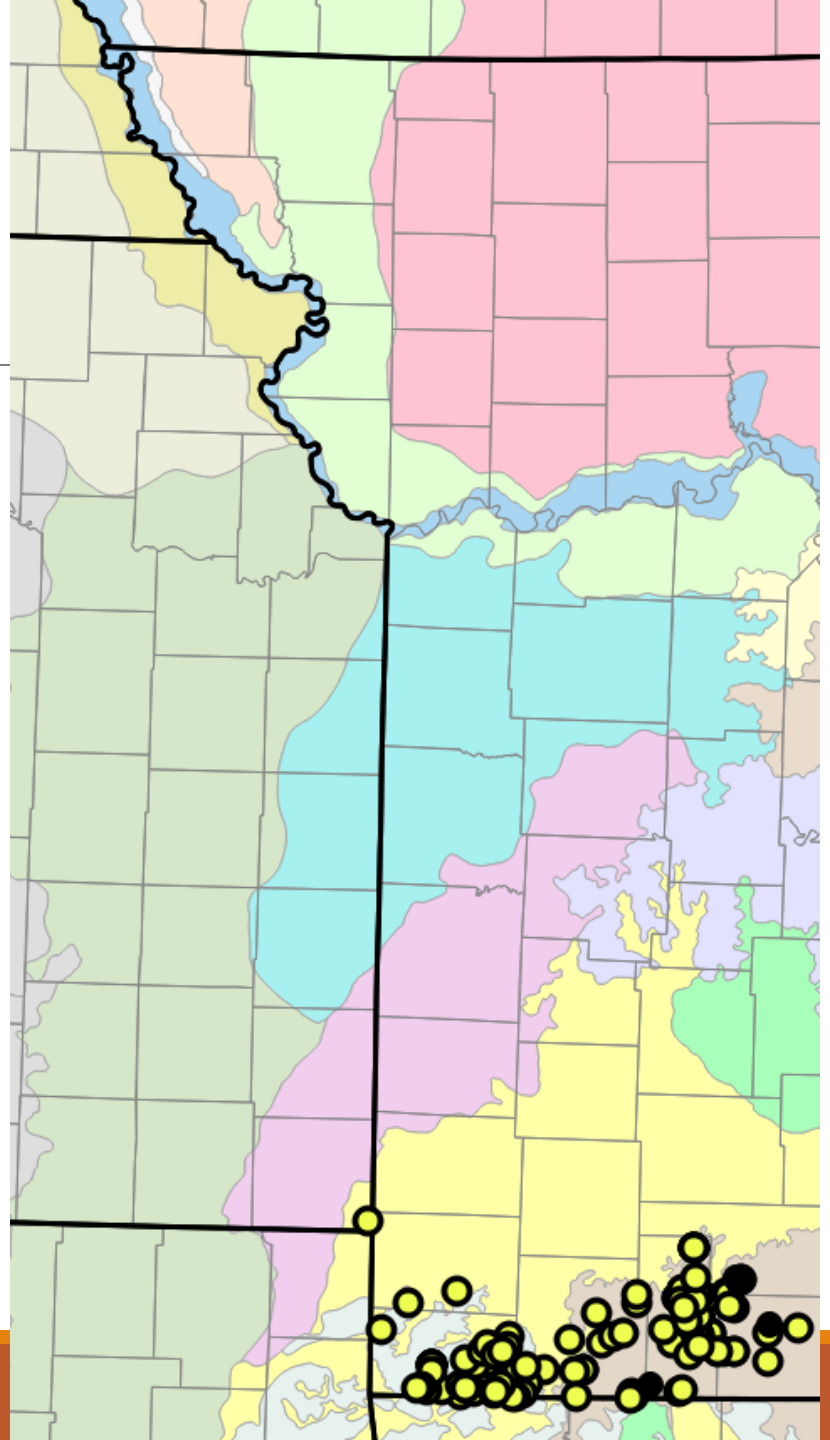
Necturus maculosus (Mudpuppy)

- Found in permanent streams and rivers.
- Often considered two different species:
  - *Necturus maculosus* (Mudpuppy) (Missouri and Mississippi Rivers, yellow watersheds)
  - *Necturus louisianensis* (Red River Mudpuppy) (Arkansas River, orange and green watersheds)
- Mudpuppies are still occasionally caught on tackle in the Mississippi River (which admittedly is a different environment than the Missouri River) and frequently encountered in hellbender rivers.
- **Assessment: Likely**



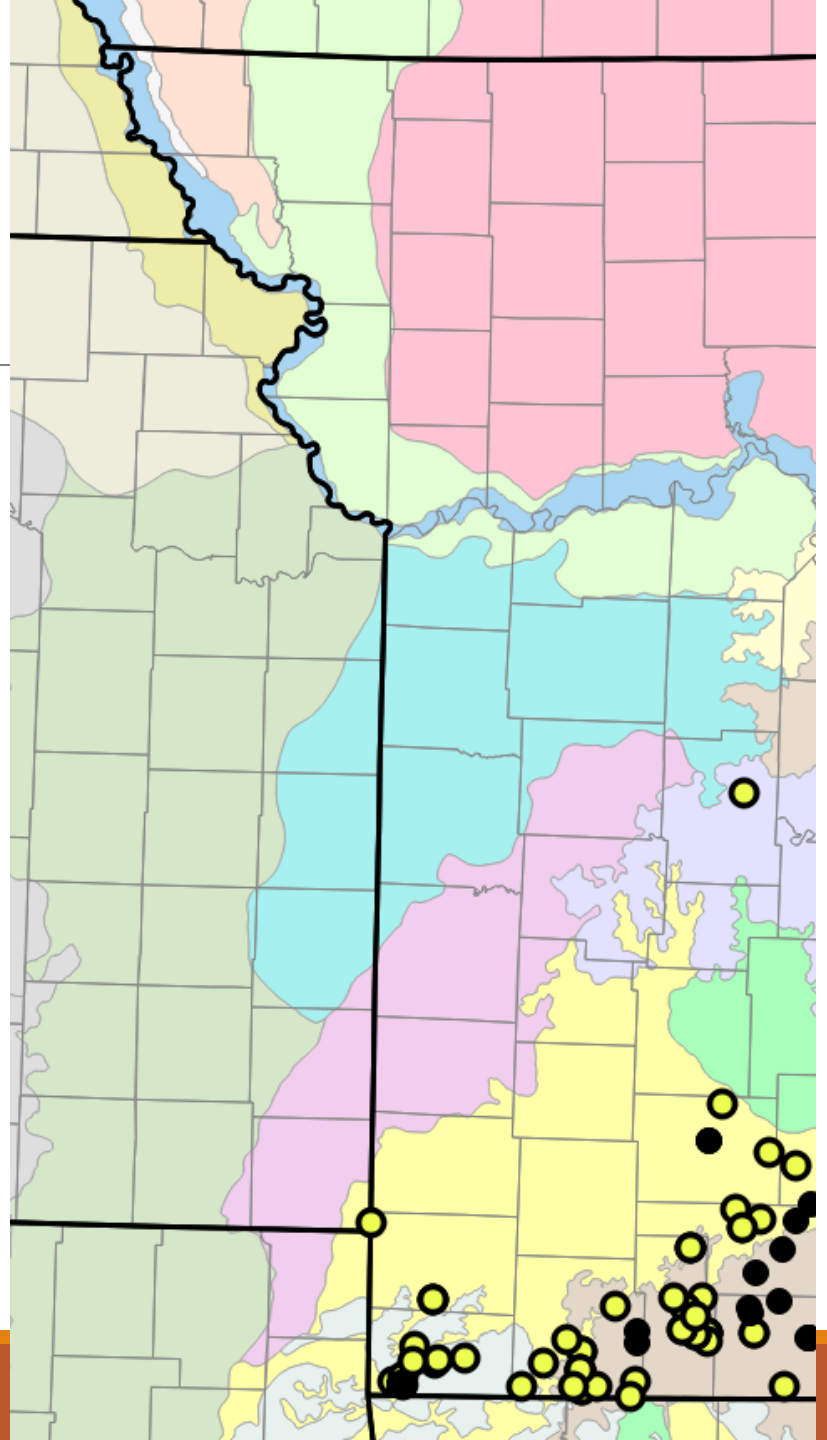
Eurycea tynerensis
(Oklahoma Salamander)

- Very nearly exclusively found in the Elk / White River Hills ecoregion.
- It appears to require high quality, spring-fed streams and lives in the interstitial spaces found in stream gravel and rarely metamorphoses.
- Grotto salamander larval forms are similar and the two species are closely related.
- **Assessment: Unlikely**



