

**Great Plains Landscape Conservation Cooperative (GPLCC)**

**Science Meeting for Prairie Rivers and Streams**

**Development of a Watershed-Scale LCD in the GPLCC Region**

**March 4, 2015: 9 a.m. to 5 p.m.**

**March 5, 2015: 9 a.m. to 4 p.m.**

**Hosted by Texas Parks and Wildlife Department**

**4200 Smith School Road, Austin, TX ‎**

**Commission Hearing Room**

**Meeting Summary (Draft)**

**Participants:** See Appendix A

**Objectives:**

* Overview of GPLCC rivers and streams science and draft strategy for GPLCC
* Identify specific conservation actions, research needs and science priorities for Pilot Watershed(s)

**Outcomes:**

* Participants generated information on specific conservation actions, research needs and science priorities for Brazos and Canadian watersheds (see Appendix B and C).

**Action Items/Next Steps:**

* The coordinators will work with the outputs from both pilot breakout groups (Canadian and Brazos) to get them into similar frameworks.
* The GPLCC Steering Committee will discuss possible FY 2015 science funding based on the outputs of the workshops.

**Overview of Presentations and Breakouts:**

**March 4, 2015**

**Welcome and introductions**

James Broska opened the meeting and reviewed the emphasis areas as outlined in the GPLCC Vision Document: Grasslands, Prairie Rivers and Streams, and Playas. A grasslands science meeting occurred in December 2014 and a playa science meeting will occur later this year. James explained that the first day of this meeting includes presentations on GPLCC prioritization and research, discussion of the GPLCC Science Strategy and pilot concept, and expert overviews of the Brazos and Canadian Rivers. Day 1 sets the stage for breaking into two working groups on Day 2 (Brazos and Canadian) to discuss science priorities and threats and determine a strategy to develop science for these watersheds.

**Overview of GPLCC Rivers and Streams Science**

* Prioritization and Research (2010-2014) *(James Broska, GPLCC Science Coordinator)*
* Presentation of draft GPLCC strategy outline *(James Broska; Nicole Athearn, GPLCC Coordinator)*

James Broska described science funded by the GPLCC specifically related to prairie rivers and streams from 2010-2014.

* In 2010, there was a rushed RFP and short timeline for project completion; three projects were funded. James described examples of performance measures set by Department of Interior; many linked back to priority species.
* In Spring 2011, the GPLCC worked more strategically to identify priority species. The Arkansas River shiner was selected as a priority species. The GPLCC was trying to relate species-specific science needs to objectives related to a landscape-scale cooperative. For the Arkansas River Shiner, the GPLCC identified specific science needs and funded research through an RFP; two projects were funded.
* In the Fall of 2011, there was a science meeting that included an Aquatics Work Group; the group identified three main issues in the Great Plains: 1) finite water resources, 2) alteration and fragmentation of watershed and physical aquatic habitats, and 3) lack of data and info on status and trends. Science needs related to alteration and fragmentation was the basis of the FY 2012 RFP; two aquatics projects were funded.
* In FY 2013 there was a shift nationally away from priority species performance measures. Nationally, it was recognized that LCCs were designed to tackle landscape scale partnerships. Performance measures focused on landscape conservation decision support information and tools, coordination of sharing of protocols, data management and analysis tools, and shared priorities with coordination planning and conservation designs. The FY 2013 RFP funded five projects ranging from conservation practices in partner and state programs to larger scale hydrologic mapping.
* Currently, in FY 2015, the GPLCC is looking to develop a conservation assessment and design strategy for specific (pilot) watersheds… to inform a broader strategy for the GPLCC.

Nicole Athearn described the GPLCC Science Strategy development process. The outline of the science strategy identifies several components of the plan. These include conservation objectives and strategies for specific habitat areas. This workshop is meant to help inform the strategy and the development of watershed pilots; the pilots will create a model that can be used in other watersheds. The GPLCC is trying to help information decision-making by partners on the ground. The Science Strategy ties back to the GPLCC’s vision document (vision, mission, values). Other planning documents include plans for communications, data management, and operations.

**Resources and Tools in the Toolbox for Implementing Watershed-Scale Conservation of Native Fishes in the Great Plains**

* Presentation by the Southeast Aquatic Research Partnership *(Tim Birdsong, SARP/TPWD)*

Tim Birdsong presented on the Southeast Aquatic Research Partnership (SARP). SARP became active in 2004; it was one of the first fish habitat partnerships in the country. Most of these partnerships have been engaged in the LCCs and have tried to bring forward science needs to implement conservation measures. Tim shared copies of SARP’s 10th anniversary report. SARP is a collaboration/consortium of agencies working toward outcomes including wild, naturally-produced, self-sustaining populations of priority species. The stressors identified at the 2011 GPLCC workshop are directly aligned with SARP’s eight primary objectives. SARP has tried to put together regional assessments on its 8 objectives; this guides funding for on-the-ground conservation actions. The partnerships do not have funding for science and monitoring so the relationship with LCCs is important. The science helps answer the question of where to put conservation measures on the ground to maximize benefits to species.

