Texas Freshwater Mussels of Conservation Concern

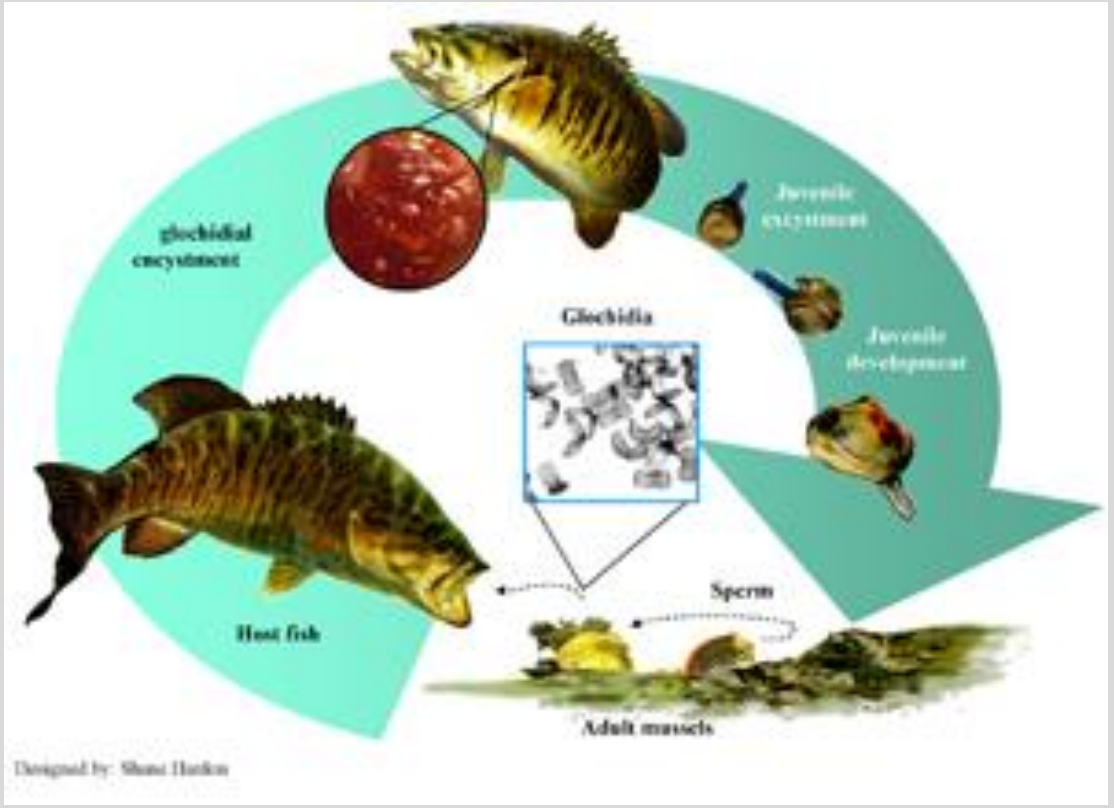
Upper Neches Basin Clean Rivers Program
Steering Committee Meeting

JUNE 17, 2019

"TO PROTECT AND RECOVER IMPERILED SPECIES AND THE ECOSYSTEMS ON WHICH THEY DEPEND."

Freshwater mussel life history

- Females brood developing eggs, embryos, and early glochidia in gill pouches
- Released glochidia encyst to the gills, face, or fins of the host fish
- After development, juveniles are released from the host
- Juveniles must settle on appropriate substrate



Triangle pigtoe
Fusconaia lananensis

- Petitioned to list in 2007, substantial 90-day finding published in 2009
- Difficult to distinguish from Texas pigtoe based shell morphology
- Genetic studies determined triangle pigtoe is a synonym of Texas pigtoe (*Fusconaia askewi*)
- Williams et al. 2017 revised list of freshwater mussels placed both in synonymy with *Fusconaia chunii*, adopting the common name Texas pigtoe. Confirmed by Pieri et al. 2018 => listing not warranted
- Likely "not warranted" determination due to taxonomic change to Texas pigtoe

