



TEXAS CONSERVATION ACTION PLAN

OVERVIEW
September 2012



Citing this document:

Texas Parks and Wildlife Department. 2012. **Texas Conservation Action Plan 2012 - 2016: Overview**. Editor, Wendy Connally, Texas Conservation Action Plan Coordinator. Austin, Texas.

ACKNOWLEDGEMENTS

This plan could not have been developed without the guidance and funding of the State Wildlife Grants program, managed in cooperation by US Fish and Wildlife Service and Texas Parks and Wildlife Department's federal aid program; the effort evident in the 2005 Plan; or the support and information from many conservation organizations and agencies, stakeholders and the public during the last two years. For many of the participants, the time and effort requested was an added burden to very full "plates;" however, the broad range of thoughtful responses made these documents possible.

Heartfelt appreciation goes to the following **TPWD biologists, coordinators, and specialists** (plus, the teams they work with and their supervisors for allowing them to participate) for going the extra mile:

- Andy Gluesenkamp, Michael Warriner, Jackie Poole, Jason Singhurst, Cliff Shackelford, John Young, Gary Garrett, and Paul Hammerschmidt (*Taxa Expert Team Leads*);
- Aron Flanders, Nathan Rains, Jonah Evans, Jesus Franco, Ricky Maxey, Brent Ortego, Terry Turney, Sean Kyle (*Regional Wildlife Diversity Biologists*);
- Duane German, Amie Truer-Kuehn, and Christin Atkinson (*GIS Lab Landscape Ecology Team*);
- David O'Donnell, Stephen Lange and Steve Schwalling (*GIS Analysts*);
- Bob Gottfried, Sandy Birnbaum and Cullen Hanks (*Texas Natural Diversity Database*); and
- Megan Bean, Doyle Mosier, Kevin Mayes, Chad Norris, Tim Birdsong, and Wendy Gordon (*specialists in freshwater aquatic and climate change issues*).

A special "Thank You" goes to those who willingly supported this process with their participation and coordinated with us for free workshop space:

- Tyler Nature Center (Tyler)
- Kokernut Lodge (Alpine)
- Fort Worth Nature Center (Fort Worth)
- Gus Engeling Wildlife Management Area (Palestine)
- Texas Tech South Llano River Campus and Field Station (Junction)
- TPWD Marine Research Center and Field Lab (Dickinson)
- Harte Research Institute (Corpus Christi)
- USDA Plant Stress and Water Conservation Center (Lubbock)

Several conservation organizations came to the table with great suggestions and helped refine the ecoregion handbooks. The Nature Conservancy of Texas, specifically John Karges, Jim Bergan, David Bezanson, Ryan Smith and Lisa Williams, provided a great deal of data and detailed input for ecoregions and the statewide level. The Association of Fish and Wildlife Agencies' Teaming With Wildlife Program Director Mark Humpert and then-Associate Terra Rentz (now Mary Pfaffko) provided guidance, labor, support, training, travel, resources and humor throughout this process. The benefits they provide to conservation practice across the nation are incredible given such a small staff and such a large mission. Organization for Issues and Actions was derived from the braintrust work of the Effectiveness Measures Work Group, 2009 - 2011.

Additionally, I am grateful to the web coordinators and survey gurus (especially Jon Purvis and Michael Warriner, TPWD) who helped broaden our ability to reach the public. TPWD's web-based outreach, project tracking, and social networking tools will evolve to benefit conservation delivery for years to come.

Finally, a word of thanks to all of you who will "carry water" using the information in this Plan to improve Texas resources' and conservation practice for future generations of Texans!

CONTENTS

ACKNOWLEDGEMENTS.....	ii
CONTENTS.....	iii
SUMMARY.....	1
HOW TO GET INVOLVED	2
ACTION PLANS: A NATIONAL CONSERVATION AGENDA	3
Species of Greatest Conservation Need (SGCN)	3
Habitats and Systems at Risk	3
Conservation Actions and Monitoring.....	3
MOMENTUM 2005 - 2011	3
Large-scale and Local Conservation.....	4
Development Project Planning	4
Funding	4
Effectiveness of Conservation Actions.....	5
TEXAS CONSERVATION ACTION PLAN – What’s in a Name?	5
PROGRESS REPORT: 2005 – 2011 Implementation.....	5
UNDERSTANDING CHANGE TO SOLVE PROBLEMS	6
SETTING PRIORITIES.....	6
TCAP DEVELOPMENT	6
“Major Revision” and Timelines.....	6
2005 Plan Review	7
Targeted Outreach.....	7
Conservation Workshops in Ecoregions	9
Ecoregions and Ecological Drainage Units	9
Workshops	13
Post-Workshop Follow-Up Surveys.....	15
Public Review	16
USFWS Region 2 Final Approval.....	16
Next Review/Revision	16
2011 CONTENT AND CHANGES.....	17
Organization and Access.....	17
Relationship to other Conservation Plans	17
Other Planning Boundaries.....	17
Other Conservation Plans and Programs.....	17

