A Multi-Disciplinary Approach to Saving One of the Last Great Wild Rivers in Texas

Sarah Robertson

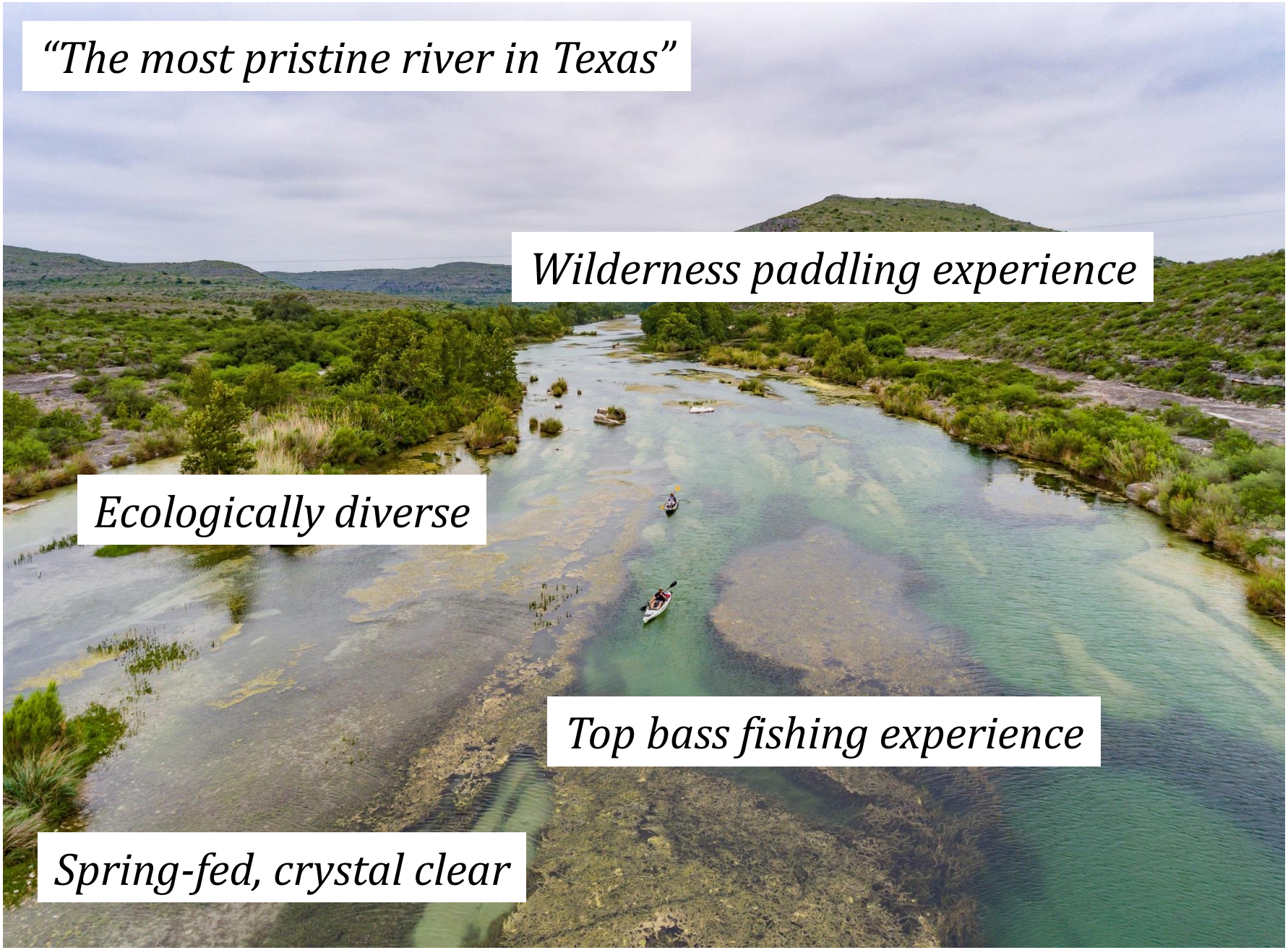
TEXAS PARKS & WILDLIFE

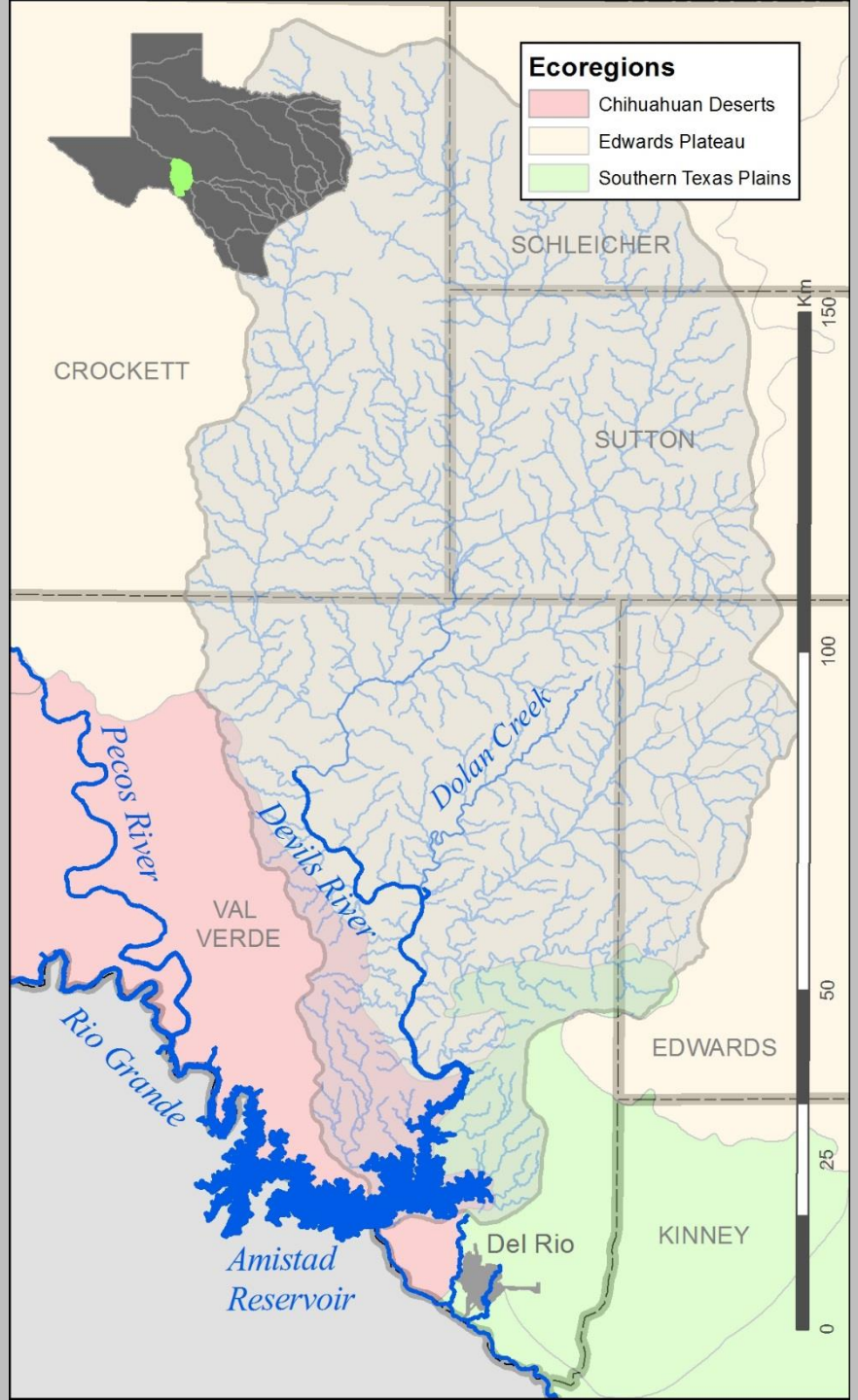
Have you ever been to the Devils River?

A. Yes

B. No

The Devils River


“The most pristine river in Texas”
Wilderness paddling experience
Ecologically diverse
Top bass fishing experience
Spring-fed, crystal clear



Devils River

- 90 miles total, with 60 perennially flowing miles
- 197,000 acre-ft/year
- Numerous springs along its length
- Important water source for Lake Amistad and the Lower Rio Grande Valley
- Occurs at the nexus of three ecoregions

How many state threatened or endangered species call the Devils River home?

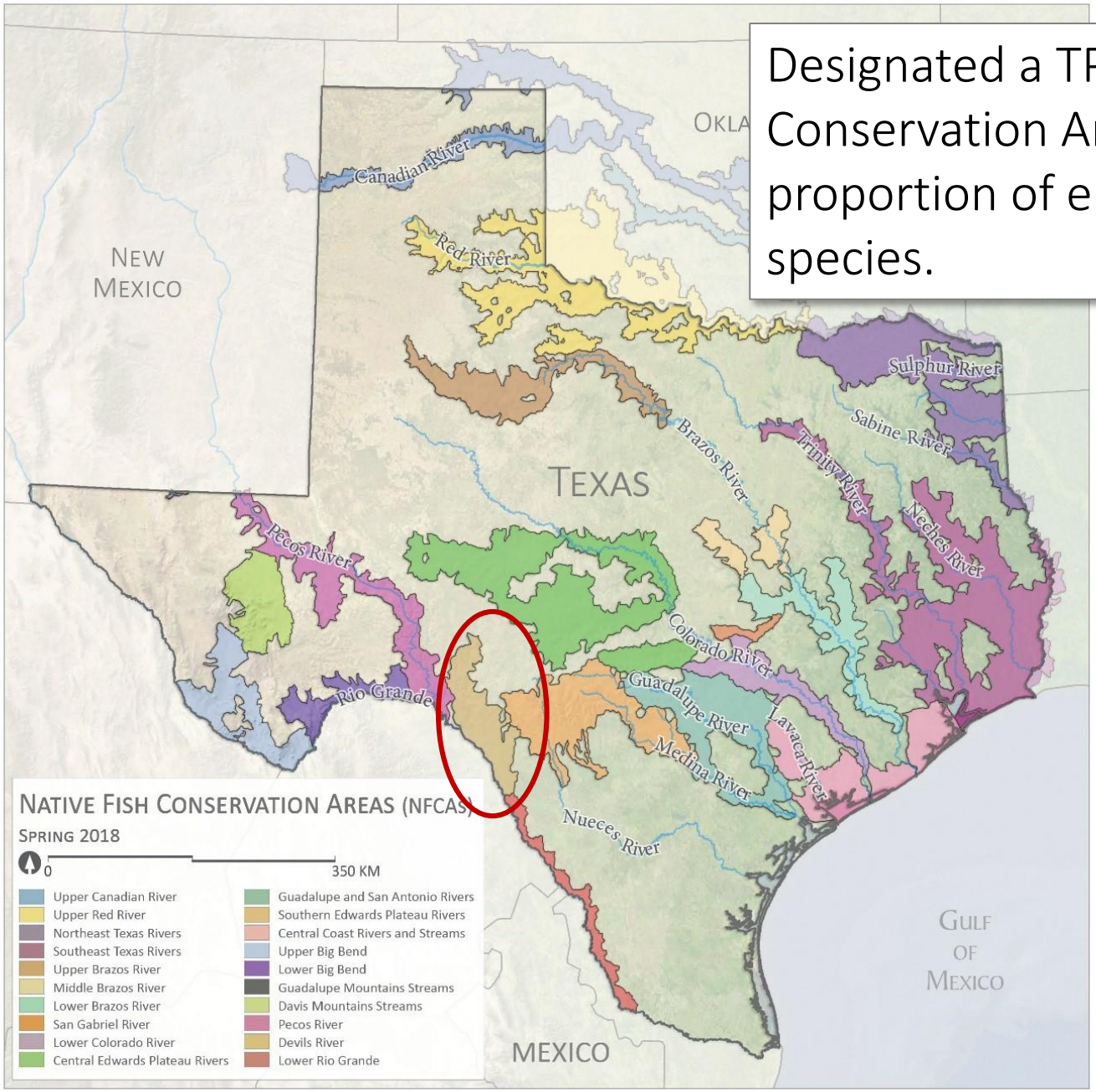
A. 1

B. 2

C. 3

D. 4

E. Over 5



Designated a TPWD Native Fish Conservation Area due to high proportion of endemic fish species.