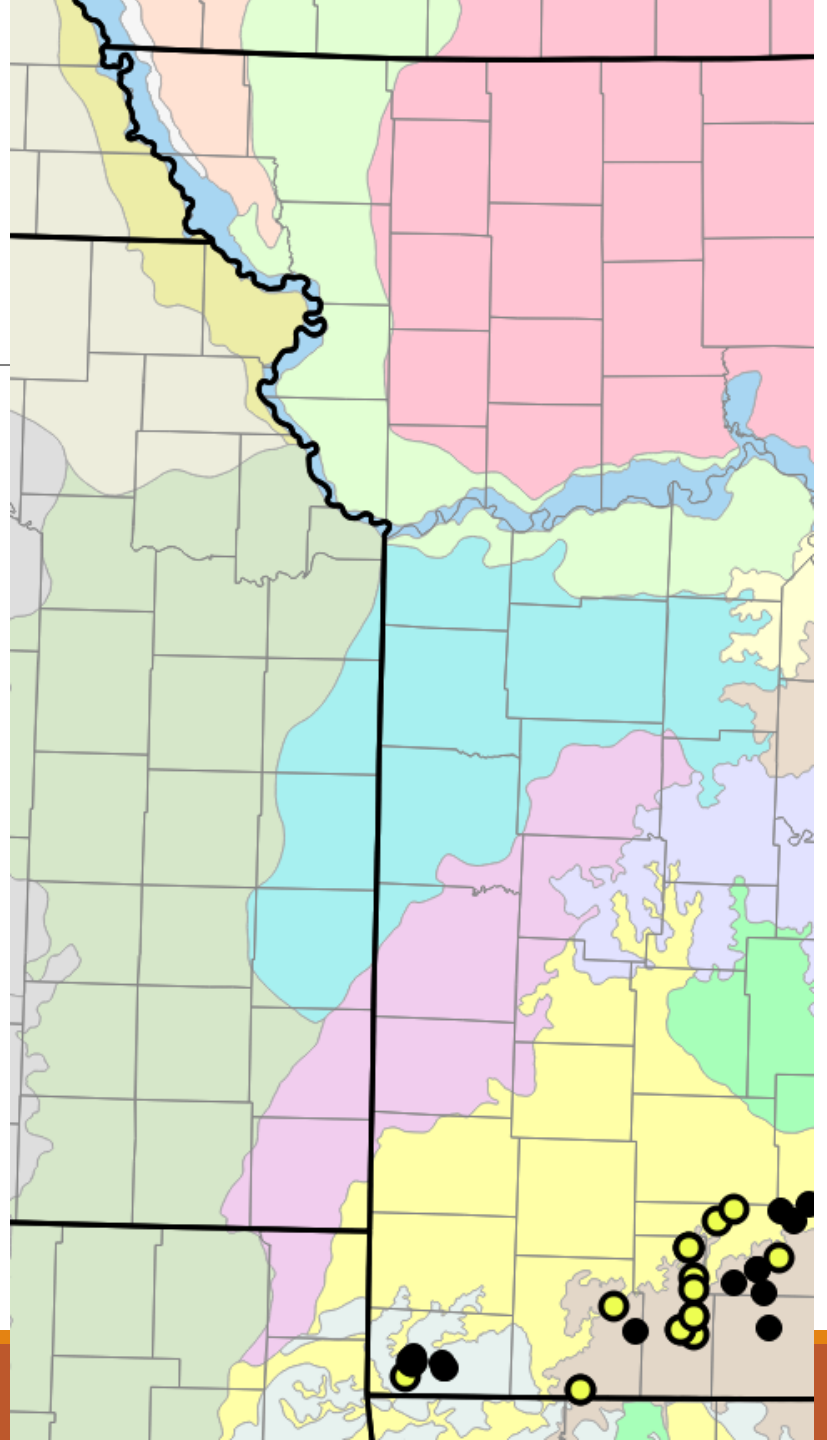
Plethodon albagula
(Western Slimy Salamander)

- Peripheral in the Springfield Plateau, and often not encountered in known locations unless conditions are just right.
- Look in any place where suitable geology is present, even on glades or open woodland situations, but particularly in moist areas. This animal appears to spend a great deal of time underground.
- Nearby records
  - Newton Co MO – 5 specimens from April, November, December of 1944 near Camp Crowder
  - Cherokee Co KS – Locality is Roaring River, which is in Barry Co MO (latitude and longitude likely incorrect)
- **Assessment: Possible**



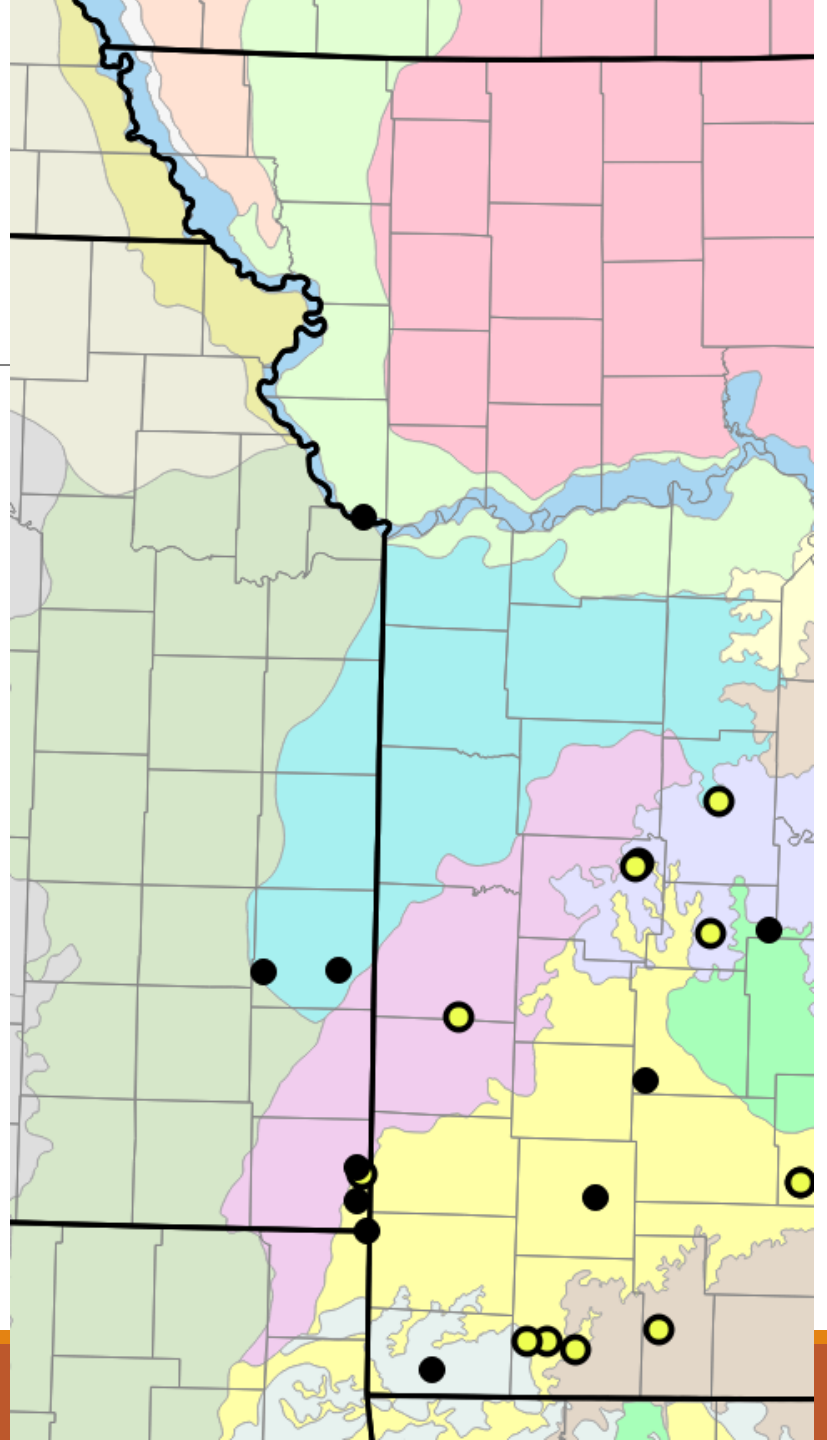
Plethodon angusticlavius
(Ozark Zigzag Salamander)

- Almost exclusively found in the Elk / White River Hills ecoregion.
- Look in deep, shaded ravines where it's damp most of the year. Usually associated with geologic outcrops but occasionally found under logs in moist woods.
- Typically found in large numbers when present, normally early spring, late fall, and possibly over winter in the right conditions.
- **Assessment: Unlikely**



