



TEXAS CONSERVATION ACTION PLAN

Western Gulf Coastal Plain ECOREGION HANDBOOK August 2012



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See links on Texas Parks and Wildlife Department’s Texas Conservation Action Plan 2012 website

<http://www.tpwd.state.tx.us/landwater/land/tcap/>

or the Wildlife Diversity Program website

http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/

for additional references and supporting documents related to this handbook.

“Action that grows out of urgency, frustration, or even determination is missing a critical ingredient. For action to be effective, for action to be meaningful, it must also grow out of respect and a deep sense of connection to the things and people that surround us.” – Orion Magazine Editors, March/April 2011

SUMMARY

The Western Gulf Coastal Plain (WGCP) Handbook is one of the Texas Conservation Action Plan (TCAP) thirteen handbooks available on the Texas Parks and Wildlife Department’s Texas Conservation Action Plan website¹:

- an **Overview** – background information about how this Plan came about and was revised;
- a **Statewide/Multi-region handbook** – broad resource concerns and opportunities; and
- 10 other ecoregion handbooks like this one for different areas of Texas with more local information.

This handbook provides insight into specific WGCP resources and conservation issues, including a list of Species of Greatest Conservation Need (SGCN), rare communities, and important habitats that support these unique features. The WGCP handbook also presents a compiled list of issues – things that prevent us from doing our best conservation work here – and proposed solutions or actions. Throughout this document, there are resources – web links, programs, incentives, and contacts – to help you participate in implementation and learn more about the natural resources this region of Texas has to offer.

The TCAP WGCP Ecoregion Handbook takes advantage of many different perspectives to understand local changes and identify actions that will reduce threats to specific natural resources: SGCN, rare communities and the habitats on which they rely. The Plan aims to ensure that we are able to share our natural heritage with future generations of Texans and that they understand what we did to make *progress* toward that goal.

It’s important to prioritize where we need to work to the degree that we can: human and financial resources are limited, certain issues demand more immediate resolution, and some species and habitats are simply more in need. The TCAP 2012 taps into a broad network of conservation service providers, natural resources managers, alliances and working groups, policy makers, stakeholders and the public to define **what’s at risk, what issues are most important, where we need to work, how to best engage the right partners to solve the problems, and what to do.**

This handbook is divided into sections to guide priority setting and actions:

- resources at risk - SGCN, rare communities, and the habitats on which they rely;
- issues that are most important, which could benefit from targeted stakeholder involvement; and
- conservation actions to benefit resources and make progress toward solving issues.

Certain resources also have a statewide context – riparian areas, grasslands – and additional actions at that level are proposed in the Statewide/Multi-region handbook. For more information about how content was developed for all handbooks of the Action Plan, please see the Overview handbook.

¹ TPWD. 2012. Texas Conservation Action Plan – all handbooks and supporting documents can be found online at <http://www.tpwd.state.tx.us/landwater/land/tcap/>

HOW TO GET INVOLVED

This handbook contains a list of partners and programs that provide conservation services and/or information in this area. Additionally, certain conservation actions at the end of this handbook may help you connect with partners working on specific issues.

There are many wonderful, energetic public and private conservation providers in Texas who have active volunteer networks, strategic needs, and programs. For more information, check the Natural Resource Conservation Programs and Services for Texas Landowners.²

If you have questions about the TCAP content and cannot find what you need on the TPWD Texas Conservation Action Plan website or in one of the handbooks,³ please contact the TCAP Coordinator at the TPWD Headquarters in Austin, Texas:

Phone (512) 389-4800

Email tcap@tpwd.state.tx.us

² TPWD. 2007 Natural Resource Conservation Programs and Services for Texas Landowners.
http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_1198.pdf

³ TPWD. 2012. Texas Conservation Action Plan – all handbooks and supporting documents can be found at this website: <http://www.tpwd.state.tx.us/landwater/land/tcap/>

OVERVIEW

The Western Gulf Coastal Plains (WGCP) ecoregion, or “Pineywoods,” is rich with meandering rivers and complex forests and woodlands. Lands and waters in east Texas connect us to southeastern forest ecology in northern and western Louisiana, southern Arkansas, east Texas, and southeastern Oklahoma. The landscape here makes even native Texans broaden their mind’s eye view of Texas – we’re not all arid west and cowboys – add forests of dappled sunlight and dark tea-stained wetlands, broad rivers, big lakes to that vision. Shortleaf pine forest, longleaf pine savanna, bottomland hardwoods form the native superstructure in this ecoregion; look deeper you’ll find a treasure-trove of wildlife and fish resources in periodically flooded river edges and oxbow lakes; unique swamps, bogs, fens, springs and seeps; and spotty lush open meadows. Rare plants and plant communities abound.

This region of Texas has more public ownership – State Wildlife Management Areas and Parks, Experimental Forests, university lands, State Forests, National Forests, National Wilderness Areas and Preserves, Federal Lakes and Recreation Areas, and National Wildlife Refuges⁴ than other ecoregions in Texas – providing ample opportunities for public hunting and fishing, wildlife viewing, hiking, paddling and other recreational opportunities. In addition to the scenic and recreational values of these lands, they form a network of very important habitats for some species found only in this important forest-prairie-wetland matrix. For instance, the 25,000 acre Trinity River National Wildlife Refuge in Liberty County contains some of the largest protected areas of bottomland hardwood forests. This Refuge also harbors floodplain canebrake areas of fairly significant size and has the largest maternity colony of Rafinesque’s big-eared bats in Texas.⁵

This ecoregion is highly dissected by perennial streams through rolling plains, forming flat fluvial terraces, bottomlands, sandy low hills and low cuestas. Soils are generally acidic, moreso than in other regions of the state. The WGCP has a mild climate and receives more rain than most ecoregions in Texas, amping up the humidity and plantlife. Historically, longleaf pine woodlands and savannas to the south and shortleaf pine – hardwood forests in the north dominated the ecology: southern red oak, post oak, white oak, hickories, and loblolly pine were common, with small areas of beech and magnolia in the south. Southern floodplain forest of water oak, willow oak, swamp chestnut oak, sweetgum, blackgum, red maple, bald cypress and water tupelo typify bottomlands. Wildlife significantly different from most of the rest of the state occurs here: beaver, muskrat, river otter, swamp rabbit, red-cockaded woodpecker, white ibis, Mississippi kite, alligator, and Louisiana pine snake. Communal bird roosts and rookeries are important in this region.

Most of the native forests have been converted to productive monotypic commercial timber stands in this ecoregion, including bottomland areas. Livestock, oil and gas production are all major land uses as well. Cropland is generally limited to leveed bottomlands and is a minor land use in the region. That said, there are few native plant communities left in the region in connected, ecologically functional landscapes. This area is a hotspot for emerging development, attractive to people seeking their own little slice of Texas heaven (small hobby farms, ranchettes, hunting clubs) and regional smaller towns like Texarkana, Longview, Tyler, Nacogdoches, Lufkin and Huntsville are fast-growing communities.

⁴ National Atlas. <http://nationalatlas.gov/printable/images/pdf/fedlands/TX.pdf>

⁵ Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United States Descriptions. Prepared for the North American Commission for Environmental Cooperation (www.cec.org), version May 11, 2010. Corvallis, Oregon.

Griffith, G.E., S.A. Bryce, J.M. Omernik, J.A. Comstock, A.C. Rogers, B. Harrison, S.L. Hatch and D. Bezanson. 2007. Ecoregions of Texas. R.S. Geological Survey, Reston VA. http://www.epa.gov/wed/pages/ecoregions/tx_eco.htm (accessed May 2009).

Table 1 crosswalks this ecoregion with other conservation planning units.⁶

Figure 1 illustrates the location and extent of this ecoregion in Texas.

Table 2 documents the Ecological Drainage Units (EDU) and Hydrologic Units (“HUC 8”, finer scale watersheds within EDUs), Reservoirs and Ecologically Significant Stream Segments⁷ (ESSS) which occur in this area.

Figure 2 shows those EDU, HUCs and ESSS by ecoregion.

⁶ For more information about planning boundaries, see the Overview handbook on the TCAP 2012 website <http://www.tpwd.state.tx.us/landwater/land/tcap/>

⁷ TPWD. 2002/2005. *Ecologically Significant Stream Segments*.

http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/

Table 1. Crosswalk of WGCP Ecoregion with Other Conservation Plan Units

Note Table is formatted 8-1/2" x 11" landscape orientation; see also Ecoregions map on TCAP 2012 website.

2012 TCAP	2005 TXWAP Gould 1960	The Nature Conservancy Terrestrial Ecoregions 1999	Ecological Drainage Units (Watersheds) National Fish Habitat Action Plan TX = Southeast Aquatic Resources Partnership and Desert Fish Habitat Partnership AFWA 2006 Fish Habitat Partnership 2009 Esselman et.al. 2010	All Bird Joint Ventures (JV) and Bird Conservation Regions (BCR) NABSCI-US 2004, USFWS 2009a	Landscape Conservation Cooperatives (LCC) USFWS 2009b	2010 TPWD Land & Water Plan Strategic Regions TPWD 2010	Major Land Resource Regions and Areas (MLRA) NRCS 2006	Natural Regions of Texas LBJ School of Public Policy 1978
Western Gulf Coastal Plain (WGCP)	Pineywoods	Upper West Gulf Coastal Plain (40) and West Gulf Coastal Plain (41)	Lower Brazos Lower Red Lower Trinity Sabine – Neches	Lower Mississippi JV West Gulf Coastal Plain/Oachitas BCR	Gulf Coastal Plain and Ozarks	Trinity – San Jacinto (7) Deep East Texas (8) Northeast Texas (9)	South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region: Western Coastal Plain (133B) Atlantic and Gulf Coast Lowland Forest and Crop Region: Western Gulf Coast Flatwoods (152B)	Pineywoods