Fishes of the Devils River

Longnose Gar
Lepisosteus osseus

Spotted Gar
Lepisosteus oculatus

Central Stoneroller
Campostoma anomalum

Blacktail Shiner
Cyprinella venusta

Proserpine Shiner
Cyprinella proserpina

Manantial Roundnose Minnow
Dionda argentosa

Devils River Minnow
Dionda diaboli

Texas Shiner
Notropis amabilis

Sand Shiner
Notropis stramineus

Bullhead Minnow
Pimephales vigilax

Gizzard Shad
Dorosoma cepedianum

Common Carp
Cyprinus carpio

River Carpsucker
Carpoides carpio

Gray Redhorse
Moxostoma congestum

Mexican tetra
Astyanax mexicanus

Rio Grande Darter
Etheostoma grahami

Headwater Catfish
Ictalurus lupus

Channel Catfish
Ictalurus punctatus

Flathead Catfish
Pylodictus olivarus

Mosquitofish
Gambusia sp.

Sailfin Molly
Poecilia latipinna

Conchos Pupfish
Cyprinodon eximius

Green Sunfish
Lepomis cyanellus

Longear Sunfish
Lepomis megalotis

Redear Sunfish
Lepomis microlophus

Bluegill
Lepomis macrochirus

Redbreast Sunfish
Lepomis auritus

Redspotted Sunfish
Lepomis miniatus

Largemouth Bass
Micropterus salmoides

Smallmouth Bass
Micropterus dolomieu

Blue Tilapia
Oreochromis aureus

Rio Grande Cichlid
Herichthys cyanoguttatus

Photos and layout by River Studies Program- Texas Parks and Wildlife Dept. and the Fishes of Texas Project

Devils River
Species of Greatest Conservation Need

Devils River
State-Threatened Species

Devils River
Federally-Listed Species

Other Devils River
Threatened, Endangered Species

Other Notable Species

Monarch Butterfly Migration Path

One of the largest Mexican Free-tail Bat Colonies at Fern Cave

Threats

What factors are threatening the future of the Devils River?

A. Groundwater pumping

B. Invasive species

C. Unsustainable recreation

D. All of the above

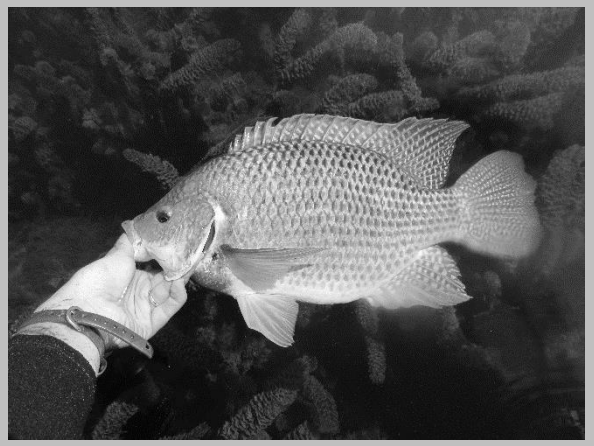
Threats to the Devils River

Invasive Species

Habitat Loss

Poor stewardship

Threats to the Devils River



Invasive Species

Habitat Loss

Poor stewardship

Threats to the Devils River

Invasive Species

Habitat Loss

Poor stewardship

Threats to the Devils River

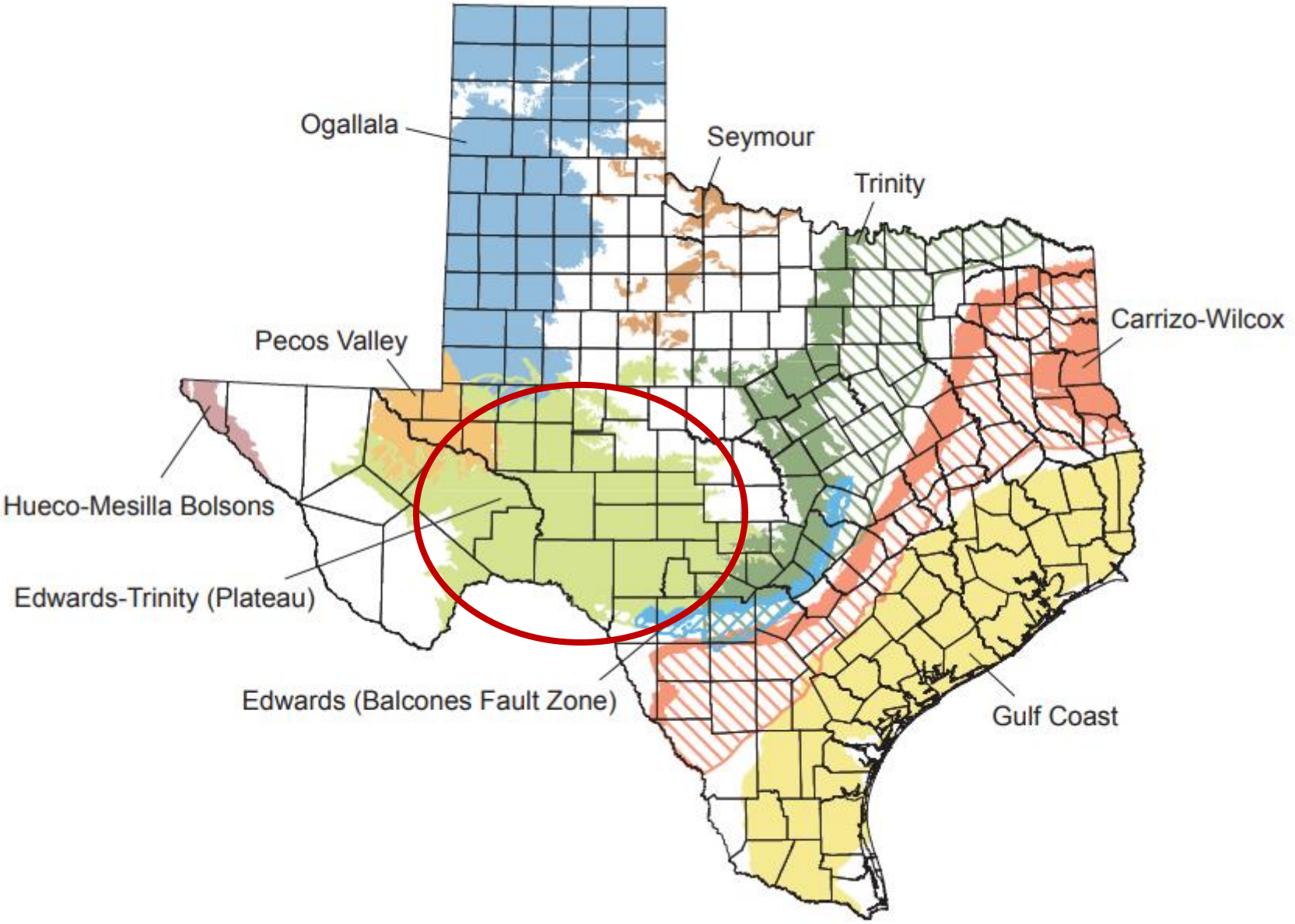
The most immediate and least understood threat to the river is large-scale groundwater pumping.

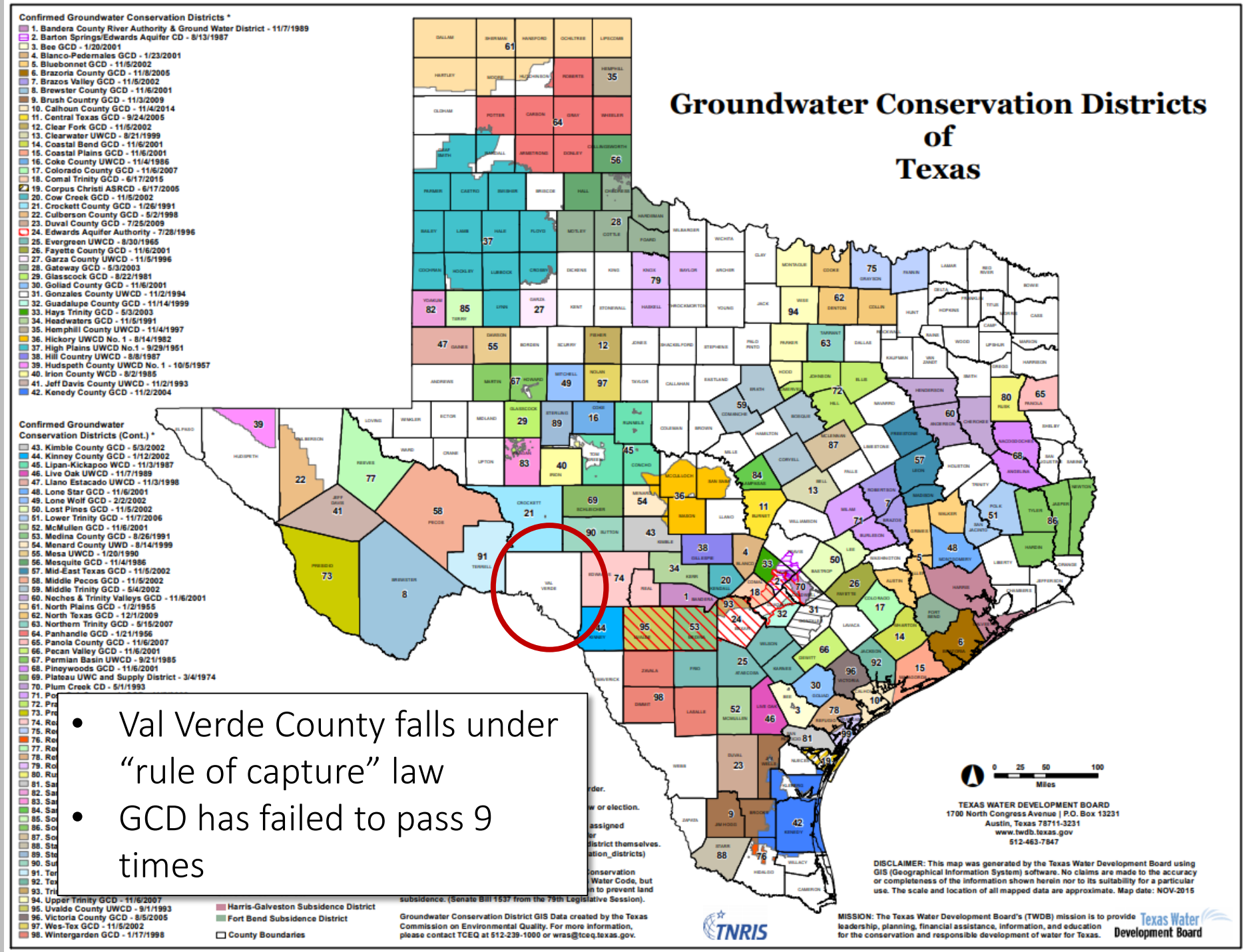
What aquifer provides baseflows to the Devils River?