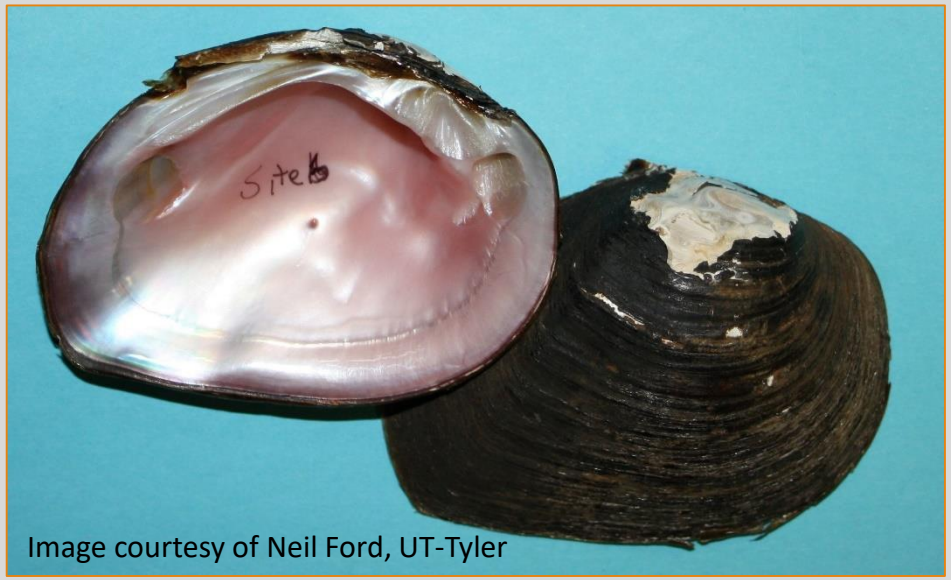


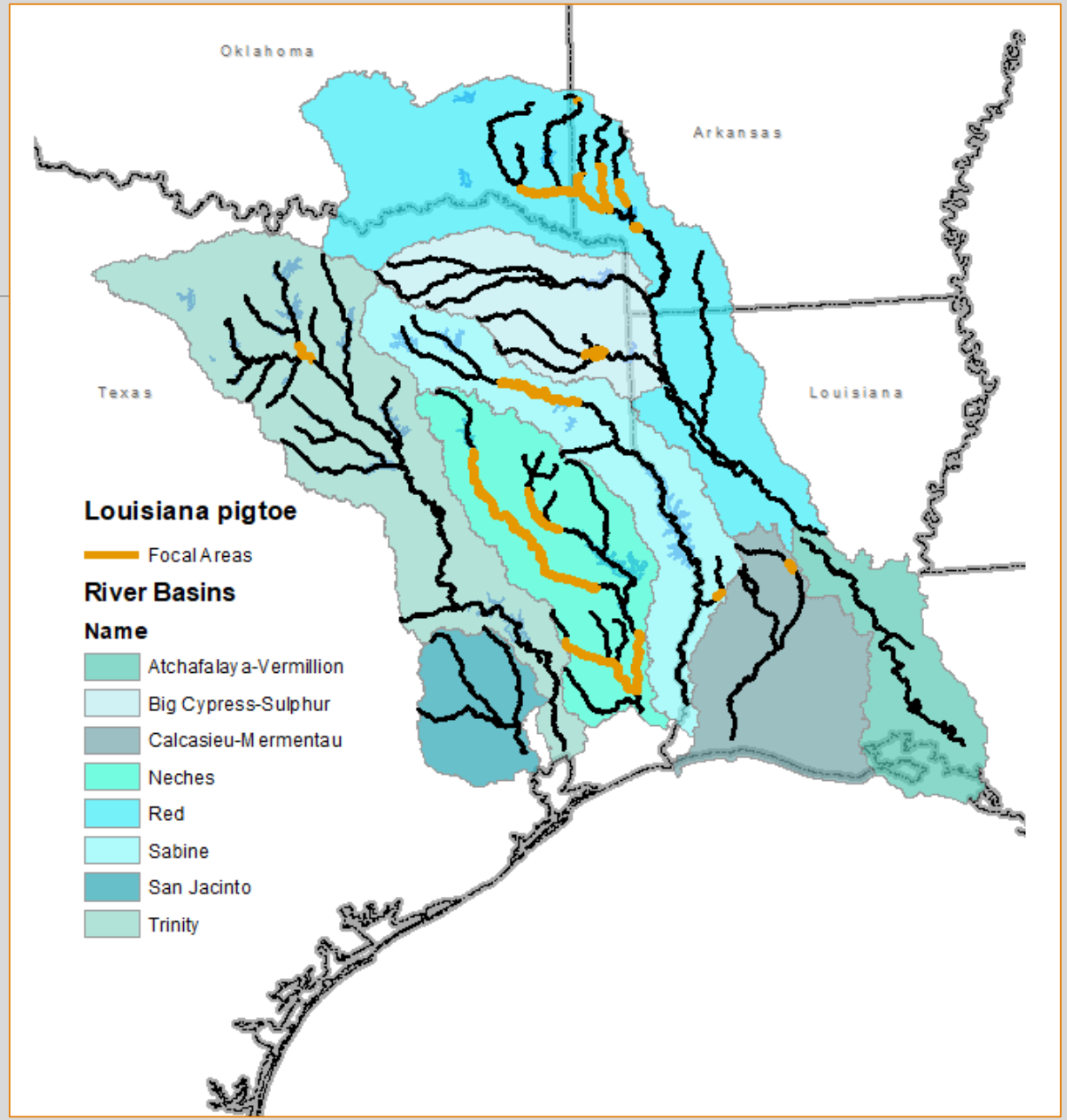
Image courtesy of Neil Ford, UT-Tyler

Louisiana pigtoe
Pleurobema riddellii

- Petitioned to list in 2007, substantial 90-day finding published in 2009
- Host fish: red shiner, blacktail shiner, bullhead minnow
- Stream flow: low to moderate flows (0.3 – 1.4 m/s)
- Substrate: riffles of cobble and rock; sand, gravel, cobble, woody debris
- SSA will be used to support the 12-month finding

Louisiana pigtoe
Historical and Current Distribution

- Endemic to 8 River Basins in AR, LA, OK, and TX
- 13 Focal Areas:
  - Trinity (1): Upper Trinity
  - Neches (3): Neches, Angelina, and Lower Neches/Village CR
  - Sabine (2): Sabine and Anacoco Bayou
  - Big Cypress/Sulphur (1): Big Cypress/Little Cypress
  - Red (5): Mountain FK, Little River/Rolling FK, Cossatot, Saline, and Lower Little River
  - Calcasieu-Mermentau (1): Calcasieu