Tim spoke about SARP’s programs and capacity to deliver on conservation actions identified through the LCC. He described the conservation assessments that SARP and other fish habitat partnerships have developed. Initiatives like the Southern Instream Flow Network and Southeast Aquatic Connectivity Program bring together best practices and policies, develop research agendas, make recommendations that inform other assessments and conservation actions (for example, riparian restoration and dam removal), provide technical assistance, and more. SARP also offers workshops for landowners and its partners have delivered substantial impacts on the ground. SARP has leveraged millions of dollars in river restoration projects and has identified high priority conservation areas; it has funded 126 restoration projects (primarily riparian) since 2004. Tim offered several examples of how SARP has worked on instream and minimum flows. Tim also described the recreational value of rivers and streams and how connecting the interests of different partners, including recreational constituencies, can help achieve conservation objectives. He emphasized that the outcomes of the GPLCC aquatics workshop and its work on the Brazos and Canadian Rivers can inform and align with the 10 year outcomes for conservation that SARP and its partners are planning and implementing. Further, this work can develop templates for other river systems throughout the LCC geography.

Please see Tim’s presentation for more details.

* Presentation by the Great Plains Fish Habitat Partnership *(Steve Krentz, GPFHP)*

The Great Plains Fish Habitat Partnership was started in 2010 and its first requirement was to conduct an assessment to identify top priorities from States and other partners. Steve described the goals of the National Fish Habitat Partnership. The mission of the partnership is to change the course of what is happening on the ground. The Partnership used Joint Ventures (for migratory birds) as a model for developing fish habitat partnerships. The focus has been on building a data management system to understand what stressors are driving aquatics issues. This included an assessment for rivers and streams and for glacial lakes; there was not a good assessment method for glacial lakes. Landscape data were overlaid with anthropogenic influences then tied to priority species; the analyses provided an output with predictive capability. A geodatabase was created and map books laid out species’ habitat needs and habitat condition. The intention is not to dictate priorities but to provide a tool to create discussions and partnerships, as well as helped partners realize common priorities. When the partnership started, there wasn’t a lot of information on what was causing degradation; the data changed many peoples’ minds on the impacts (for example, cattle was assumed to be a main cause of degradation, but the analysis showed differently). The Partnership is working on a decision support tool that helps to focus on areas of higher conservation needs and identifying stressors that are impacting these areas. The assessment allows the partnership to move forward in a more strategic fashion. Now there are ways to link aquatic and terrestrial considerations. Other programs can use these tools to support spatially explicit and strategic habitat conservation decisions and more. The models are available online at <http://www.midwestfishhabitats.org>.

**Data-Driven Approaches to Selection of Priority Watersheds for Conservation of Native Fishes**

* Case Study from the Colorado River Watershed, Texas *(Dean Hendrickson, UT-Austin; Gary Garrett, UT-Austin)*

Dean framed his presentation around the ‘knowing – doing’ gap. Dean described the use of geo-referenced fish occurrence records and specimens to provide rigorous information on fishes of Texas. The records form the basis for modeling probabilities of occurrence at 1km scale. The models do work, although skepticism is common. Dean provided an example of the use of the model in the James River watershed, which demonstrated that the model worked in predicting probability. The Species Distribution Models can be applied in climate change predictions, bio-assessments, and conservation assessments. They have been used in a variety of contexts, including LCCs. Examples include identification of focal freshwater areas based on Species of Greatest Conservation Need. The approaches are data-driven, scientifically defensible and can be used to develop spatial roadmaps for conservation. The process is also scalable and amenable to tweaking.

Gary discussed how these models can be applied. The Texas Conservation Action Plan supports this approach given its focus on priority conservation areas. TPWD’s role in regulatory and technical issues means it is active across the state in these issues. Gary focused on a case study of the Colorado River Watershed on the Edwards Plateau. The Guadalupe Bass initiative actually looks broadly and holistically at a number of species. It is developing a holistic, watershed-scale approach to restoration and management to address threats and limiting factors. Actions include removing fish passage barriers, restoring and conserving habitats using voluntary tools and organizing networks of public and private landowners that promote economic and ecological values. Conservation demonstration areas are helpful for these networks. The effort is also working to prevent invasive species introduction and minimize impacts, describe benefits of restoration and management actions to other native species, and adopt conservation approaches that are cost effective and sustainable over time. Gary also described the importance of monitoring, evaluation, adaptive management and reporting to the public.

**Background for Selection of the Brazos and Canadian Rivers as Pilots for Development of Watershed Based Landscape Conservation Design(s)**

* Geographic overlap and opportunities for integration with the GPLCC Grasslands LCD Pilot *(James Broska, Nicole Athearn)*

James discussed Landscape Conservation Design and its use in the Great Plains LCC:

* + It is a planning process of collaborative conservation that defines goals, targets, and desired landscape conditions to support conservation objectives.
	+ It is a collaborative product that is science-based, and spatially explicit.