A. Carrizo-Wilcox

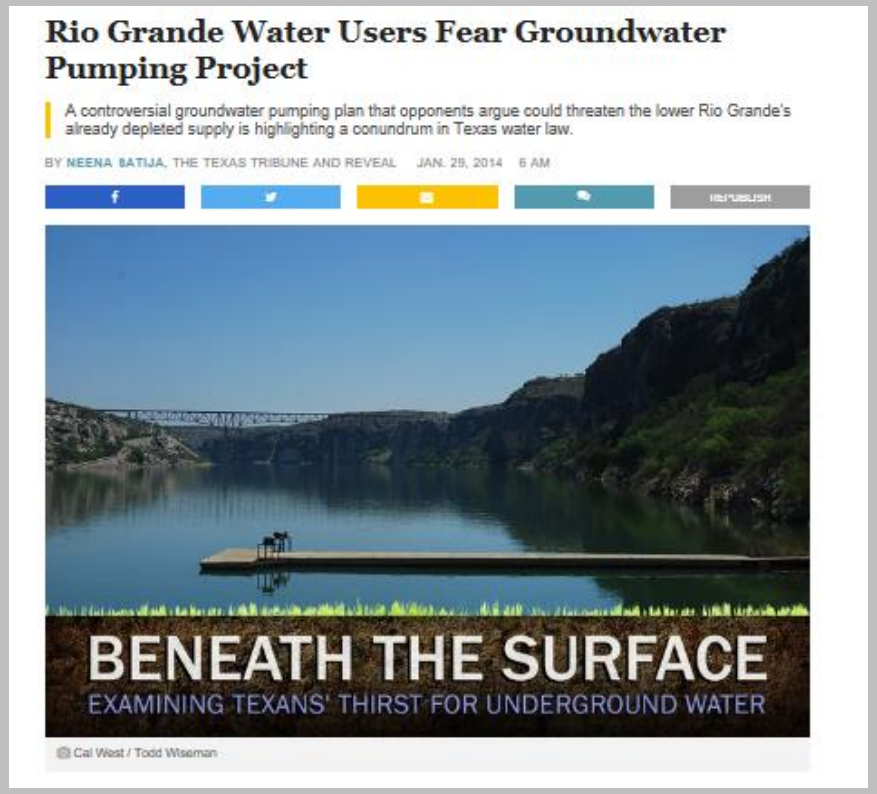
B. Edwards Trinity

C. Ogallala


Ogallala
Seymour
Trinity
Carrizo-Wilcox
Pecos Valley
Hueco-Mesilla Bolsons
Edwards-Trinity (Plateau)
Edwards (Balcones Fault Zone)
Gulf Coast



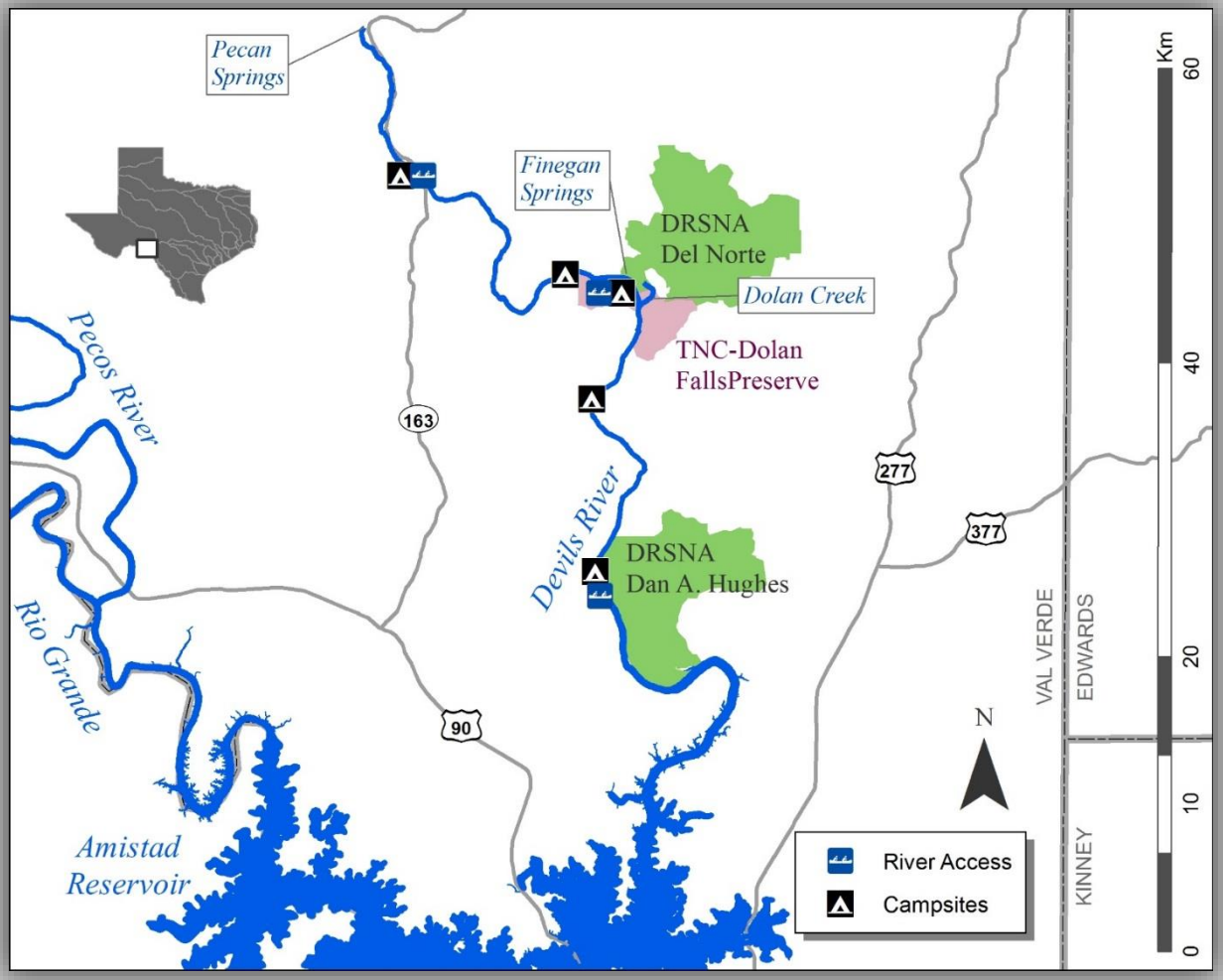
- Val Verde County falls under "rule of capture" law
- GCD has failed to pass 9 times



- Water developers have been shopping Val Verde County groundwater to San Antonio, San Angelo, and rural West Texas counties.
- Texas House Natural Resources Committee held a public meeting September 2018 to readdress issue.
- Consensus was that action is needed and science should guide management.

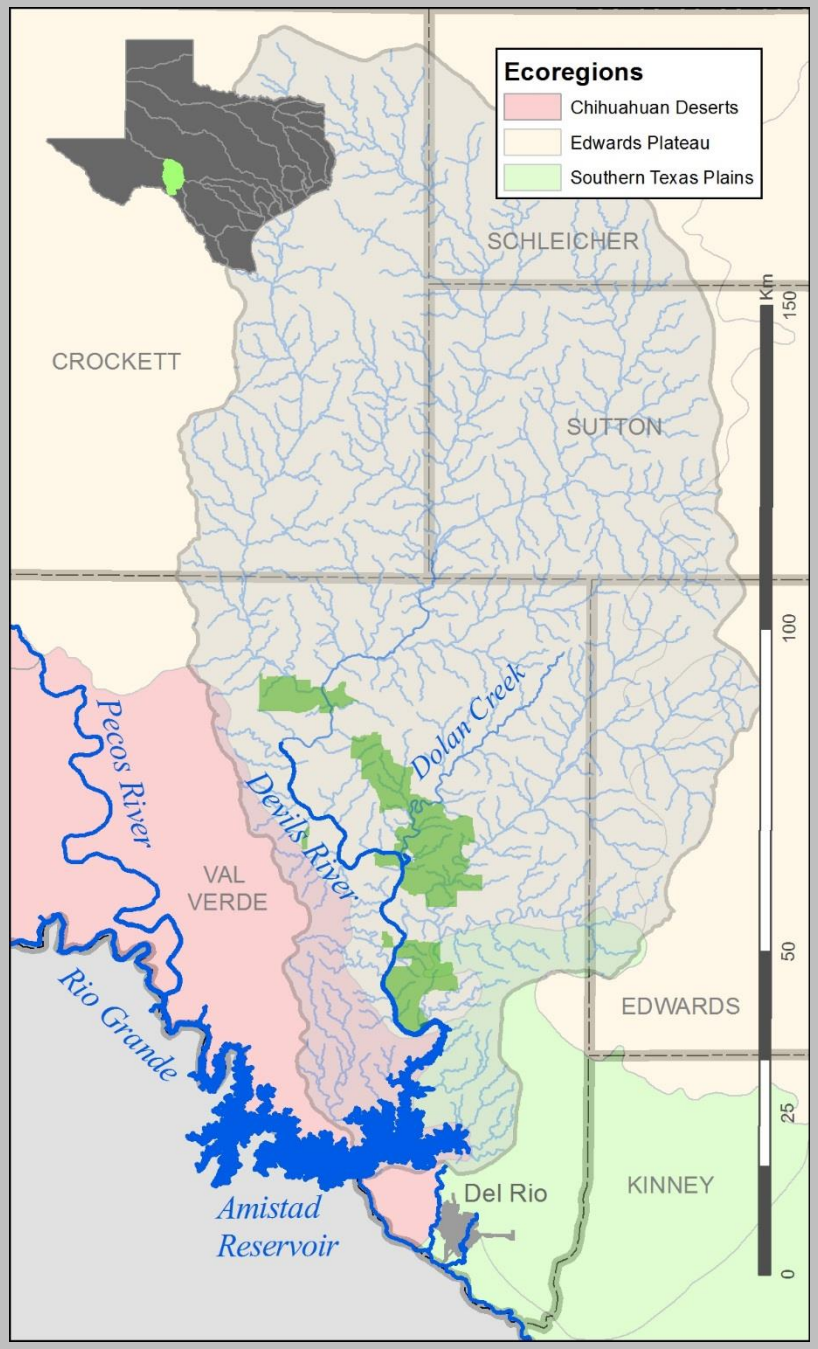
Barriers to Conservation

- Devils River Watershed is over 98% privately owned.
- Remote location, limited access.



Devils River is Ideal for Conservation Investments In Other Ways

- Small watershed with few landowners
- Largely undeveloped
- Over 100,000 acres already under conservation easement
- Local NGO conservation partners



Research

Research Priorities

- Understand habitat needs of priority species
- Understand relationships between groundwater, surfacewater, and habitats

- Provide groundwater and instream flow recommendations to lawmakers and state agencies

Devils River Hydrology and Lidar Study

- TPWD is funding 4 years of hydrology data collection by University of Texas-Bureau of Economic Geology
- Measuring groundwater level, spring discharge, stream discharge, precipitation, water temperature, water chemistry