Figure 1. WGCP Ecoregion with County Boundaries

Western Gulf Coastal Plain ecoregion in yellow

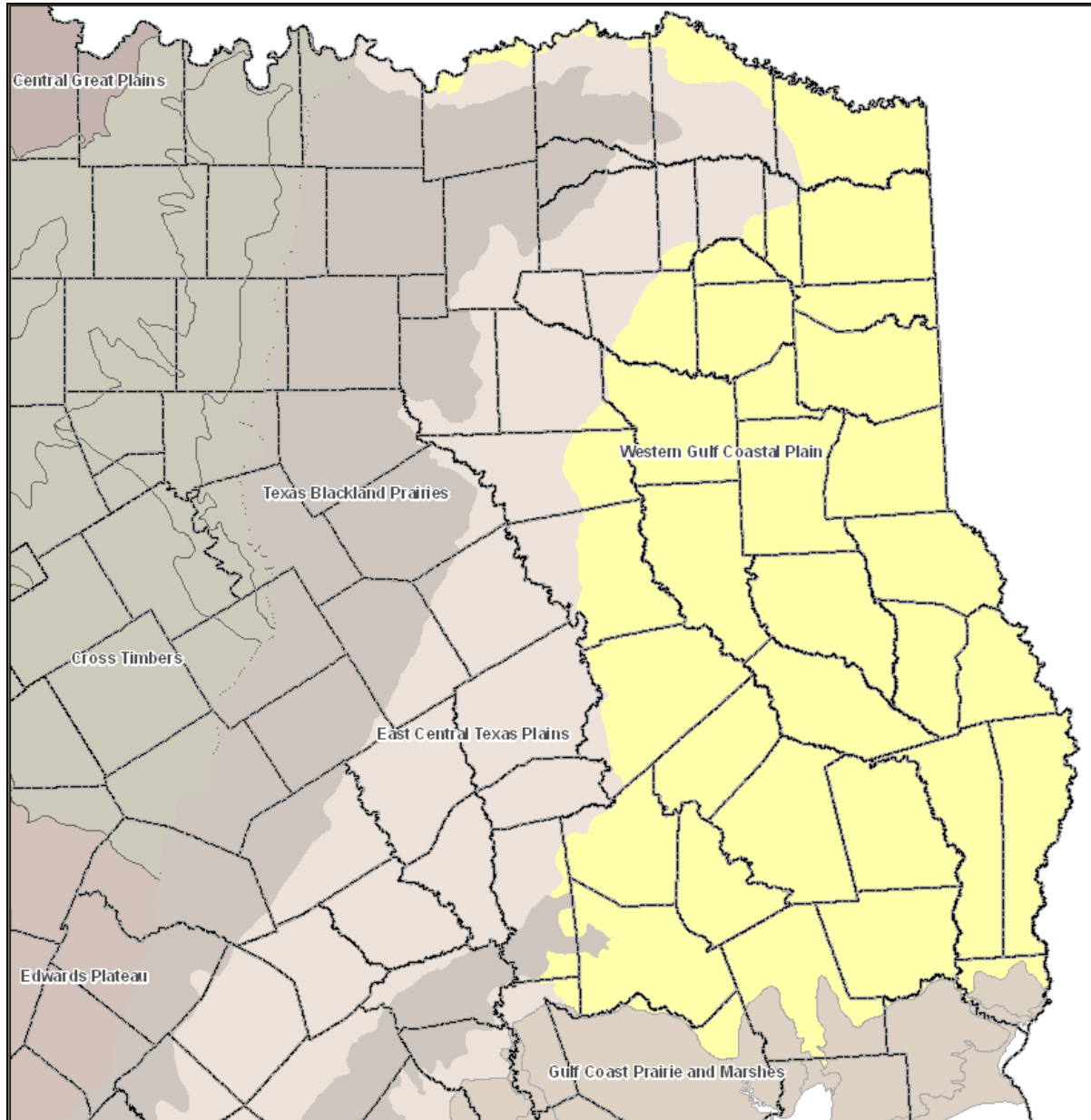


Table 2. WGCP EDUs with Ecologically Significant Stream Segments and Reservoirs

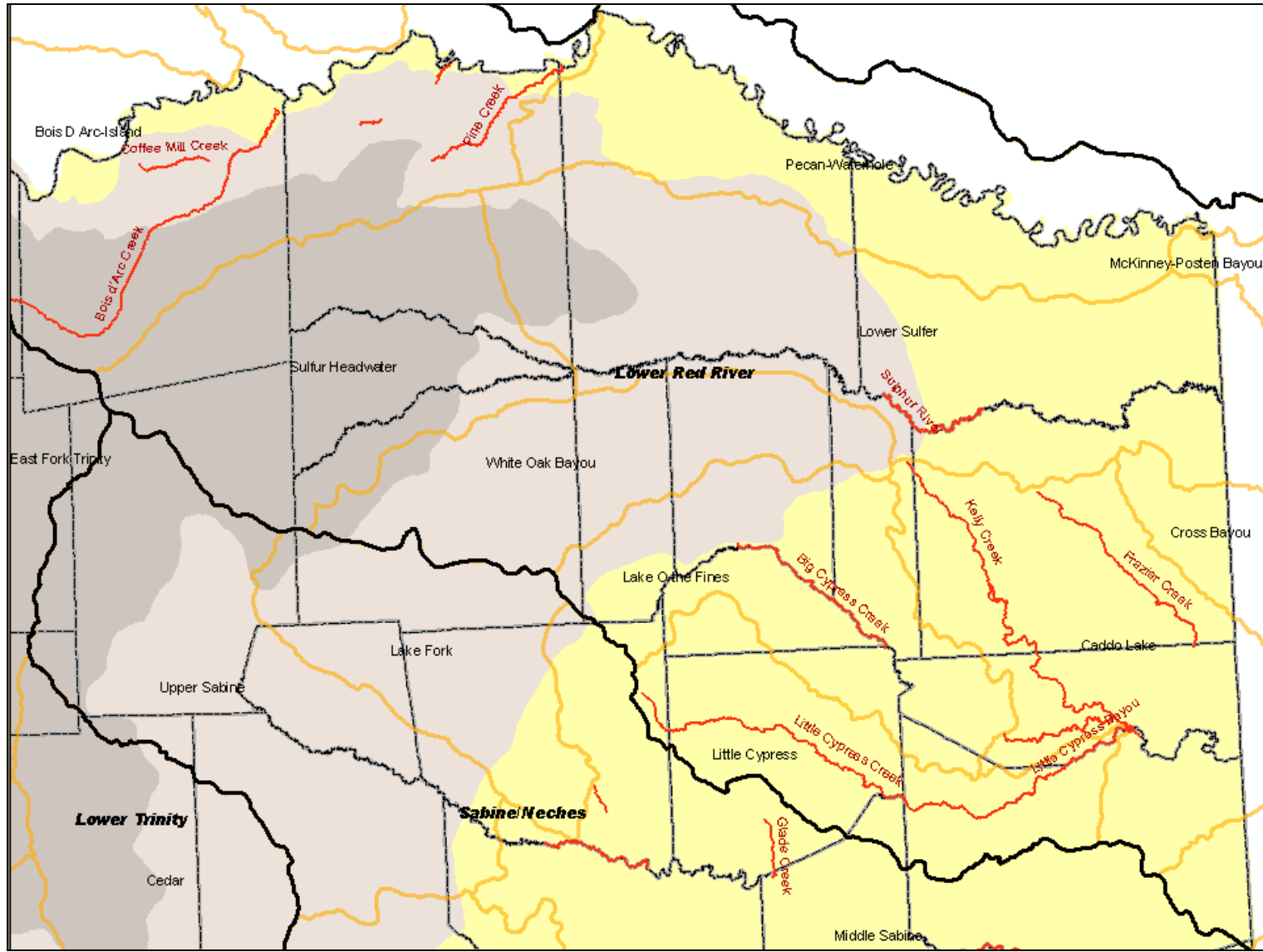
ECOLOGICAL DRAINAGE UNIT SubBasin (HUC 8)	<i>Ecologically Significant Stream Segment TPWD 2002, w/updates 2005</i>	Lakes and Reservoirs
LOWER RED RIVER		
Bois d'Arc - Island	Sanders Creek, Pine Creek	
Lower Sulphur	Sulphur Creek	Wright Patman Lake
Pecan - Waterhole		
Lake O' the Pines	Big Cypress Creek	Lake Cypress Springs, Lake Bob Sandlin, Lake Monticello, Welsh Reservoir, Ellison Creek Reservoir, Johnson Creek Reservoir, Lake O' the Pines
McKinney - Posten Bayou		
Caddo Lake	Kelly Creek, Frazier Creek	Caddo Lake
Cross Bayou		
Little Cypress	Little Cypress Bayou	Lake Gilmer
SABINE - NECHES		
Upper Sabine		
Lake Fork		
Upper Neches	Neches River, San Pedro Creek, Austin Branch, Bowles Creek	Lake Athens, Lake Palestine, Lake Jacksonville
Middle Sabine	Little Sandy Creek, Sabine River, Irons Bayou	Lake Winsboro, Lake Hawkins, Lake Gladewater, Eastman Lakes, Brandy Branch Cooling Pond, Lake Cherokee, Martin Lake, Lake Murvaul, Toledo Bend Reservoir
Toledo Bend		Toledo Bend Reservoir
Lower Sabine	Sabine River, White Oak Creek, Trout Creek, Cypress Creek	
Upper Angelina	Mud Creek, Alazan Bayou, Angelina River	Lake Tyler, Lake Tyler East, Lake Striker, Lake Nacogdoches
Lower Angelina	Attoyac River, West Creek, Red Branch Angelina River, Angelina River downstream of Rayburn	Pinkston Reservoir, Lake Kurth, Sam Rayburn Reservoir
Middle Neches	Neches River, Sandy Creek, Hickory Creek, Heger Creek, South Fork Cochino Bayou, Cochino Bayou, Boggy Slough, Hackberry Creek, Alabama Creek, Lynch Creek, Piney Creek	
Lower Neches	Neches River	B.A. Steinhagen Lake

Village	Big Sandy Creek, Turkey Creek, Village Creek, Little Beech Creek, Beech Creek	
Pine Island Bayou	Pine Island Bayou, Little Pine Island Bayou	
LOWER TRINITY		
West Fork San Jacinto	Lake Creek, East Sandy Creek	Lake Conroe, Lake Houston
Lower Trinity - Kickapoo	Trinity Creek, Nelson Creek, Harmon Creek, Henry Lake Branch, Double Lake Branch, Big Creek, Menard Creek	Lake Livingston
Lower Trinity - Tehuacana		Houston County Lake
Spring		
East Fork San Jacinto	East Fork San Jacinto, Winters Bayou, Caney Creek, Luce Bayou	Lake Houston
Lower Trinity	Trinity River	

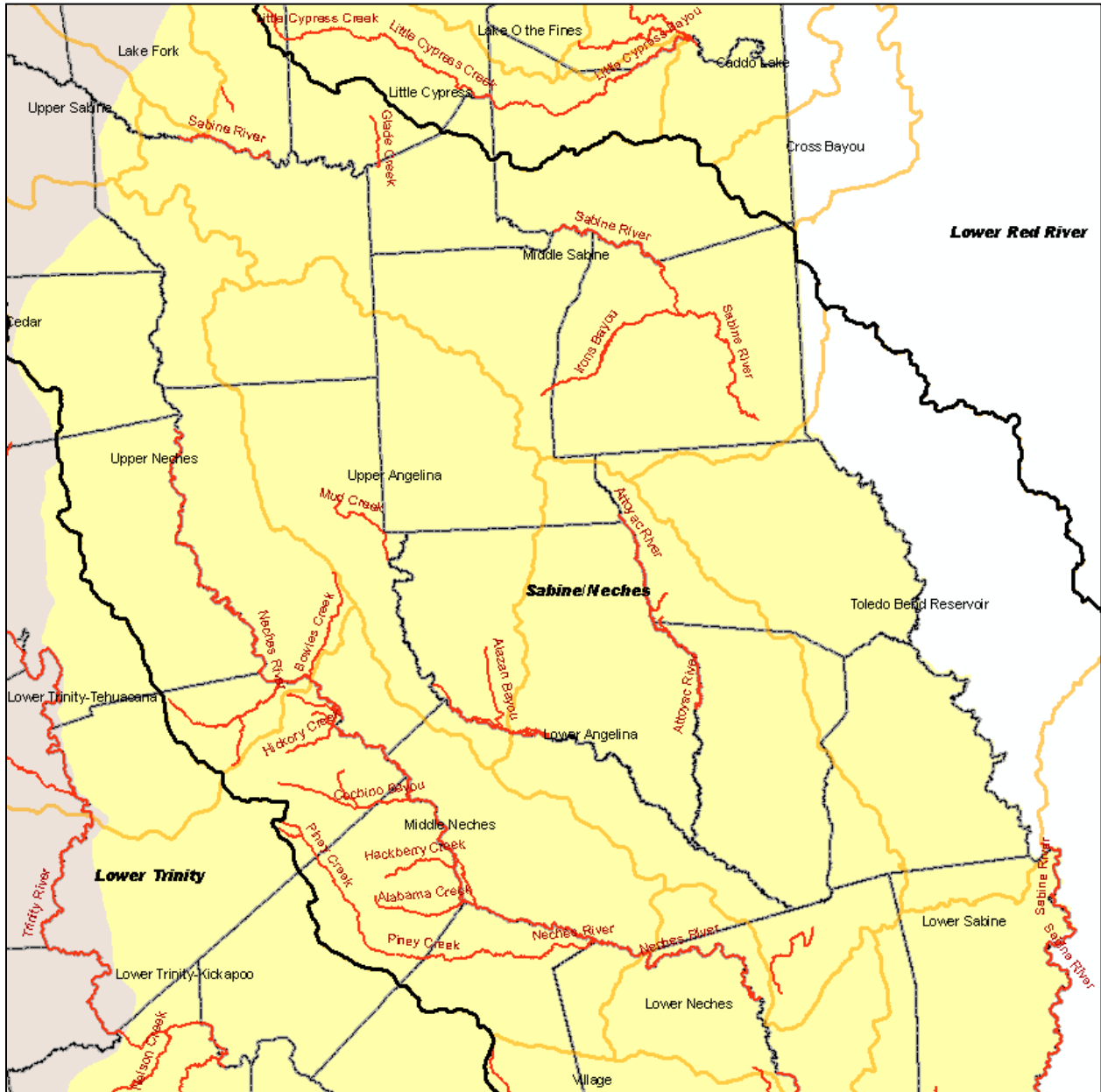
Note: Ecologically Significant Stream Segments and Reservoirs which occur in the Subbasin (HUC 8) but not in the ECOREGION are not included in this table. There may be other significant stream resources mentioned in the Priority Habitats section

Figure 2. WGCP EDUs, HUC 8s, and ESSS

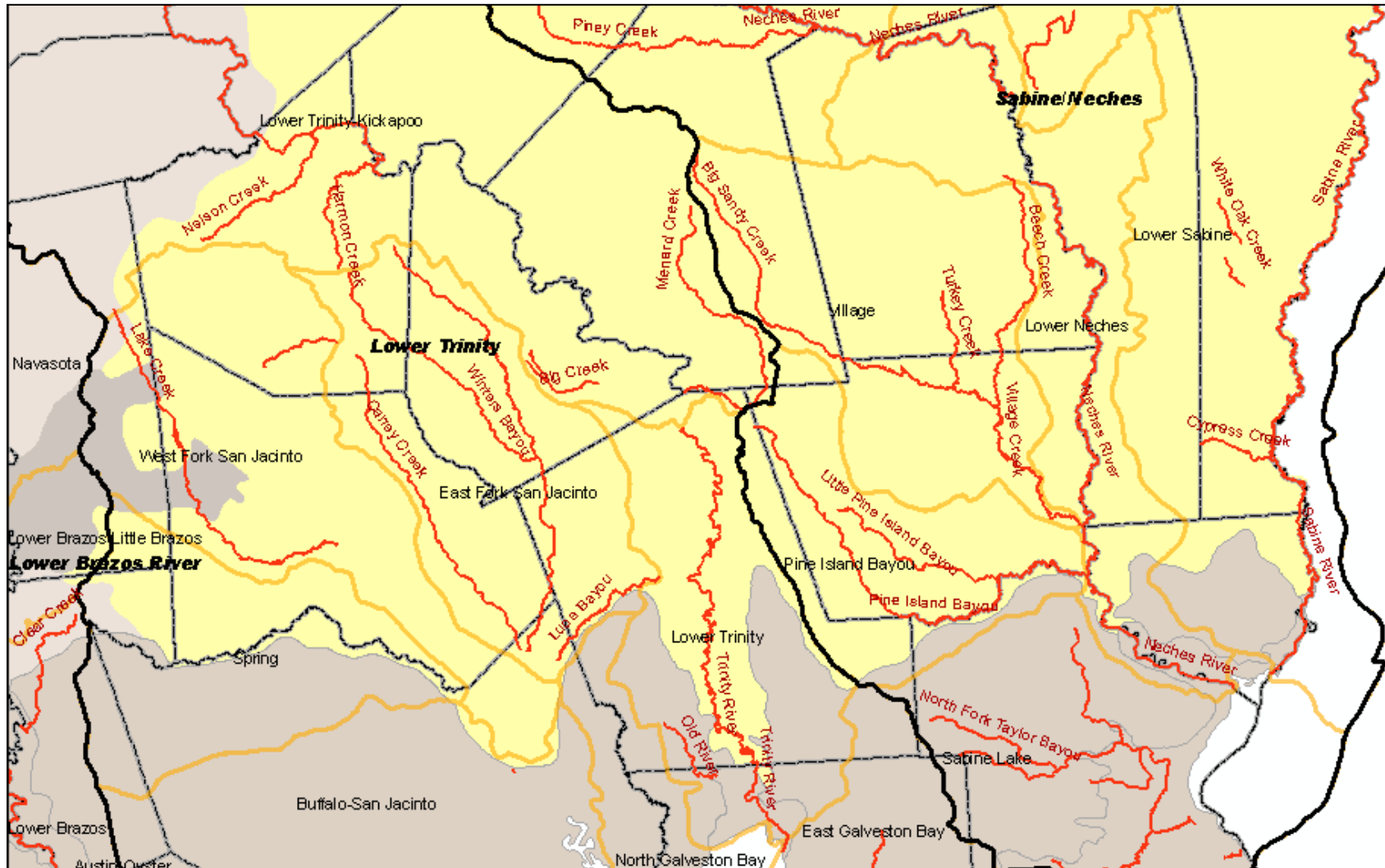
Lower Red River EDU black outline (Sabine Neches continued next page), HUC 8s orange outline, ESSS red lines



Northern portion of Sabine – Neches EDU black outline (Lower Trinity and lower Sabine –Neches on next page) black outline, HUC 8s orange outline, ESSS red lines



Lower Trinity and lower Sabine-Neches EDUs black outline, HUC 8s orange outline, ESSS red lines



Note: other important stream segments may be mentioned in the Priority Habitats section

RARE SPECIES AND COMMUNITIES

While most conservation work is done at the habitat level to address issues and threats, Action Plans' stated primary purpose is to improve and sustain *species'* populations and prevent the need to list species as federally or state threatened or endangered.⁸ The Species of Greatest Conservation Need (SGCN) list, one of the Eight Required Elements in all states' Action Plans, is the foundation for the habitat- and issues- based actions in the Plan. In Texas, we've also identified Rare Communities for this planning process. For more information about how the SGCN and Rare Communities lists were developed, including the changes from the 2005 list, see the Overview Handbook.⁹

Species and rare communities included in the 2012 TCAP Final SGCN and Rare Communities lists are supported by current science, peer-reviewed references and/or other dependable, accessible source documentation, and expert opinion.¹⁰ Each species has a NatureServe calculated state and global conservation rank, which accounts for abundance, stability and threats.¹¹ Additionally, several species have federal¹² and/or state¹³ listing (endangered, threatened, candidate) status. See the key to conservation status and listing ranks¹⁴ on the TPWD TCAP 2012 website.