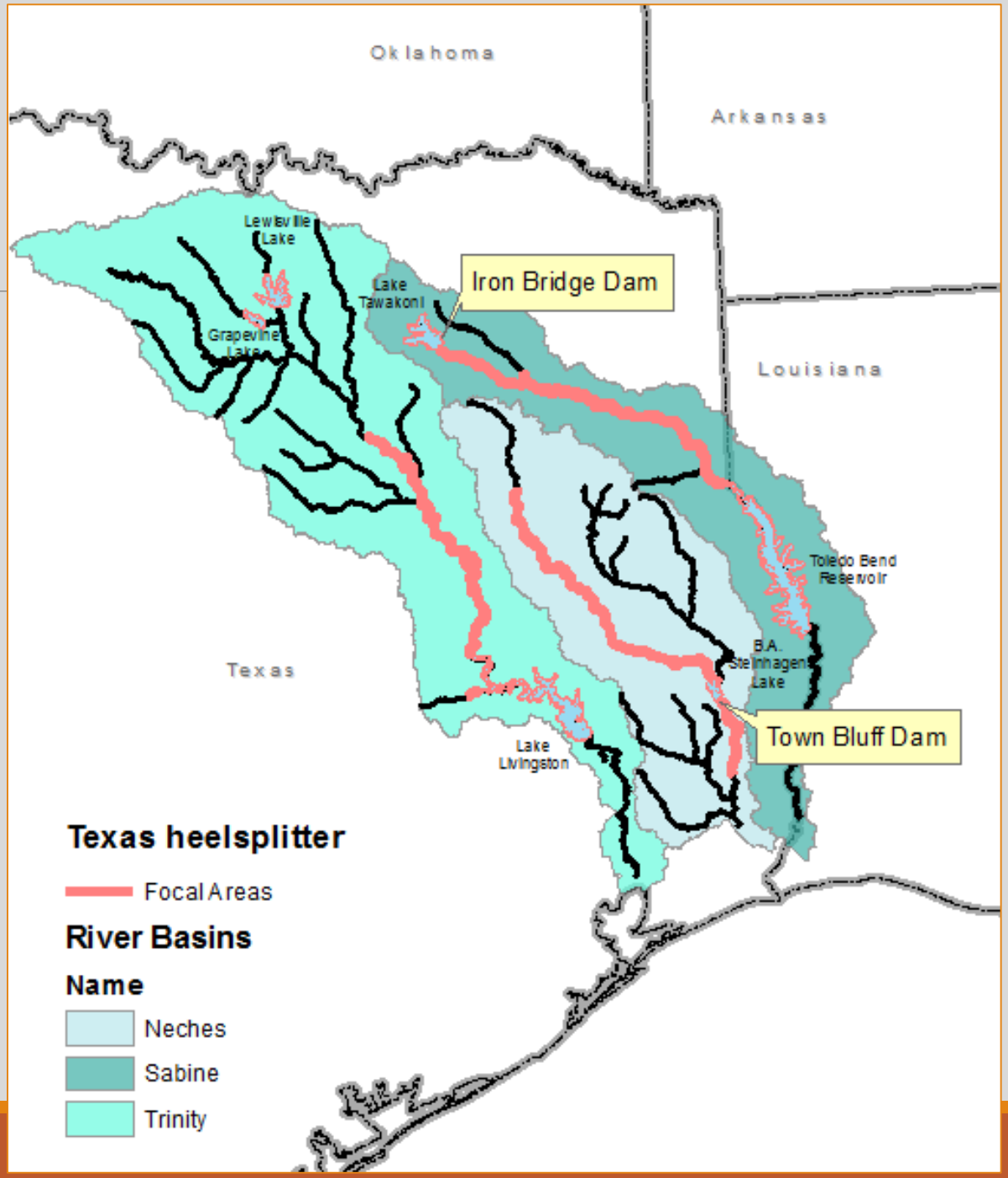
Texas heelsplitter
Potamilus amphichaenus

- Petitioned to list in 2008, substantial 90-day finding published in 2009
- Host fish: freshwater drum
- Stream flow: low to moderate flows, associated with deeper pools and backwater areas; can tolerate impoundments
- Substrate: mud, sand, finer gravels, and mixtures of those; sometimes associated with fallen timber
- SSA will be used to support the 12-month finding

Texas heelsplitter

Historical and Current Distribution

- Endemic to Trinity, Neches, and Sabine River Basins in TX
- Seven Focal Areas:
  - Trinity:
    - Lewisville Lake
    - Grapevine Lake
    - Trinity River/Lake Livingston
  - Neches:
    - Neches River/B.A. Steinhagen Reservoir
    - Lower Neches River
  - Sabine:
    - Lake Tawakoni
    - Sabine River/Toledo Bend Reservoir



Threats

- **Habitat Modification**
  - **Altered hydrology** - anthropogenic changes to flow regimes, increasing demands for water (e.g. pumping, diversions), decreased baseflow (e.g., stream drying), scouring from high-flow runoff events
  - **Siltation** – erosion causes increased movement and deposition of fine sediment; unstable substrate, streambank collapse; sedimentation can bury & smother mussel beds
  - **Barriers to fish movement** - dams, diversions, reservoirs, crossings, fragmentation, local extirpations of host fishes?
  - **Pollution** – point and non-point sources degrade water quality; cause changes to basic water chemistry (DO, salinity, temp) and increased contaminant input. Can cause acute and chronic toxicity (e.g., deposit Persistent Bioaccumulative and Toxic (PBT) Chemicals in sediment. Influence of wastewater on WQ is > during low flows
  - **Climate change** – more extreme weather events; droughts, floods; hotter and drier future
- **Invasive species**/Predation/Collection, Disease - interactions with other species, native and exotic
- Threats can impact mussels directly or fish hosts

The Anthro-Eco Relationship

1. Setting / Land Use

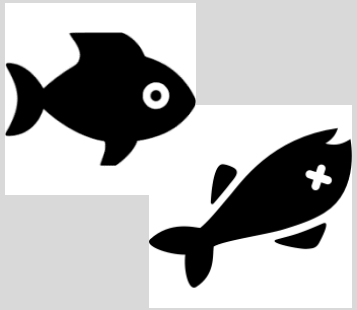
- Industrial / Commercial
- Agriculture
- Urban
- Forest