Groundwater Supplies

→

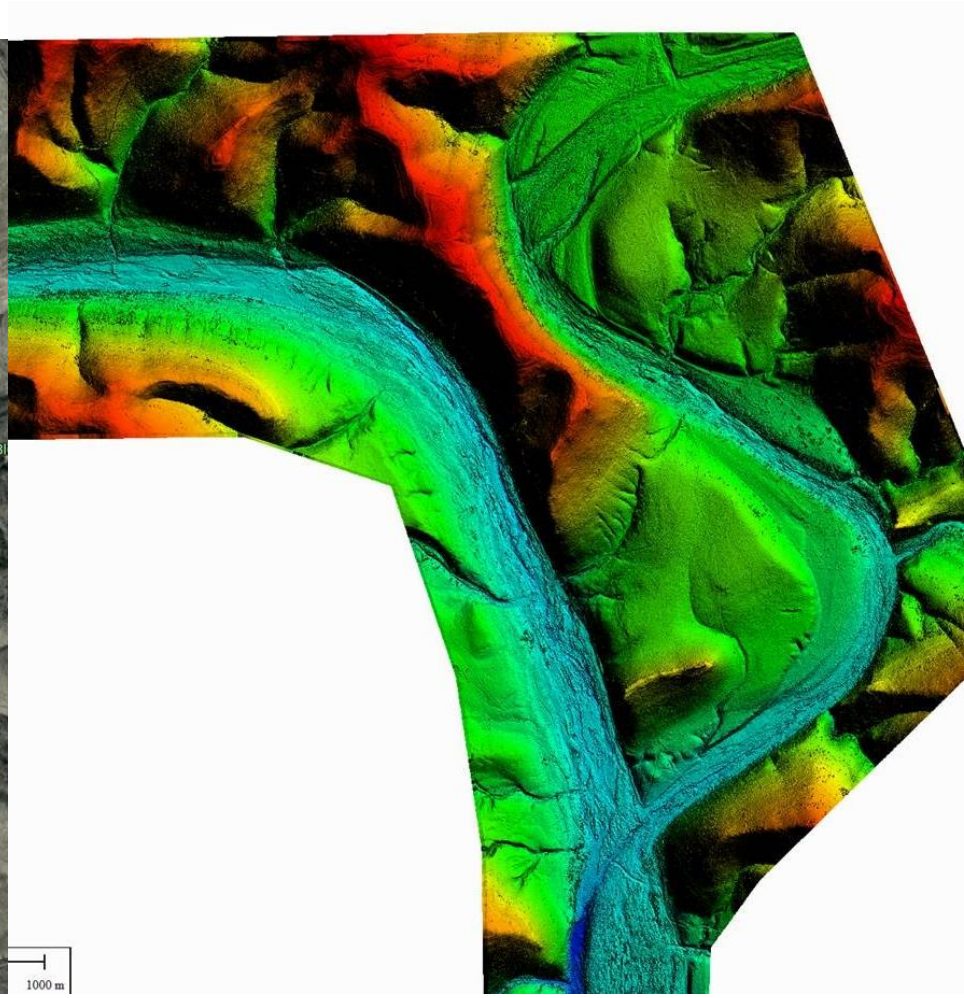
Surfacewater Supplies

Devils River Hydrology and Lidar Study

- Collection of water-penetrating Lidar for 45 miles of river

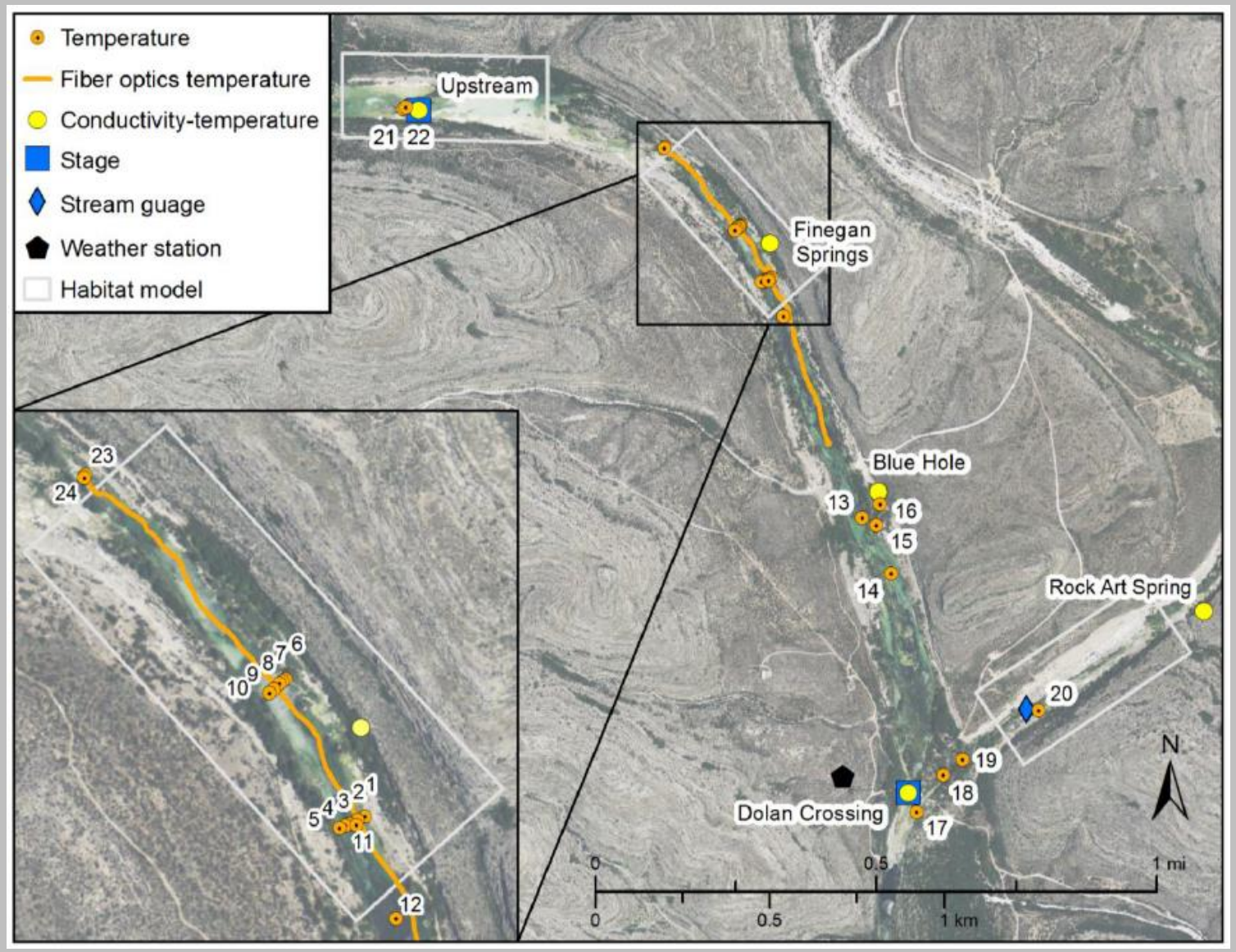
Bureau of Economic Geology

Lidar will be used to produce a digital elevation model which can be used in model development.

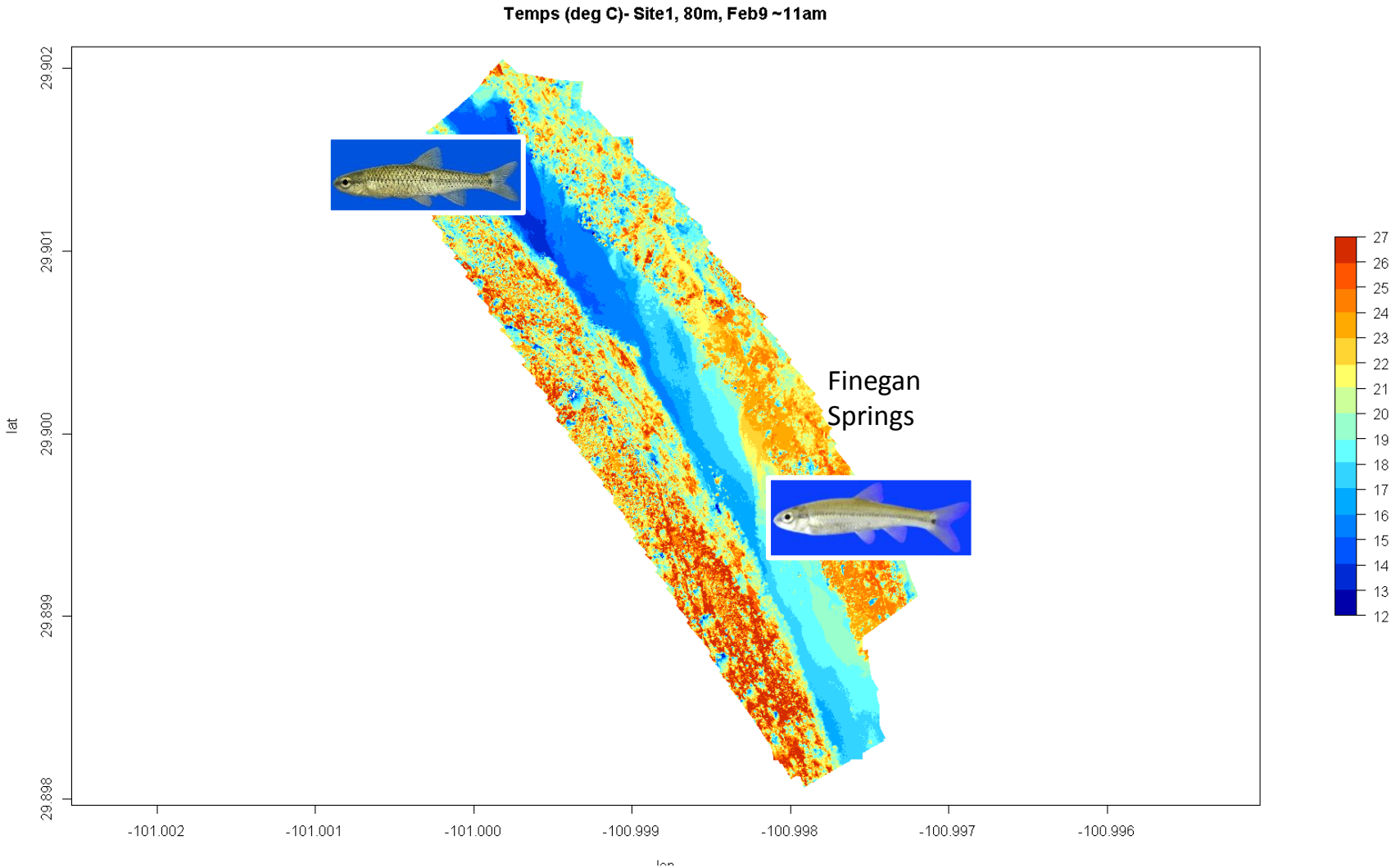


High quality imagery will facilitate habitat mapping

Collection of temperature data in priority reaches of Devils River and Dolan Creek



Concurrent collection of temperature and fish assemblage data in priority reaches

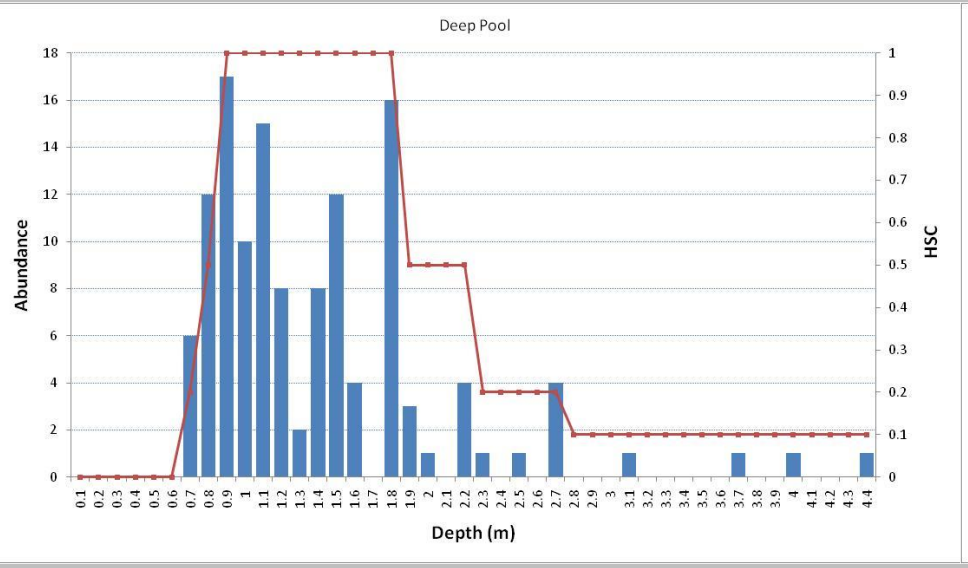


Fish Community Monitoring

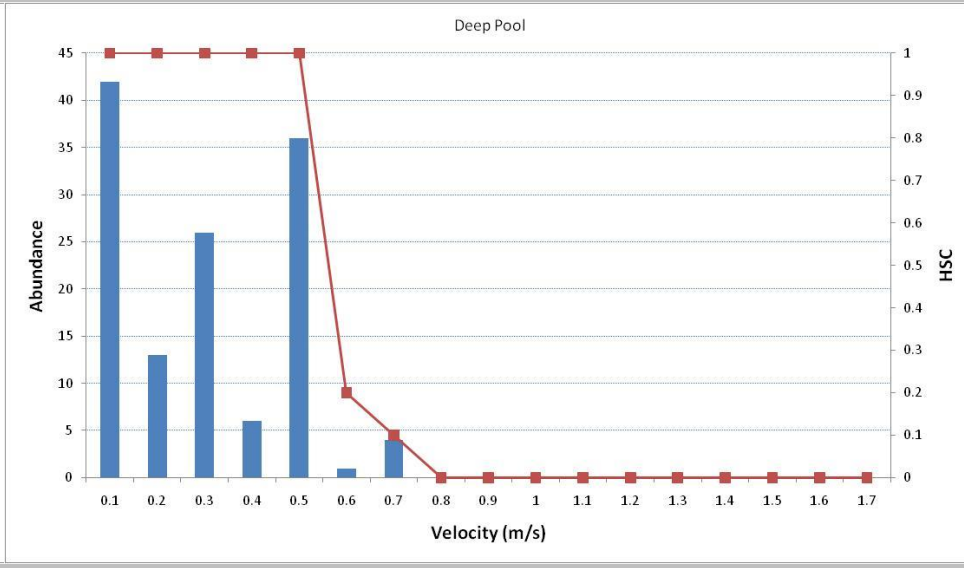
- Annual fish community monitoring at 5 sites
- Habitat use data collection
- Sport fish surveys

Generating Habitat Suitability Criteria

- What depths and velocities are optimal for different species



Depth



Velocity

Available Habitat

Texas Hornshell Research and Monitoring

- Distribution mapping
- Temperature tolerance research
- Development of habitat suitability criteria