The revised lists for TCAP 2012 are substantial and representative of conservation targets needing attention in this Plan and are sorted into the following categories:

Mammals	Birds
Reptiles and Amphibians	Freshwater Fishes
Invertebrates	Plants
Plant Communities	

Both the SGCN and Rare Communities Lists are on the TCAP 2012 website as large-but-sortable Microsoft Excel files: <http://www.tpwd.state.tx.us/landwater/land/tcap/sgcn.phtml>

Once you open this webpage, you can choose to look at the SGCN or Rare Communities lists. In each workbook, the first bottom tab is the complete final statewide compiled list, with habitat information and additional references where available; **each ecoregion tab in the workbook provides an excerpt of the statewide list, sorted to contain just the ecoregion's species or communities.**

⁸ Association of Fish and Wildlife Agencies. 2011. State Wildlife Action Plans. <http://www.wildlifeactionplans.org/>

⁹ TPWD. 2012. Texas Conservation Action Plan: Overview Handbook.

http://www.tpwd.state.tx.us/landwater/land/tcap/documents/tcap_draft_overview.pdf

¹⁰ TPWD. 2012. Texas Conservation Action Plan: Species of Greatest Conservation Need List and Rare Communities Lists. <http://www.tpwd.state.tx.us/landwater/land/tcap/sgcn.phtml>

¹¹ NatureServe. 2011. A network connecting science and conservation (online resources). <http://www.natureserve.org/explorer> (accessed 2011).

¹² USFWS. 2011. Endangered Species List, by state and county.

<http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm> (accessed 2011).

¹³ TPWD. 2011. State Listed Species.

http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species (accessed 2011)

¹⁴ TPWD. 2011. Texas Conservation Action Plan: Key to Conservation Status and Listing Ranks.

http://www.tpwd.state.tx.us/landwater/land/tcap/documents/species_key_tcap_2011.pdf

PRIORITY HABITATS

Nationally, an SGCN list forms a basis for every Action Plan; however, *species* conservation cannot be successful without defining the *lands and waters species need to survive and thrive*. If it was only important to know about individuals or even populations, we could put representatives in zoos or herbaria or other curated collections and that would be enough; but, it's not **It's important to conserve populations in the context in which they thrive, to the best of their abilities, where they can contribute to and benefit from the systems in which they live.**

Broad habitat categories were developed to organize all ecoregional handbooks.¹⁵

See also the Statewide/Multi-region handbook for habitats that are of broader importance – shared with many other regions and/or other states or nations (e.g. riparian or migratory species' habitats as a general category).

See documentation for *Ecoregions of Texas* and the *Texas Ecological Mapping Systems Project*.¹⁶

Priority habitats in these ecoregions which support SGCN were identified through workshops, surveys and other ecologists' and/or literature and are listed in Table 3.

¹⁵ TPWD. 2011. Texas Conservation Action Plan: Broad Habitat Category Definitions.

http://www.tpwd.state.tx.us/landwater/land/tcap/documents/habitat_categories_tcap_2011.pdf

¹⁶ Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United States Descriptions. Prepared for the North American Commission for Environmental Cooperation (www.cec.org), version May 11, 2010. Corvallis, Oregon.

Griffith, G.E., S.A. Bryce, J.M. Omernik, J.A. Comstock, A.C. Rogers, B. Harrison, S.L. Hatch and D. Bezanson. 2007. Ecoregions of Texas. R.S. Geological Survey, Reston VA. http://www.epa.gov/wed/pages/ecoregions/tx_eco.htm (accessed May 2009).

TPWD, Missouri Resources Assessment Partnership, and Texas Natural Resources Information Service. In progress, 2005 – 2012. Ecological Systems Classification and Mapping Project <http://www.tpwd.state.tx.us/landwater/land/maps/gis/tescp/index.phtml> (accessed 2010). Austin TX.

Table 3. WGCP Priority Habitats

Note Table is formatted 8-1/2" x 11" landscape orientation

GENERAL HABITAT TYPES	WESTERN GULF COASTAL PLAIN (WGCP) also called "Pineywoods"	WGCP Ecological Systems
NATURAL AND SEMI-NATURAL TYPES	<i>Habitats in this column were identified in the workshop; additions were made by editor to riverine and cultural aquatic</i>	<i>NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications for Ecological Systems of Texas' Western Gulf Coastal Plain. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 08 October 2009.</i>
Grassland	Prairies, glades within the forest mosaic	East-Central Texas Plains Xeric Sandyland Texas Blackland Tallgrass Prairie West Gulf Coastal Plain Southern Calcareous Prairie
Savanna/Open Woodland	Longleaf pine savanna (both upland and wetland)	West Gulf Coastal Plain Stream Terrace Sandyland Longleaf Pine Woodland East-Central Texas Plains Post Oak Savanna and Woodland West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland South-Central Saline Glade West Gulf Coastal Plain Catahoula Barrens West Gulf Coastal Plain Weches Glade West Gulf Coastal Plain Pine-Hardwood Flatwoods (mixed upland and wetland)
Woodland	Pine-oak woodlands	West Gulf Coastal Plain Sandhill Oak and Shortleaf Pine Forest and Woodland
Forest <i>See also Riparian and Wetlands</i>	ravine and side-slope forests pine forests pine-oak forest mesic mixed hardwood forest types; beech-magnolia forest; beech-white oak forests	West Gulf Coastal Plain Mesic Hardwood Forest West Gulf Coastal Plain Pine-Hardwood Forest

GENERAL HABITAT TYPES	WESTERN GULF COASTAL PLAIN (WGCP) also called "Pineywoods"	WGCP Ecological Systems
Riparian	periodically flooded or subirrigated intact floodplain of Lower Red, Sabine-Neches (incl headwaters), Lower Trinity rivers and tributaries mature bottomland hardwoods mature woody wetlands (see also Freshwater Wetland) floodplain canebrakes	Red River Large Floodplain Forest West Gulf Coastal Plain Large River Floodplain Forest West Gulf Coastal Plain Nonriverine Wet Hardwood Flatwoods West Gulf Coastal Plain Small Stream and River Forest West Gulf Coastal Plain Wet Longleaf Pine Savanna and Flatwoods
Lacustrine <i>See also</i> Cultural Aquatic	Caddo Lake oxbows and bayous associated primarily with larger river systems of the region	West Gulf Coastal Plain Seepage Swamp and Baygall West Gulf Coastal Plain Flatwoods Pond

GENERAL HABITAT TYPES	WESTERN GULF COASTAL PLAIN (WGCP) also called "Pineywoods"	WGCP Ecological Systems
Riverine	<p>Instream habitats of all watersheds which intersect this ecoregion (see Figure 2)</p> <p><u>Ecologically Significant Stream Segments</u> Sanders Creek, Pine Creek, Sulphur Creek, Big Cypress Creek, Kelly Creek, Frazier Creek, Little Cypress Bayou, Neches River, San Pedro Creek, Austin Branch, Bowles Creek, Little Sandy Creek, Sabine River, Irons Bayou, White Oak Creek, Trout Creek, Cypress Creek, Mud Creek, Alazan Bayou, Angelina River, Attoyac River, West Creek, Red Branch Angelina River, Angelina downstream of Rayburn Reservoir, Sandy Creek, Hickory Creek, Heger Creek, South Fork Cochino Bayou, Cochino Bayou, Boggy Slough, Hackberry Creek, Alabama Creek, Lynch Creek, Piney Creek, Big Sandy Creek, Turkey Creek, Village Creek, Little Beech Creek, Beech Creek, Pine Island Bayou, Little Pine Island Bayou, Lake Creek, East Sandy Creek, Trinity Creek, Nelson Creek, Harmon Creek, Henry Lake Branch, Double Lake Branch, Big Creek, Menard Creek, East Fork San Jacinto, Winters Bayou, Caney Creek, Luce Bayou, Trinity River</p>	NA
Freshwater Wetland	Oxbows, Swamps Baygalls seeps and springs bogs, fens flatwood ponds floodplain canebrakes floodplain wetlands of all types	West Gulf Coastal Plain Herbaceous Seep and Bog

GENERAL HABITAT TYPES	WESTERN GULF COASTAL PLAIN (WGCP) also called "Pineywoods"	WGCP Ecological Systems
Aquifer	Carrizo – Wilcox (outcrop) Carrizo – Wilcox (suboutcrop)	NA
CULTURAL TYPES	<i>habitats in this column must support SGCN or rare communities to be considered in this plan</i>	
Agricultural	Managed timber lands – public and private Agricultural fields along borders with adjacent western and southern ecoregions	NA
Developed		NA
<i>Urban/Suburban/Rural</i>	Most urban and developed areas in this region have a large forested component	NA
<i>Rights of Way</i>	In some areas, native prairie and wetland openings are maintained on transmission and pipeline ROW	NA
Cultural Aquatic	Reservoirs: Wright Patman, Cypress Springs, Bob Sandlin, Monticello, Welsh, Ellison, Johnson Creek, Lake O' the Pines, Caddo, Gilmer, Athens, Palestine, Jacksonville, Winsboro, Hawkins, Gladewater, Eastman, Brandy Branch, Cherokee, Martin, Murvaul, Toledo Bend, Tyler, Tyler East, Striker, Nacogdoches, Pinkston, Kurth, Sam Rayburn, B.A. Steinhagen, Conroe, Houston, Livingston, Houston County, Houston	NA

SHARED HABITAT PRIORITIES WITH ADJACENT STATES

Texas shares its border with four states – New Mexico, Oklahoma, Arkansas, and Louisiana. WGCP shares its eastern border with Arkansas and Louisiana. Table 4 identifies habitat priorities which have been identified in the both adjacent states’ Wildlife Action Plans which may be adjacent to the WGCP. Every adjacent state’s Action Plan mentions the importance of **intact native riparian zones and floodplains, high quality instream habitats, wetlands** of all types, and **native grasslands**. These habitat types are also found in the WGCP and are priorities for conservation in this ecoregion. See Statewide/Multi-region handbook for broadscale Conservation Actions for these priorities.

Table 4. WGCP Shared Habitat Priorities with Adjacent State – Arkansas and Louisiana

Adjacent States	Ecoregions Shared with Texas	Habitat Priorities Shared with Texas ¹⁷ <i>(Action Plans and the National Fish Habitat Action Plan viewer online)</i>
Arkansas	Western Gulf Coastal Plain	pine savanna oak-hickory-pine forest bottomland forests blackland prairie ephemeral and perennial tributaries and mainstem of the Red River, and associated riparian zones and floodplains TX – AR HUC 8 at moderate risk: Cross Bayou TX – AR HUC 8 at high risk: McKinney-Posten Bayous TX – AR HUC 8 at very high risk: Lower Sulphur
Louisiana	Western Gulf Coastal Plain Gulf Coast Prairies and Marshes	oak-hickory-pine forest bottomland forests swamps, seeps, bogs, other wetlands dry sandhill woodlands hardwood slope forests mixed hardwood – pine forests longleaf pine savanna prairies, glades and barrens coastal marshes and grassland cypress and cypress-tupelo swamp coastal live oak-hackberry forest (chenier) ephemeral and perennial tributaries and mainstem of the Sabine River, and associated riparian zones and floodplains Marine environments seaward of the Gulf Intracoastal Waterway to three miles TX – LA HUC 8 at moderate risk: Cross Bayou, Bayou Pierre, TX – LA HUC 8 at high risk: Middle Sabine

¹⁷ Priorities were determined by reviewing the states’ Action Plans online (Arkansa Comprehensive Wildlife Conservation Strategy, 2006 (<http://www.wildlifearkansas.com/strategy.html>); Louisiana Comprehensive Wildlife Conservation Strategy, 2006 (http://www.wildlifeactionplans.org/pdfs/action_plans/la_action_plan.pdf); and the National Fish Habitat Risk Assessment Viewer online (NBII and USGS. 2011. http://fishhabitat.org/index.php?option=com_content&view=category&layout=blog&id=42&Itemid=61).

ISSUES

There are **activities and conditions** which may negatively affect the SGCN populations, rare communities, and the habitats on which they depend in this region. These issues can include **direct or indirect harm** (e.g. inappropriate mining reclamation which uses non-native vegetation or indirectly provides an opportunity for non-native invasive vegetation, streambed gravel mining that directly removes spawning habitat and/or indirectly creates poor water quality downstream) **plus basic “gaps” that prevent us from acting most effectively** (e.g. lack of information, lack of coordination to share current data, incompatible practices among land managers, lack of funding). For information about how this list was developed, see the Overview Handbook and the descriptions of the broad issue categories.¹⁸

Habitat fragmentation and habitat loss, including open-space land conversion, are always going to be broad issues that need to be addressed, at various scales – local, regional, statewide, interstate, and international. These are such broad categories and, depending on the scale of the problem, these three issues can be symptoms or causes of many other issues. These three issues are not specifically included in the Issues list, although they may be implied in many of the categories presented.

The issues covered in the WGCP Ecoregion Handbook in Table 5 attempt to present more of the specific causes of SGCN, rare communities, and habitats’ decline, providing appropriate context to help target our actions, identified later in this handbook. Several of the habitat types in this handbook are also considered priority habitats in the Statewide/Multi-region handbook.