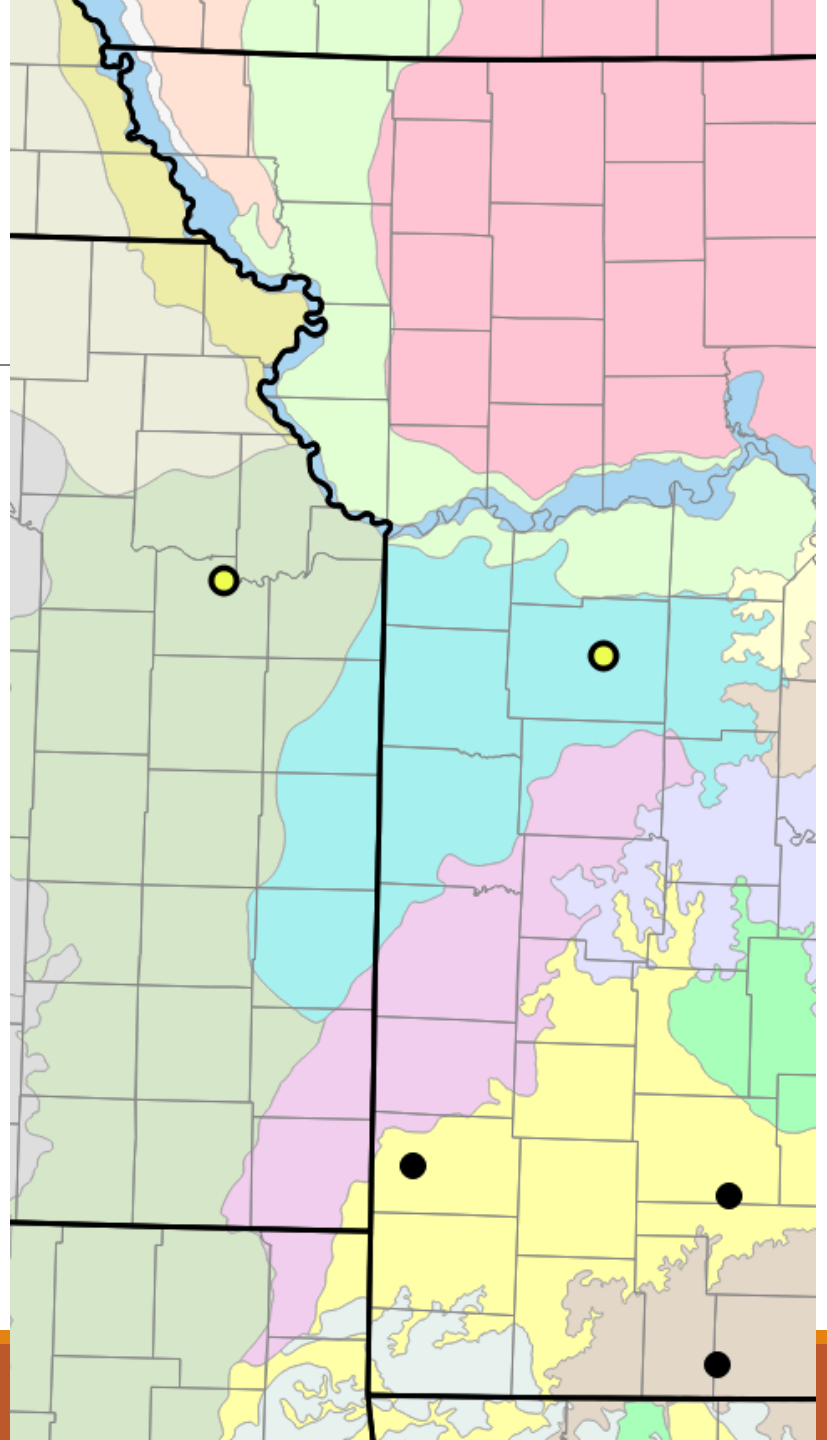
Anaxyrus fowleri
(Fowler's Toad)

- Low confidence in the validity of any identifications in the Ozarks, which brings up the possibility that the nearby plains populations are questionable.
  - Animals that appear to be "good" Fowler's Toads are rare, although Fowler's characteristics sometimes are present.
  - Fowler's Toad choruses are not heard in the Ozarks.
  - "Good" Fowler's Toads are frequently found in the bootheel and in places in northern and northeastern Missouri and heard in chorus.
- This complex of toads (American, Dwarf, Fowler's, Woodhouse's) needs further study in Missouri.
- **Assessment: Unknown**



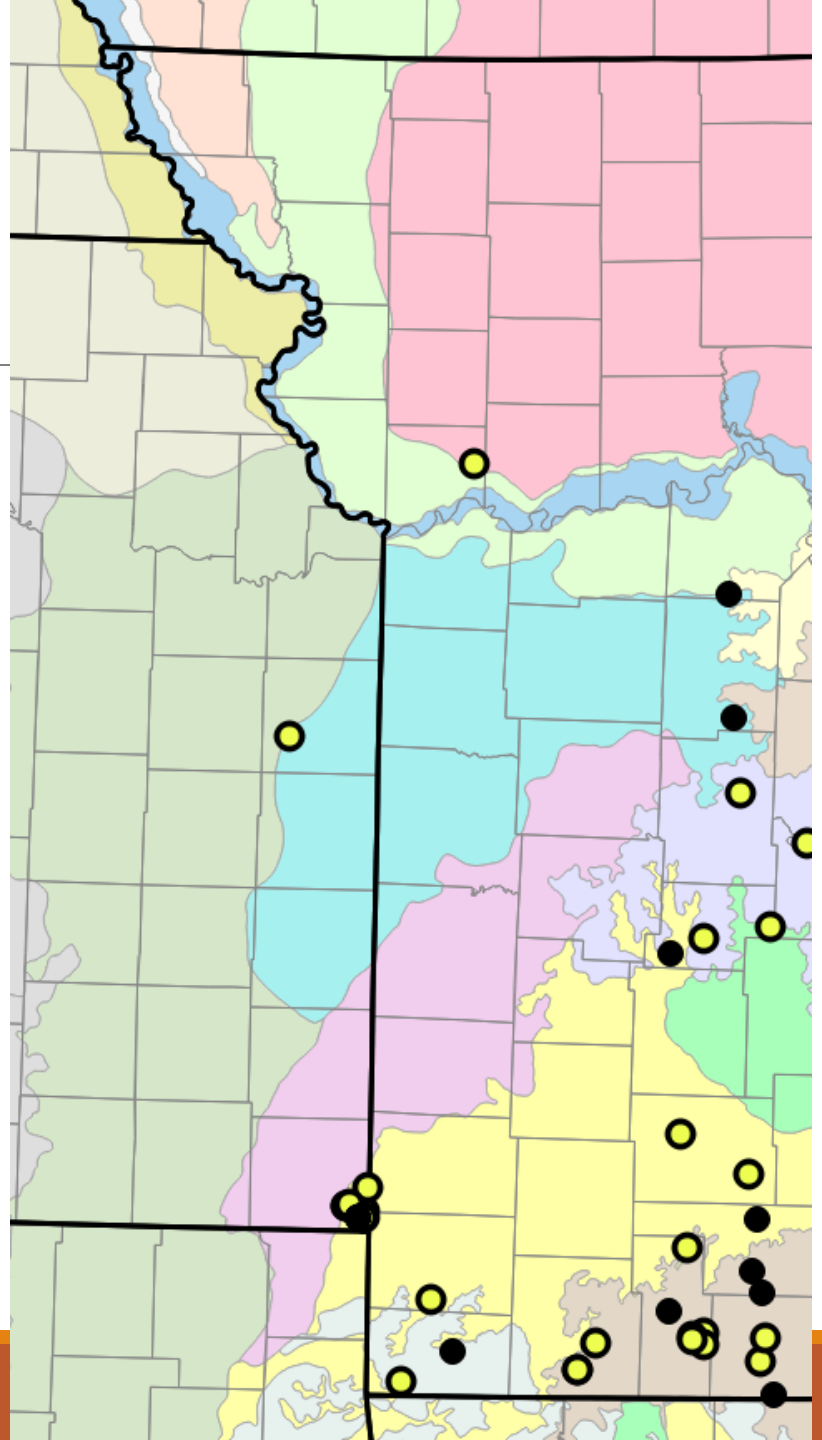
Hyla cinerea
(Green Treefrog)

- Naturally found in the alluvial plains in southeast Missouri but breeding populations are established in several places now.
- Their call is distinctive (like a flock of quacking ducks).
- Look for them at fish hatcheries or anywhere that fish, bait, or aquatic plants might be dumped.
- Nearby records
  - Greene Co MO – 2013, photo, calling males
  - Jasper Co MO – 2010, photo, calling males
  - Johson Co MO – single animal from 1976, unknown whether or not a breeding population exists there
  - Taney Co MO – 2012, photo from fish hatchery
- **Assessment: Likely**



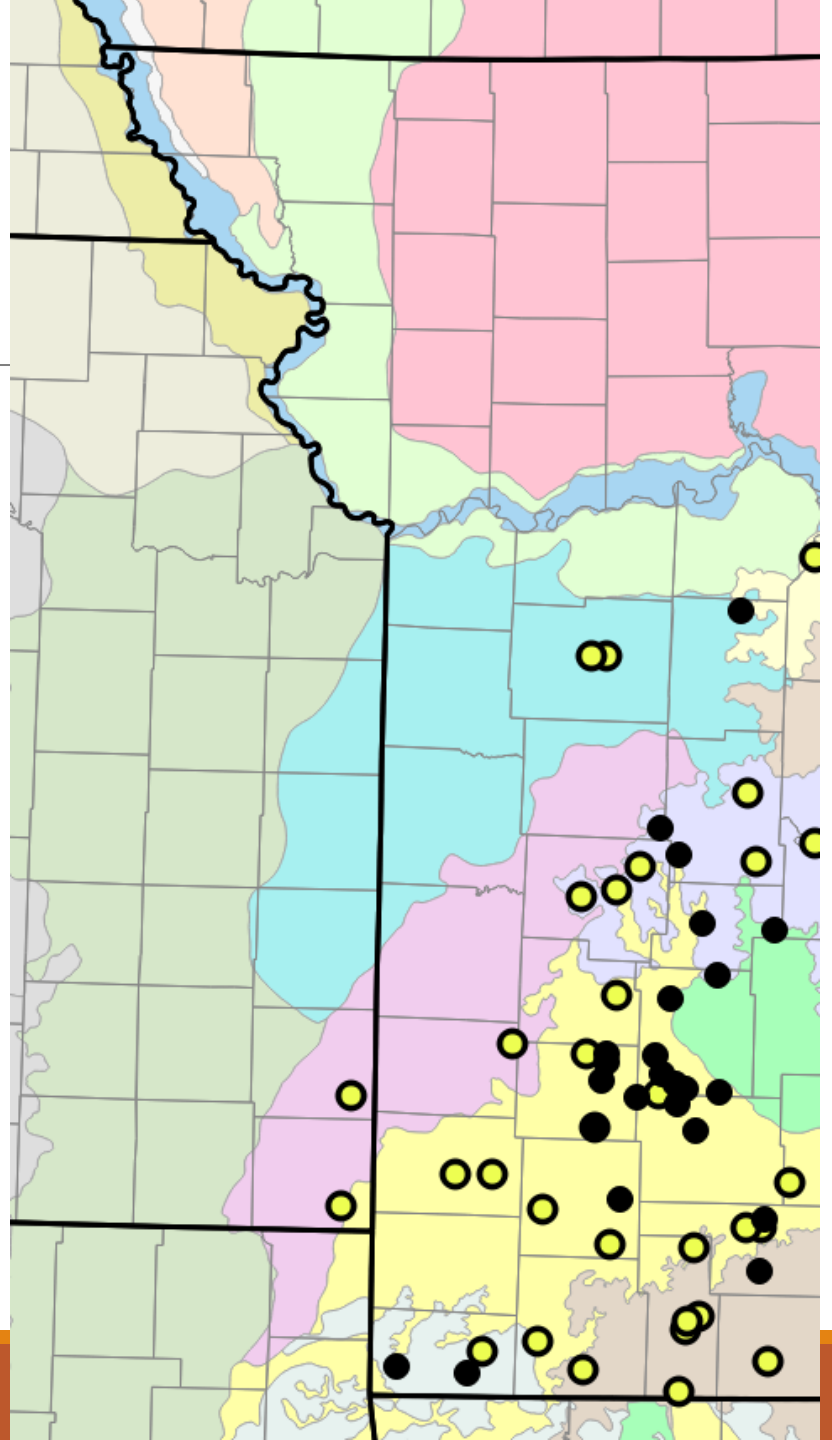
Lithobates clamitans
(Green Frog)