Bureau of Economic Geology

Texas A&M Institute of Renewable Natural Resources

U.S. Fish & Wildlife Service

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The Nature Conservancy

Create a Hydraulic-Habitat Model

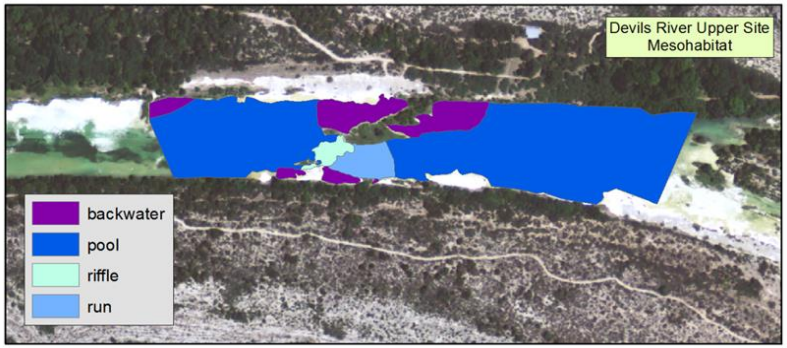
- Create a model to determine how changes in river flow relates to changes in available habitat for priority species

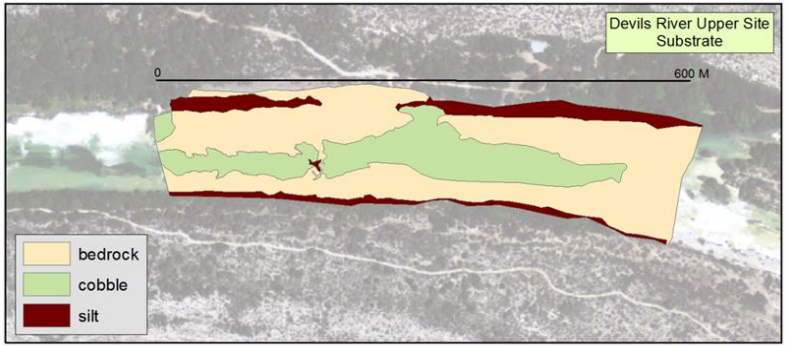


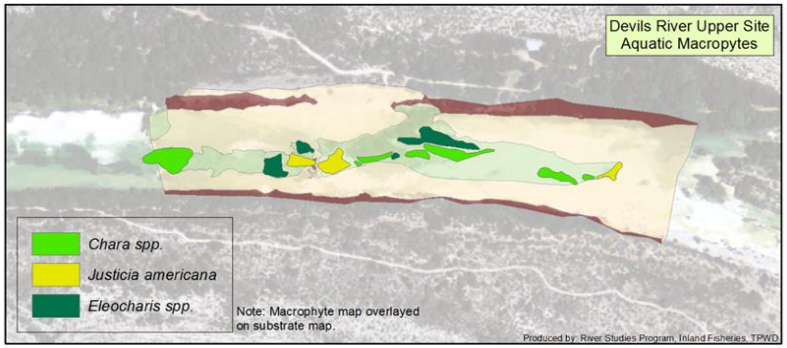



Surfacewater Supplies → Available Habitat

Map mesohabitats, substrates, aquatic vegetation







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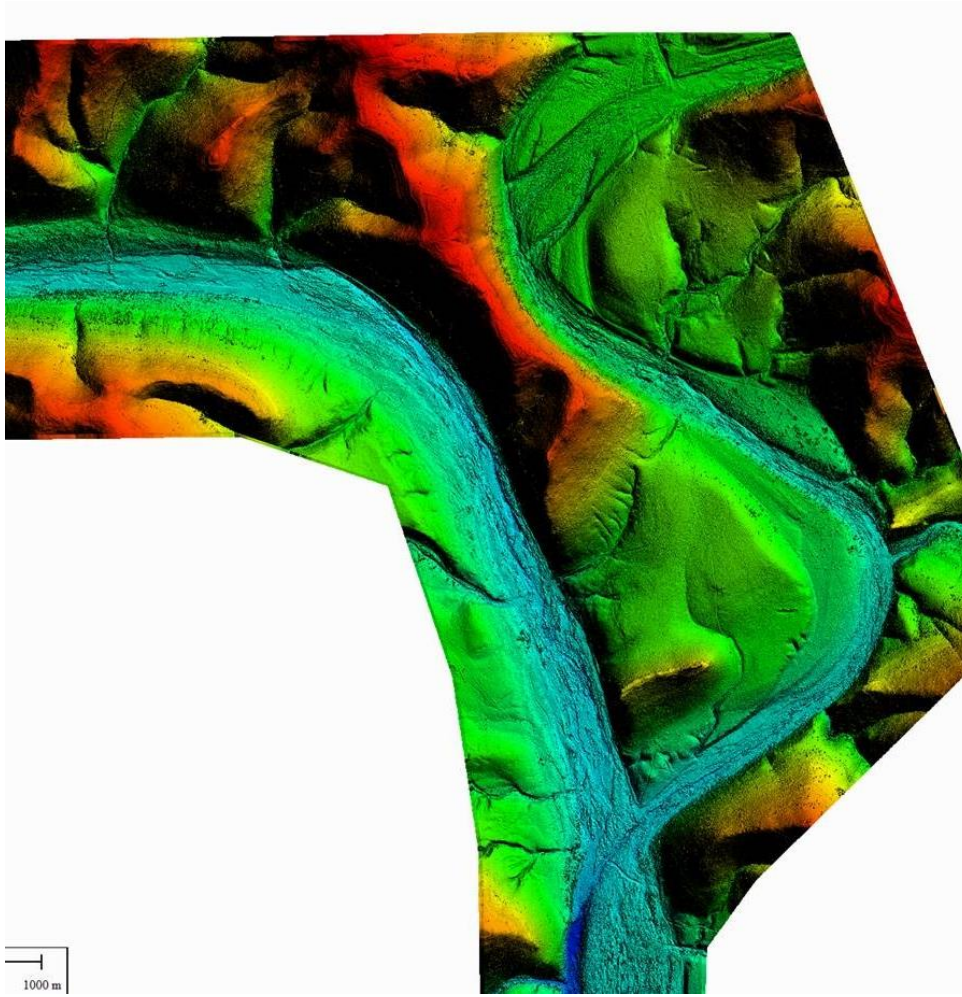
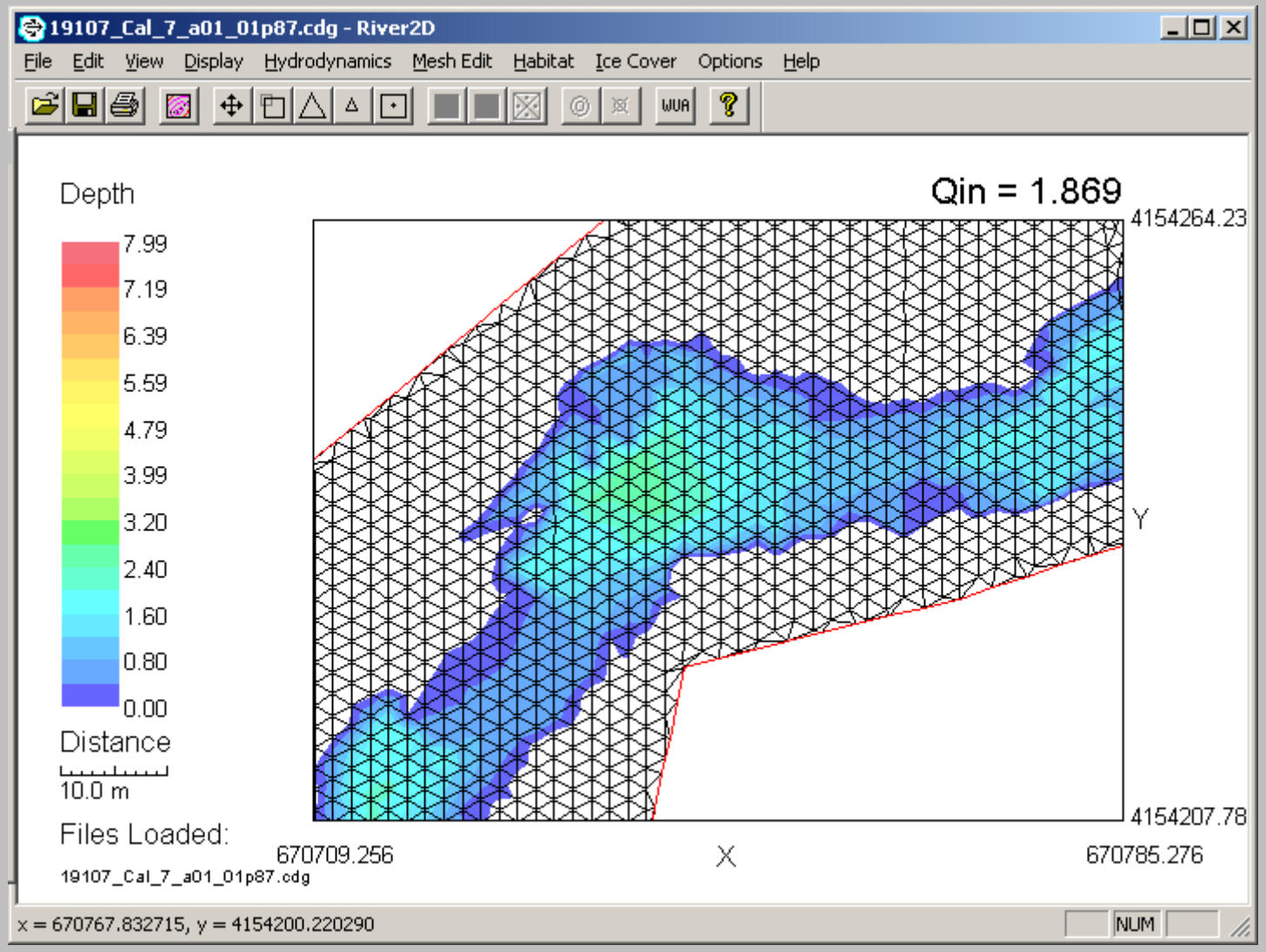
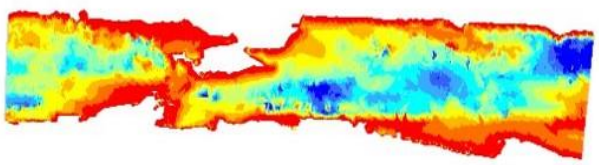


2-Dimensional Hydraulic Model



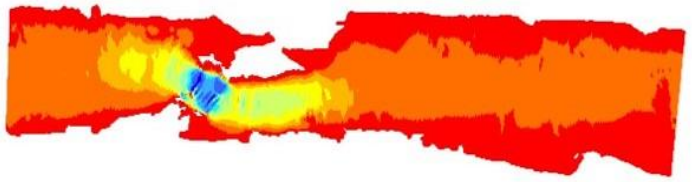
Model how depths and velocities change with changing river flows.