The rationale for selecting the grasslands pilot areas included engaging more than one state, looking at conservation priorities and looking at where GPLCC has already invested in science. The Grasslands LCD Pilot focuses on assessing the current state of grassland condition in the pilot area and assessing the impacts of several drivers/threats on a suite of species.

The Canadian and Brazos watersheds were selected for watershed pilots because they overlap with the grasslands pilot area. The watershed pilots will facilitate a connection between terrestrial and aquatic assessments, research prioritization and conservation planning and design.

The intent is not to choose between the watersheds but to move forward with both. The watershed pilot areas are not bounded by the shading on the map that was presented; that is meant to just show the overlap with the grasslands area (for example, the Canadian pilot does not end at the Oklahoma border).

**Strategic Conservation Assessment to Inform Selection of Priority Watersheds for Conservation of GPLCC Priority Fishes**

* + Presentation *(Ben Labay, UT-Austin Fishes of Texas)*

Ben described how the conservation assessment was created for Great Plains fishes, shared some of the assessment products and maps, and discussed next steps and implications. Keith Gido and Josh Perkin’s work on transformation of the landscape and transformation of fish communities forms a foundation for this work. The purpose of this work is to help fill the implementation gap, and help to address questions of how to effectively/efficiently implement actions considering a multi-species landscape, inter/intra-jurisdictional decision-making and fragmentation issues. The study focused on native fish conservation areas and considered priority fishes (range-wide models, spatial prioritization and proposed tiered management landscapes). The priority fishes were grouped into guilds and species distribution models were created to provide a continuous probability gradient on the landscape. Area prioritization was achieved through zonation and prioritization based on two approaches: a core area approach and a ‘bang for buck’ approach. There was also accounting for species-specific responses to fragmentation and consideration of what species are affected and how. Other condition variables included habitat and global vs. local conservation rankings. Ben described the analyses sequence for incorporating all of these components.

The analysis results in a geospatial/mapped landscape ranking for the priority taxa; it shows recommended species management units, or conservation priority areas. Ben showed examples of maps depicting disturbed vs. undisturbed habitats (for considerations of protection vs. restoration). Ben also showed examples of priorities based on global vs. state rankings of species conservation status, as well as for ‘bang-for-buck’ vs. core priorities. This conservation framework allows you to look at priority species and landscapes; it is a system for accounting for priority species life requirements. The framework provides a data-driven spatial strategy for conservation planning. For example, a tiered framework can be identified to provide different conservation actions at different levels. Josh Perkin also developed an approach for prioritizing and deprioritizing different stream segments, and Perkin’s outcomes validated the prioritization that Ben and Dean developed. Behind Ben and Dean’s recommendation is a dynamic tool that users can adapt. Ben suggested that the framework be used for the entirety of the Great Plains, and that it be used as a science integration framework.

During discussion, a participant raised a concern that the resulting prioritization maps did not correlate with his experience on the ground. Ben responded that the benefit of this approach is to provide a framework for action at a broader scale; it provides information to groups coordinating the funding at a broader scale. The framework can be evaluated by on-the-ground experts. It was acknowledged that ‘all models are wrong but some are useful.’ This framework can also be a communications tool for those that are not focused on fish.

**Overview of Pilot Watersheds for Development of Watershed-Based Landscape Conservation Designs in the GPLCC Region for Conservation of Native Fishes**

* Brazos River *(Gene Wilde, Texas Tech University)*

Gene described the geography of the Brazos River basin. Historically, it fed off of the Ogallala, and as a result the volume has decreased over the years. It is also fed by irrigation runoff and from Lubbock’s treatment system. Water flow volume in the Brazos has decreased significantly over time; approximately a tenth of a CFS per year since 1930. This is due to depletion of the Ogallala; the Southern Great Plains is the largest contiguous cotton producing area of the world.

Dams and drought impact reproductive success of pelagic spawners in Great Plains Rivers, as does river flow due to the need for suspension. Gene showed survey results demonstrating different kinds of spawning fishes and their occurrence over time. There has been a shift indicating a decreased abundance of pelagic spawning fishes over time. Other conservation issues include introduced species (e.g., Red River Pupfish and Sheepshead), establishment of salt cedar, and potential mussel species of concern. The fishes in the Brazos are naturally affected by drought; they can tolerate low oxygen, high salinity and high temperature. However, over time, as isolated pools persist, only certain species survive.

There are lines of evidence showing that the Smalleye Shiner spawn multiple times; they are thought of as flood-spawning fish. During the course of the season, fish are continuously spawning; there seems to be some sort of synchronization on flood pulses. The exception to continuous spawning is no flow. Running water is needed to successfully reproduce. The fish only live 2 years at best. Early fish survival has been modeled as a function of river discharge. The population goes up in wet years and down in dry years. A reservoir has been proposed that would eliminate these fish.