2. Stressors (% change from historical)

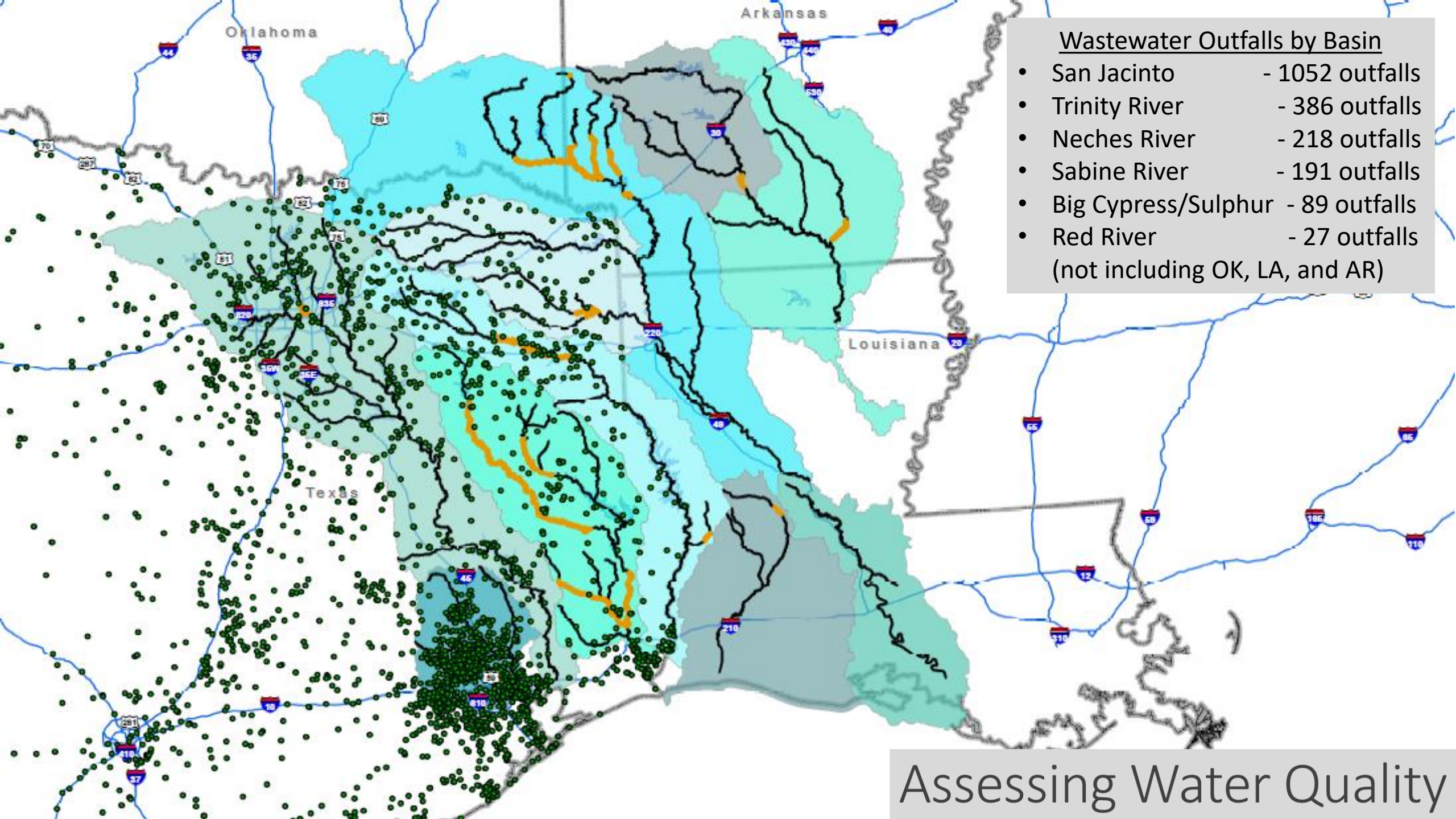
- Contaminants
- Nutrients
- Sediments
- Hydrology
- Habitat
- Climate Change

3. Ecology (Community Structure)

- Algae
- Inverts
- Fish



- Stream function and health (Box 3) are a reflection of stressors (Box 2) that result from various activities and land uses within the watershed (Box 1).
- **Remaining populations for rare mussels are more likely to be found in undisturbed watersheds with fewer stressors (e.g., Neches)**
- We know much less about the toxicity of multiple stressors
- Climate change and hotter temps will likely translate into 1) less dilution for point source pollutants and 2) warmer temperatures causing an increase in toxicity for many pollutants (many contaminants become more toxic at higher temperatures and heat stress alone makes organisms more vulnerable to other stressors)



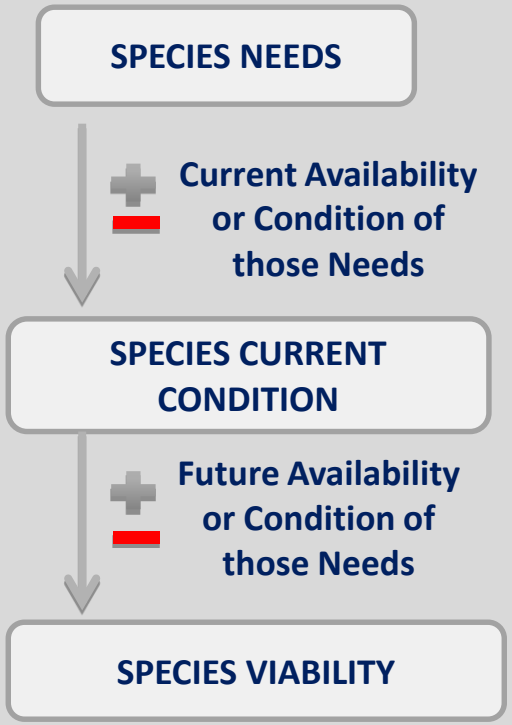
Wastewater Outfalls by Basin

- San Jacinto - 1052 outfalls
- Trinity River - 386 outfalls
- Neches River - 218 outfalls
- Sabine River - 191 outfalls
- Big Cypress/Sulphur - 89 outfalls
- Red River - 27 outfalls