35 cfs – Depth (m)



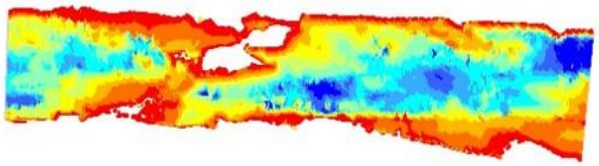
Depth
- 0.005000 - 0.147305
- 0.147306 - 0.254844
- 0.254845 - 0.369492
- 0.369493 - 0.483945
- 0.483946 - 0.597461
- 0.597462 - 0.714492
- 0.714493 - 0.831602
- 0.831603 - 0.975000
- 0.975001 - 1.203670
- 1.203671 - 2.384800

35 cfs – Velocity (m/s)

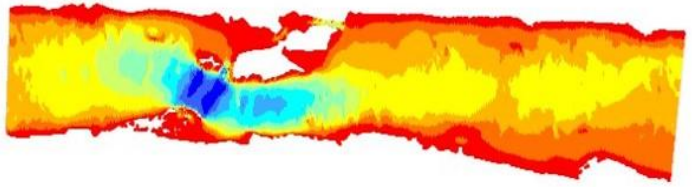


Velocity
- 0.000000 - 0.014093
- 0.014094 - 0.028702
- 0.028703 - 0.040643
- 0.040644 - 0.055147
- 0.055148 - 0.075054
- 0.075055 - 0.099830
- 0.099831 - 0.130144
- 0.130145 - 0.184595
- 0.184596 - 0.259861
- 0.259862 - 0.371389

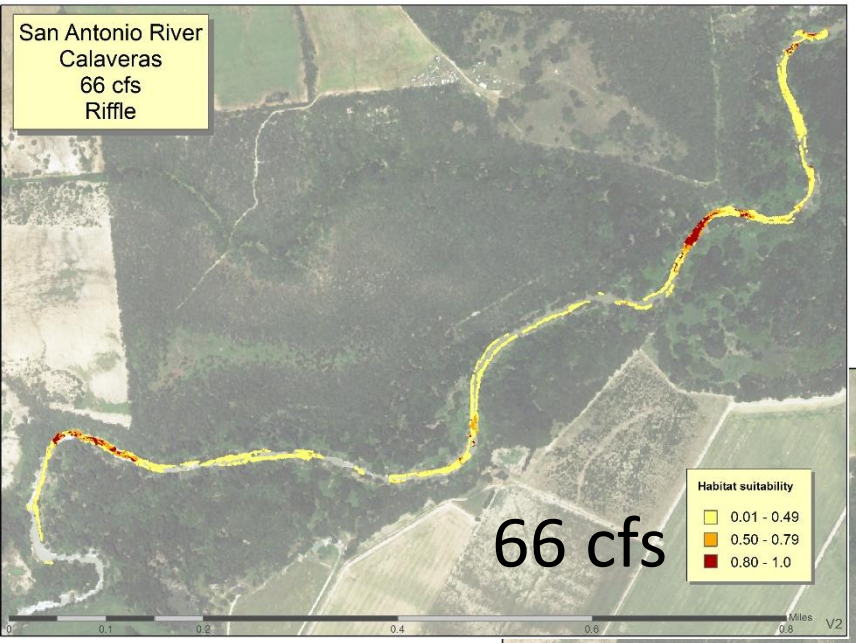
75 cfs – Depth (m)

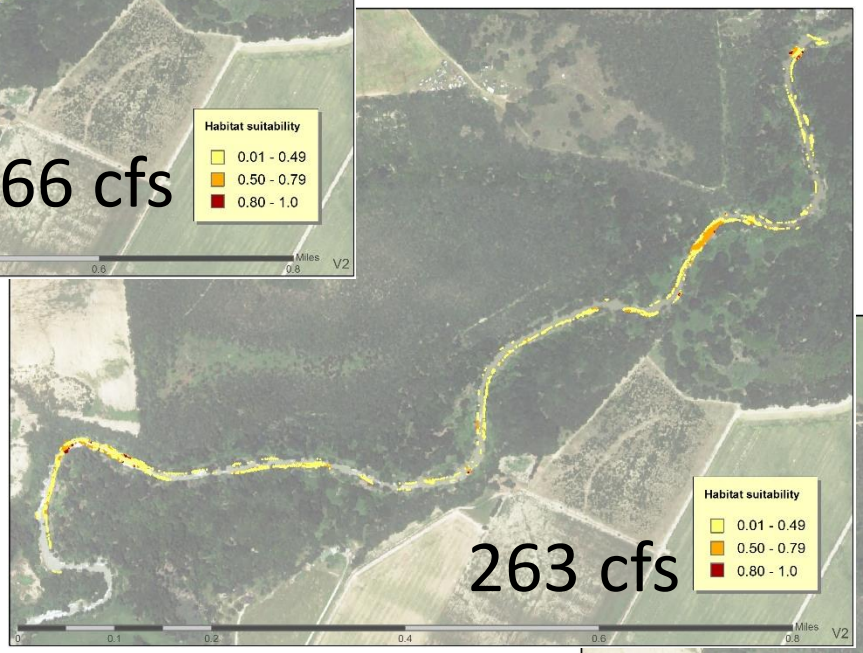


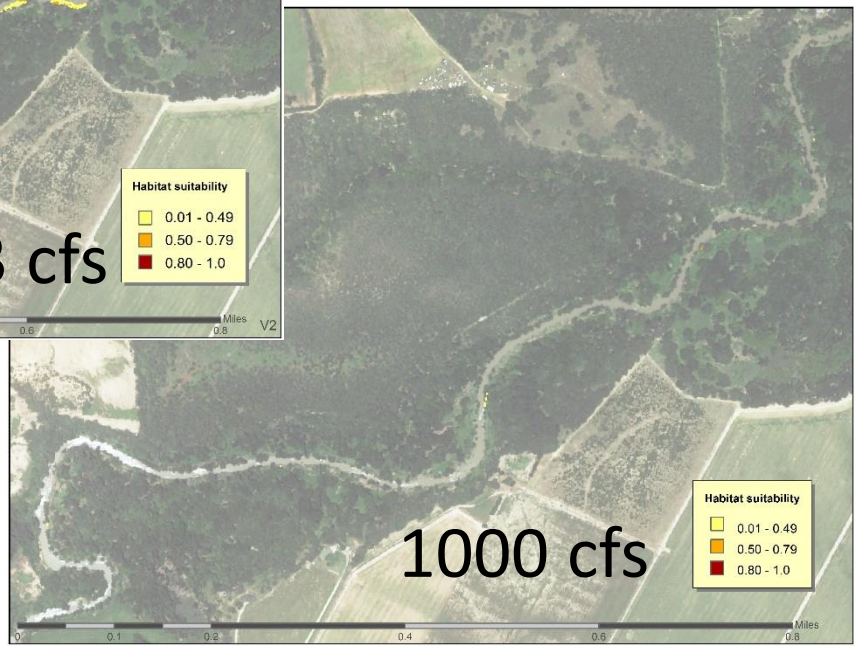
75 cfs – Velocity (m/s)



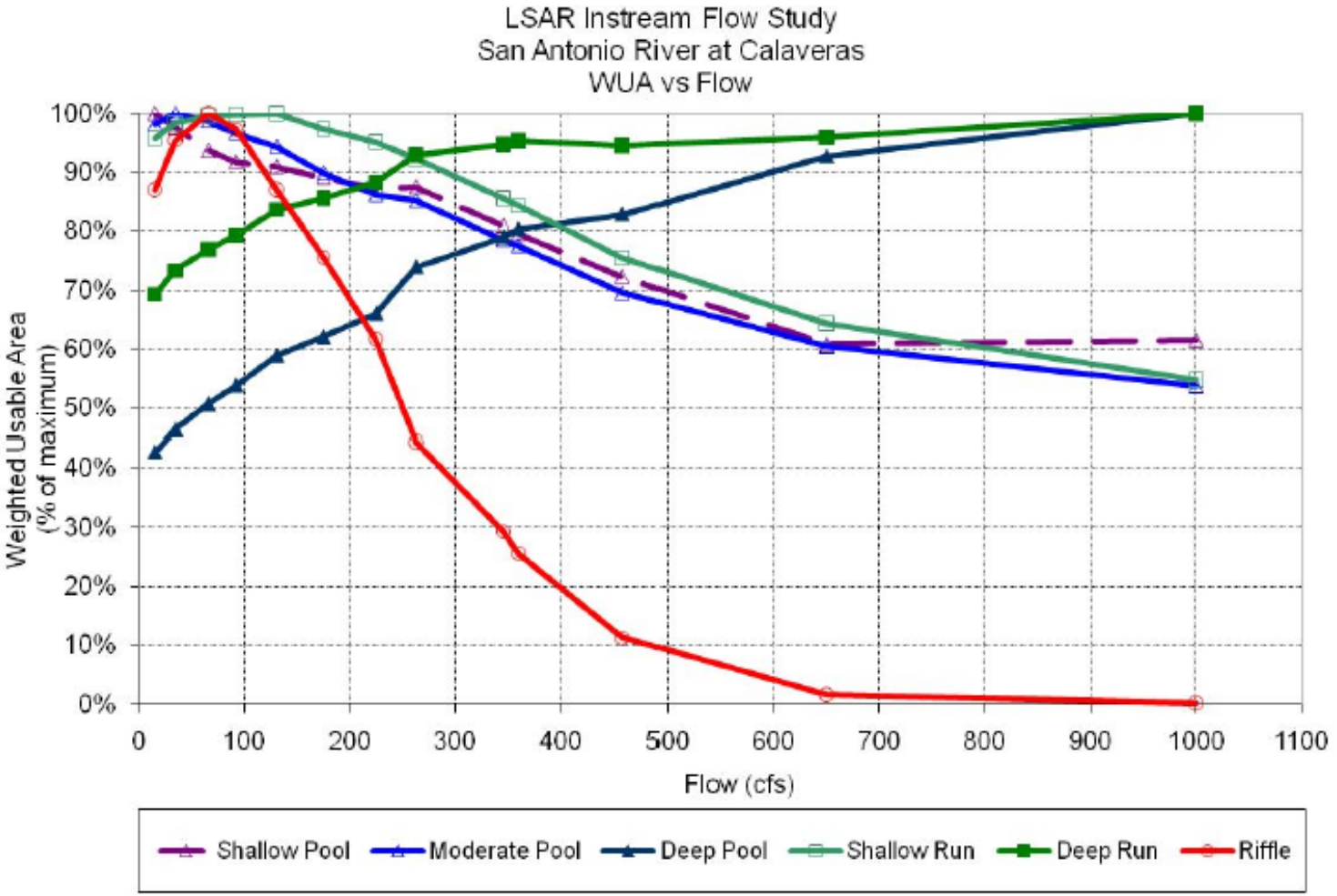
Quantify how available suitable habitat changes with changing river flow.







At what river flows are habitats for all species maintained?



Recommended Flow Regime

CALAVERAS

Overbank Flow

Magnitude = 11,500 cfs
Frequency = 1 event
Duration = 2 days

Key Indicators:
Riparian: Inundates approx. 90% of hardwood forest community
Sediment transport: Channel maintenance

Magnitude = 8,000 cfs
Frequency = 1 event
Duration = 2 days

Key Indicators:
Riparian: Inundates approx. 75% of hardwood forest community
Sediment transport: Channel maintenance

High Flow Pulses

Magnitude = 4,000 cfs
Frequency = 2 events
Duration = 2-3 days
Key Indicators: Cottonwood

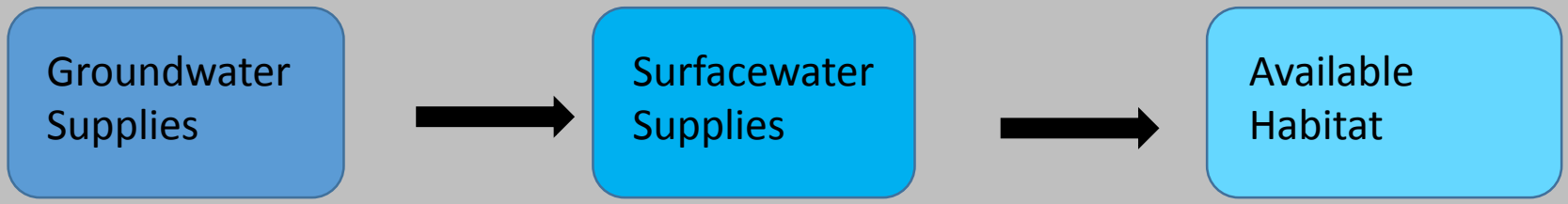
Magnitude = 4,000 cfs
Frequency = 2 events
Duration = 2-3 days
Key Indicators:
Riparian: Green Ash / Box Elder

Magnitude = 3,000 cfs
Frequency = 3 events
Duration = 2-5 days
Key Indicators: Riparian - Black Willow