¹⁸ TPWD. 2012. Texas Conservation Action Plan: Broad Issues Categories
http://www.tpwd.state.tx.us/landwater/land/tcap/documents/broad_issues_categories.pdf

Table 5. WGCP Priority Issues Affecting Conservation

General Issue	Ecoregion Issue Identified in Workshops (2010) and Surveys (2011)	Description of Adverse Effects Identified in Workshops (2010) and Surveys (2011)
Invasive Species		
Non-native Plant	<p>Bahia Grass, Bermuda Grass</p> <p>Non-native invasive plants and those sold in nursery trade - Chinese/Japanese privet or Ligustrum, chinaberry, nandina, Japanese honeysuckle); Chinese tallow, trifoliolate orange, eucalyptus</p> <p>Aquatic invasives – giant salvinia, water hyacinth, hotspots include Sam Rayburn, Toledo Bend, Pinkston, Timpson reservoirs</p>	<p>Non-native grasses in this ecoregion are typically installed deliberately as improved pastures for livestock production, roadside right-of-way erosion control or remediation after construction/mining, and as part of landowner incentive programs or even restoration/stabilization projects. These aggressive grasses have established in nearly every habitat type and (especially sodforming invasives) are a substantial threat to prairie and wetland dependent SGCN. Establishment of nonnative grasses for production typically requires excessive fertilizer and water inputs initially which are detrimental in runoff into regional waterways</p> <p>Non-native nursery plants which “escape” out of managed urban areas via waterways, are distributed by bird and animal droppings and/or are deliberately placed in suburban and rural-suburban developments quickly can invade riparian areas, any wet swale or depression, and/or native grassland/woodland complex. These species displace native plant communities with which native wildlife have evolved; can smother or choke out small isolated bog, seep or spring communities; and contribute to loss of native pollinators (e.g. honey bee, moths, hummingbirds, others) and the animals which rely on insect fauna now changed by these invasions. Observed noticeable increase in trifoliolate orange expansion in bottomland areas of Trinity River Refuge. Most of these woody exotics are shade-tolerant, difficult to detect under canopy, especially detrimental in bottomland areas and riparian zones.</p> <p>Aquatic infestations create potential for anoxic conditions, detrimental to fishes, aquatic invertebrates, freshwater mussels, and other water-dependent life downstream of these infestations</p>
Non-native Animal	<p>feral and/or free-ranging "pets"</p> <p>feral hogs</p> <p>Red Imported Fire Ants (RIFA)</p> <p>Raspberry Crazy ants</p> <p>introduced fishes and mollusks - freshwater springs, streams and marshes</p> <p>Baitfish released by anglers and “aquarium dumping” by hobbyists</p>	<p>Free ranging pets (cats, dogs as individuals and as packs) are introduced predators which primarily adversely affect small mammals, small reptiles, and birds; in packs, can also adversely affect larger mammals and ground-nesting birds; also contribute pathogens and diseases. It is estimated that 60-100 million feral cats reside in the US and another 60 million pet cats are allowed to roam outside. “Neuter and release” programs only address fecundity in a limited way, and do not address the impact to natural resources. The number of birds predated by feral cats in the U.S. is annually is more than 1 Billion; numerous SGCN are affected. The IUCN ranks feral cats as one of the world’s worst invasive species. (see The Wildlife Society, Wildlife Professional publication, Spring (March) 2011, Vol. 5 No. 1).</p> <p>Feral hogs decimate important and fragile habitats (e.g. springs, seeps, riparian areas, wetlands, swales, bogs, fens), degrade instream water quality, and decrease hardwood seedling viability (rooted up, eaten)</p> <p>RIFA are swarming indiscriminate predator to ground-nesting and some shrub-nesting birds, larvae and adults of many other insects, small mammals, reptiles and amphibians, and even the young of mid-sized mammals.</p> <p>Raspberry Crazy Ants are a new menace, very little known; however, anecdotal evidence of intense swarming and predation on caterpillar and honey bee larvae indicates that potential exists for adverse effects to pollinators. More research is needed.</p> <p>Within streams, zebra mussels compete with native freshwater mussels, many of which are listed as state threatened. May also be gill parasites on certain fishes, unknown if they adversely affect any SGCN freshwater fishes. Smallmouth bass are voracious non-native predators taking a toll on smaller fishes in these systems. Non-native baitfish and aquarium species releases compete with native fishes in many habitats and can be very detrimental if they are predacious.</p>
Native Problematic	<p>Native shrub (e.g. yaupon, juniper) or "brush" encroachment</p> <p>Brown-headed cowbird (BHCN)</p>	<p>Juniper invasion of prairies/grasslands throughout ecoregion, yaupon thicket invasion in pine-oak woodlands, longleaf and shortleaf savannas, and pine forests – lack of fire, inappropriate grazing practices; native brush invasion, where these species should not naturally occur or in abundances that are out of balance within the native communities, degrades grassland suitability, pine and hardwood regeneration potential, impedes native savanna animal movements.</p> <p>Brown-headed Cowbirds are brood parasites on many breeding bird species in this region, especially those which are impacted by edge creation in interior forested habitats</p>
Pests, Parasites, Pathogens		
Pathogens	<p>Oak wilt, Oak decline</p> <p>Chinquapin wilt</p> <p>Red Bay Infection</p>	<p>The key woody plant communities in this ecoregion are hardwood dependent – oak pine savanna, oak woodlands, and bottomland hardwoods – all potentially affected by the wilt and decline pathogens. Redbay is part of a declining and rare plant community also.</p>

General Issue	Ecoregion Issue Identified in Workshops (2010) and Surveys (2011)	Description of Adverse Effects Identified in Workshops (2010) and Surveys (2011)
Pests	Pine bark beetle	Damage is intensified during stress periods – drought, intense summers; can affect clusters of trees; may be particularly adverse in areas where native restoration efforts are just getting established
Pathogens	White Nose Syndrome (WNS)	It's unknown yet whether WNS is a credible threat to cavity roosting bats (such as Rafinesque's big-eared bat); therefore, to be conservative, it's in this ecoregion's plan as a potential issue. WNS is caused by <i>Geomyces destructans</i> , a nonnative fungus primarily known to adversely affect hibernating bats and is frequently fatal.
Power Development and Transmission		
Hydro (Dam and Reservoir)	There are many dams and hydropower facilities in this and adjacent ecoregions, from the Red River to the Coast; operations impact downstream aquatic and riparian communities	<i>See also Water Development, Management and Distribution below</i>
Coal-fired plants	Texas has 40 coal-fired generators at 20 locations, totaling 21,240 megawatts (MW) of capacity. Nine new coal fired plants proposed in Texas, three online since this Plan was last updated; several in this ecoregion	Primary concern with coal fired plants in any location, including this ecoregion, is surface and/or groundwater consumption. Footprint of power plant and adjacent reservoir is direct loss of terrestrial habitat. If the water cooling pond is a dammed natural waterway, then it contributes to loss of instream flows for aquatic SGCN and riparian communities; if cooling pond is a stand-alone feature, water must still be drawn from existing water budgets which currently do not adequately account for fish and wildlife needs. Coal fired plants are also a source of evaporative loss from the water system – towers and open ponds
Transmission	New development and expansion of existing lines/corridors construction of new power infrastructure corridors to meet urban user needs, maintenance and operations maintaining clear right-of-way for vehicle clearance/access, prevention of line and tower danger	Broad, long, linear fragmentation of all habitat types. During route selection, environmental considerations are given secondary consideration to agricultural and developed areas. Contributes to edge through interior habitats (woodlands, savanna and forest), causing potential for greater predator and invasive species access. Impacts to important wetland communities as canopy openings dry sites and create adverse microclimates to wetland species' persistence. While some of these facilities could be compatible with grassland and prairie communities in this ecoregion (few species have aversion to tall structures in this region, unlike High Plains or Coastal Prairies), these pathways are not required to reclaim or maintain cleared areas with native seed or plant sources and become pathways for invasive species. Mowing and trimming activities during bird breeding seasons or migratory events adversely impact species success; inappropriate seasonal oak trimming can contribute to oak wilt, oak decline; "brushhogging" borders leaves splintered, jagged cuts and adjacent vegetation communities vulnerable to disease and infestations (oak wilt, oak decline, Red Bay disease). Broad open space maintained in a grassland condition hinders daily or seasonal movements and behavior for woodland or forest species which avoid open areas.
Distribution	Development to power grid and retail users: construction of new power infrastructure corridors to meet urban user needs	Mowing and trimming activities during bird breeding seasons or migratory events adversely impact species success; inappropriate seasonal oak trimming can contribute to oak wilt, oak decline; "brushhogging" borders leaves splintered, jagged cuts and adjacent vegetation communities vulnerable to disease and infestations (oak wilt, oak decline, Red Bay disease). directly takes habitat and species during construction (loss), degrades adjacent habitat (fragmentation), and may hinder movement (daily or seasonal) Migratory bird strikes are more prevalent with distribution facilities than transmission facilities; more careful site selection is important to avoid or minimize impacts when near the coast, along waterways, adjacent to wetlands and throughout the flyway.
Biofuels	Eucalyptus Other "whole tree" utilization plantation corn cultivation, albizia and bamboo	Eucalyptus is highly invasive and is being planted for biofuel production in lieu of other more native (or naturalized) timber/woody "crops" corn cultivation, albizia and bamboo are being planted throughout the Mississippi Alluvial Valley; similar sites and production values may mean these biofuel crops will also appear in east Texas in the near future Whole tree utilization favors fast-growing, short rotation and typically only to a certain point (not even a period as long as pulp production); shorter period, more intensive management, less viability as a natural system for native wildlife Many of these biofuel sites are not using timber management accepted Best Management Practices for riparian conservation or minimal ground disturbance
Oil and Natural Gas Production and Delivery		
Traditional extraction site development/operation,	The expanding of existing right of ways AND construction of new pipelines is a constant issue in this region as it is a producer and also lies between	Aside from the edge effect swath through interior habitats (see comment under Transmission above), off-road vehicle trespass and allowed use creates soil erosion (damages vegetation and water quality), open areas and vectors for invasive grass species (Bahia, Bermuda) introductions to the system,

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transmission/delivery facilities (distribution lines, roadway)	coastal production sites and other delivery points. Broad and long unforested corridors are typically not replanted or maintained in native vegetation.	and hydrologic changes in recharge and runoff which prevents adjacent wetlands and bottomlands from functioning as they should
Hydraulic fracturing ("fracking") or "shale gas" extraction	Haynesville Bosier shale gas play within the Western Gulf Basin covers much of east Texas and extraction of shale gas is a fast-developing, not well-regulated industry http://www.eia.gov/oil_gas/rpd/shale_gas.pdf	This resource extraction is potentially very harmful to the quantity and quality of the Carrizo-Wilcox aquifers and perched water table resources which support area springs, seeps, bogs, fens, subirrigated riparian zones, rivers, streams and other wetlands
Delivery	Pipelines for oil and natural gas delivery cross the area; long, linear cleared swaths through rangelands, native habitats	Similar to electrical transmission lines, communications lines, and transportation corridors, oil and gas pipelines create edge through forested and bottomland habitats, impact wetlands which are not jurisdictionally protected (isolated bogs, seeps, springs); little to no native reclamation is required. These openings create opportunity for enhanced predator access to interior woodlands, invasive species (many thrive in disturbed sites), and canopy openings dry wetland sites and create adverse microclimates to wetland species' persistence..
Lack of Reclamation	reclamation standards vary, requirements limited	Reclamation not required back to NATIVE vegetation (invasive species allowed to colonize or are directly planted for soil stabilization) Sites are also not required to restore lost wetland features if these were determined to be nonjurisdictional or isolated wetlands Sites not required to restore the full complement of desired ecological condition that was removed during construction or operations.
Mining		
Sand and Gravel - upland and riverine	Occurs in upland sites as well as along and within streams and rivers	lack of reclamation; mining off of water courses do not go through TPWD review for potential natural resources impacts Not all are required to have stormwater pollution prevention facilities or plans (acreage threshold)
Lignite	Upland sites and drainages affected	loss of vegetation and water resources (dewatering, stream diversion, ponding, wetland fill) during construction and operation over large landscape and long periods of time; complete loss of soil microorganism integrity Environmental review late in process to avoid or minimize impacts, no input into reclamation review or evaluation Reclamation not back to desired ecological conditions (tied to productivity levels in a certain time frame, short, 5-year window for "recovery"), so companies use fast-growing species, not necessarily native seed or plant source materials, usually monotypic instead of diverse natural community
Lack of Reclamation – all kinds	reclamation standards vary, requirements limited	Reclamation not required back to NATIVE vegetation (invasive species allowed to colonize or are directly planted for soil stabilization) Sites are also not required to restore lost wetland features if these were determined to be nonjurisdictional or isolated wetlands Sites not required to restore the full complement of desired ecological condition that was removed during construction or operations.
Communications Infrastructure		
Cell and other communication towers	towers need to be limited in height and lit to minimize bird strikes (bird-friendly)	Species impacted by towers include all nocturnal migrants
Transportation		
road and bridge construction (new)	I-69/Hwy 59 – while no longer Trans Texas Corridor (TTC), area highways are going to be upgraded to accommodate interstate levels of traffic through the area, from the Valley and Corpus Christi to Texarkana; while most routes take these improvements close to developed and impacted areas then north, route alternatives cross some sensitive areas; opportunities for public land connectivity may be reduced; and, there will be adjacent capacity developed for urban connections, including new toll roads which are usually developed for larger future capacity	Texas Department of Transportation coordinates with TPWD regarding potential natural resources impacts to listed species; however, there is little accommodation for sensitive habitats unless those features are federally protected (federally listed species habitat, critical habitat, jurisdictional wetlands). State-listed species habitats, SGCN, rare communities and the habitats on which they rely are unprotected. The transportation improvements proposed under the I-69 upgrade of existing and new construction may create barriers to fish and wildlife resources' daily and seasonal movements, water quality impacts through stormwater runoff; loss of nonjurisdictional wetlands, and important riparian, bottomland, prairie and savanna habitats that are not protected under regulation. In addition to these larger facilities, local connection transportation projects may also contribute to the same kinds of losses and may require even less coordination regarding environmental impacts from planning to implementation if no federal money is used. Mitigation of mature hardwoods, riparian areas, rare savannas and wetlands is typically insufficient to address ecological functional losses. Remediation efforts following construction are allowed to use nonnative grasses which contribute to prairie loss and degradation.
right of way maintenance	maintaining clear right-of-way for vehicle clearance/access, minimizing fire danger, and maintaining driver visibility	Mowing and trimming activities during bird breeding seasons or migratory events adversely impact species success; inappropriate seasonal oak trimming can contribute to oak wilt, oak decline; "brushhogging" borders leaves splintered, jagged cuts and adjacent vegetation communities