For the Sharpnose Shiner, ova are buoyant; it does not take much flow to suspend the ova. However, the larvae are negatively buoyant so they will sink and become covered with sediment. It takes 55 days to move 50 miles upstream; the fish migrate large distances and they need large distances.

Gene is now using ‘living streams’ in warehouses as hatcheries and grow out ponds – working on restoration.

Gene identified the following relevant science needs for the Brazos, and encouraged everyone to think and act on the right scale:

Salt Cedar

* Effects of Salt Cedar on channel morphology and river flow.
* Do changes in channel morphology and flow impact fish movement?
* Does Salt Cedar eradication have a positive effect?

Fragmentation

* What are the potential impacts of proposed river modifications (dams, chloride control projects, etc.)?
* How can these be mitigated? (refugia, conservation water rights (for new projects), hatcheries)
* Do small artificial barriers (low water crossings, pipelines, etc.,) impede fish movement?
* Where do fish spawn and which tributaries contribute most to recruitment?

Conservation delivery

* Can priority species be propagated?
* Can they be repatriated? What are the obstacles?
* Can instream refugia be created to help fish persist through periods of drought?
* Can water be secured to facilitate reproduction? Can we ‘manage’ these species?
* Can barriers/refugia be constructed to conserve the Brazos River form of Red River Pupfish?

During Q/A, Gene addressed the following:

* The Plains Minnow is common in the Brazos, but it is not as common as it was 10 years ago. There is one population of Plains Minnow in the Brazos.
* *How does flow immediately affect survival of young?* We know there is recruitment to catchable sizes every day. Gene believes there is greater spawning on the flood. There is a sharp change in the size of ova.
* *Can sending water out of dams to spawning fish help?* Most fishes do well in pools, except for chubs. The amount of water matters.
* *Why is there such a long migration – to spawn? Or do they spawn as they go?*  Gene believes it is a bias in movement. He believes it is a one-way movement.
* *The Alan Henry dam filled in 1998 – are you tracking sediment starvation upstream and downstream? How about salt cedar?* There is concern that the river is scouring down. For a long time, Alan Henry was a catchment basin.
* *Getting the right amount of water to match habitat downstream is the trick. Can you spawn the fish on a spike, e.g., find the right flow to get the appropriate habitat across the channels?* There is notenough information to begin speculating about this. The general prediction is that we’re going to have more dry periods and an associated explosive increase in salt cedar.
* *Will there be introduction of salt cedar beetle?* This is uncertain.
* *It is worth knowing about greater survival and greater spawning off of flood peaks. It would be useful to know whether it is better to have 4 or 5 peaks in a wet year vs 1 big one in dry year.*
* *What causes salt cedar expansion during drought?* It requires sand conditions; there are perfect conditions in dry years when sandbars are exposed.
* Canadian River *(Shannon Brewer, USGS Oklahoma COOP and Tim Grabowski, USGS Texas Tech University)*

In the Canadian River watershed, the pelagic spawning minnows are the species of concern. There are four species of concern: Plains Minnow, Peppered Chub, Arkansas River Shiner and Flathead Chub. In Oklahoma, there is also the Shoal Chub and the Red River Shiner. There are 19-20 broadcast pelagic species. At least 13 are listed with some form of conservation concern. The Plains Minnow gets more attention than species with smaller endemic ranges.

Researchers used a species distribution model and looked at historic and present conditions. Historically, there was broad distribution of the pelagic broadcast spawners. Understanding why distributional changes occur is important. Historic and current models indicate that discharge is important. Distributional shifts among reservoirs show there is a refuge area for some of the endemic species. The distributions are changing rapidly. For example, the Peppered Chub is only found in 10% of its range and has not been found in Kansas since the droughts. One science need is to understand the fine-scale distributions of other species in order to manage them effectively. Looking at species when they are extirpated to the fringes is misleading.

In addition to distribution, Shannon and Tim discussed flow alteration, habitat, and introduced species:

* Fragmentation and flow alteration go together; nearly 70% of US rivers are regulated and larger rivers are most affected. The Mississippi-Missouri basin is particularly affected. Flow alteration is thought to be problematic for a variety of reasons. There are 3950 barriers in the Arkansas River basin.
* A study of habitat degradation utilizing egg surrogates found that discharge drives downstream drift rate and that habitat complexity increases retention; the difficulty is linking egg survival and geomorphology over a landscape scale.
* The Arkansas River Shiner (ARS) was introduced in Pecos and rapidly colonized. There’s speculation that the flow regime is the difference. The Red River Shiner was first detected in Cimarron River 1976. Is the Red River Shiner creating issues for the ARS because they are similar? Why didn’t ARS persist in Cimarron?

Shannon and Tim identified the following science needs:

Distribution Changes: Do we need to understand the fine-scale distributions of other species in order to manage them effectively?