Species and Rare Communities of GREATEST CONSERVATION NEED	21
SGCN List Review Kick-off	21
Status and Ranks	21
Information Sources and Taxa Teams’ Rationales	24
Core Ecoregion Teams’ Reviews and Expert Taxa Team Responses.....	26
Final SGCN and Rare Communities Lists	27
Habitat	28
Broad Habitat Types and Definitions	28
Habitat Types in the Statewide/Multi-region Handbook	32
Habitat Types in Ecoregion Handbooks	32
Issues.....	33
Broad Issues Types and Definitions	34
Issues in the Statewide/Multi-region Handbook.....	41
Issues in Ecoregion Handbooks.....	41
Actions	42
Action Types and Definitions	42
Actions in the Statewide/Multi-region Handbook.....	43
Actions in Ecoregion Handbooks	43
MEASURING PROGRESS	48
RESOURCES AND REFERENCES.....	49
Cited References in this Document	49
Additional Internet Resources	57

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.

OVERVIEW HANDBOOK FIGURES

Figure 1. Ecoregions with County Boundaries and Names	11
Figure 2. Ecological Drainage Units (labeled) with Ecoregions.....	12

OVERVIEW HANDBOOK TABLES

Table 1. Ecoregion Name Abbreviations (alphabetical order).....	10
Table 2. Core Ecoregion Workshops for TCAP Input, in chronological order	14
Table 3. Core Team Participation in Follow-Up Surveys.....	15
Table 4. Crosswalk of Conservation Planning Boundaries (approximate).....	18
Table 5. Listing Status and NatureServe Ranks Key	22
Table 6. Broad Habitat Types and Definitions	29
Table 7. Broad Issues Categories	35
Table 8. Conservation Actions, Definitions and Examples.....	44

SUMMARY

Each United States (US) state and territory has completed a **Wildlife Action Plan** or **Comprehensive Wildlife Conservation Strategy** to improve the stability and recovery of species which are in decline, already listed as threatened or endangered, and/or are representative of the diversity and health of the State's wildlife. To date, these plans across the nation have become important guides for natural resources management programs, conservation funding and partnership building, project development and mitigation strategy, and problem-solving at local and regional levels.

Texas Parks and Wildlife Department (TPWD) is the steward of this conservation plan, formerly called the *Texas Comprehensive Wildlife Conservation Strategy 2005 - 2010* or *Texas Wildlife Action Plan*. **This revised Texas plan is a series of 11 regionally-specific Ecoregion handbooks, a Statewide/Multi-region handbook, and this Overview document.** Collectively, they are now called the **Texas Conservation Action Plan (TCAP)**. This name change reflects the Plan's intention to be a conservation guide for all natural resources (not just "wildlife", which in Texas usually implies game and non-game terrestrial animals). In some media and national-level conservation outreach, the Plan is still called the Texas Wildlife Action Plan.

In this Overview, you will find:

- Background of the State Action Plans and State Wildlife Grants
- Conservation Progress Report 2005 – 2010, based on available information
- Discussion of participants* in the revision process
- Summary of the revision process for species, habitats, issues and actions
- Description of the differences between the 2005 Plan and this Plan
- Explanation of the Statewide/Multi-region and 11 Ecoregion handbooks.

**No individual names are provided – a list of Participants' Affiliations is on the website.*

The Statewide/Multi-region (SMR) Handbook provides information on larger conservation issues in Texas, and a few we share with our neighboring states, other states, Mexico and Canada. The SMR handbook also presents statewide and multi-region habitats and conservation actions. The statewide compiled Species of Greatest Conservation Need (SGCN) list is linked to that handbook.