(not including OK, LA, and AR)

Assessing Water Quality

Species Status Assessment Framework (SSA)

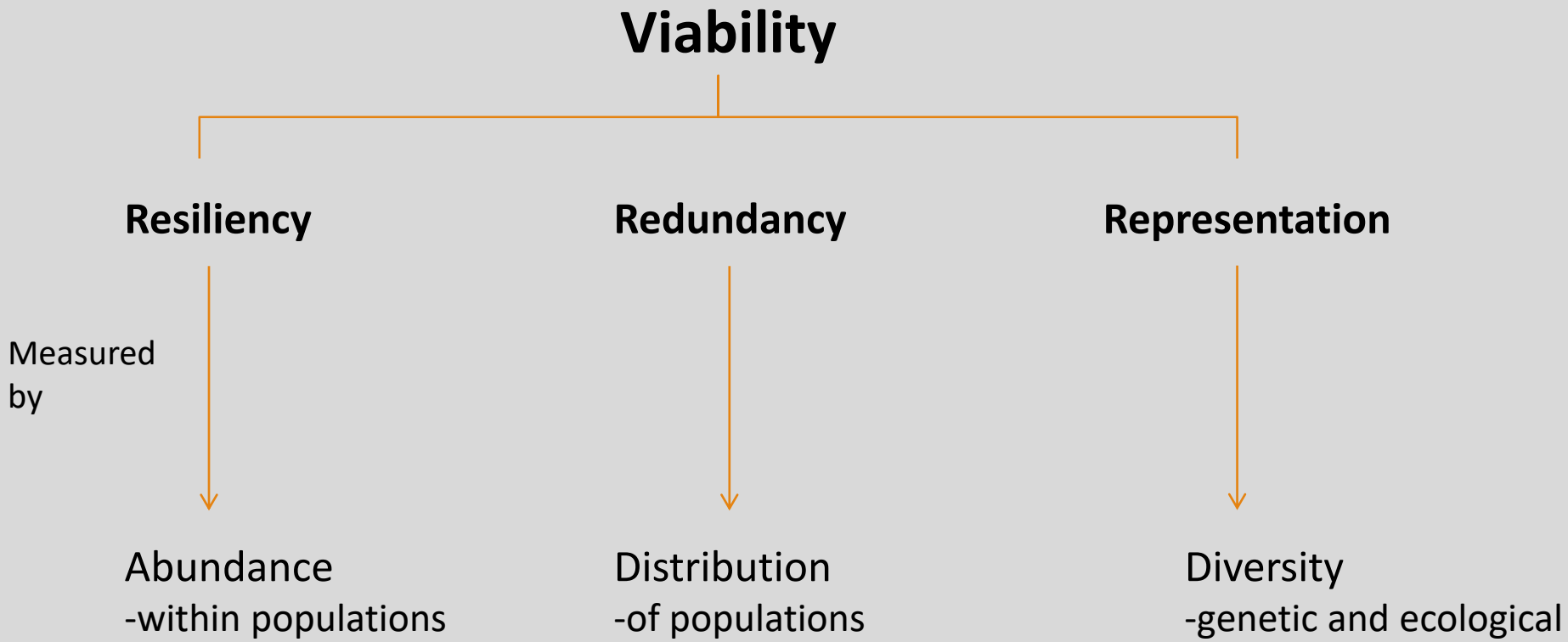


-The SSA Framework is a different way of thinking about biological status assessments under the Endangered Species Act (ESA).

-Its purpose is to describe the viability of species in a way that supports our ESA decisions.