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		<p>vulnerable to disease and infestations (oak wilt, oak decline, Red Bay disease).</p> <p>Some rare plants are known only from sites in ROW; these are not always adequately protected as staff changes occur, management plans and information may not be passed along with changes in staff</p> <p>Adjacent landowners are allowed to clear within TXDOT right of way which can adversely impact any conservation measures that agency has put in place in ROW.</p>
Timber Production & Management		
Land Management/Ownership Changes	Changes in land ownership (private timber companies to TIMOs and/or subdivisions), which changes the motivation and number of forest landowners	Vast acreages have been transferred from private forestlands to Timberland Investment Management Organizations (TIMOs) and the opportunity that exists for long term conservation through easements, mitigation has been lost to some degree. For more than 50 years, family forest owners controlled over 60 percent of East Texas forest land, forest industry owned approximately 35 percent, and the remainder was controlled by the National Forest System or other public ownership. Since 2000, industry has divested all of its land and it is now controlled by investors such as TIMOs and Real Estate Investment Trusts (REITs). This change has resulted in a shift in the perception of long-term land management and brought to discussion the future of traditional forestry in Texas. Land conservation priorities in East Texas have been identified by a group of stakeholders that includes NGOs, Land Trust, TIMOs and Agencies.
Hardwood Harvest Best Management Practices	<p>Harvest without protection for sensitive sites, communities</p> <p>Conversion and short rotations</p> <p>Certain kinds of understory treatments (mechanical or herbicide)</p> <p>Lack of Streamside Buffers</p> <p>Lack of Fire</p>	<p>Mature bottomland hardwoods are a very rare community type and even dead snags in this community are important to many regional SGCN and in the adjacent East Central Texas Plain (Post Oak Savanna) and the Gulf Coast Prairies and Marshes (chenier). Hardwoods in pine-oak savanna community also serve to diversify the forage and roosting habitats in these systems. Hardwoods are a key component to pine-oak and bottomland systems which support many types of rare bogs, seeps, springs, and other wetlands. Bogs in particular are very tiny, isolated and scattered throughout East Texas; significant change and loss of these independent sites can cause the loss of entire population of rare plants, communities, and the fauna which rely on them. <i>Bogs, baygalls and forested seeps</i> are threatened by unsuitable logging practices which can alter the vegetation, temperature, and water quality of these sites, adversely affecting the plant communities.</p> <p>Important hardwood community losses are incurred due to conversion to faster pine production, clearing for recreational access to bottomlands, fire suppression (overgrowth of brushy species can smother bog species), and commercial (all operators) timber harvest without adequate protections for streamside buffers and wetlands. Streamside buffers retained may also be insufficient even using current BMPs.</p>
Land & Water Mgmt: FARM	See also Water Development section	
Lack of soil and water management/conservation practices	<p>Indiscriminate pesticide use, especially adjacent to or within overspray area of native grasslands, rangelands, woodlands</p> <p>Chemical-laden (pesticide, herbicide, fertilizer) irrigation water runoff</p> <p>Border – to – Border farming (no fallow areas at edges/fencelines)</p> <p>Lack of streamside management zones</p> <p>Overhaying</p>	<p>Overspray pesticide and/or herbicide in fields can decrease or completely wipe out native insect fauna, important pollinators, and native vegetation in adjacent native and/or recovering grassland systems</p> <p>Insufficient stormwater controls between agricultural production and waterways (or dry drainages that lead to waterways during rain events) adverse lead to chemical impacts to sensitive aquatic insects, freshwater mussels, riparian invertebrates, freshwater fishes, amphibians, and eventually bay and estuary systems – invertebrates, fishes, and birds.</p> <p>Streamside Management Zones are important buffers between agricultural practices and aquatic impacts, and these riparian areas serve as important habitats in their own right for many forest and woodland dependent SGCN. Riparian and floodplains are frequently cleared for agricultural production because they are relatively flat, have access to water, and soils are productive.</p> <p>“Clean farming” – removing brushy, grassy, or irregular borders around fields and clearing into swales, ravines, and depressions – decrease suitable habitat available for many grassland/woodland matrix species, which benefit from a bit of cover adjacent to open areas. These “clean” areas also can contribute to invasive species, erosion, and faster runoff rather than infiltration of rain events.</p> <p>Over-frequent haying of native prairie decreases grassland diversity (certain seed sources are not allowed to naturally develop and reseed the area; without diverse natural reseeding, certain species become more dominant and the entire prairie loses diversity over time) and contributes to invasion of non-native grasses; haying during bird breeding season also contributes to decline in several ground-nesting SGCN birds (<i>Northern Bobwhite, Dickcissel, Eastern Meadowlark, LeConte’s Sparrow, Henslow’s Sparrow</i>).</p>
Clearing and loss of important natural sites/habitats	Local surface water development: small impoundments on tributary creeks, streams, springs, seeps to form stock tanks, ponds, private lakes	Similar to reservoir development on mainstem rivers, negative impacts caused by impoundments on creeks and springs are just at a smaller scale: loss of instream habitats, loss of wetlands, loss of riparian habitats and natural floodways. The replacement value – still deeper water for flowing waters, pond for stream – is not ecologically synonymous. This may be more of an issue in the emerging communities experiencing unprecedented growth with people buying small “hobby farms” and “ranchettes.” There is some recent evidence that too many ponds in a given area may encourage individuals of certain seasonal amphibian populations to disperse too widely across the landscape, making it more difficult to find a mate and adversely

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		affecting recovery. This may also be true for other localized, wetland-dependent species.
Landowner/land management incentive programs working at cross-purposes	Farm Bill programs not competitive (conservation vs. production) enough to keep lands in conservation state Farm Bill penalty insufficient to deter short term conversion Land management recommendations may be working at crosspurposes even from year to year, site to site – e.g. native grasslands, clearing woodlands	Using Farm Bill programs can be one of the best tools to engage private landowners in conservation practices; however, must be market-competitive and contract-savvy to be effective as a conservation tool. Typically, terms are not long enough to be able to see consistent longterm benefits or well-funded enough to encourage lands to remain in conservation uses or compatible production uses. Additionally, some programs actually recommend using nonnative grasses and/or clearing ravines, woodlands, and fencerows.
Land & Water Mgmt: RANCH	See also Water Development section	
Incompatible stocking practices	In some areas, working lands are still recovering from historic uses, out-of-date stocking and grazing practices (prior to soil, native vegetation, and water conservation knowledge we have today) on the advice of county tax appraisers rather than range scientists or ecologists historic and/or current range-intensive livestock operations “continuous” even if rotational; out of sync with land capacity landowners may not be aware of potential benefits of wildlife valuation for recovery, rest, or native habitat conversion	Stocking practices incompatible with native range can encourage conversion of native woodlands (which may harbor bogs and other wetlands) and grassland to non-native (Bermuda, other sod-forming grasses) which is very detrimental to an entire suite of wildlife. Intensive grazing degrades native plant communities and contributes to the need to supplemental feed livestock, which then introduces exotics into remaining native plant communities. Concentrated feeding of livestock herds attract large numbers of brown-headed cowbirds which are parasitic nesters to a number of SGCN birds.
Landowner/land management incentive programs working at cross-purposes	Farm Bill programs not competitive (conservation vs. production) enough to keep the regional level of enrolled lands in conservation state; Farm Bill penalty insufficient to deter short term conversion Land management recommendations may be working at crosspurposes even from year to year, site to site – e.g. native grasslands, clearing woodlands, modifying wetlands Landowners do not have a one-stop shop to choose best management practices for their site, for their goals; and, occasionally, the incentive programs, technical guidance, and management assistance "menu" is limited by the <i>perception</i> that landowners are interested primarily in production and are not open to other beneficial management practices for nongame	Using Farm Bill programs can be one of the best tools to engage private landowners in conservation practices; however, must be market-competitive and contract-savvy to be effective as a conservation tool. Typically, terms are not long enough to be able to see consistent longterm benefits or well-funded enough to encourage lands to remain in conservation uses or compatible production uses. Additionally, some programs actually recommend using nonnative grasses and/or clearing ravines, woodlands, and fencerows. Landowners need to be able to have a full menu in front of them to understand the benefits and drawbacks of certain management strategies from the complete picture of livestock and timber production, game and nongame management, and water quality and quantity protection.
Clearing and loss of important natural sites/habitats	conversion of woodland to pasture conversion of bottomlands conversion of diverse pine-hardwood forest to fastergrowing monotypic pine forest riparian and floodplain clearing for livestock watering access Small impoundments on tributary creeks, streams, springs, seeps to form stock tanks, ponds, private lakes.	Hardwood clearing for rangeland production contributes to the loss of this very important community Longleaf and Shortleaf savanna types are all but gone in this ecoregion due to timber conversion Impoundments: similar to reservoir development on mainstem rivers, negative impacts caused by impoundments on creeks and springs are just at a smaller scale: loss of instream habitats, loss of wetlands, loss of riparian habitats and natural floodways. The replacement value – still deeper water for flowing waters, pond for stream – is not ecologically synonymous. Woodland and forest clearing can also contribute to the loss of important isolated wetlands (see comments above in Transmission about drying sites)
Lack of soil management and conservation practices	lack of soil conservation (vegetation conservation/restoration) along stream courses (Streamside Management Zones, Streamside Best Management Practices/Buffers) Lack of reclamation	Riparian areas to floodplain extents are not conserved or fenced off from livestock access; hydrology and streamside vegetation are altered, soil and vegetation is lost in upland areas, water quality is degraded through sediment-laden runoff; dealing with historical and contemporary issues, need, in some instances, different approaches for recovery/restoration Lack of reclamation after timber harvest (see Lack of Reclamation comments in other sections above)
Subdivision of larger lands into smaller parcels ("ranchettes")	Ownership changes in values, approaches to management (not always a detriment to conservation practices) Subdivided lands create many more land management philosophies, approaches in one area	While not all land subdivision is necessarily a negative event for conservation, subdivision typically brings with it very diverse land ownership styles and objectives, increased potential for feral animal and escaped landscaping (see Invasive comments above), additional surface and groundwater demands on regional resources, and loss of habitat for homesite development and “ponds” Similar to reservoir development on mainstem rivers, negative impacts caused by impoundments on creeks and springs are just at a smaller scale: loss of instream habitats, loss of wetlands, loss of riparian habitats and natural floodways. The replacement value – still deeper water for flowing waters, pond for stream – is not ecologically synonymous. There is some recent evidence that too many ponds in a given area may encourage individuals of

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		<p>certain seasonal amphibian populations to disperse too widely across the landscape, making it more difficult to find a mate and adversely affecting recovery. This may also be true for other localized, wetland-dependent species.</p> <p>Outreach, technical guidance and incentive programs have a more difficult time serving this constituency because the effort and resources required are multiplied, but no more service resources (people, time, money) are available. Additionally, it is difficult to provide conservation services that are of value to the ecological needs of the area with many fractured landscapes and objectives. Some tools (e.g. RX fire) and incentive programs are not available for use at smaller scales or cannot be effective to improve conservation values.</p>
Land & Water Mgmt: Municipal	See also Water Development section	
Lack of Zoning and Planning	Throughout this and adjacent ecoregions, urban expansion, sprawl, and suburban development into the outlying counties to escape city jurisdictions is an evergrowing issue. Most of this area is part of many of the emerging communities, identified in the Texas State Forest Resources Strategy	Metropolitan Planning Organizations, Councils of Government, Regional Transportation authorities, and other planning entities which encompass emerging and outlying communities would benefit from greater consideration of fish and wildlife resources, rare communities and habitats as part of their first-round constraints process in development, zoning, and permitting. Counties rarely have authority to require stormwater pollution prevention, flood control projects, appropriate road development, conservation of nonjurisdictional wetlands, open space planning, or water or other conservation measures from developers. Urban sprawl, bedroom communities, suburban commuter communities all continue to contribute to native grassland loss, bottomland hardwood clearing, filling/drying non-jurisdictional wetlands, and degradation of instream and stream-adjacent habitats from water quality and quantity impacts. This is not just an issue for fish and wildlife resources, but also for prime farmland, timberland and ranchland in this ecoregion. Authorities who exercise their ability to protect sensitive features, water quality, and open space can benefit their local water planning processes, recreation opportunities, future food production and urban quality of life.
Water Demands	Dallas – Fort Worth and emerging areas (Temple, Waco) San Antonio and emerging areas Houston	<p>These growing metropolitan areas and their outlying emerging communities continue to seek water resources outside of their basins: reservoir development, interbasin transfers, groundwater development and pipelines – on waterways within this ecoregion.</p> <p>See also Water Development, Management and Distribution below</p> <p>Water costs are related to what ratepayers will pay and not related to the water development impacts – mitigation for resource loss under reservoirs, to groundwater, and to estuaries, is insufficient and rates do not replace ecological values.</p>
Land & Water Mgmt: Conservation & Recreation		
Restoration Barriers	Lack of locally adapted seed/seedling sources	Lack of native seed and plant material sources for pine savanna, bottomland, herbaceous wetland and grassland: species adapted to low pH sandier soils need to be made available commercially at affordable prices; species such as longleaf pine, shortleaf pine, appropriate and diverse oak and bottomland hardwood species, splitbeard bluestem, pinehill bluestem or cultivars of the big 4 prairie grasses that are adapted to local ecotypes need to be collected and increased at plant material centers.
Inadequate/Inappropriate Management	Prescribed fire	<p>Difficult to apply prescribed fire in urban-wildland interface for restoration</p> <p>Many landowners are unfamiliar with their potential to use RX fire for brush control or grassland improvement</p> <p>Regional conservation service providers do not have enough RX fire certified leaders and teams to implement on conservation lands or provide this as a landowner incentive service, even if the demand could be enhanced</p>
Inappropriate Recreational Uses	ORV use in sensitive areas (stream beds, sand hills, wet soils of all types, bottomlands)	While most public lands in this region are managed for recreation compatible with wildlife and fisheries resources, some improvements could be made to trails and recreation facilities and uses to prevent soil erosion and water quality impacts, vegetation loss (especially near water resources), reduce human disturbance in roosting, breeding areas and in sensitive soil and wetland types
Lack of long-range conservation planning and cohesive land conservation/management strategies in each ecoregion	Lack of ecological connectivity between/among existing public and private conservation lands: land and water trusts, NGO preserves and conservation easements, Habitat Conservation Plan lands, wildlife managed lands for conservation, parks and wildlife management areas	Conservation benefits could be realized by mapping existing conservation lands and practices, reviewing opportunities to share resources and improve land management through shared guidance, and identifying landowners and sites which could benefit landscape and conservation management connectivity in the long term through landowner incentive programs – riparian, prairie, mature oak woodlands, longleaf and shortleaf pine savanna, bottomland hardwoods.
Water Development, Management and Distribution	SEE ALSO STATEWIDE HANDBOOK	
Surface Water Planning	Natural resources not well-defined or required as a "constraint" in Regional Water Planning (RWP) processes	<p>Natural resource professionals are not consistently involved in RWP processes</p> <p>Large municipalities' demands, especially out of the region, are a driving force in surface and groundwater planning</p> <p>TMDL recommendations need to consider fish and wildlife resources needs as well</p>