Each of the 11 Ecoregion handbooks is related to a regional subset of the SGCN list, habitat descriptions, conservation challenges and issues, and conservation actions needed in that specific ecoregion. These handbooks are intended to encourage more local solutions to local needs and collaboration among conservation services' providers who work on similar issues.

References used in the revision, acronyms key, glossary, other resource documents and all TCAP handbooks are available in searchable, downloadable, printable documents on the TCAP website:

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

Editor's Note: The 2005 edition of this plan will remain in the TPWD online archives as background information to this second edition.

"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



HOW TO GET INVOLVED

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 handbook for your ecoregion (or the one in which you are most interested in participating) and the Natural Resource Conservation Programs and Services for Texas Landowners (TPWD 2007). Additional internet resources and contacts are also posted on the TCAP website:

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

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

Phone (512) 389-4800

Email tcap@tpwd.state.tx.us

ACTION PLANS: A NATIONAL CONSERVATION AGENDA

In 2000, the Association of Fish and Wildlife Agencies (AFWA) Teaming with Wildlife (TWW) coalition representing more than 3,500 agencies, conservation groups and businesses led the passage of two important wildlife and fisheries conservation funding acts: Wildlife Conservation and Restoration Program (WCRP) and State Wildlife Grants (SWG) (TWW 2008 – 2011, *see new* TWW 2012). The following year, the United States' Congress required each state and territory to develop a "comprehensive wildlife conservation strategy" to guide the distribution of these funds (USFWS 2000).

Eight elements of conservation success were identified by the US Fish and Wildlife Service (USFWS 2000) and a representative team from state fish and wildlife agencies and conservation organizations to guide the plans' development. The elements address species, habitats and communities, problems and issues, conservation actions, monitoring, plan reviews, coordination with conservation partners, and public involvement.

SPECIES OF GREATEST CONSERVATION NEED (SGCN)

Each state identified a list of species representative of the diversity, health and importance of the wildlife of their state. While the lists could include game and other state and federal regulated species, SGCN lists primarily focused on rare, declining, and vulnerable fish and wildlife species needing special attention for recovery, stability, and/or to prevent listings under state or federal regulation (e.g. Endangered Species Act). In general, few states included plants or plant communities because plants are ineligible for SWG funding; additionally, few states included invertebrates, limited either by their statutory authority or lack of information about invertebrate status.

HABITATS AND SYSTEMS AT RISK

While the SGCN list formed the basis for every plan, species conservation cannot be successful without defining the lands and waters species need to survive and thrive. Habitat and system definitions are complex, may affect many species, and are ever-changing in positive and negative ways. Most plans were organized by ecological regions, systems or habitats to identify manageable conservation actions for terrestrial, freshwater, and (where applicable) coastal/marine habitats benefit SGCN.

CONSERVATION ACTIONS AND MONITORING

Conservation actions (e.g. research, survey, restoration, land or water protection, partnership-building) were defined to *address the threats and issues* which negatively affect species, habitats and systems. A baseline assessment of existing habitats was important for many states to define and prioritize where actions were most needed. For some states, this assessment could not be accomplished with the available data; therefore, baseline development itself became a conservation action. Actions were developed on the framework of existing conservation for each state: private landowner outreach, partnerships with other agencies and organizations, public involvement, legislative and regulatory support, to name a few. Measuring and reporting progress, lessons learned and successes ("effectiveness") is best accomplished through monitoring. This component is very important, yet frequently it is the most difficult to achieve due to very limited time, money and human resources.

MOMENTUM 2005 - 2011

By 2006, 56 plans were created – one for each US state and territory – and approved by USFWS Regional review teams (TWW 2012). These plans were called State Wildlife Action Plans (SWAP) or Comprehensive Wildlife Conservation Strategies (CWCS). Since plans were approved, conservation partners and resource conservation agencies have seen the value in these plans grow as information resources, support or guidance for their conservation activities, and platforms for conservation practice improvement.

LARGE-SCALE AND LOCAL CONSERVATION

In the last six years, Action Plans have become more than just SWG distribution criteria. Across the nation, Action Plans are being used to prevent state and federal threatened and endangered species listings, improve the stability and recovery of species which are in decline or already listed, guide the collaborative use of natural resources management programs and funding, unite local and regional conservation partnerships around common actions, heighten awareness of sensitive and important resources to avoid during project development, and communicate conservation needs to local, state, regional and national audiences.