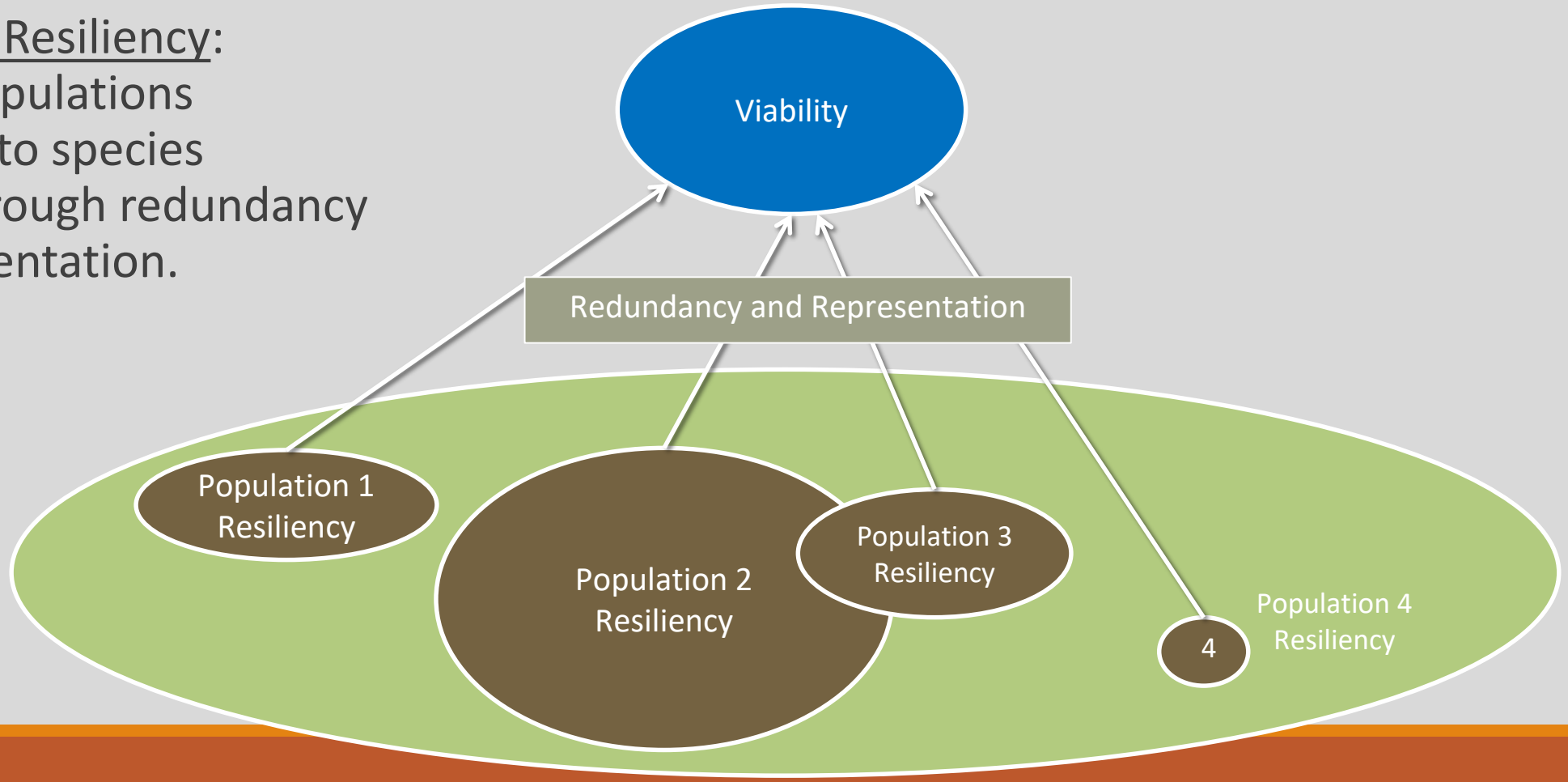
-Viability is defined as the ability of a species to sustain populations in the wild over time.

Viability is Measured using 3 Rs



How Populations Influence Species Viability

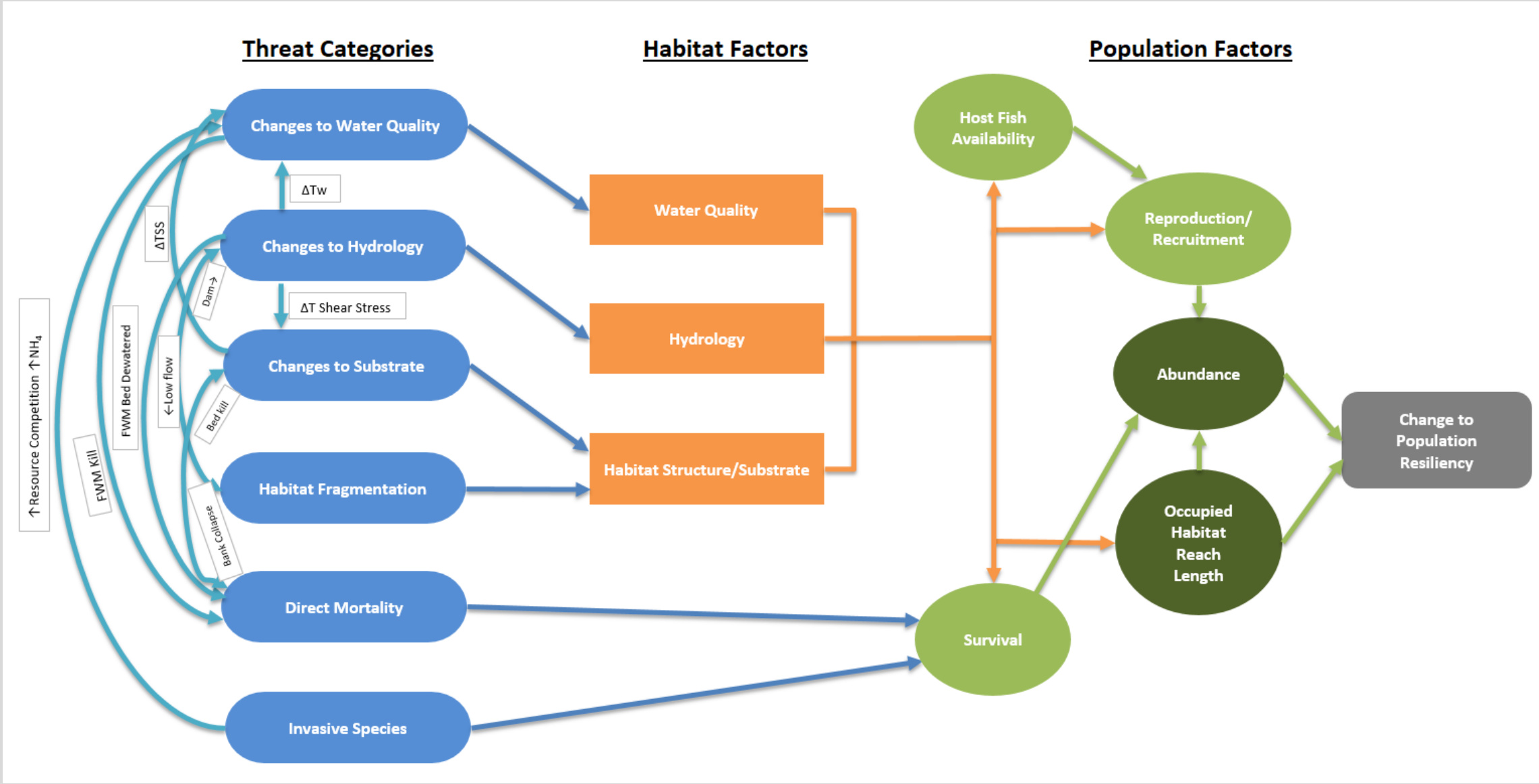
Population Resiliency: resilient populations contribute to species viability through redundancy and representation.