- Seemingly similar in size and habits to bullfrogs but also much more restricted in habitat.
- Peripheral to the Springfield Plateau and seems to drop out quickly once you get away from big timber.
- Distinctive call can be heard from medium to large size rivers pretty much all summer.
- Nearby records
  - Clay Co MO – 1917 record we consider questionable since it's so far away from other records
  - Miami Co KS – Seems questionable
- **Assessment: Unlikely**



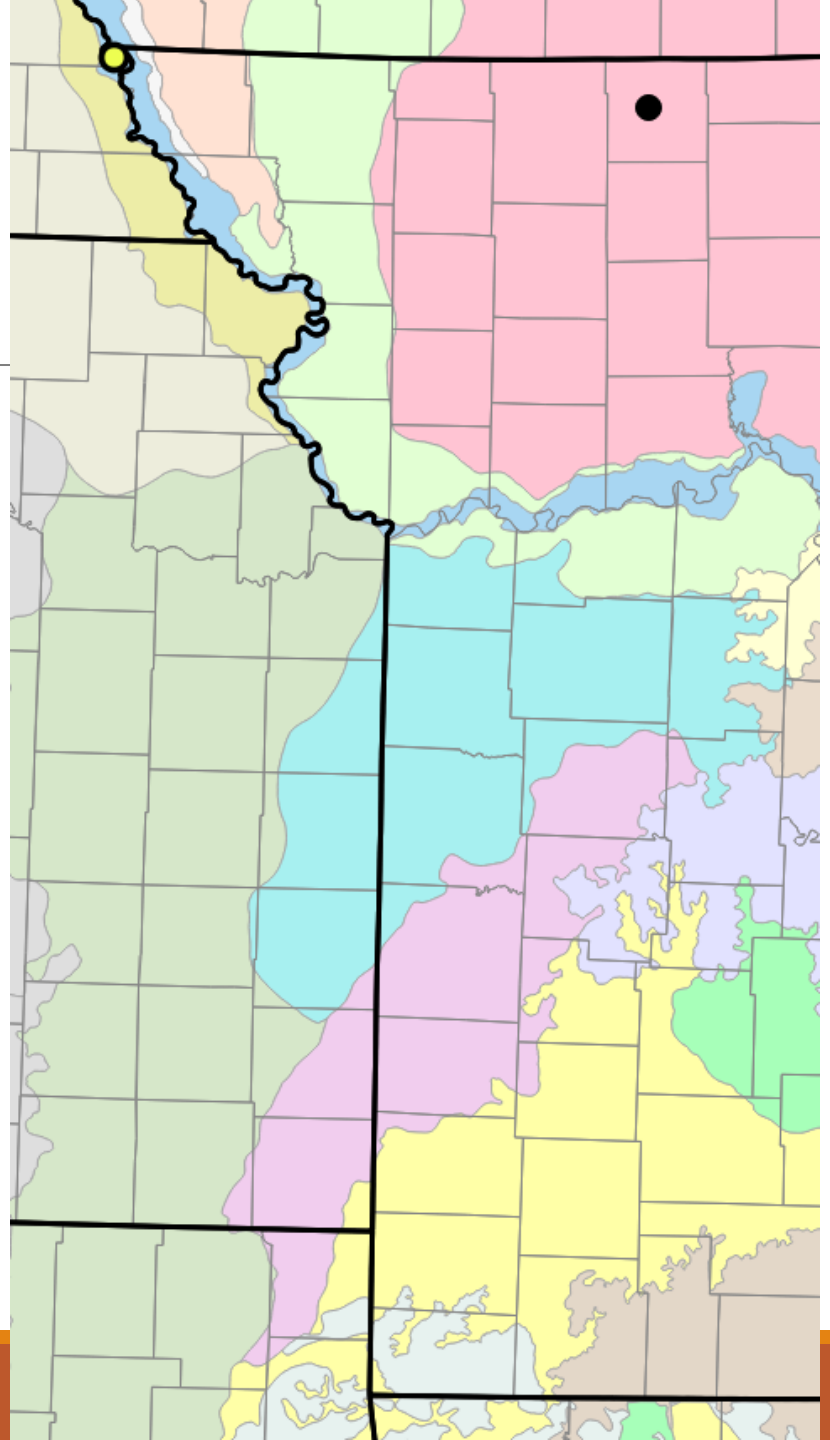
Lithobates palustris
(Pickerel Frog)

- Often found in caves, springs, glades, and everywhere that the geology is close to the surface.
- But they are often found far from water sources, perhaps the most terrestrial of the ranids in Missouri.
- Rarely heard calling, usually very subdued or even underwater but early spring is their time.
- Search in forested areas and also in rocky areas near those places, even if not forested.
- **Assessment: Possible**



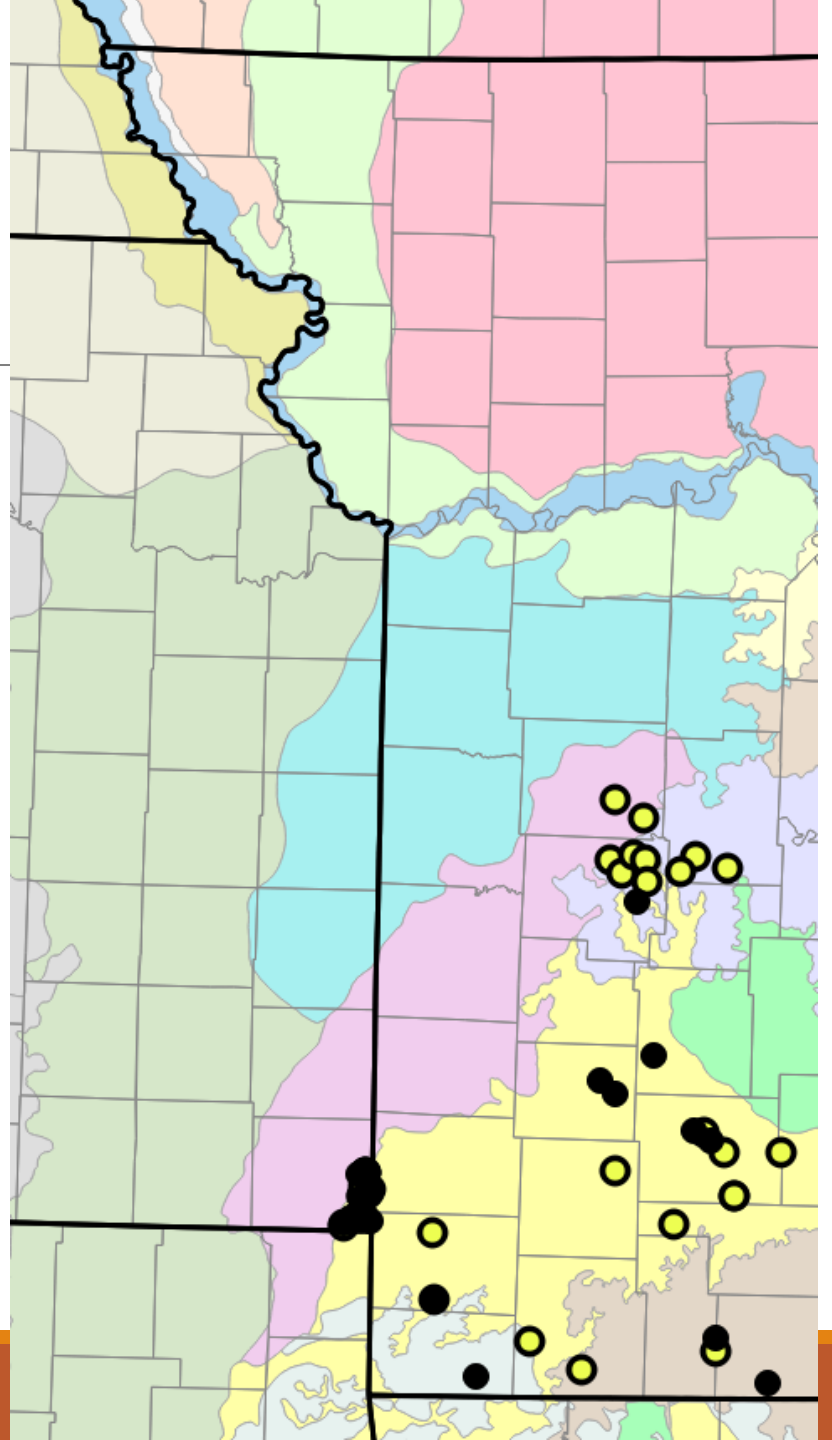
Lithobates pipiens
(Northern Leopard Frog)