* Remaining populations are fragmented in some cases.
* What are the factors driving these changes? Can conditions be restored to support these populations?

Distribution Changes: What are the population genetics of pelagophilic cyprinids both within the Canadian Basin and Range-wide?

* Need for cataloging intraspecific genotypic and phenotypic diversity for captive breeding/reintroduction program
* What is the effective population size?
* For ARS, is the Pecos population a suitable refugial population?
* Need a better understanding of Macrhybopsis complex?

Fragmentation: What are the flows/fragment lengths necessary to allow persistence of species?

* Recent evidence (Medley and Shirer 2013) suggest egg retention by habitat features (e.g., floodplain) may complement the importance of increasing available drift distance?
* Floodplain use and egg retention reported for Rio Grande Silvery Minnow- unknown for other species?
* Presumed minnow migrations remain undocumented for many species?

Habitat: What are the nursery habitat requirements of pelagophilic cyprinids in the Canadian River?

* Evidence suggests that altered flows and fragmentation are driving recruitment.
* However, is suitable nursery habitat available when/if flows are improved?

Habitat: What are the spawning habitat requirements of pelagophilic cyprinids in the Canadian River?

* How much suitable habitat is available?
* How does availability/quality vary with changes in discharge? Some evidence for importance of suspended sediment and temperature….(floodplain v mainstem)
* How similar are requirements among species?
* Migrations, migrations, migrations..?
* Can spawning habitat be created and placed to maximize available drift distance?

Water Quality: How do changes in water quality influence the reproductive success/recruitment of pelagophilic cyprinids in the Canadian River?

* Evidence to suggest that elevated temperature, TDS, and TSS may alter the time required to complete embryonic development, survival, and current velocities required to keep eggs in suspension. Relate to possible floodplain use? Other geomorphic features?
* Importance relative to flow alteration and fragmentation?
* Consider the cost of barrier removal, water, and habitat creation?

Water Quality: How does water quality influence spawning habitat of pelagophilic cyprinids in the Canadian River basin?

* How does water quality influence the availability of suitable spawning habitat? Fragment length in the Cimarron River is okay?
* How similar are requirements among species?
* Different environmental tolerances?
* Feeding ability in different systems? Competition with introduced species?

Tim and Shannon concluded that there are many species of conservation concern in the Canadian. There is disparity in information between species but it does impact their conservation status. There are still large gaps in ecological knowledge (e.g., upstream migrations, reproduction, ‘differences’ in ‘similar species’), and that species face multiple interactive threats. They also noted that water availability is important – but how much and when is it needed, and now will this be influenced by water re-use in the future (S. Canadian)? They also noted that there is a lack of knowledge in fine-scale distributions of many species, differences in reproduction and recruitment (larvae and juvenile needs), the general ecology of the ‘chub complex’ and the systematics of those species, water quality issues in the basin (Cimarron River), Ichthyoplankton and reservoirs, and scenario planning. Finally, conservation opportunities in the Canadian include small barrier removal, experimental flow releases, assisted migration, captive breeding, and experimental population reintroductions.

During Q/A, Shannon, Tim, and others addressed the following:

* *Many of the science needs are biological as well as management questions. What are you more worried about?* Previously, Oklahoma focused on reservoirs; they are now moving toward rivers and streams. Ecological questions should be developed in the spirit of developing a management action.
* *There is opportunity for a lot of influential factors. Do we know much about the influence of land use on some of these factors?* There is a good relationship between suspended/dissolved solids and land use. In prairie streams, land use doesn’t impact temperature due to lack of a canopy in those systems. Ground water pumping is also influential. In Oklahoma and Texas, surface and ground water are treated separately for permitting.
* *Elaborate on assisted migration?* California has done this – they haul truckloads of spawning salmon beyond the reservoir.
* *Could you justify introduction of species due to climate change?* Dr. Brewer emphasized she would never be associated with moving a fish where it doesn’t belong. However, there is discussion of this elsewhere. There’s also the issue of rapidity of changing conditions and how you keep up with them.

The day adjourned with a description of the working group approach for Day 2.

**March 5, 2015**

Breakout groups on the Canadian and Brazos met to address the following questions:

* What conservation actions are needed to support the long-term persistence of focal fishes within the Pilot Watershed?
	+ What on-the-ground actions could be taken to conserve our focal aquatic species?
	+ What are the intended outcomes of these conservation actions for habitats and populations of focal species?
	+ What conservation programs/initiatives of GPLCC partners have the capacity to implement these on-the-ground actions?
* What are the specific research, monitoring and data needs to guide and inform conservation of focal aquatic species within the Pilot Watershed?

The final output of the Brazos Watershed group is found in Appendix B.

The final output of the Canadian Watershed group is found in Appendix C.

Following the breakouts, the full group reconvened and shared their outputs. However, there are also similarities in issues, e.g., fragmentation, flow, and invasive species. It was acknowledged there will be differences between watersheds. Overall, there is a goal to create a framework for the pilots that is also transferable to other watersheds.