How we determine Species Status

- **Best available science**
- **Start with notice and collection & review of scientific literature –** collect all available information on species (e.g., life history, distribution, toxicity) from academia, state and federal agencies, and other credible sources
- **Watershed characteristics** – urban or rural, population, land use (online NLCD database)
- **WQ**
  - TWDB and River Authorities – State Water Plan and Clean River Program reports
  - TCEQ online database (i.e., webmapper with location of NPDES permits, 303 impaired waters, legacy pollution, etc)
- **Hydrology**
  - USGS Flow data – what are characteristics of river, avg. volume of flows, has flow ever ceased (drought)
  - Climate Change – Precipitation Runoff Modeling System (PRMS) model – USGS model based on 13 international climate change models - estimates % change from historical hydrologic conditions based on 52 streamflow metrics (e.g., annual average 7-day minimum flow, summer minimum base flows)

Effects Pathway



Model Output

Determine condition of focal populations (high, moderate, low, functionally extirpated) for 2 future scenarios at 3 time intervals (6 Model outcomes)

Future Scenario	RCP*	Stressors
1 - Continuation of current trends	4.5	Current conditions continue
2 – Increase in stressors	8.5	Additional Stressors plus high carbon emission scenario
All scenarios projected out to 10, 25, and 50-yrs		

*RCP = Representative Concentration Pathway Scenario

Timeline:

Begin SSA process, assemble Team, notify public, and convene expert meeting	Spring 2018
SSA report for Peer and Partner Review	Summer 2019
Recommendation Meeting	Fall 2019
12-month finding	December 2019 (or later)
If not warranted, shorter horizon with FR notice	
If warranted (T or E), longer horizon with development of Critical Habitat, followed by proposed rule in FR	
12 months later issue final rule	

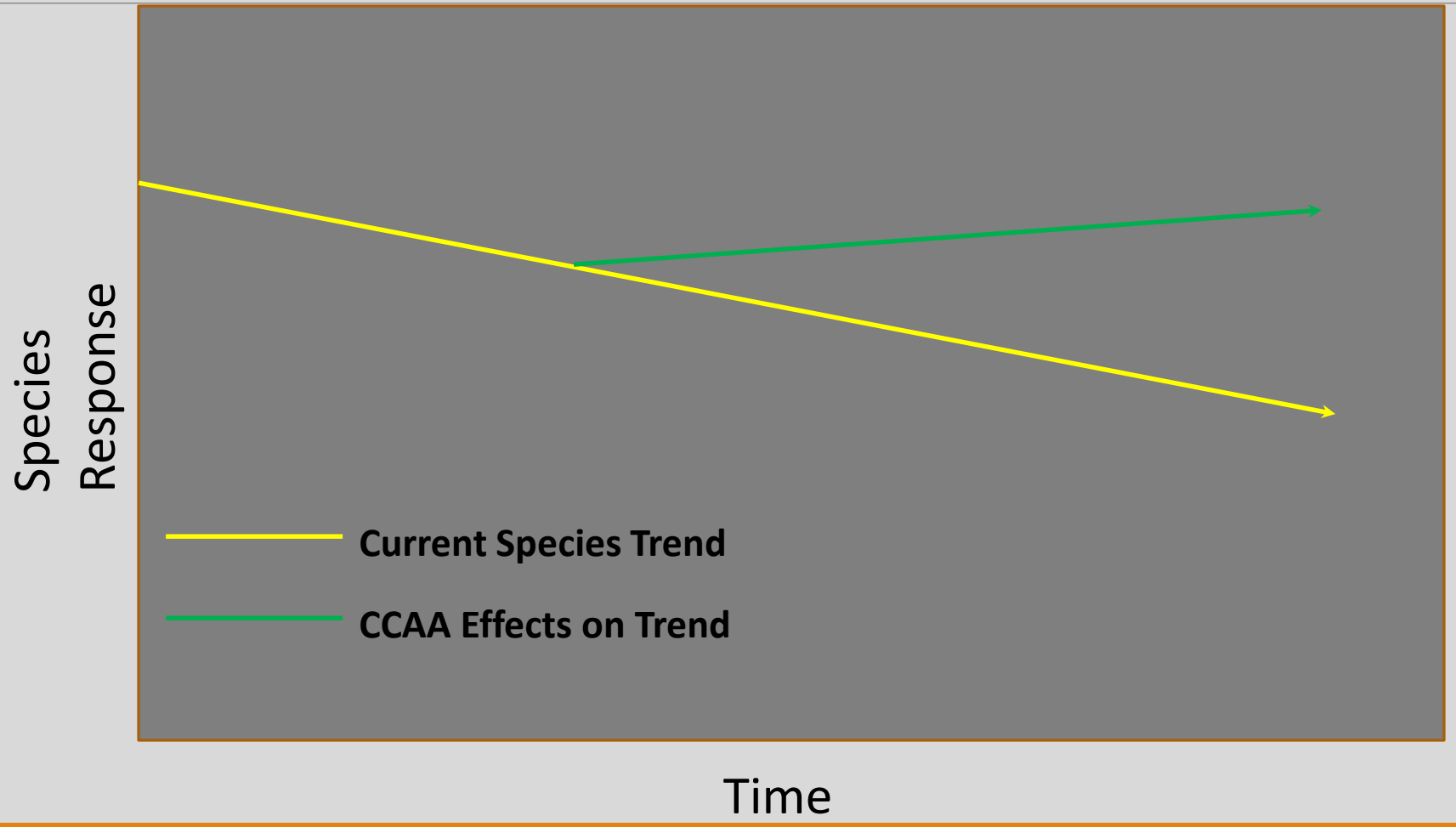
Voluntary Conservation Programs

- Candidate Conservation Agreement (CCA)
- Candidate Conservation Agreement with Assurances (CCAA); permit holder can issue certificates of inclusion to private landowners
- Safe Harbor Agreement (SHA)
- Partners for Fish and Wildlife Program (PFW-FWS)
- Working Lands for Wildlife (NRCS)
- Landowner Incentive Program (TPWD)

What are CCAAs and what is their purpose?