General Issue	Ecoregion Issue Identified in Workshops (2010) and Surveys (2011)	Description of Adverse Effects Identified in Workshops (2010) and Surveys (2011)
		<p>Instream flow recommendations need to be stepped out from headwaters to estuaries to influence regional water planning processes</p> <p>Overallocation/dewatering and damming of region's principle rivers</p>
Reservoir Construction and Operation (ties in with Surface Water Planning above)	<p>Creation of new and modification (expansion) of existing reservoirs;several new reservoir sites in this region proposed in the 2007 State Water Plan, all on important regional resource streams</p> <p>Unregulated small stream impoundments on private lands</p> <p>Timing/Periodicity/Intensity of Water Releases releases are unnaturally intense, in the "wrong" season to mimic natural flooding processes, and change water chemistry and sediment load in all areas downstream, to the estuaries</p> <p>Shoreline development - vegetation removal to water's edge for viewshed, recreational access; hardening and armoring banks (bulkheading), on-site septic leakage or non-compliance, development on steep sites.</p> <p>Invasive species</p>	<p>Reservoir construction: Several streams in this region are of high quality (Ecologically Significant); bottomland hardwoods and intact native riparian zones are highly threatened and important to instream aquatic and stream-adjacent SGCN habitats; Ecologically Significant Streams and high quality riparian are rarely considered during site selection for new reservoirs or operations. These areas support SGCN and rare communities, contribute high quality water to reservoirs and downstream segments. Reservoir construction and operation creates a barrier to SGCN movement, completely inundates important and irreplaceable riparian zones, spring systems, and instream habitats.</p> <p>Impoundments: similar to reservoir development on mainstem rivers, negative impacts caused by impoundments on creeks and springs are just at a smaller scale: loss of instream habitats, loss of wetlands, loss of riparian habitats and natural floodways. The replacement value – still deeper water for flowing waters, pond for stream – is not ecologically synonymous. This may be more of an issue in the emerging “urban/suburban” areas.</p> <p>Unnatural hydrograph from reservoir operations/dam releases scours instream and stream-adjacent habitats, decreases “natural” nutrient and sediment loads to estuaries, changes water chemistry (oxygen, salinity), shifts vegetation communities out of sync with other riparian communities where flooding is more "natural", rare communities and instream SGCN (invertebrates and fishes) cannot "rely" on the seasonal changes under which they evolved and decline. BA Steinhagen, Toledo Bend, Sam Rayburn, Lake Livingston have flood control, irrigation contracts and/or hydropower operations which require them to release waters at periods that do not coincide with natural flood period or intensity. Lake Livingston has changed historic hydrological regimes of the Lower Trinity River; slow changes occurring to habitat and bayous on the Refuge and points downstream, but more study is needed. There are current plans to divert an additional 400 million gallons of water per day (Luce Bayou project) on top of the over one billion gallons per day already diverted to Houston for use. “Normal” flooding regimes needed for paddlefish reproduction and other SGCN dispersals are not occurring as in the past.</p> <p>Shoreline Development: In addition to the loss of instream and riparian habitat following inundation, the now-“riparian” and upland habitats surrounding the lake edge is at risk from development. Regional reservoir managers do not reserve much in the way of “setback” from the inundation pool level in their easements. This allows residential development (water withdrawals and septic installation), bulkheading shorelines, clearing and “landscaping” to the water’s edge. These lakeside activities contribute fertilizers and other chemicals (e.g. boat gas/oil), untreated or poorly treated human waste (some lake authorities actually have permitting programs to manage/reduce this factor, but not all), and sedimentation to the lake, which eventually impacts in-lake and downstream habitats. Typically, residential development in these areas is also a vector for invasive aquatic and terrestrial plants and feral pets. See Invasive species section above.</p>
Flood Control	Changes to natural stream courses to block or convey floodwaters through urban areas	Levees, bank armoring, culverts all remove instream and stream adjacent habitats, contribute to unnatural sediment and nutrient loading downstream and to estuaries
Groundwater Planning and Distribution	<p>Several areas in east Texas lack groundwater conservation districts</p> <p>Groundwater districts are political subdivisions, typically by county, not aligned necessarily with aquifer boundaries; Groundwater Management Areas are based on Groundwater Districts</p> <p>Rule of first capture is the “management plan,” and in many areas, groundwater pumping occurs without full accounting and does not include water for fish and wildlife as a "use"</p>	<p>Groundwater conservation districts would allow management for conservation, preservation, recharging, and prevention of waste of groundwater resources (Carrizo-Wilcox and minor regional aquifers).</p> <p>Subirrigated, instream and stream-adjacent and isolated habitats such as bogs, baygalls and forest seeps, which rely on groundwater are adversely affected by dry conditions, some of which are permanently impacted after drought periods; overpumping lowers water table and and changes instream and wetland conditions such as temperature, oxygen availability, and other nutrient and chemical factors on which aquatic life relies</p> <p>In some instances, a significantly low water level can decrease and degrade aquifer recharge capacity ("drying out the sponge " at certain levels within the aquifer can affect the flow quantity and quality into the aquifer from future recharge events)</p>
Other Water Source Developments and Technologies	<p>Interbasin Transfers (Surface and Groundwater) (Dallas, Houston)</p> <p>Reuse</p> <p>Water Treatment Wetlands</p>	<p>Most of this is addressed at the statewide level</p> <p>Many of the new construction proposed dams to serve urban water needs in and outside of the region (e.g. interbasin transfers to Dallas, Houston) are on some of the most unique, intact, and/or potentially restorable rivers in east Texas, important to many aquatic and riparian SGCN and communities. There are current plans to divert an additional 400 million gallons of water per day (Luce Bayou project) on top of the over one billion gallons per day already diverted to Houston for use.</p> <p>Water Reuse reduces available water at any particular time (needs to account for instream flows) and can change the chemistry (temperature, oxygen, and other characteristics) from the discharge.</p> <p>While a useful tool and potentially a benefit to some wildlife and fish resources, Water Treatment Wetlands are not typically managed as natural systems (e.g. vegetation homogenous, not natural habitats for local wetland dependent SGCN)</p>

General Issue	Ecoregion Issue Identified in Workshops (2010) and Surveys (2011)	Description of Adverse Effects Identified in Workshops (2010) and Surveys (2011)
Lack of Information & Resources	One response stated this is an issue, but did not provide additional information	
Many SGCN in this region lack updated status or any information from which to determine status, recovery, or management	Without full accounting of species distributions, habitat needs, and range, it is difficult to make accurate management recommendations; apply landowner incentive programs for best conservation benefit; recover, downlist or delist species	<p><i>Information and Research Needs by SGCN</i></p> <ul style="list-style-type: none"> ▪ <i>Black Bear</i> see Black Bear Management Plan 2005-2015 http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_pl_w7000_1046.pdf ▪ <i>Rafinesque's big-eared bat</i> and <i>Southeastern myotis</i>– determine potential for new roost locations ▪ <i>Eastern spotted skunk</i> – survey to determine status ▪ <i>Houston Toad</i> – more information needed in historic range, research needed re pond proliferation and breeding success dilution ▪ <i>Texas Horned Lizards</i> – identify areas of suitable habitat and survey to determine status in these areas; coordinate with RIFA evaluation/survey to determine impact ▪ <i>Amphibian and Reptiles</i>: need status update on all SGCN, primarily Timber Rattlesnake, Alligator Snapping Turtle, Softshell turtles. ▪ <i>Joint Venture research priorities</i> ▪ <i>Bachman's Sparrow</i> –Increase survey efforts along western edge of range to identify boundary and suitable occupied habitat, such as within Red River County ▪ <i>Freshwater Mussels</i> – Continue documentation of distribution and status for all SGCN mussels, identify areas where most impacted and by what, craft management plans ▪ <i>Turtle Harvest Regulation effectiveness</i>
Perception of Management Needs More Information	Predator control without biological standards or supporting management	<p>It is unknown whether predator control activities are affecting the stability of SGCN populations or their contribution to natural system function. Predator control efforts cannot be declared "insufficiently regulated" or "underreported" as limited information is available to assess the stability of these populations. Community-based solutions will need to be devised based on a full and accurate accounting of these populations and their effects on the natural systems in which they range.</p> <p>Predator trapping and/or baiting has an adverse effect on non-target species including black bears and smaller mammals such as skunks, foxes</p>
Inadequate Policies, Rules, Enforcement		
Non-jurisdictional Wetlands	Loss of and impact to "non-jurisdictional" wetlands and jurisdictional wetlands on non-federal, non-state lands and projects (lack of awareness, no regulatory nexus or enforcement opportunity for protection on these sites)	private lake/stock pond construction, control structures, fill and conversion for agriculture and other development, mining: bogs, seeps, marshes, forested wetlands, and other intermittent and perennial waterways affected
Sand and gravel mining	Lack of stormwater pollution prevention Lack of reclamation	<p>Reclamation back to native vegetation community consistent with what was taken is not required.</p> <p>Although new TCEQ rules now require water quality permitting for stream and river adjacent mining, none of the sand and gravel permitting review processes require a site assessment to avoid or mitigate impacts to habitats (riparian, sand hills, wetlands, and uplands)</p> <p>Mining off of water courses do not go through TPWD review for potential natural resources impacts. Not all are required to have stormwater pollution prevention facilities or plans (acreage threshold)</p>
Lignite and other surface mining in the region	Lack of Reclamation appropriate to the desired ecological condition of the site	lack of reclamation or reclamation that does not require native seed and plant materials in context with desired ecological condition; permitting process does not adequately allow environmental review to require avoidance, minimization or mitigation of impacts to instream and stream-adjacent habitats (riparian, sand hills, and uplands); Not all are required to have stormwater pollution prevention facilities or plans (acreage threshold)
Non-target wildlife impacts	Unmonitored or abandoned trot-lines for fishing, especially those with non-degradable hooks	Unmonitored or abandoned trot lines for fishing are potentially an "attractive hazard" to alligator snapping turtles, which are in decline, and other aquatic SGCN. Thousands of feet of these lines abandoned in the Trinity River, stainless steel hooks with varying species decomposing on those lines.
Other Cross-Cutting Issues		
Climate Change	See also CLIMATE CHANGE SECTION in Statewide handbook	<p>Based on current information, isolated and water-dependent habitats may be more at-risk than others: wetlands, pockets of prairie grasslands, instream aquatic, bottomland hardwoods</p> <p>May change frequency/intensity of extreme disturbances (flood, fire, tornado, drought, pest infestations); uncertain impacts on sustainability due to physiological tolerances, trophic decoupling, phenologic disruptions, etc.. Climate change also puts a premium on habitat connectivity and dispersal to allow species to effectively respond to impacts - need to consider actions at multiple scales.</p> <p>Carbon sequestration needed to offset the effects of climate change and airquality non-attainment in the region (perhaps the state)</p> <p>Climate change models, GIS analysis of land conversion and change overtime, species specific information, community-specific information all needed</p>

General Issue	Ecoregion Issue Identified in Workshops (2010) and Surveys (2011)	Description of Adverse Effects Identified in Workshops (2010) and Surveys (2011)
Economics	Working Lands – Timber, Farmland, Ranchland	Landowner incentives cannot compete currently with market forces to keep enrolled lands in conservation activities OR to keep the regional enrollment at a constant level; market forces in some areas cannot support continued large ranch or timberland ownership and contribute to urban conversion

CONSERVATION ACTIONS

“Like the resource it seeks to protect, wildlife conservation must be dynamic, changing as conditions change, seeking always to become more effective.” – Rachel Carson

To make conservation progress, we need to work with the information we have, document our progress, share lessons learned, and adapt our approach when necessary. Conservation actions in this handbook are aimed at reducing the negative effects of issues that affect SGCN, rare communities and their habitats at various scales. Broad actions categories are defined to help organize handbooks. For information about how the Actions framework was developed and for definitions of Action categories, see the *Overview Handbook*.¹⁹

Actions proposed for the WGCP (Table 6) state what we need to work on, where, and why (what problem we can solve with that action). Actions lay out how that work contributes to a specific desired effect –progress and success.

It is important to acknowledge that one conservation action typically does not solve one conservation problem. There may be several actions employed over time to achieve a conservation goal. In some instances, defining the conservation goal *is* the action – for some things, we don’t yet know enough to define what successful conservation looks like for that SGCN population, rare community, or habitat.

It has become increasingly important to determine if the work we do is actually leading to the overall conservation outcomes we desire – **restoration, recovery, sustainability, and resiliency**. As conservation practitioners, we can use milestones (or intermediate results) and reporting to communicate our progress and leverage future conservation action, partnerships, policy changes, and funding.

From project inception, well-crafted monitoring and evaluation (cost effective, answers key questions) informs management and allows conservation practitioners to “course-correct” as necessary for effective conservation.²⁰ With the need for Action Plans to take advantage of several “pots of conservation money,” the people we serve and those who govern private and public conservation funds demand reporting, transparency, and *demonstration* that projects are *positively impacting the conservation of species and habitats*. To get beyond reporting that money was spent and projects were done, AFWA TWW convened a committee in 2009 to craft “effectiveness measures” for the conservation actions across all Plans. A toolkit for classifying and measuring conservation action effectiveness was produced in 2011, approved by AFWA TWW Executive Committee comprised of state

¹⁹ TPWD. 2011. Texas Conservation Action Plan: Broad Action Category Definitions.

http://www.tpwd.state.tx.us/landwater/land/tcap/documents/action_categories_tcap_2011.pdf

The category “*Data Collection, Analysis, and Management*” meets Action Plan Required Element 3 – “priority research and survey”. Many of the proposed actions include a monitoring component (Action Plan Required Element 5) and all actions are encouraged to follow the Effectiveness Measures to assist with adaptive management.

²⁰ Conservation Measures Partnership. 2010. http://www.conservationmeasures.org/wp-content/uploads/2010/04/CMP_Open_Standards_Version_2.0.pdf

Salzer, D. and N. Salafsky. 2006. Allocating resources between taking action, assessing status, and measuring effectiveness of conservation actions. *Natural Areas Journal* 26(3): 310-316.

fish and wildlife agency directors and others.²¹ These measures will be an important part of moving the plans and conservation forward.

With this revision, the TCAP becomes more involved in a national movement to track conservation actions and progress across local, state, regional and national levels. As with the 2005 Plan, actions presented in this edition vary in detail, scale, and duration; however, this edition encourages the use of the incremental measures of success for conservation projects' development, implementation, and tracking. To that end, the toolkit in *Measuring the Effectiveness of State Wildlife Grants*²² is **strongly recommended** to define conservation projects, target audiences and partners, identify desired step-wise intermediate results, and collect the "right" data to report our conservation achievements.