Next steps:

* The coordinators will work with the outputs from both pilot breakout groups (Canadian and Brazos) to get them into similar frameworks.
* The GPLCC Steering Committee will discuss possible FY 2015 science funding based on the outputs of the workshops.

**Appendix A: Participant List**

|  |  |  |
| --- | --- | --- |
| Nicole | Athearn | Great Plains LCC |
| Preston | Bean | Texas Parks and Wildlife |
| Tim | Birdsong | Texas Parks and Wildlife |
| Barry | Bolton | Oklahoma Department of Wildlife Conservation |
| Shannon | Brewer | USGS, Oklahoma COOP |
| Brent | Bristow | US Fish and Wildlife Service |
| James | Broska | Great Plains LCC |
| Alex | Daniels | Playa Lakes Joint Venture |
| Daniel | Fenner | US Fish and Wildlife Service |
| Gary | Garret | Texas Parks and Wildlife |
| Tim | Grabowski | USGS, Texas COOP |
| Roger | Grosse | Rainwater Basin Joint Venture |
| Dean | Hendrickson | University of Texas - Austin |
| Jordan | Hofmeier | Kansas Wildlife, Parks and Tourism |
| Greg | Hughes | US Fish and Wildlife Service |
| Steve | Krentz | Great Plains Fish Habitat Partnership |
| Ben | Labay | University of Texas - Austin |
| Mike | Langston | South Central Climate Science Center |
| Stephen | Magnelia | Texas Parks and Wildlife |
| Daniel | Manier | USGS, Ft. Collins Science Center |
| David | Mehlman | The Nature Conservancy |
| Mike | Montagne | US Fish and Wildlife Service |
| Clint | Riley | US Fish and Wildlife Service |
| Dana | Roth | US Fish and Wildlife Service |
| Julie | Shapiro | The Keystone Center |
| Jason | Singhurst | Texas Parks and Wildlife |
| Jude | Smith | US Fish and Wildlife Service |
| Bryan | Sowards | Kansas Wildlife, Parks and Tourism |
| Kyle | Taylor | Playa Lakes Joint Venture |
| Brian | Trusty | National Audubon Society |
| Gene | Wilde | Texas Tech University |
| Matt | Wunder | New Mexico Game and Fish |

**Appendix B: Brazos River Watershed – Pilot Breakout**

**Great Plains Landscape Conservation Cooperative**

**Brazos River Workgroup**

**What conservation actions are needed to support the long-term persistence of focal fishes within the Pilot Watershed?**

* What on-the-ground actions could be implemented or are being implemented to conserve our focal aquatic species?

**Land management:**

\*Double Mountain Fork (DMF) Salt Cedar eradication

\*Create refugia (riverside ponds filled by solar powered pumps with outflow to river)

**Fragmentation:**

Inventory and assessment of instream impediments to fish movement

Inventory and assessment of in-channel refugia during low flows

Removal of detrimental barriers

**Flow issues:**

\*Removal of small dams on tributaries to support main-stem flows

\*For future and planned reservoirs there is a need to develop flow prescriptions/strategies

* What are the intended outcomes of these conservation actions for habitats and focal species populations?

\*DMF – restoration of geomorphology; increased flows; restoration of native veg. species; improved fish movement

\* Refugia: Pond outflow provides constant water source to reaches of river

\* Increased flows to main-stem Brazos River from the removal of small dams on tributaries

* What conservation programs/initiatives of GPLCC partners have the capacity to implement these on-the-ground actions?

\*DMF - TexasLandowner incentive program; USWFS Partners program; Brazos River Authority; NRCS priority quail areas program; TX Soil and Water Supply Enhancement Program; Oaks and Prairies Joint Venture Quail program

**What are the specific research, monitoring and data needs to guide and inform conservation of focal aquatic species within the Pilot Watershed?**

**Research Needs –**

\*Surveys need to inform multi-species information needs (mussels, etc.)

\*Information on the impacts of removal of small dams on tributaries

\*Research on salt cedar removal benefits (increased base flows; improved channel geomorphology; native vegetation establishment; native wildlife habitat benefits)

\*(For Middle/Lower Brazos) Evaluation of State of Texas Brazos River Water Management Plan and the Plan’s impacts on fish and wildlife (identifying fragmented river reaches that have potential value to wildlife with given flow regime)

\* Information on the link between flows and fish reproduction/recruitment to inform water management especially at planned water diversion/impoundment sites

**Monitoring Needs –**

\*Surveys need to inform multi-species information needs (mussels, etc.)

**Data Needs-**

\*Surveys need to inform multi-species information needs (mussels, etc.)