- Barely enters northern Missouri.
- Recent Iowa records come right up to the northern Missouri border and there are almost certainly numerous populations in our northern counties.
- Call is distinctive and chorusing males should be sought in early spring.
- Nearby records
  - Atchison Co MO – 1985 series deposited at KU
- **Assessment: Likely**



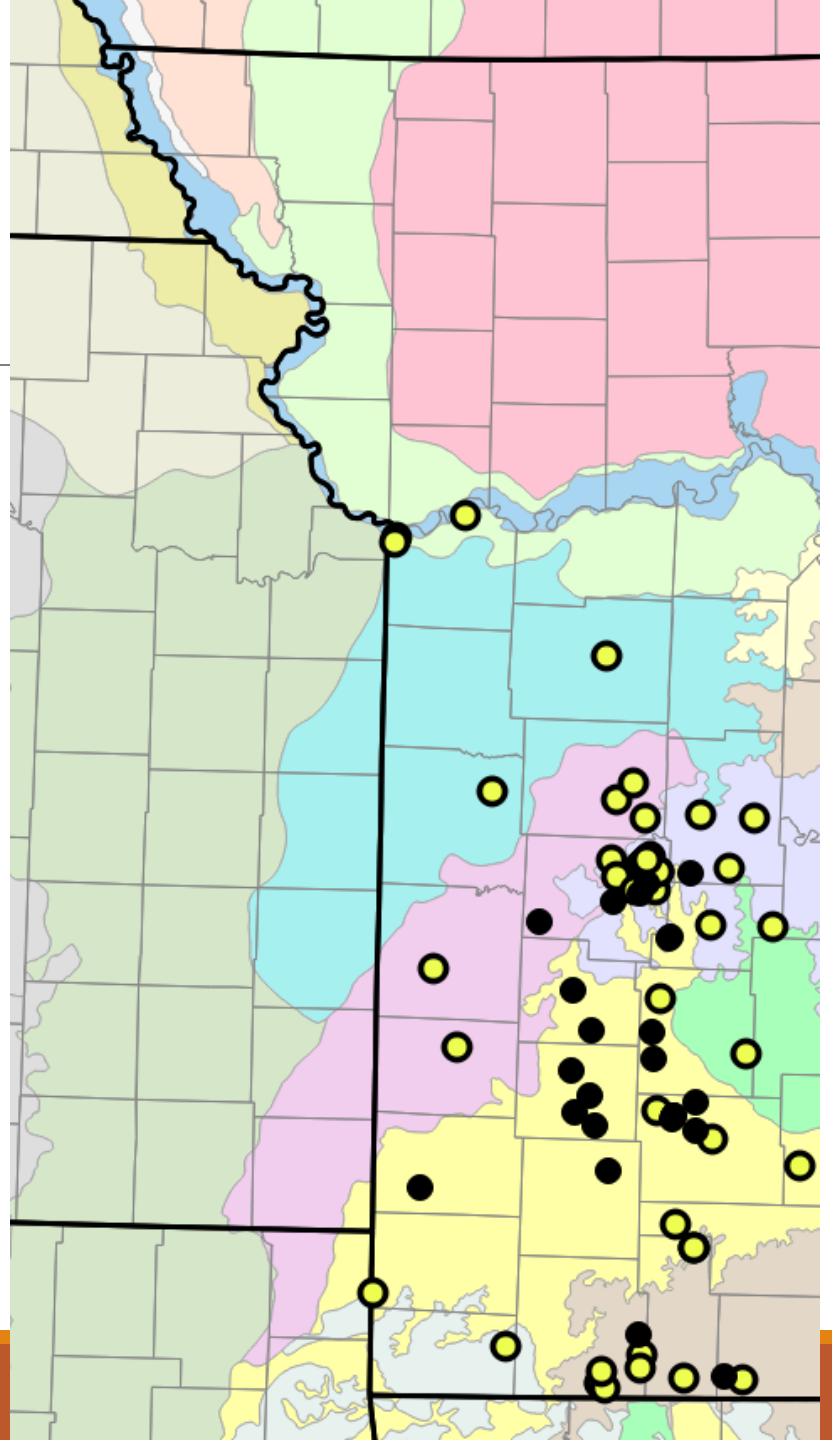
Gastrophryne carolinensis
(Eastern Narrow-mouthed Toad)

- Sporadically encountered in the Ozarks, but scattered in the Springfield Plateau and in a few places outside of the Ozarks proper.
- Historical records in the northwestern Ozarks are likely just a collecting artifact.
- **Assessment: Unknown**



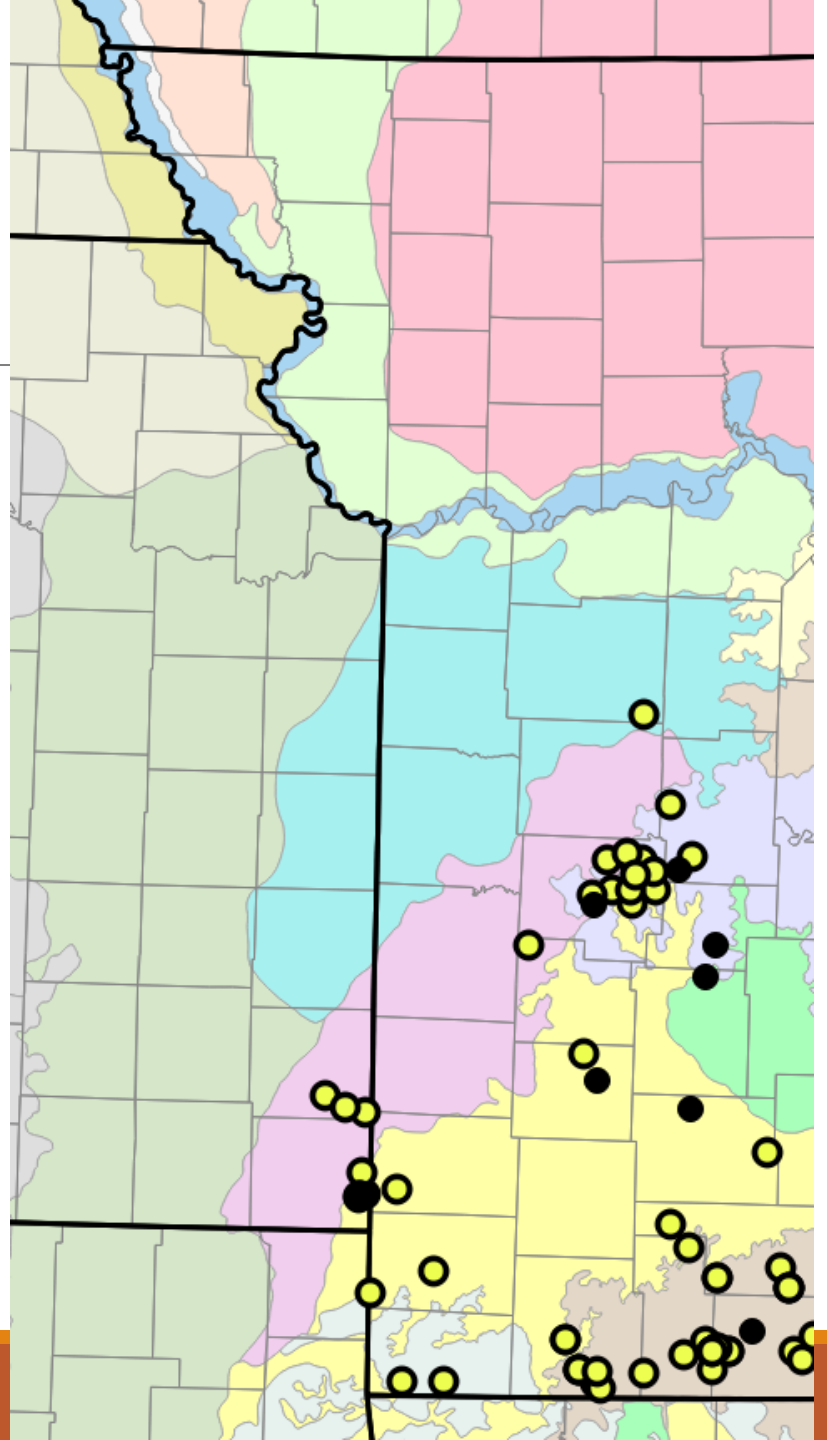
Coluber flagellum
(Eastern Coachwhip)