²¹ Association of Fish and Wildlife Agencies Teaming with Wildlife. *Measuring the Effectiveness of State Wildlife Grants (conservation actions)*. 2011. <http://www.fishwildlife.org/files/TWW-Effectiveness-Measures-FULL-Report-Appendices.pdf>

²² Same as above

Table 6. WGCP Conservation Actions

Note: Table is formatted 11" x 17", landscape orientation – SEE ALL OF THE EFFECTIVENESS MEASURES FOR EACH OF THE OVERALL ACTIONS TO ESTABLISH FINER DETAIL IN PROJECT IMPLEMENTATION

Conservation Action
Invasive Species
Work with private landowners and conservation partners to minimize feral hog populations through hunting and trapping (aerial shooting is not a good technique in this area given the amount of closed canopy). Provide technical guidance and educational programs about the impact and management of feral hogs to benefit ground nesting birds, small mammals, aquatic species. Evaluate eradication efforts and technical guidance programs with effectiveness measures – do they make a difference to stocking or hunting pressures, do they positively impact the status of SPECIFIC SGCN and Rare Communities?
Promote the use of native grasses in landowner incentive programs for wildlife and fish resource improvement (e.g. Farm Bill, SWG, LIP, and others) on appropriate sites. Sod-forming exotic grasses and cultivars should not be used in any restoration project, much less those with state or federal dollars, as these are known to be detrimental to native habitats and the wildlife on which they depend. A restoration guide to suitable native grasses for this ecoregion, local sources for native seed and stock, and techniques would be immensely useful to a wide variety of conservation service providers, landowners, and recreation land operators. Promote conversion of nonnative grasses to site appropriate desired ecological conditions especially on lands adjacent to sites already managing for conservation objectives (land trust properties, WMAs, State Parks, some Wildlife Cooperatives and Wildlife Management Plan holders, preserves, sanctuaries, etc.).
Conservation practice providers need to identify a suite of plant species for each priority habitat type which can be promoted with one voice to plant materials centers and commercial distributors. Engage Master Naturalists, Native Plants Society of Texas, Native Prairies Association, land trust and NGO volunteers in coordinated/targeted seed and material collection. Assess success of these programs and the use and success of the materials over time to determine if this is an effective approach or whether on-site or nearby collection on a project-by-project basis is more effective (conservation and costs).
Provide workshops for landscape design and installation service providers, local and "big box" nurseries' producers and buyers, city planning boards for landscaping, managers for urban parks and recreation sites, Home Owners Associations, Texas Master Gardener classes, and garden clubs: <i>in areas upstream and adjacent to high priority streams and water courses, conservation projects and wildlands</i> to deter the promotion or use of the invasive species listed above and state-prohibited species. Encourage these plant users to adopt a stream segment for nonnative plant removal and restoration under the guidance of a local ecologist. Follow the outreach effectiveness measures to determine if the workshops are successful in targeted areas to slow or prevent the spread of these very detrimental invaders <i>in areas with a high concentration of oak wilt, oak decline, Red Bay decline and other vulnerable species and a lot of tree trimming activity</i> (urban areas, parklands) to deter the inappropriate timing or disposal of oak trimming to slow/prevent the spread of this disease. Document areas of oak wilt or oak decline with the Texas Forest Service to help them concentrate their outreach and incentive programs on this front (see also <i>Power Development</i> below)
Intensify outreach and public education efforts especially near boat ramps and high-traffic fishing tournament areas to reduce or prevent the introduction of aquatic invasives – plants, mollusks and baitfishes. Highly isolated and vulnerable aquatic SGCN in this region would be severely threatened (more so than they are currently) by such introductions. Identify effectiveness measures for this outreach effort and document progress.
Begin a multi-agency coordinated aquatic invasives mapping, assessment and control/removal effort, starting in headwater areas to reservoir; document methods (herbicides, salvinia weevils, water level manipulations), successes and lessons learned in literature and on TexasInvasives.org; use effectiveness measures for data collection and direct management to guide project development.
Target outreach for red imported fire ant (RIFA) proper identification (not confused with other beneficial ant species) and control in conjunction with other habitat restoration recommendations, especially where grassland bird, native prairie, amphibians and smaller ground-dwelling SGCN are the conservation targets. See Information Needed section for Raspberry Crazy Ant.
Pests, Parasites, Pathogens
Monitor tree-roosting bats for WNS and document any findings with the Western Bat Working Group, USFWS WNS Working Group, and the Landscape Conservation Cooperative.
<i>in areas with a high concentration of oak wilt, oak decline, Red Bay decline and other vulnerable species and a lot of tree trimming activity</i> (urban areas, parklands) to deter the inappropriate timing or disposal of oak trimming to slow/prevent the spread of this disease. Document areas of oak wilt or oak decline with the Texas Forest Service to help them concentrate their outreach and incentive programs on this front
Power Development and Transmission
In areas with a high concentration of oak wilt or oak decline, vulnerable species and/or a lot of tree trimming activity (e.g. ROW) deter the inappropriate timing or disposal of oak trimmings to slow/prevent the spread of this disease. Follow Texas Forest Service Guidelines for tree trimming timing, cut treatment, equipment protocols and trimming disposal. Avoid the use of brush-hogging vertically to trim back ROW edges. Document areas of oak wilt or oak decline with the Texas Forest Service to help them concentrate their outreach and incentive programs on this front
Work with Transmission Line and Distribution Line ROW developers and maintenance plans to promote: <ul style="list-style-type: none"> • use of native grasses in ROW reclamation post-construction • spanning and retaining stream and wetland buffers of existing native vegetation to floodplain extents where possible • active eradication of non-native species • conservation of all wetlands and wet areas, including the native buffers surrounding them to prevent drying • seasonally-sensitive maintenance to avoid impacts to ground-nesting and migratory birds Where possible, emphasize restoration of the desired ecological condition after construction. Evaluate outreach efforts with effectiveness measures over time

Conservation Action
Oil and Natural Gas Production and Delivery
<p>Work with ROW developers and maintenance plans to promote:</p> <ul style="list-style-type: none"> • use of native grasses in ROW reclamation post-construction • minimum clearing and no canopy removal in stream and wetland buffers of existing native vegetation to floodplain extents where possible • active eradication of non-native species • conservation of all wetlands and wet areas, including the native canopy and buffers surrounding them to prevent drying • seasonally-sensitive maintenance to avoid impacts to ground-nesting and migratory birds <p>Where possible, emphasize restoration of the desired ecological condition after construction. Evaluate outreach efforts with effectiveness measures over time</p>
Mining
<p>Building on the recent work of the TPWD Habitat Assessment Program and the east Texas mining community, work with mining site developers and reclamation contractors to promote:</p> <ul style="list-style-type: none"> • use of native grasses in reclamation • avoidance of stream and wetland buffers of existing native vegetation to floodplain extents where possible • alternatives to damming, impounding, or diverting natural waterways • active eradication of non-native species • conservation of all wetlands and wet areas, including the native buffers surrounding them to prevent drying or contamination • seasonally-sensitive activities in feasible areas to avoid impacts to ground-nesting and migratory birds <p>Where possible, emphasize restoration of the <u>desired ecological condition</u> after construction. Evaluate outreach efforts with effectiveness measures over time</p>
Transportation
<p>In areas with a high concentration of oak wilt or oak decline, vulnerable species and/or a lot of tree trimming activity (e.g. ROW) deter the inappropriate timing or disposal of oak trimmings to slow/prevent the spread of this disease. Follow Texas Forest Service Guidelines for tree trimming timing, cut treatment, equipment protocols and trimming disposal. Avoid the use of brush-hogging vertically to trim back ROW edges. Document areas of oak wilt or oak decline with the Texas Forest Service to help them concentrate their outreach and incentive programs on this front</p> <p>Work with ROW developers and maintenance plans to promote:</p> <ul style="list-style-type: none"> • use of native grasses in ROW reclamation post-construction • minimum clearing and no canopy removal in stream and wetland buffers of existing native vegetation to floodplain extents where possible • active eradication of non-native species • conservation of all wetlands and wet areas, including the native canopy and buffers surrounding them to prevent drying • seasonally-sensitive maintenance to avoid impacts to ground-nesting and migratory birds <p>Where possible, emphasize restoration of the desired ecological condition after construction. Evaluate outreach efforts with effectiveness measures over time. See also transportation ROW maintenance setbacks in adjacent ecoregion, Post Oak Savanna; may be appropriate in this ecoregion as well</p> <p>Provide outreach to landowners adjacent to TXDOT ROW in areas where TXDOT has implemented native restoration (native grasses used) or conservation (rare plant protection plans, maintenance plans to protect rare communities or features) to support SGCN recovery or protection to further understanding of these important resources and their site-appropriate management, reduce landowner maintenance in these areas, and promote SGCN recovery. Use outreach effectiveness measures to document progress.</p> <p>Work with TXDOT Regional Engineers and Environmental Review prior to segment development of I-69 Corridor; work together as a conservation community to identify the top concerns, avoidance solutions and mitigation opportunities for key priority habitat types at a functional ecological scale which may be affected. Avoid wetland <i>creation</i> as a mitigation option where possible. Use Environmental Review effectiveness measures.</p>
Land & Water Mgmt: FARM
<p>A North Carolina State University study of linear and block field borders on 24 farms found that quail populations almost doubled on farms where 2-3 percent of the cropland edge was allowed to go fallow. It also found that blocks of fallow habitat (one quarter acre to 6 acres in size) produced twice the number of quail as narrow (10-foot) linear field borders. While this study targeted quail production, other SGCN grassland birds, small mammals, reptiles, some plants and insects would also benefit from these practices:</p> <ul style="list-style-type: none"> • Leave brushy or grassy borders around fields. These borders can help with erosion and if left un-mowed can provide nesting areas • Leave jagged edges on fields. Fields with straight edges appear to provide less habitat • Preserve or restore woody draws (cover in draws will re-establish naturally if left unplowed or un-mowed; invasive nonnative plants should be removed). • Alternating crops in the same field is an excellent way to reduce erosion and build soil fertility. Planting row crops followed by wheat or other small grains the next year provides habitat diversity for quail. Planting legumes or grass every third or fourth year is a good rotation for soil conservation and SGCN. • Remove dense sod-forming monoculture grasses. Thick mats of grass hinder movement and make feeding difficult. Native warm-season grasses, properly managed, provide cover and food. Mixing legumes with grasses improves habitat for young quail.

Conservation Action
Conservation incentive providers need to work with willing landowners especially adjacent to and in corridors between well-managed public lands to restore and manage forest communities in large single-ownership or smaller acreage cooperatives – opportunities to connect/improve historically fragmented management. Select landowners with willingness to share information, capacity for longterm commitment, diverse landscape with larger conservation benefits, longleaf pine savanna and natural aquatic resources first. Use the effectiveness measures for Lease/Easement/Acquisition to assess the efficacy and benefits to SGCN and rare communities.
Land & Water Mgmt: RANCH
Conservation incentive providers need to work with willing landowners especially adjacent to and in corridors between well-managed public lands to restore and manage forest communities in large single-ownership or smaller acreage cooperatives – opportunities to connect/improve historically fragmented management. Select landowners with willingness to share information, capacity for longterm commitment, diverse landscape with larger conservation benefits, longleaf pine savanna and natural aquatic resources first.
Host local and absentee landowner workshop series related to SGCN and habitat “target areas” (see Effectiveness Measures for training and technical guidance), add a focus module on conservation instruments – Safe Harbor Agreements, Candidate Conservation Agreements, conservation easements – to dispel myths about regulatory constraints and promote benefits in preventing the need to list and promoting recovery. Showcase specific studies and examples from the region (or adjacent ecoregions) for better relationship building. Document through conservation practice and partner surveys over the course of three to five years whether the workshops increase opportunities for these tools to be used and the SPECIFIC barriers to their use. Share lessons learned in an annual conference through the Land Trust community.
Promote the use of native grasses in landowner incentive programs for wildlife and fish resource improvement (e.g. Farm Bill, SWG, LIP, and others). Sod-forming exotic grasses and cultivars should not be used in any restoration or enhancement project as these are known to be detrimental to native habitats and the wildlife on which they depend. A restoration guide to suitable native grasses for this ecoregion, local sources for native seed and stock, and techniques would be immensely useful to a wide variety of conservation service providers, landowners, and recreation land operators. Promote conversion of nonnative grasses to site appropriate desired ecological conditions especially on lands adjacent to sites already managing for conservation objectives (land trust properties, WMAs, State Parks, some Wildlife Cooperatives and Wildlife Management Plan holders, preserves, sanctuaries, etc.).
Provide site appropriate brush removal advice and project implementation to restore native grasslands and savanna, retain intact riparian areas, and protect wetlands and outcrop features. Promote use of site-appropriate methods – prescribed fire, herbicides or mechanical – to preserve water quality and prevent soil erosion and invasive grass colonization. Document and share site-appropriate restoration and maintenance plans for the benefit of other conservation practitioners – document what works and what does not in specific site types. Target areas adjacent to landowners (public or private) already implementing conservation practices or with high quality resource potential first. Use the effectiveness measures for Direct Management (Stewardship) to assess the efficacy and benefits to SGCN and rare communities.
Conservation easements, purchase of development rights programs, land and water trust instruments, and landowner incentive programs enhance landowner participation in conservation practice in this region. Landowners with intact priority habitats, with restoration potential for little investment (especially those contiguous with public and private lands employing conservation practices and/or on sites mapped as potential intact remnants), willing to manage streamside vegetation as native riparian buffer along Ecologically Significant Stream Segments (and to their headwaters) and to floodplain extent as practicable, and/or with any of the rare wetland communities (e.g. acidic bogs and baygalls) should be first-eligible. Monitoring of SGCN by habitat type must be a part of these projects. Information about methods, short and longterm success (or failure) need to be shared through conservation networks. Use the effectiveness measures for Lease/Easement/Acquisition to assess the efficacy and benefits to SGCN and rare communities.
Land and Water Management: Timber
Conservation easements, purchase of development rights programs, land and water trust instruments, and landowner incentive programs enhance landowner participation in conservation practice in this region. Timber landowners with intact priority habitats, with restoration potential for little investment (especially those contiguous with public and private lands employing conservation practices and/or on sites mapped as potential intact remnants), willing to manage streamside vegetation as native riparian buffer along Ecologically Significant Stream Segments (and to their headwaters) and to floodplain extent as practicable, and/or with any of the rare wetland communities (e.g. acidic bogs and baygalls) should be first-eligible. Monitoring of SGCN by habitat type must be a part of these projects. Information about methods, short and longterm success (or failure) need to be shared through conservation networks. Use the effectiveness measures for Lease/Easement/Acquisition to assess the efficacy and benefits to SGCN and rare communities.
Recent land ownership changes in timber management investment companies - TIMOs and REITs - in this region may adversely affect the management and conservation of significant vegetation communities which currently support SGCN. Past collaborative relationships need to be rebuilt and perhaps redefined with these new owners. Land conservation priorities in East Texas have been identified by a group of stakeholders that includes NGOs, Land Trust, TIMOs and Agencies. Cooperative management guidelines, distilled best management practices outreach, and the opportunities for conservation need to be promoted (e.g. emphasize protection of US Forest Service inholdings, buffer Big Thicket, easements or fee simple using Forest Legacy Program or other funding sources). Use the effectiveness measures for Outreach and Lease/Easement/Acquisition to assess the efficacy and benefits to SGCN and rare communities.
Land & Water Mgmt: Municipal
Focus outreach to Metropolitan Planning Organizations, Councils of Government, Regional Transportation authorities, and other planning entities which encompass emerging and outlying communities to address consideration of SGCN, rare communities and habitats as part of their first-round constraints process in development, zoning, and permitting. Support counties authority to require stormwater pollution prevention, floodplain buyouts, appropriate road development, conservation of nonjurisdictional wetlands, open space planning, or water or other conservation measures from developers. Encourage water quality protection measures in HUC 12 watersheds identified in the National Fish Habitat Action Plan (see viewer: http://www.nbii.gov/far/nfhap/) to improve SGCN habitat and reduce human impacts in these watersheds. Use the effectiveness measures for Outreach to assess the efficacy and benefits to SGCN and rare communities
Land & Water Mgmt: Conservation & Recreation
Strategically identify areas where currently managed public conservation properties (Big Thicket National Preserve, National Forests adjacent to Longleaf Ridge) could benefit from public-private conservation easements to incentivize conservation action on private lands through purchase of development rights, conservation easements, work with local land or water trusts, state or federal management incentives. Beyond buffering, connect habitat utility (not necessarily fenceline to fenceline, but functional “stepping stones”) for sound ecological reasons the over ½ million acres of federal, state, county, city, and mitigation banks already protected to varying degrees in the Pineywoods. Use the effectiveness measures for Outreach and Lease/Easement/Acquisition to assess the efficacy and benefits to SGCN and rare communities
Identify all necessary criteria for designation of Neches Wild and Scenic River, even if not officially pursued; use the criteria to establish private lands incentive program to participate in conservation of this important site. Identify SGCN which would serve as keystone monitoring species for this area and establish a longterm monitoring program to determine how the incentives affect SGCN status improvement. Use the effectiveness measures for Conservation Area Designation to assess the efficacy and benefits to SGCN and rare