\*Ground truthing of aerial imagery to assess current conditions

**What strategies can help to achieve results for identified conservation actions?**

\*DMF – 1) Demonstration Project of Salt Cedar eradication (ie: Asian Beetle introduction, USFWS: John Taylor methodology); 2) restoration of native grasses; BMPs grazing practices to reduce sedimentation;

\*For fragmentation: Develop a prioritization strategy of barrier removal

**BRAZOS PILOT WORK GROUP: FINAL NEEDS ASSESSMENT for UPPER BRAZOS RIVER**

**Land management:**

Salt Cedar Eradication:

1. Research Need – a) Quantify how eradication of salt cedar result in increased water flows and/or native forage for cattle: Quantify what’s in it for the landowner by demonstrating improved value of land. b) Quantify how eradication of salt cedar result in increased water flows and improved channel geomorphology for fish and wildlife, c) Delineate which areas best benefit focal species.

(Possibly a literature review for a & b)

1. Identify / prioritize locations of salt cedar for removal
2. Monitor demonstrate sites for surmised benefits
3. Develop strategies to communicate benefits to land owners and conservation delivery partners

**Fragmentation:**

Impediments to fish movement:

1. Inventory and assessment of barriers to fish movement
2. Identify / prioritize detrimental barriers for removal or modification to allow fish passage
3. Inventory and assessment of in-channel refugia during low flows
4. Create and/or augment refugia (creating riverside ponds filled by solar powered pumps with outflow to river)
5. Monitor demonstrate sites for surmised benefits

**Flow issues:**

1. Inventory and assessment of small dams and other diversions on tributaries of the Brazos
2. Hydrologic analysis of the effects of the removal of small dams and diversions on tributaries to support main-stem flows
3. Prioritization of small dams and diversions for removal (or other strategies) that maximize benefits to flows on the main stem Brazos River
4. Monitor demonstrate sites for surmised benefits

**Informing site selection and operations of water development projects:**

1. Research the link between flows and fish reproduction/recruitment to inform water management especially at planned water diversion/impoundment sites
2. Surveys needed to inform multi-species information needs (mussels, etc.) to inform water management especially at planned water diversion/impoundment sites

**Appendix C: Canadian River Watershed – Pilot Breakout**

Science needs: final output:



**Canadian River Breakout Worksheet:**

**Overall objectives**:

5 year strategy… Get to actions and outcomes; to get there: what kinds of outcomes are we looking for? Inform conservation actions to deliver the outcomes. To get to actions, understand what we need to know – what are the species of concern, what are the science needs?

What is the new baseline we are trying to get to? Not the historic condition, but better than no further loss.

What is the achievable restoration goal or conservation outcome?

* Sustainable populations in the Canadian River Basin above and below Lake Meredith: No more decline over time (note: the Canadian is in better shape that other systems like Cimmaron, which has seen more dramatic declines)

**What is the scope of concern?**

* **Geographic Scope:**
	+ Upper (Texas Panhandle) or Lower, or both?
	+ To be biologically meaningful to the fish, you have to talk about the whole river
* **Species of Concern:** (these are not necessarily the indicators for monitoring) –Fish as a primary focus (at least for now) but conservation actions can benefit multiple species/types of species
	+ Fish:
		- Shoal Chub
		- Peppered Chub
		- Plains Minnow
		- Red River Shiner
		- Arkansas River Shiner
		- Flathead Chub
	+ Invertebrates are not of strong concern here
	+ Birds:
		- Interior Least Tern (ask bird expert – may not be in our focal area)
		- Piping plovers?
	+ Mammals:
		- Bats (use the riparian corridors for movement and feeding) (check with other experts)
		- Mountain lions (use river corridors)
* **Threats** (categories are overlapping):
	+ Water availability
		- Groundwater pumping
		- Surface water pumping
		- Aquifer flow
		- Water pumping for agriculture (~80% of pumping is for irrigation),
		- Water use for energy (oil and gas development) and municipalities
		- Inter-basin transfer of water
	+ Changes in hydrology
		- Dams – existing large impoundments, small impoundments on tributaries
		- Other barriers and obstructions that alter hydrology – culverts, roads
	+ Changes in channel morphology
		- Stream incisions (change from braided systems)
		- Salt cedar
	+ Water quality
		- Dissolved organic matter introduction and eutrophication due to ag inputs near waterways
	+ Climate change (including impacts to water availability and quality)
	+ Wind power generation
	+ Invasive species
		- Salt cedar
		- Red River Shiner
		- Red River Pupfish
		- Sheepshead Minnow (in Brazos… is it an issue in Canadian)?
	+ Disease
		- Golden algae
	+ Other land use threats
	+ Sediment
	+ Entrainment
	+ Commercial minnow seiners

**What conservation actions are needed to support the long-term persistence of focal fishes within the Pilot Watershed?**

Overall, focus on increasing recruitment.