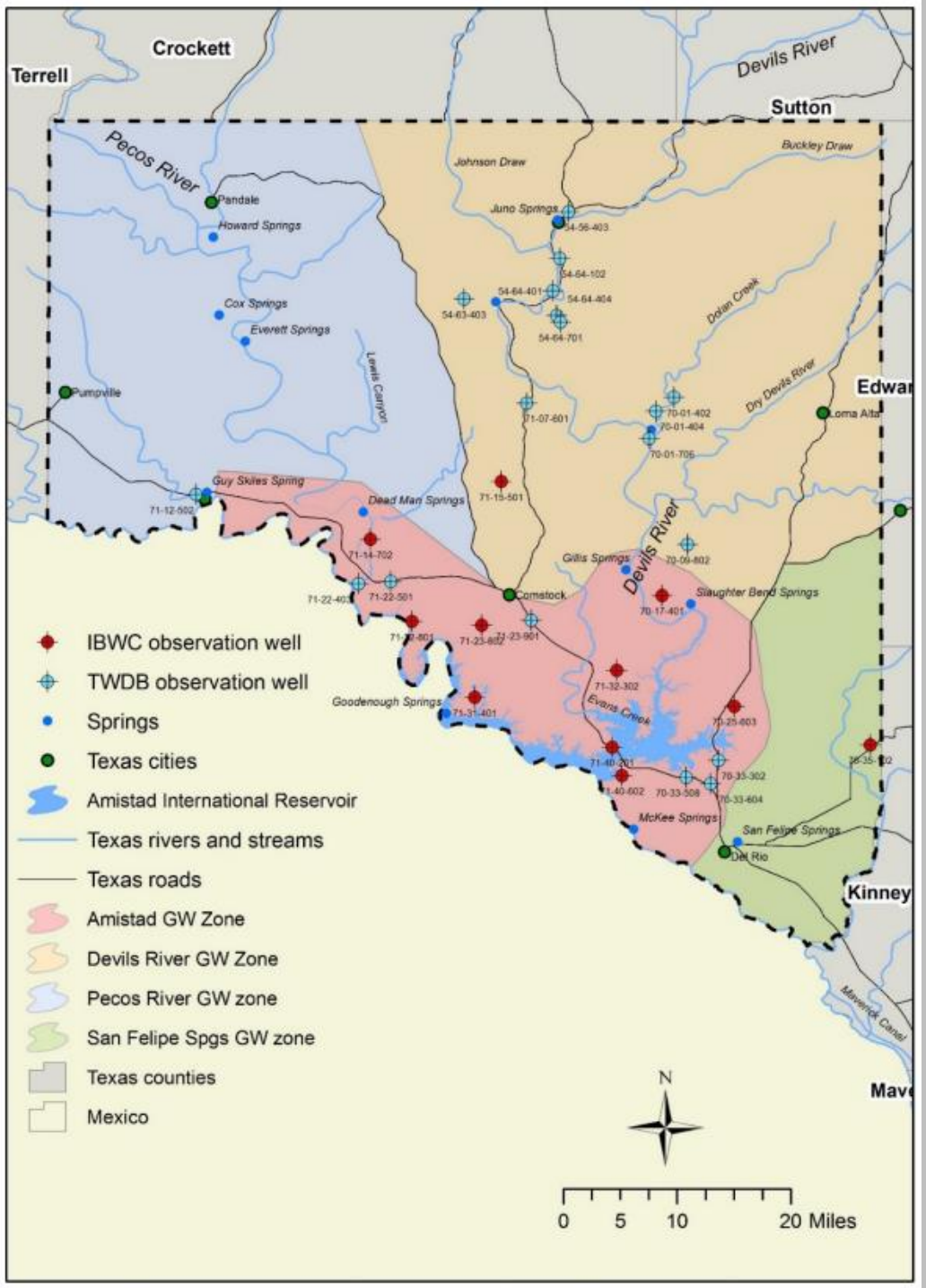
BASE FLOWS (cfs) - Aquatic Habitat protection (intra- and interannual variability)									Key Indicators: Aquatic Habitat, Water Quality			
Base Wet	319	336	329	338	372	382	384	303	336	357	390	355
Base Average	264	268	256	235	259	216	177	160	195	220	226	225
Base Dry	119	113	114	109	113	98	90	90	107	90	91	101
SUBSISTENCE FLOWS (cfs) - Water quality protection and maintainence of limited aquatic habitat									**Key Indicators: Water Quality, Aquatic Habitat**			
Subsistence	80	80	80	80	80	80	80	80	80	80	80	80
MONTH	January	February	March	April	May	June	July	August	September	October	November	December

Tie Instream Flow Recommendations to Groundwater

- Make connections between instream flow recommendations and groundwater levels
- Inform legislative action on groundwater management (flow triggers, groundwater management zones)



Potential Groundwater Management Zones



Partnerships

Partnership with the Devils River Conservancy

- Help TPWD connect with landowners in the basin
- Expand TPWD's research footprint
- Conduct landowner workshops
- Working Days Events- biannual TPWD-DRC-landowner paddle trips

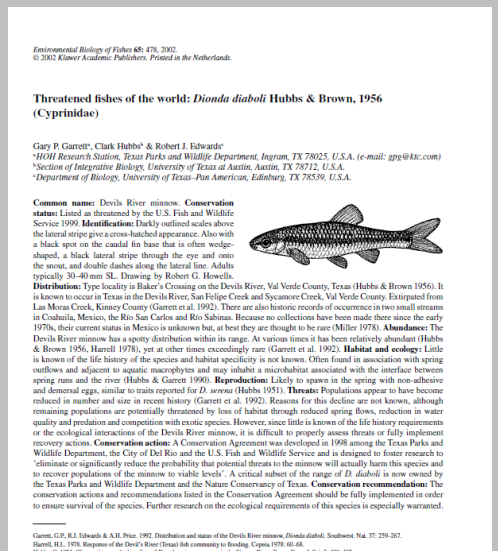
DEVILS RIVER CONSERVANCY
Treasure. Preserve. Protect.

Paddler manual bandana

Devils River Database Project

DEVILS RIVER CONSERVANCY
Treasure. Preserve. Protect.

- Compile and organize all available publications, raw data, historical documents, and gray literature associated with the Devils River watershed.
- Design and implement a database and web-platform to house resources and make them publically-available.
- Make it easier to compile long-term datasets for population analysis
- Help resource managers prioritize data gaps



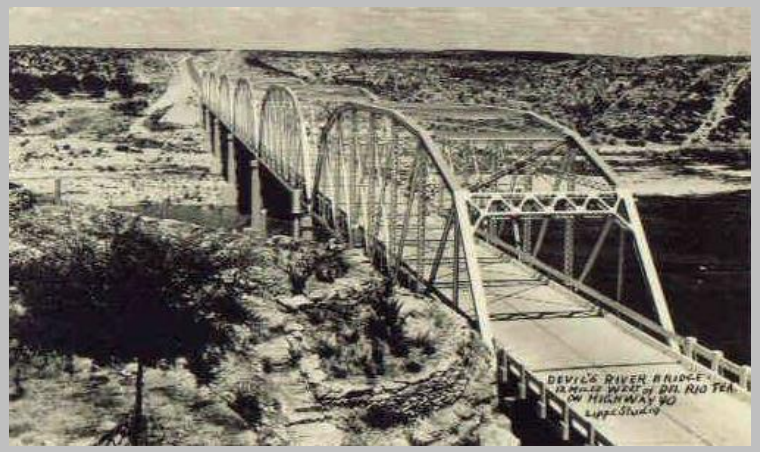
Environmental Biology of Fishes **65:** 478, 2002.

Threatened fishes of the world: *Dionda diaboli* Hubbs & Brown, 1956 (Cyprinidae)

Gary P. Garrett[a], Clark Hubbs[b] & Robert J. Edwards[c]
[a]*HOH Research Station, Texas Parks and Wildlife Department, Ingram, TX 78025, U.S.A. (e-mail: gpg@ktc.com)*
[b]*Section of Integrative Biology, University of Texas at Austin, Austin, TX 78712, U.S.A.*
[c]*Department of Biology, University of Texas–Pan American, Edinburg, TX 78539, U.S.A.*

Common name: Devils River minnow. **Conservation status:** Listed as threatened by the U.S. Fish and Wildlife Service 1999. **Identification:** Darkly outlined scales above the lateral stripe give a cross-hatched appearance. Also with a black spot on the caudal fin base that is often wedge-shaped, a black lateral stripe through the eye and onto the snout, and double dashes along the lateral line. Adults typically 30–40 mm SL. Drawing by Robert G. Howells. **Distribution:** Type locality is Baker's Crossing on the Devils River, Val Verde County, Texas (Hubbs & Brown 1956). It is known to occur in Texas in the Devils River, San Felipe Creek and Sycamore Creek, Val Verde County. Extirpated from Las Moras Creek, Kinney County (Garrett et al. 1992). There are also historic records of occurrence in two small streams in Coahuila, Mexico, the Río San Carlos and Río Sabinas. Because no collections have been made there since the early 1970s, their current status in Mexico is unknown but, at best they are thought to be rare (Miller 1978). **Abundance:** The Devils River minnow has a spotty distribution within its range. At various times it has been relatively abundant (Hubbs & Brown 1956, Harrell 1978), yet at other times exceedingly rare (Garrett et al. 1992). **Habitat and ecology:** Little is known of the life history of the species and habitat specificity is not known. Often found in association with spring outflows and adjacent to aquatic macrophytes and may inhabit a microhabitat associated with the interface between spring runs and the river (Hubbs & Garrett 1990). **Reproduction:** Likely to spawn in the spring with non-adhesive and demersal eggs, similar to traits reported for *D. serena* (Hubbs 1951). **Threats:** Populations appear to have become reduced in number and size in recent history (Garrett et al. 1992). Reasons for this decline are not known, although remaining populations are potentially threatened by loss of habitat through reduced spring flows, reduction in water quality and predation and competition with exotic species. However, since little is known of the life history requirements or the ecological interactions of the Devils River minnow, it is difficult to properly assess threats or fully implement recovery actions. **Conservation action:** A Conservation Agreement was developed in 1998 among the Texas Parks and Wildlife Department, the City of Del Rio and the U.S. Fish and Wildlife Service and is designed to foster research to 'eliminate or significantly reduce the probability that potential threats to the minnow will actually harm this species and to recover populations of the minnow to viable levels'. A critical subset of the range of *D. diaboli* is now owned by the Texas Parks and Wildlife Department and the Nature Conservancy of Texas. **Conservation recommendation:** The conservation actions and recommendations listed in the Conservation Agreement should be fully implemented in order to ensure survival of the species. Further research on the ecological requirements of this species is especially warranted.

Garrett, G.P., R.J. Edwards & A.H. Price. 1992. Distribution and status of the Devils River minnow, *Dionda diaboli*. Southwest. Nat. 37: 259–267.
Harrell, H.L., 1978. Response of the Devil's River (Texas) fish community to flooding. Copeia 1978: 60–68.




DEVIL'S RIVER NEWS.