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communities.
Initiate a short-leaf pine savanna restoration initiative similar to long leaf pine alliance to identify suitable ecologically functional areas for restoration efforts, project partners, and potential plant resources. Create a longterm implementation plan with multiple partners – USFWS Partners Program, NRCS Farm Bill programs, The Nature Conservancy, local land trusts. Include a monitoring plan in the implementation to determine effectiveness of the efforts and any adaptive management avenues for the future
Provide site appropriate brush removal advice and project implementation to restore native grasslands and savanna, retain intact riparian areas, and protect wetlands and outcrop features. Promote use of site-appropriate methods – herbicides or mechanical – to preserve water quality and prevent soil erosion and invasive grass colonization. Document and share site-appropriate restoration and maintenance plans for the benefit of other conservation practitioners – document what works and what does not in specific site types. In some instances, prairie restoration to control brush is more economical than non-native pasture conversion back to native grasses. Use the effectiveness measures for Direct Management (Stewardship) to assess the efficacy and benefits to SGCN and rare communities.
Water Development, Management and Distribution
See http://www.twdb.state.tx.us/wrpi/rwp/map.asp for a current map of Regional Water Planning Groups that intersect this ecoregion. Water management is a key issue in this ecoregion. Identify a coalition or natural resources advisory group to take available science-based information about impacts and instream flow needs to craft specific recommendations (where to avoid inundation, where to improve water quality, what technologies are incompatible with natural resources goals for the region) to conserve SGCN and rare communities and priority habitats related to surface water management. Given small budgets for time and travel, elect a spokesperson (or rotating spokesperson) to attend and participate in Regional Surface Water Planning meetings and convey the group’s recommendations.
Support the establishment of east Texas groundwater conservation district(s) that align most closely with the aquifer boundaries [Carrizo-Wilcox] and use areas in and out of these basins to support management for conservation, preservation, recharging, and prevention of waste of groundwater resources. Form a regional natural resources advisory group to identify key concepts and actions to incorporate fish, wildlife and recreation needs into the ground water conservation district planning process. Evaluate the effectiveness of this activity and share lessons learned in other regions which could benefit from this experience. Support the conversion or transfer of existing unused water rights to the Texas Water Trust to protect instream uses. Develop a means to aid in funding the transfer of unused water rights to Texas Water Trust.
Lack of Information & Resources
Form multi-partner working group(s) to establish scientifically sound written best management practices for riparian, bottomland hardwood, and pine savanna restoration, including timing, water needs, reasonable recommendations for initial planting diversity, ways to encourage full complement of desired ecological condition of community, how to prevent or control specific invasives without negatively impacting restoration, locally sourced seed and plant materials for the ecoregion (and finer scales if needed) Identify key suites of SGCN and rare communities (not all that may occur in the type) for each restoration type which can be monitored to assess the prescription’s effects on species sustainability. Work with system experts AND rare species experts to identify concerns, barriers, and solutions. Document the BMPs and share with other land managers in the region. Identify effectiveness measures for the restoration as well as the outreach to others.
Prescribed fire is a useful tool in grassland and savanna restoration and maintenance. A study of rangelands in south Florida, conducted by the Tall Timbers Research Station in cooperation with the University of Georgia, and University of Florida found that quail populations could be doubled in as little as 2 years with improved management. Specifically, it found the use of summer fire rather than winter fire and roller drum chopping in summer offered both improved forage for cattle and improved quail habitat. Summer fire is not often used in Texas as a tool; where it has been used (or where natural wildfires have occurred in the summer), little has been documented about the vegetation community (including invasives) and SGCN response following summer fire. Initiate and publish post wild fire studies to document vegetation community and target SGCN responses. Review current literature and provide recommendations for overcoming barriers to summer fire application, best management and conservation practices for followup and monitoring, and resources for applying this information. Review the effectiveness measures for stewardship (direct management) activities and determine what information would be required to demonstrate progress in summer fire use for conservation in Texas. Form multi-partner working group(s) to establish scientifically sound best management practices for prescribed fire application for the ecoregion (timing/season, period/duration, intensity, parameters for RX) for the restoration of sites and heterogeneity in grasslands, but also the longterm health and sustainability of desired ecological conditions (plant communities); work with Rx fire technical experts and SGCN/rare communities experts to identify concerns, barriers, and solutions. Explore the barriers to applying this tool on private lands and make recommendations to overcome these barriers (policy? Targeted outreach? Technical workshops?). Identify <u>key</u> SGCN from a variety of taxa and rare communities to monitor to determine effectiveness of the applied practices.
Host landowner workshops on conservation instruments – Safe Harbor Agreements, Candidate Conservation Agreements, others – to dispel myths about regulatory constraints. Showcase specific studies and examples from the region (or adjacent ecoregions) for better relationship building. Document through conservation practice and partner surveys over the course of three to five years whether the workshops increase opportunities for these tools to be used and the SPECIFIC barriers to their use. Use the effectiveness measures for Outreach to assess the efficacy and benefits to SGCN and rare communities
Identify a host website to share ecoregional practitioner (not novice, not landowner, but professional) cross-training opportunities for RX fire, stream rehabilitation, reintroductions, brush management, GIS and corridor identification
Using the Texas Ecological Systems data and local conservation service provider knowledge, identify at the ecoregion level priority habitats which are relatively connected of high enough value to develop conservation initiatives to keep them connected and productive. Include an assessment of existing public lands to determine ecological and conservation function needs (buffer, management changes, adjacent land use threats). Work with willing landowners and land trusts <i>especially adjacent to and in corridors between</i> well-managed public lands to restore and manage bottomland hardwood, shortleaf pine savanna, and riparian communities in large single-ownership or smaller acreage cooperatives – opportunities to connect/improve historically fragmented management

Conservation Action

Create a multi-disciplinary ecology committee to identify three to five years of highest priority research projects (actual projects, not just concepts) that can be rolled out to universities and colleges to collect the information most needed at the PRACTICAL level for management and conservation improvement on the ground. Many SGCN in this region lack distribution and POPULATION status information; more information and cooperation from private landowners may reduce the risk of listing, enhance recovery options, and contribute to conservation of many sensitive habitats just through awareness and documentation. Priorities identified in the TCAP process to date include:

- *Black Bear* Black bear observation trends are on the rise in the northern post oak along the Red River and Sulphur River basins so increased outreach/education efforts, monitoring and research of movements is necessary. Also, minimizing conflicts through the development of conflict management protocols would be beneficial. Identify key gaps in landscape scale habitats that can be restored and use long term conservation tools to retain large, contiguous blocks of black bear habitat. Black bears serve as an excellent umbrella species for many hardwood forest / riparian dependent SGCN. Conservation efforts for black bear in this region should include monitoring for other represented SGCN taxa in this type of habitat. See also Black Bear Management Plan 2005-2015 http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_pl_w7000_1046.pdf
- *Rafinesque's big-eared bat* and *Southeastern myotis*— continue monitoring roosts and identify new roosts. Support long-term conservation of bottomland hardwoods. Increase awareness among forest managers and owners. Promote BMPs for species among stakeholders. Retain large hollow trees, such as blackgum and water tupelos. Identify protect roosts in artificial structures. Support WRP and similar programs. Perform hardwood restoration.
- *Eastern spotted skunk* – determine status
- *Texas Horned Lizards* – raise awareness of beneficial native ants. Combat indiscriminate use of pesticides and buildup within ecosystems. Support native prairie restoration and long-term conservation efforts in areas of suitable habitat. Identify existing populations. Identify expansive suitable habitats under conservation for release and on landowner cooperators.
- *Amphibian and Reptiles*: Survey private landowner cooperators to update data sets and monitor populations.
- *Timber Rattlesnake*: Limit road construction near and within suitable habitats. Utilize strategies similar to black bear and bottomland hardwood bat spp. for habitat conservation. Implement awareness campaign to landowners and public lands in occupied habitat. Limit human related mortality. Increase data gathering.
- *Alligator Snapping Turtle* – Status determination and key locations. Raise awareness among outdoor users.
- *Alligator gar* - Document findings for the current comprehensive research and apply to management/recovery plan
- *Bachman's Sparrow* – short-leaf pine savanna restoration in northeast Texas could increase suitable habitat. Start initiative similar to longleaf alliance. Build off Lennox woods project area. Increase use of prescribed burns on private lands. Increase survey efforts along western edge of range to identify boundary and suitable occupied habitat, such as within Red River County. Promote BMPs within forest management agencies and industries.
- *Northern Bobwhite, Dickcissel, Eastern Meadowlark, LeConte's Sparrow, Short-eared Owl, Loggerhead Shrike, Northern Harrier, Swainson's Hawk, Henslows Sparrow* –Prairie restoration, conservation and management are critical NOW for these species. Promote rotational grazing, fallow fields, delay haying on some fields until after breeding season.
- *Interior Least Tern* – new reservoirs could be engineered to provide small island habitat at varying reservoir levels. The islands would surface during lower water levels in the summer so that they would be devoid of vegetation.
- *Swainson's Warbler, Kentucky Warbler, Louisiana Waterthrush, Prothonotary Warbler* – Reduce water consumption in the urban areas that leads to destruction of bottomland hardwoods for reservoir development. Identify high priority conservation areas for bottomland hardwoods. More conservation lands protecting intact bottomland hardwoods are needed in northeast Texas. Promote BMPs for this habitat among agencies and cooperators.
- *Freshwater Mussels* – Additional distribution and habitat requirements information are needed to identify instream flow standards, recommendations for water conservation areas, sites to protect from reservoir development, outreach and activities to prevent zebra mussel spread, greater water quality protections in mussel watersheds to prevent pollution and sedimentation
- *Raspberry Crazy Ants* - new menace, very little known; however, anecdotal evidence of intense swarming and predation on caterpillar and honey bee larvae indicates that potential exists for adverse effects to pollinators. More research is needed.
- Study current water use and rates paid in large urban areas, versus the cost of longterm ecological loss from reservoirs or other water development projects. Convey the findings to regional surface water planning groups and make recommendations for changes to accommodate realistic mitigation.
- Study application of hydraulic fracturing and the effects to specific groundwater and surfacwater dependent SGCN; make management and mitigation recommendations for use by the Texas Parks and Wildlife Habitat Assessment section for project review.

Form a working group with adjacent Post Oak Savanna and Gulf Coastal Prairies and Marshes aquatic and terrestrial ecologists to identify river rehabilitation goals in/adjacent to undammed stretches below last impoundment to the estuaries to evaluate/implement instream flow recommendations; improve the quality, timing, and seasonality of releases, improve riparian restoration, and increase connectivity to improve resilience to climate

Inadequate Policies, Rules, Enforcement

Similar to the crab trap programs on the coast, provide guidelines for trotline construction and use in line with conservation of nontargeted species, identify target audiences and conduct outreach, and monitor implementation related to marking and removal of abandoned trot-lines; if voluntary ineffective, craft rule similar to the one for crab trap removal in Trinity Bay. Review current rules to see if there are ways to better the regulations for identification and removal of abandoned lines.

In conjunction with public outreach efforts and information signage at boatramps and marinas on area waterways, target a few specific problematic sites for law enforcement concentration and presence for giant salvinia and other illegal aquatic species education and outreach, enforcement if necessary.

Other Cross-Cutting Issues

Determine market values that are driving agricultural conversion (biofuels?), timber conversion, livestock production, hunting and other recreation, and land subdivision in this region. Craft a recommendation to landowner incentive program providers that can be used to index conservation practice incentives in ecoregions. Monitor whether this approach was effective to change the conservation program values AND landowner participation in those programs to benefit specific SGCN in sites.

Climate Change: Use downscaled climate models to conduct vulnerability assessments on SGCN and rare communities; develop adaptation strategies that offset impacts or foster adaptive capacity to minimize projected vulnerabilities. Specific activities may include increasing habitat heterogeneity at local and landscape scales to increase resilience, improving connectivity across large landscapes by eliminating bottlenecks and barriers to dispersal in terrestrial and aquatic systems, protect climate refugia and other unique geological features across the landscape, etc. Work in partnership to ensure strategies are consistent and compatible across state and ecoregion boundaries. Carbon sequestration efforts in this region can go hand in hand with desired ecological condition: – Trinity River Refuge has planted over 60,000 native bare-root seedlings to assist in carbon sequestration efforts and conversion of farm/ranch lands back to a somewhat functional bottomland hardwood forest. This approach could be explored further in other areas and programs (Farm Bill) to provide landowner incentives for bottomland hardwood, longleaf pine and shortleaf pine savanna

NOTE: Almost all of these actions would benefit from more regular cooperation among conservation practitioners in the region. A share-site for conservation practice would be a useful tool. See Statewide/Multi-region handbook AND the Effectiveness Measures report's evaluation of existing conservation practice sharing tools (Appendix IV). This will go a long way toward landscape-level planning and shared priorities.