- Voluntary agreements with non-Federal property owners who want to help conserve candidate or other at-risk species
- Provide assurances and incidental take through an enhancement of survival permit
- Goal is to provide net conservation benefit by addressing threats to species on enrolled properties, and in some cases, preclude or influence a listing decision

CCAA Concept



CCAA Benefits

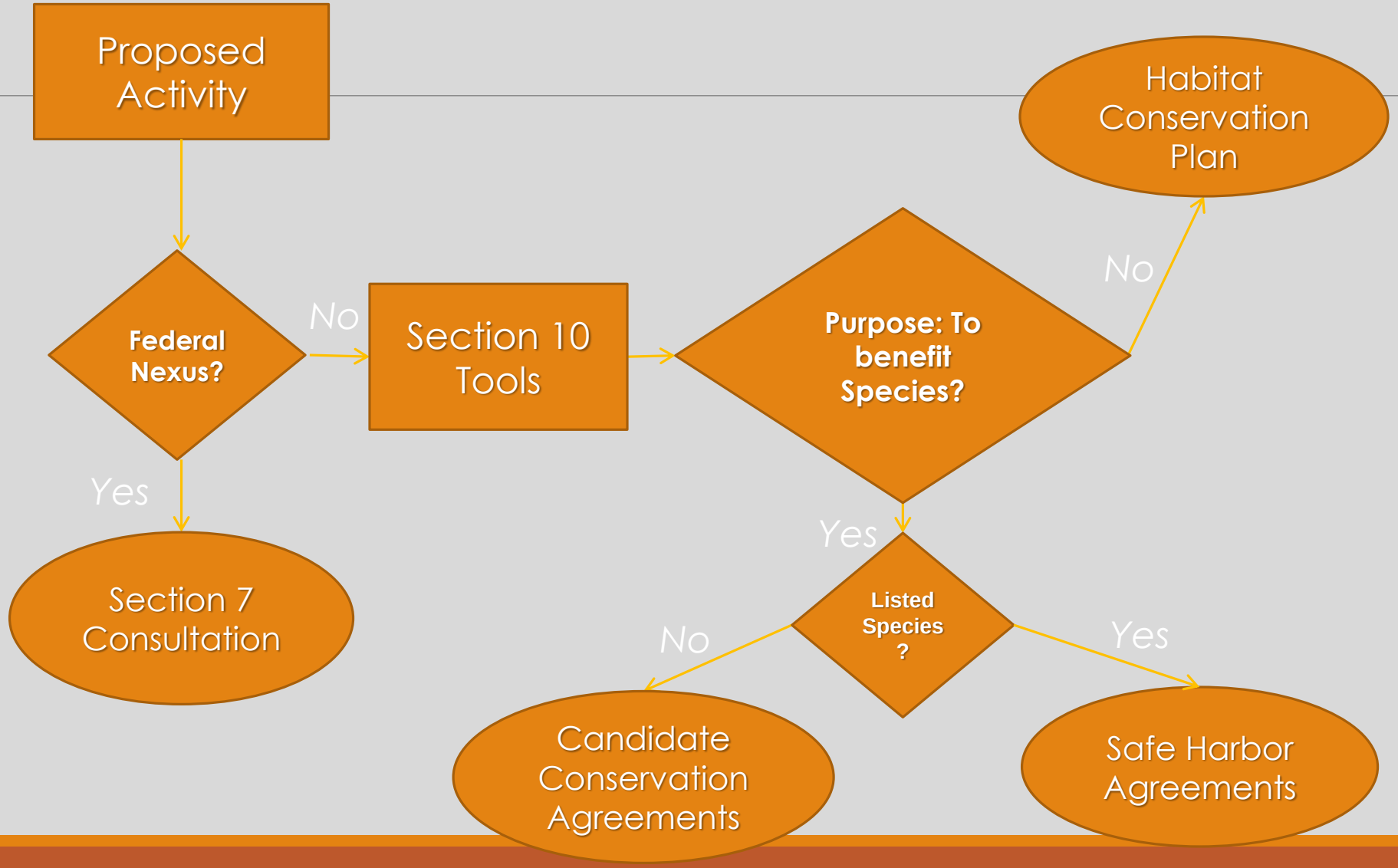
If listing is warranted, regulatory landscape will change

- CCAAs provide
  - regulatory certainty and streamline environmental compliance for future projects
  - Enhancement of Survival Permit provides **Incidental take coverage** for ongoing activities
  - **assurances** (no additional requirements or conservation measures beyond those listed in the CCAA if species is listed)
- Conservation programs (outlined in CCAA) are considered in listing decisions
- Conservation partnerships facilitate good environmental stewardship and protect natural resources

CCAA Process

1. Species Needs
2. Species Threats
3. Threats w/in applicants Control to Address
4. Dev Conservation Strategy with Cons Measures
5. Feedback Mechanism (is strategy working? e.g. are #'s stable or increasing and if not, can applicant address?)
6. Change as needed (i.e., adaptive mgmt) over period of agreement (10, 15, 20 yrs)

Conservation Tools Once Listed



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Questions, comments, or other feedback?

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