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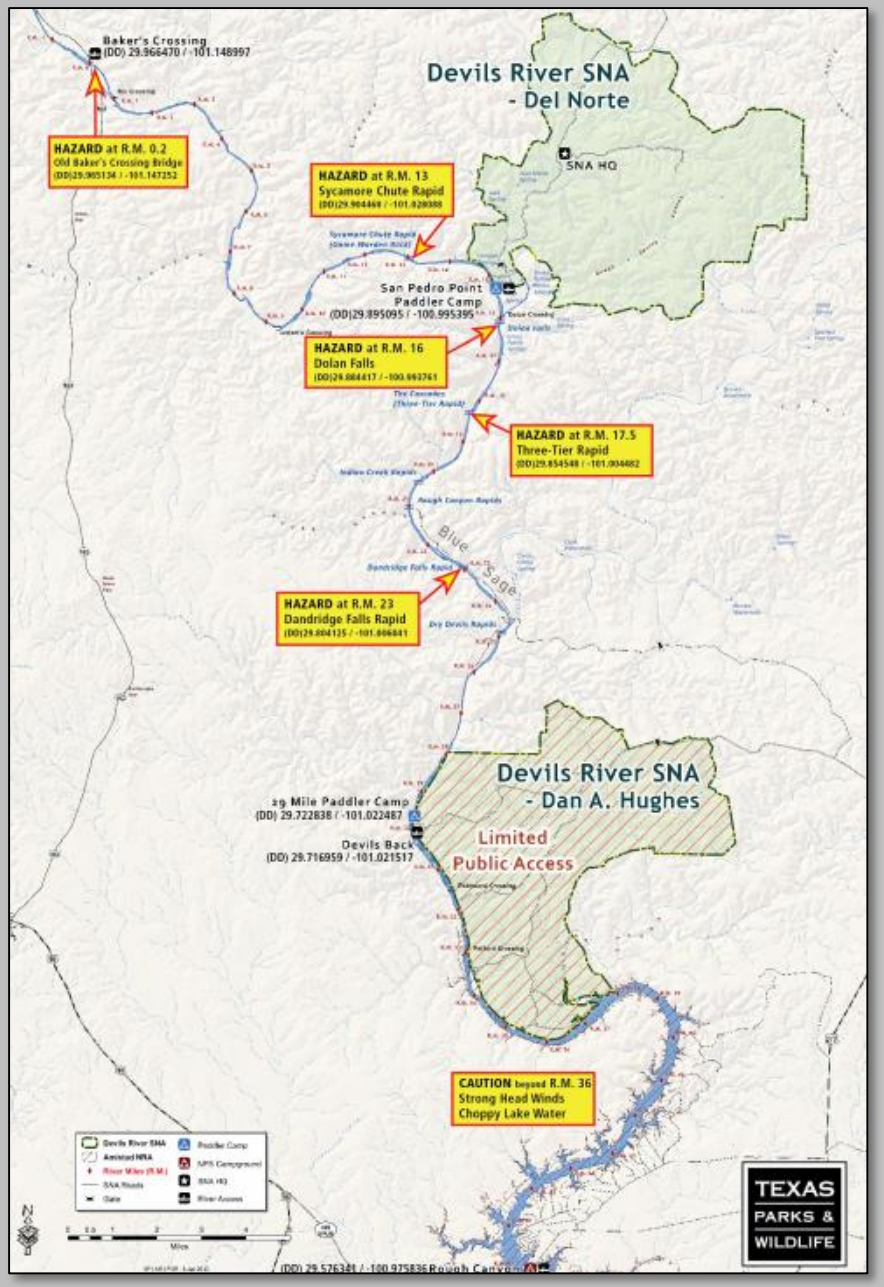
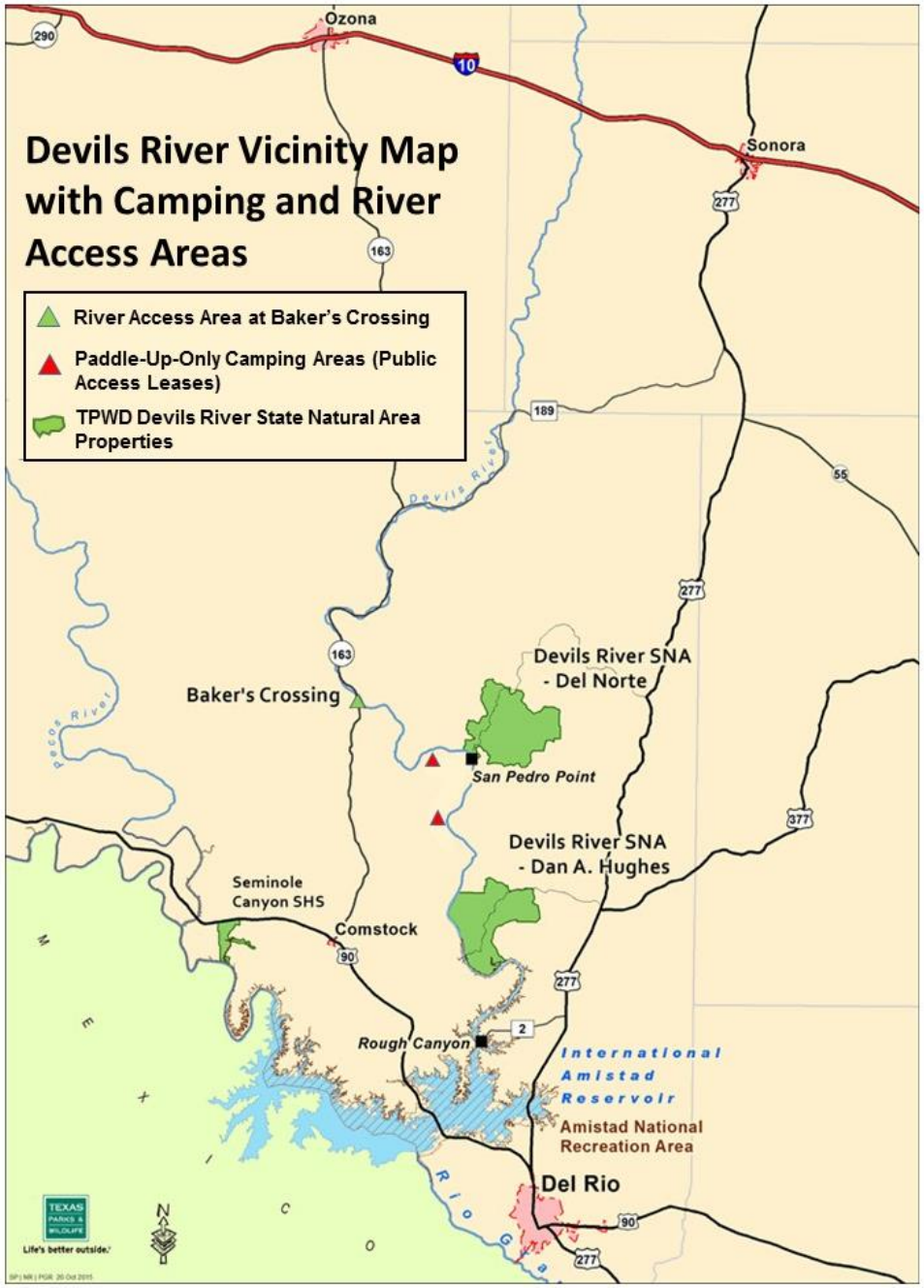


Partnership with Devils River SNA

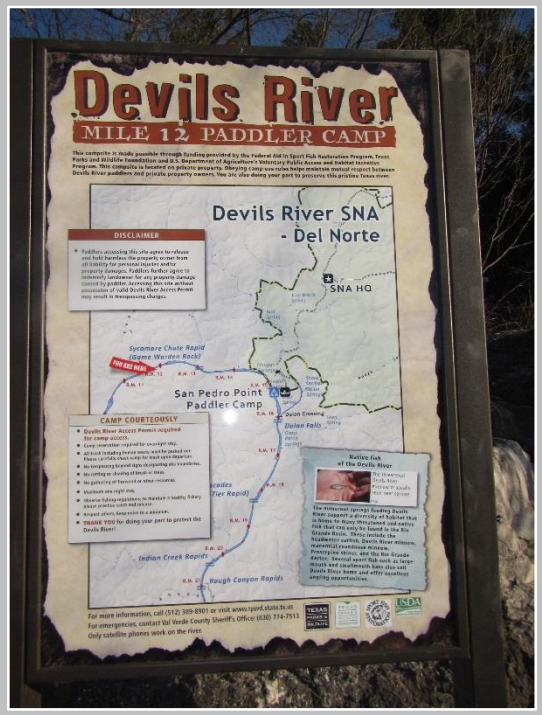
- Manage for sustainable recreation
- Preserve wilderness experience
- Limit the number of paddlers per day through permit process
- Problems:
  - Long distances between SNAs
  - Litter
  - Trespassing
  - Poor relations between paddlers and landowners

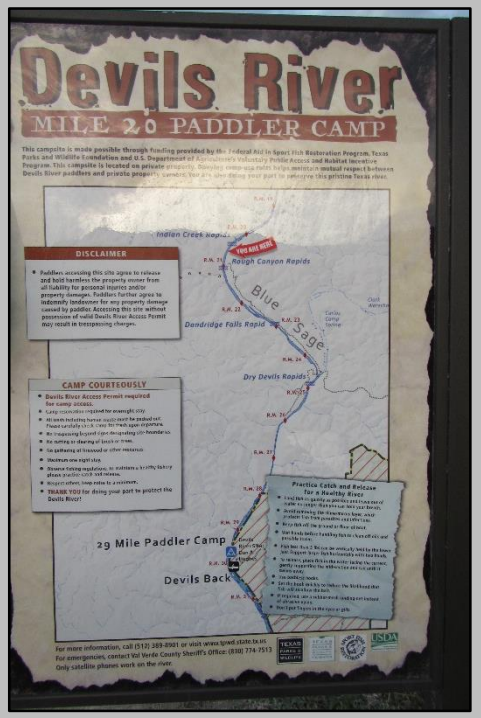


River Access and Conservation Areas Program

- Expand angler access to Texas rivers through public-private partnerships
- Funded via federal grants and TPWD Rivers License Plate funds
- Added two paddle-up campsites on the Devils River to break up long paddles

Mile 12 Campsite





Mile 20 Campsite

Devils River Recreational Use Assessment: Evaluation of River Stewardship Outcomes Achieved through Establishment of the Mile 12 and Mile 20 Paddler Camps

Sarah Robertson

Inland Fisheries Division
Texas Parks and Wildlife Department
Austin, Texas
March 2018

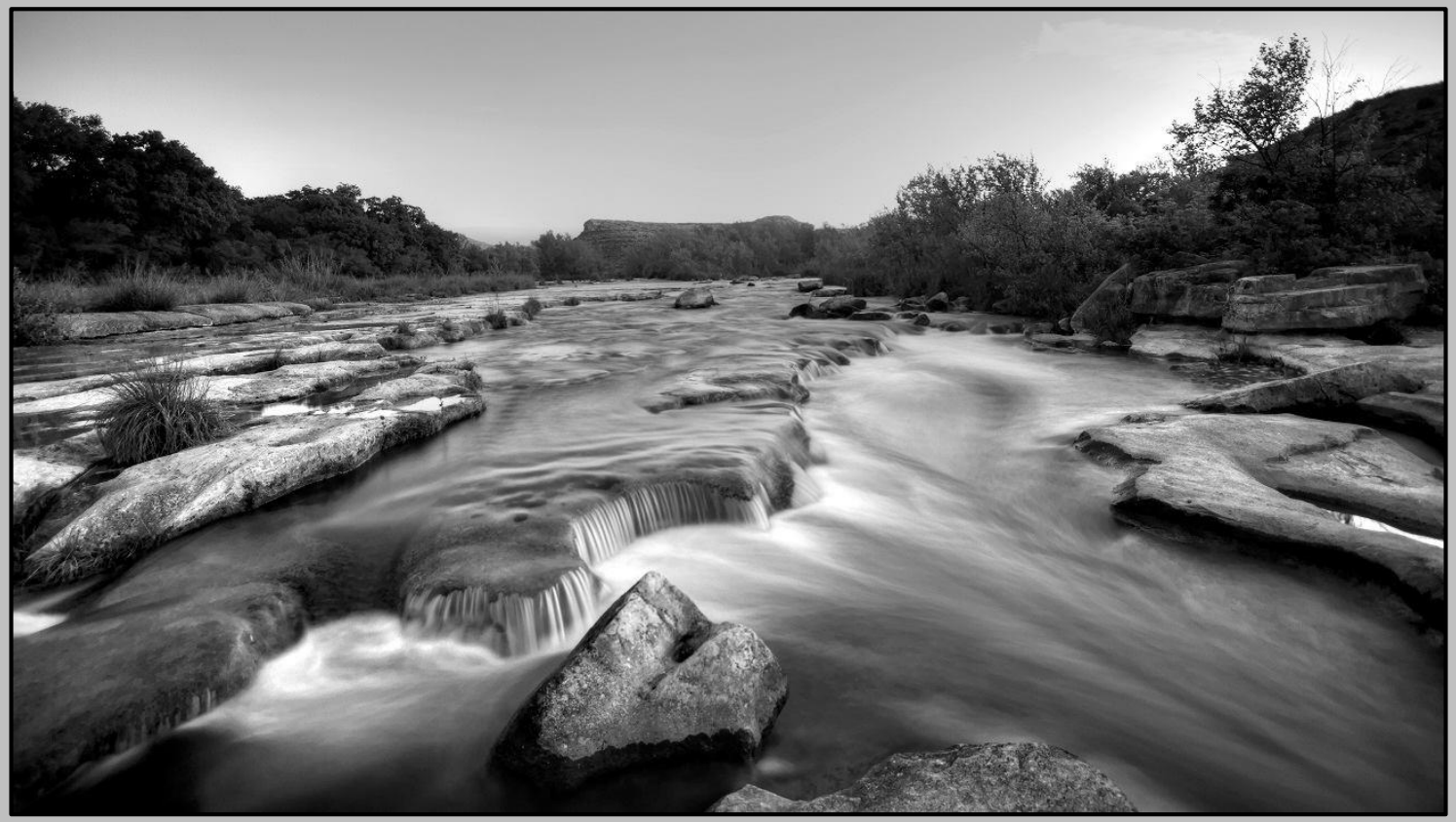
TEXAS PARKS & WILDLIFE

"Overall the trespassing went down drastically. I think the campsites are working really well." – Ali Hatten, Game Warden

"There are fewer active campsites and less litter. It is clear the sanctioned paddler campsites are aiding majorly in condensing recreational impacts and trespassing."
– Devils River Conservancy

Holistic approach to Devils River Conservation

- Building partnerships with landowners and local advocacy groups to expand footprint of conservation efforts in invaluable
- Conduct research to fill data gaps and establish baseline data
- Provide science to policy-makers, stakeholders



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The Nature Conservancy

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