- Sporadically encountered in the Ozarks but little collecting has been done in the prairie regions of western Missouri.
- Nearby records
  - Bates Co MO – Anderson, 1958
  - Jackson Co MO – 3 records, one from 1937, others unknown, but Anderson considered these invalid
  - Johnson Co MO – 1 record from 1976
- **Assessment: Possible**
- ***Note**: Kansas records are missing from this map. They have been found as far north as Bourbon Co (1969) in eastern Kansas but most eastern KS records are clustered in southeast Cherokee Co.*



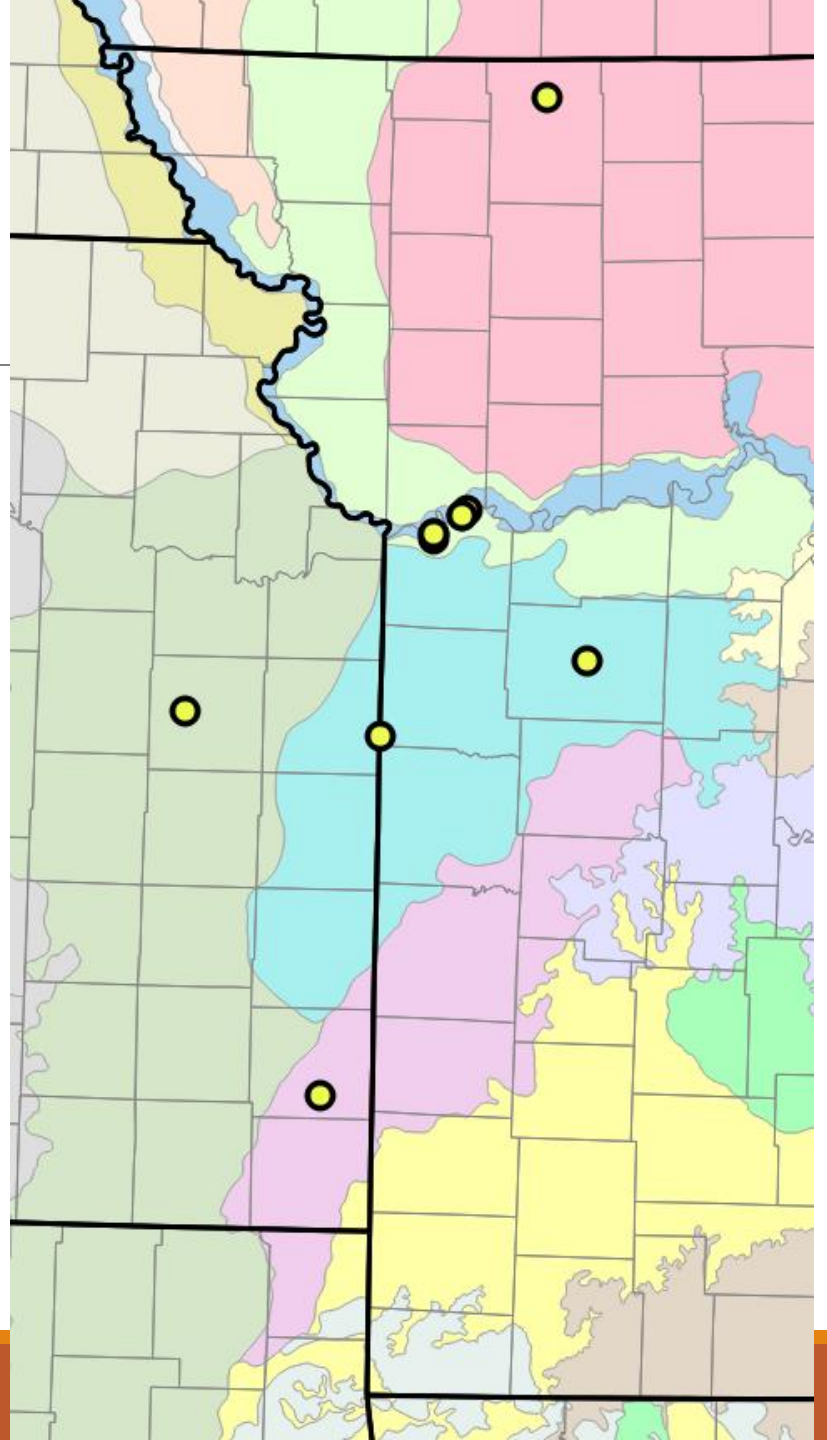
Haldea striatula
(Rough Earthsnake)

- Seemingly confined to glades in the Ozarks, and presumably similar rocky habitats outside of the Ozarks.
- **Assessment: Unknown**



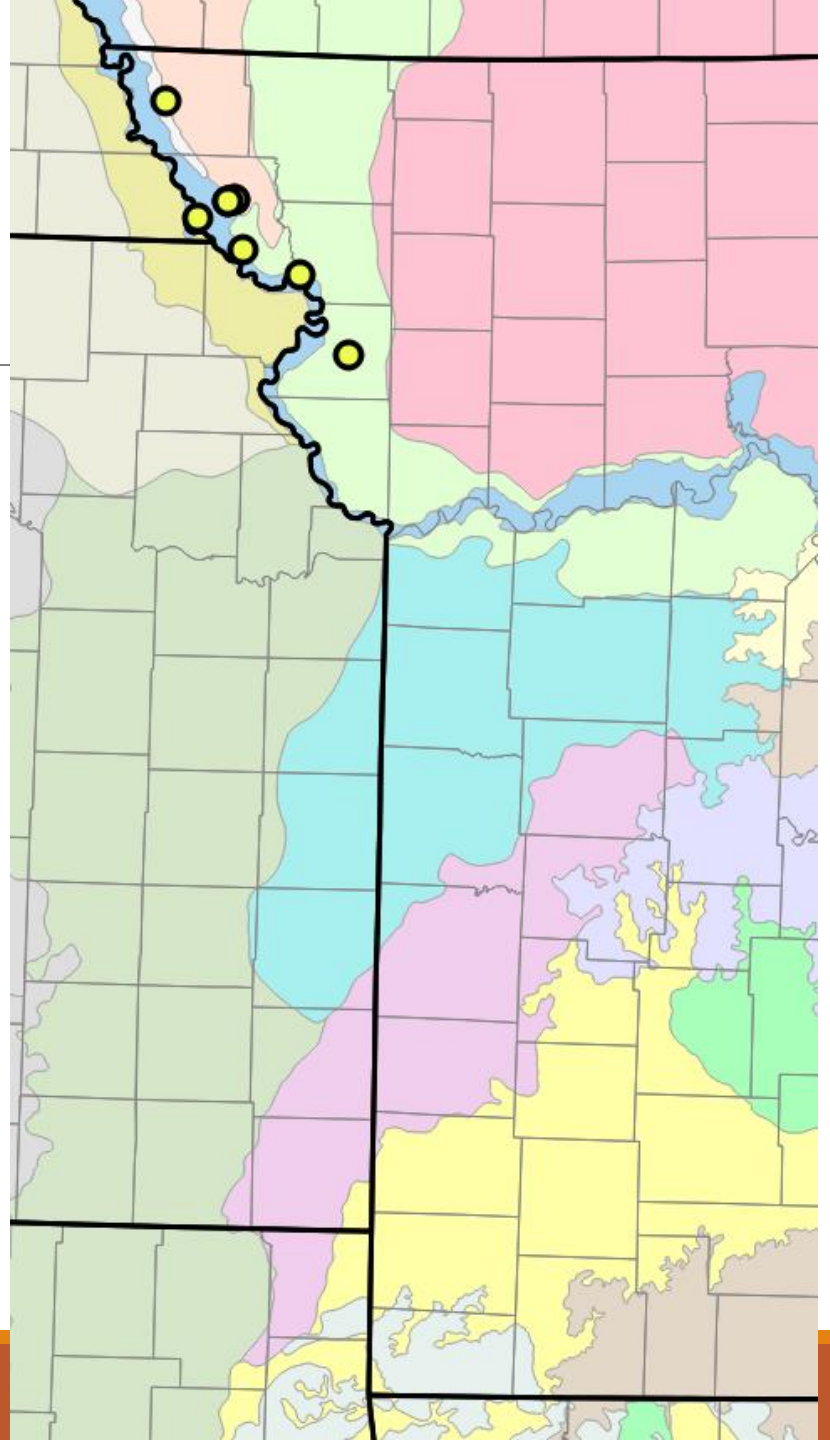
Opheodrys vernalis (Smooth Greensnake)

- This one is a mystery. It seems like it could be hanging on in some wetlands and prairies but nobody has seen it in Missouri for 50 years.
- Nearby records
  - Cass Co MO – Anderson, 1957
  - Harrison Co MO – Easterla, 1970
  - Jackson Co MO – several records up to 1933 (most unknown date) from Hurter, Anderson, and others
  - Johnson Co MO – Hurter, unknown dates
- **Assessment: Possible**