* **What on-the-ground actions could be implemented or are being implemented to conserve our focal aquatic species?**
	+ In-stream flow requirements
	+ Obtain water rights permits
	+ Monitoring and enforcing existing permits
	+ Education on water use; outreach to build collaboration efforts (landowners and lobbying)
	+ Working with States, as appropriate, on water conservation to improve water availability in stream (first identify appropriate mechanisms, e.g., water conservation credits)
	+ Releases from major reservoirs; pulse flows
	+ Small dam removal
	+ Vegetation management and morphology
	+ Sediment augmentation
	+ Targeted CRP enrollment
	+ Secondary enrollment along stream banks
	+ Develop an emergency response plan for drought
	+ Emergency response plan for spill releases (oil/gas, brine)
	+ Refugia areas next to the rivers that allow pump backs to the river – for salvage/emergency response operations
* **What are the intended outcomes of these conservation actions for habitats and focal species population?**
	+ Sustainable populations in the Canadian River Basin above and below Lake Meredith: No more decline over time
* **What conservation programs/initiatives of GPLCC partners have the capacity to implement these on-the-ground actions?**
	+ Partners for Fish and Wildlife
	+ SARP
	+ NRCS – link to private landowners
	+ The Nature Conservancy (owns some land along the riparian corridor)
	+ Extension
	+ USDA Climate Hubs

**What are the specific research, monitoring and data needs to guide and inform conservation of focal aquatic species within the Pilot Watershed?**

See chart, above, for final recommended priorities. Original brainstorming is included below:

* **Research Needs** – most critical needs are likely to center around hydrology

**General brainstorm:**

* + Hydrology
		- How much water is needed, when is it needed?
			* What are the different needs for different species?
			* Are there limiting factors that are different among these species?
			* Would the targeted management response be different for different species? (for today, general consensus that management responses would be similar; there may be minute differences that we identify beyond today)
		- Modelling: What would be the impact on hydrology of removing 10% of small dams/impoundments on tributaries?
		- If there were water in the streams, would the fish come back?
			* What are the impacts of invasive species?
			* What are the impacts of altered geomorphology?
		- Salt cedar removal and influence on hydrology:
			* Influence of beetles on salt cedar and subsequent re-vegetation; what would a lack of re-vegetation do to impact morphology and hydrology?
			* What are the management techniques for re-vegetation post- salt cedar? Influence of fire and flooding?
			* What does control of salt cedar do to the riparian stream conditions (e.g., temperature)?
		- What is different in the systems where fishes persist vs. where they have disappeared? (this could inform a recovery plan)
	+ Biology
		- Predators
	+ Other – these points are secondary to the hydrology questions
		- What is the influence of other factors in the watershed (if you were to change the hydrology, are there other factors that would still influence the survival of the fish)?
		- What do we know about the relationship between the upland landscape, land use, and water quality?
		- Modelling the tie between land use and water use, and impacts on hydrology.
	+ Land Use
		- Landowner opinions survey (similar to the Playas study).
		- How does water conservation impact hydrology/water budget in the stream?
		- Monitoring to identify water use in the basin.
	+ Geomorphology

**Monitoring Needs**

**Data Needs**

**In-Stream Flow Science Needs**  - many of these questions could also relate to refugia

* **Biology**
	+ - * + How much water do the species need? When and how often (how many peak flows each year)?
				+ How is spawning and recruitment related to hydrology?
				+ Where is the water needed?
				+ What are the threshold responses?
				+ Are there different needs for different fishes?
				+ \*\*Early life history, movement, nursery areas
* **Hydrology**
	+ - * + Where can efforts be maximized to create longer, more connected reaches?
				+ Where would small dam removal or alteration be most effective?
				+ What alternatives can be used to alter small dams to meet flow goals and still meet other interests (e.g., for water fowl, ranching)?
				+ Modelling: If climate change creates isolated intense storms on tributaries, will that create a pulse lasting long enough for fish spawning and reproduction?
				+ What is the influence of the dry days?
				+ Monitoring: gauges on the river to monitor low-flow events
* **Geomorphology**
	+ - * + Salt cedar removal and influence on hydrology:

Influence of beetles on salt cedar and subsequent re-vegetation; What would a lack of re-vegetation do to impact morphology and hydrology?

What are the management techniques for re-vegetation post- salt cedar? Influence of fire and flooding?

What does control of salt cedar do to the riparian stream conditions (e.g., temperature)?

* + - * + Entrainment: How does this impact fish movement
* **Land Use**
	+ - * + What alternatives can be used to alter small dams and still meet other interests (e.g., for water fowl, ranching)?
				+ How would changes in land management practices (e.g., terraces) impact hydrology?
				+ Develop a basic water budget to understand land and water use in the basin.
				+ \*\*Land owner attitudes related to water use in the basin and in stream flows.
				+ \*\*What are the impediments of getting to an instream flow?

**Science Needs for Other Conservation Actions**

* Data layer for oil and gas (get from USGS and playa lakes) – where infrastructure exists and where it is likely to go in the future (\*this is under development through grasslands LCD pilot)
* Database on locations and uses of small dams

**What strategies can help to achieve results for identified conservation actions?**

(not completed)