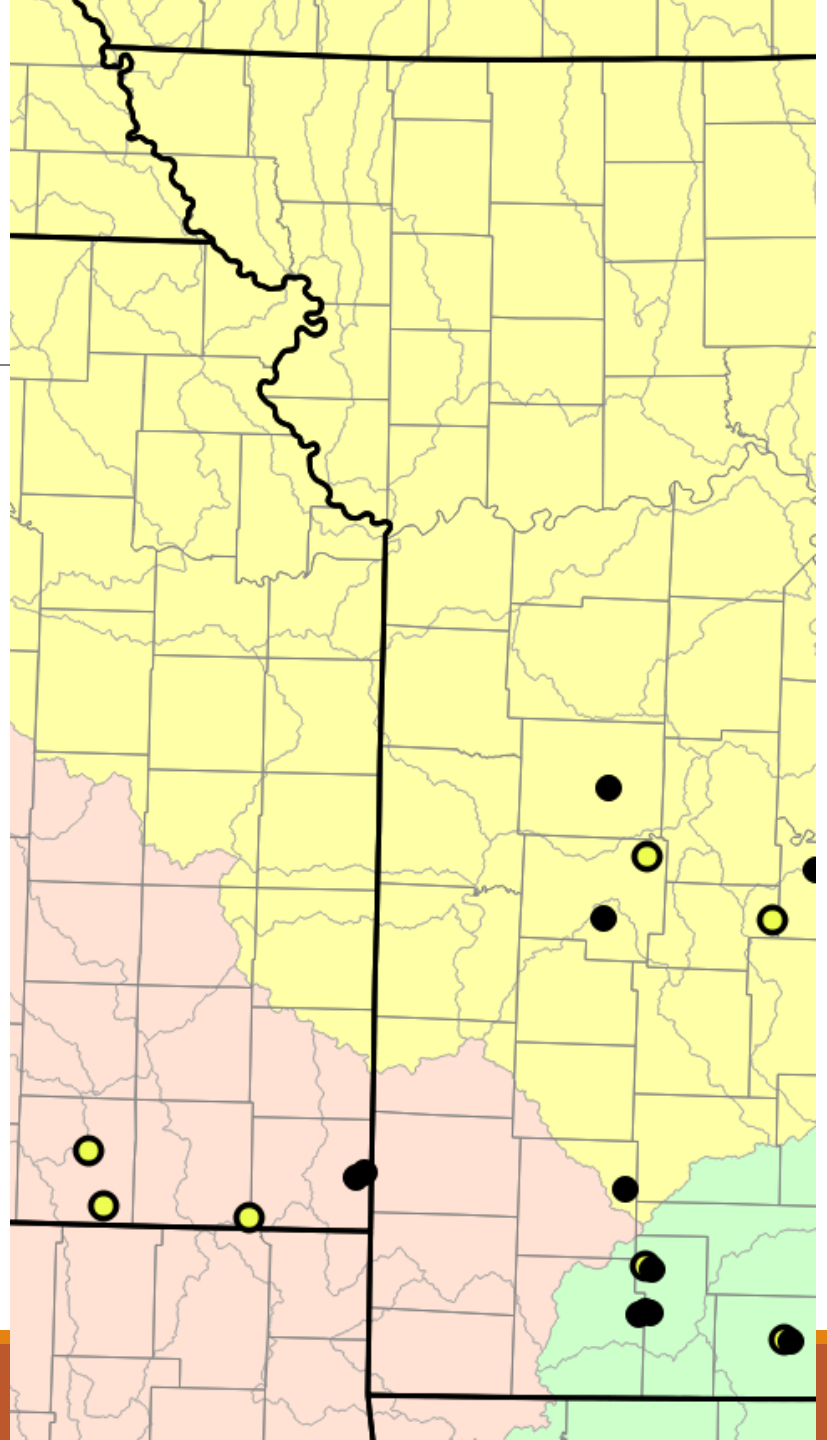
Pantherophis ramspotti (Western Foxsnake)

- Foxsnakes are northern snake species that come into Missouri along our big rivers.
- All shown records are 1980 or prior but we caught a few animals as recently as 2004 as part of an MHA meeting.
- Nearby records
  - Andrew Co MO
  - Atchison Co MO
  - Buchanan Co MO
  - Holt Co MO
- **Assessment: Likely**



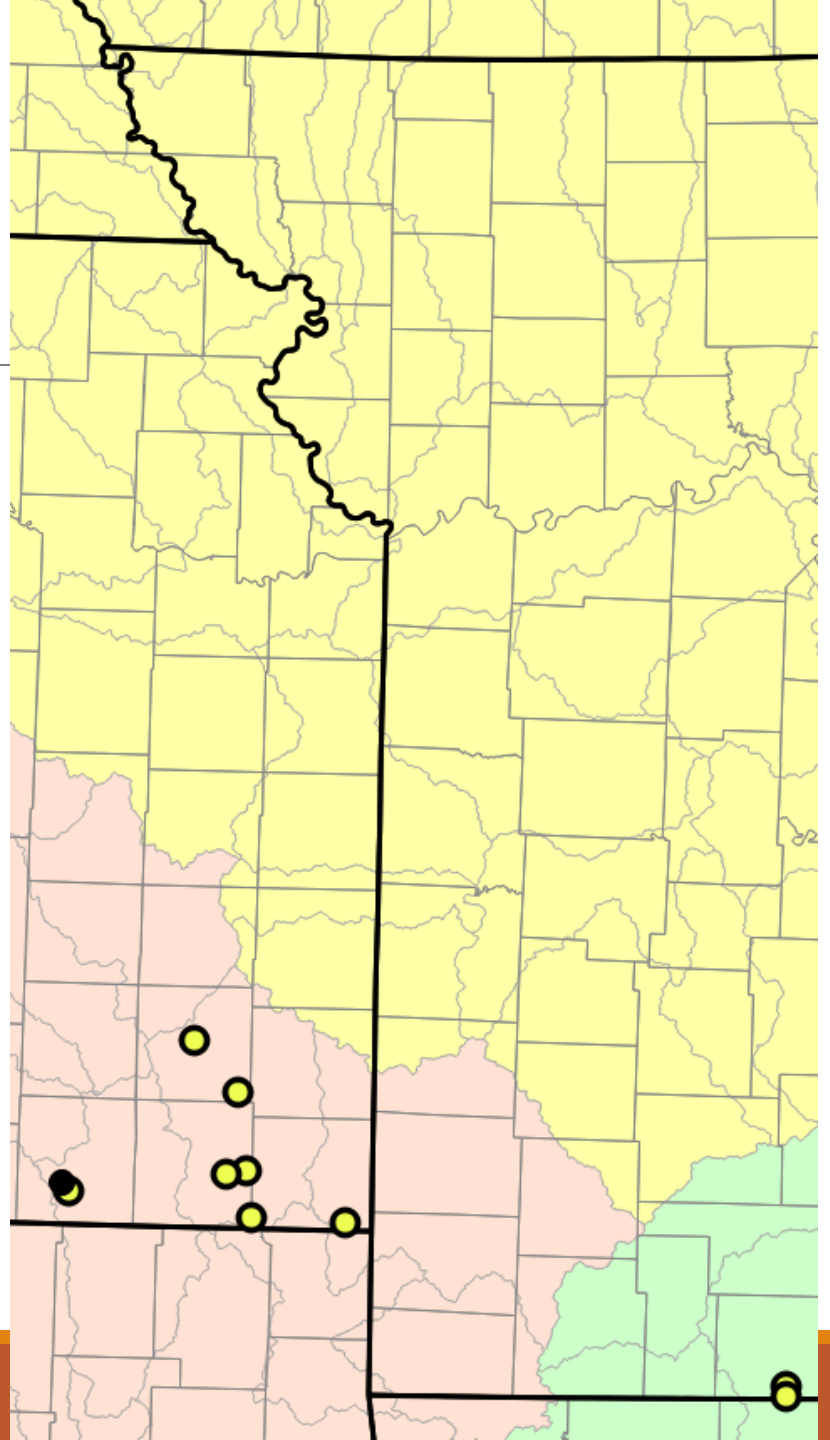
Agkistrodon piscivorus
(Western Cottonmouth)

- Scattered and sporadic in the Ozarks, mostly along clear, spring-fed streams (at least in the southern Ozarks), where they are often found in high densities.
- Apparently more terrestrial in some locations in the Ozarks than elsewhere in their range.
- Nearby records
  - Henry Co MO – 2007 record
  - Saint Clair Co MO – Osage and Sac Rivers as recently as 2009
- **Assessment: Possible**



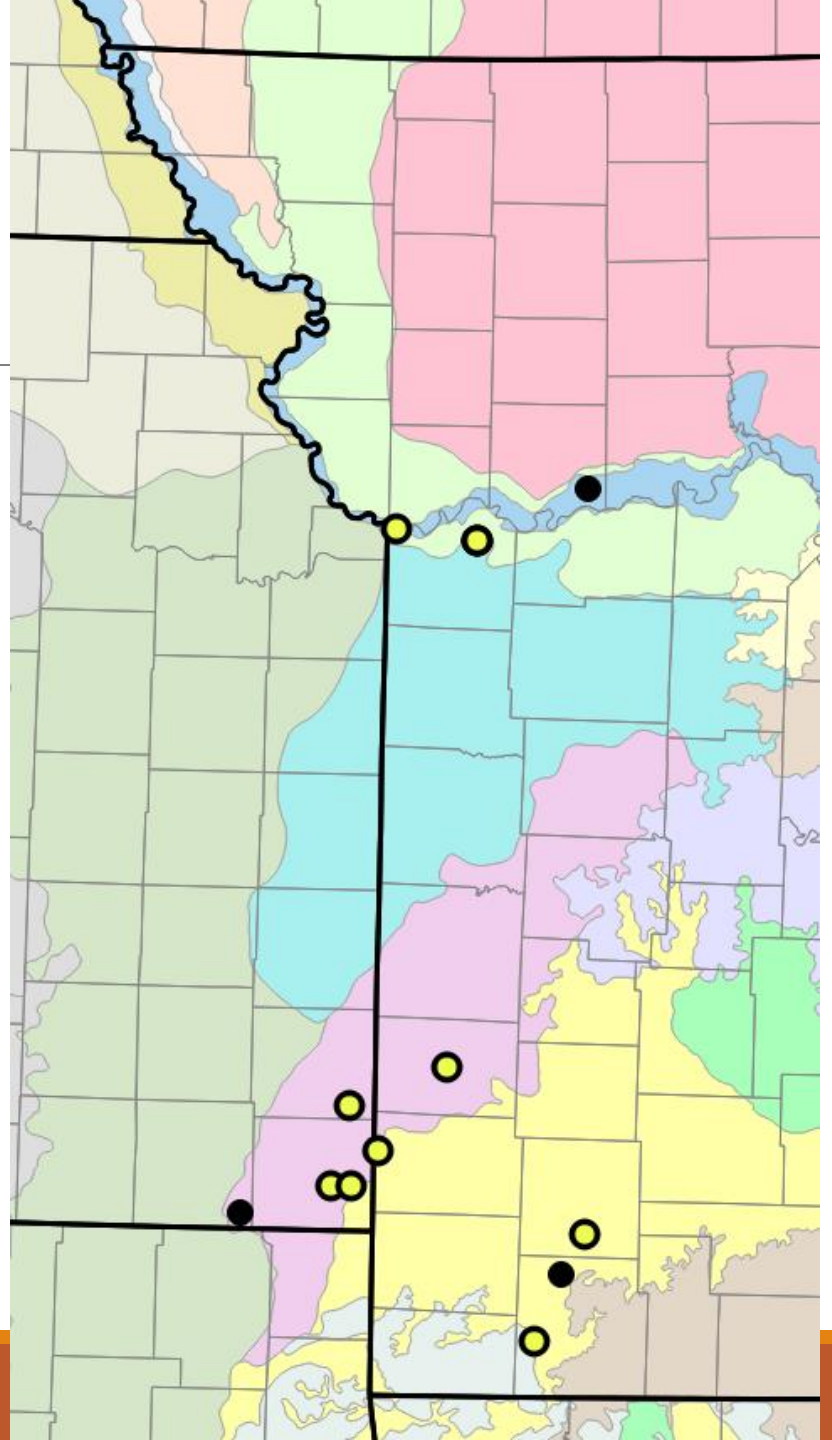
Macrochelys temminckii
(Alligator Snapping Turtle)

- Found in larger rivers and reservoirs in the southern part of Missouri (south-flowing drainages) and along the Mississippi River.
- Species of conservation concern in Missouri, and nearly impossible to encounter casually so records are uncommon.
- Reports of them being more common and possibly moving further up into larger rivers (Current, Eleven Point, Saint Francis, *etc.*).
- Almost certainly in more places than shown on this map (and some online maps erroneously show them as being found only in the eastern part of the state).
- **Assessment: Possible**



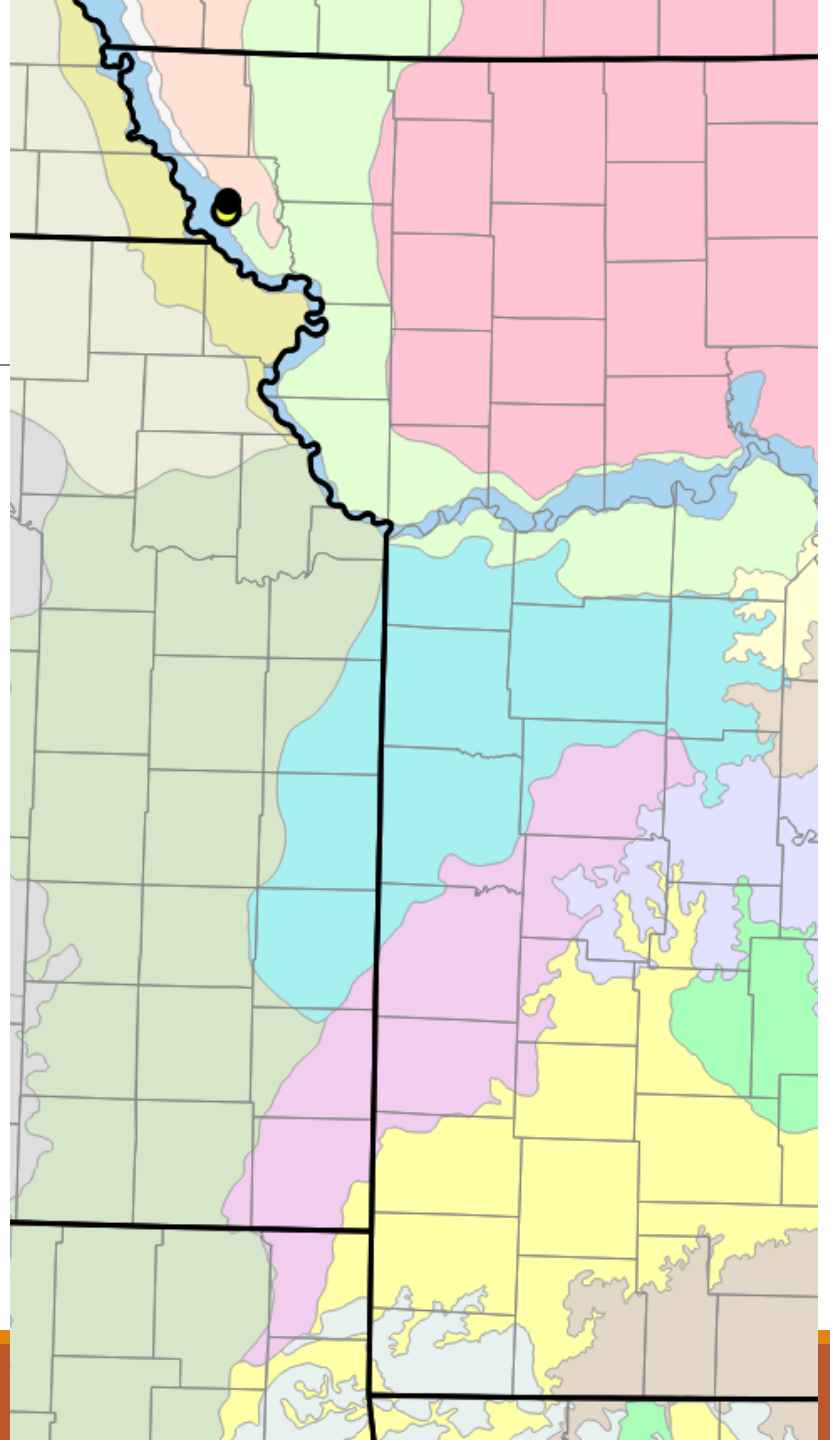
Kinosternon flavescens (Yellow Mud Turtle)

- Known from three primary areas in Missouri:
  - Along the Missouri River below Kansas City
  - Along the Mississippi River in northeast Missouri (where populations might be contiguous with Illinois populations)
  - In scattered localities in southwest Missouri and adjacent states
- Nearby records
  - Barry Co MO – 1967 and 2002
  - Barton Co MO – 1970
  - Clay Co MO – Unknown date
  - Jackson Co MO – several records, as late as 1941
  - Jasper Co MO – unknown date
  - Lawrence Co MO – 1964
  - Ray Co MO - 1989
- **Assessment: Possible**



Emydoidea blandingii
(Blanding's Turtle)

- Northern species that descends into the state along our big rivers.
- Look for it in marsh systems along the Missouri River.
- The population in Holt Co MO has been monitored and studied recently.
- Nearby records
  - Holt Co MO
- **Assessment: Possible**



Discussion

General Observations

- More recent records are more reliable than historical records for several reasons:
  - Better record-keeping and better technology
  - Better understanding of distributions so notable finds are treated differently
  - Closer in time to collections so information can be personally corroborated
- Collectors tend to collect in their own states, especially in modern times.
- Collectors tend to collect in regions of higher local diversity or where uncommon / peripheral species are found.
- In the Midwest, this tends to result in a concentration of collections in the southeast corner of states as this is where the highest diversity and peripheral southern and eastern species occur. This has been called a "shadow effect".
- Unlike collectors, wild species would presumably not be bothered by artificial political boundaries but this might not always hold true. Why?

Summary

- A few species seem ready to be discovered in Kansas:
  - Green Treefrog (*Hyla cinerea*)
  - Northern Leopard Frog (*Lithobates pipiens*)
  - Western Foxsnake (*Pantherophis ramspotti*)
- Several other species probably occur in larger numbers or in more localities than range maps currently indicate.
- Some graduate student needs to look at toads in the Ozarks!
- Biologists everywhere should pay more attention to neighboring states! And they should also pay attention to landscape and border anomalies near state boundaries.
- Please submit photo records of any western Missouri finds to:
  - https://mha.moherp.org/submit-a-record/

References

- Atlas of Missouri Amphibians and Reptiles (Daniel and Edmond 2019)
  - https://atlas.moherp.org/
- EPA for ecoregions (based on Omernik)
  - https://www.epa.gov/
- Kansas Herpetofaunal Atlas (Taggart 2019)
  - http://webapps.fhsu.edu/ksherp/
- Missouri Spatial Data Information Service (MSDIS) for base maps
  - http://msdis.missouri.edu/
- National Atlas for base maps
  - https://www.usgs.gov/core-science-systems/national-geospatial-program/national-map
- Natural Resources Conservation Service for watershed maps
  - https://datagateway.nrcs.usda.gov/
- United States Geological Survey (USGS) for rivers and streams maps
  - https://pubs.er.usgs.gov/

Questions?

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