Across the nation, these plans provide information, support and a venue for collaborating with other strategic natural resources conservation efforts such as Joint Ventures, Statewide Forestry Resources Assessment and Stewardship programs, NatureServe and National Geographic's LandScope project, National Wildlife Federation's (NWF) climate change emphasis, and various land conservation activities by non-governmental organizations (NGOs), including land trusts. The activities in each plan engage a broad audience of land stewards, resource professionals, and the public – in Texas, especially private landowners – in regional and community-based conservation.

These plans have evolved beyond the states' fish and wildlife management agencies and their regulatory jurisdictions to provide a communication tool for all resource managers. In addition to local action, larger emerging conservation needs can be addressed across political boundaries: climate change, environmental water flows ("water for fish and wildlife"), migratory species, international conservation issues, and corridors and connectivity among conservation areas.

DEVELOPMENT PROJECT PLANNING

Action Plans provide valuable information on species distribution, habitat needs, and vulnerability which project planners (e.g. transportation authorities, surface and groundwater planning groups, wind and solar energy developers) can consider early in development stages to identify sensitive habitats and vegetation communities to avoid, ways to minimize the unavoidable impacts, and areas where compensatory mitigation could be ecologically beneficial.

FUNDING

Because states' and territories' plans were written primarily to support the distribution of SWG, many states built their first plans around a suite of SWG-eligible actions (USFWS 2007). Because of this initial relationship, many people still confuse "SWG" with "SWAPs;" however, several states expanded their plans beyond this one-to-one relationship to be able to fund SWAP actions with more than just SWG.

While there are still very few dedicated funding sources for non-game conservation actions, states and their conservation partners have scabbled for implementation funding in private competitive grants and other federal programs. Action Plans now provide some selection criteria for other resource management funding programs: some Farm Bill conservation and forestry title incentive programs, individual state funding sources (in Texas, this is primarily the Horned Lizard License Plate non-game conservation fund), Landowner Incentive Program, USFWS Partners Program, and private grant funds such as Doris Duke Foundation and Wildlife Conservation Society, among others.

That said, no state has a secure funding source to implement all conservation actions needed to stabilize or reverse the decline of their SGCN (TWW 2007). Until FY11, Texas annually received approximately \$3.5 million (MM) in SWG funding to implement their Action Plan. It has been estimated that Texas would need about \$50 MM (TPWD 2010a) to implement most of the conservation actions from the 2005 Plan, and far more than that to see many of these multi-year (in some cases, multi-generational) projects to completion.

Each year, Congress determines whether or not SWG will be apportioned and a state's share of SWG changes on this political platform. Because most conservation funding is grant-related, these sources are

variable and insecure *each year*. In Fiscal Year 2011, SWG was reduced to near 2001 levels. TWW, now a coalition of more than 6,000 organizations, continues to strive for stable conservation funding (TWW 2012).

EFFECTIVENESS OF CONSERVATION ACTIONS

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 2010 (precursor report) and 2011 (final report), approved by AFWA TWW Executive Committee comprised of state fish and wildlife agency directors and conservation leaders. These measures will be an important part of moving the plans and conservation forward and are mentioned throughout this document (see also *Measuring Progress* section).

TEXAS CONSERVATION ACTION PLAN – WHAT’S IN A NAME?

Texas called their first Action Plan (TPWD 2005a) a Comprehensive Wildlife Conservation Strategy (CWCS). USFWS approved the document in January 2006. Texas’ 2005 plan was primarily a guidance document for and by TPWD, shaped by statewide stakeholder, conservation partner, and public input.

Shortly after all states’ plans were approved, the TWW coalition began using the term “State Wildlife Action Plan” to strengthen messaging about the importance of all states’ plans under this program; therefore, you may hear the Texas plan also referred to as the **Texas Wildlife Action Plan**.

Based on perceptions and input during this revision process, the handbooks are now collectively called the **Texas Conservation Action Plan (TCAP)**. This name change expands the Plan’s perception as a conservation planning tool for all natural resources, not just “wildlife” which, in Texas, usually infers game and non-game terrestrial animals. Additionally, this edition of the Plan is more inclusive of conservation actions by all practitioners in the state – agencies, non-governmental organizations, universities and colleges, local land and water trusts, private landowners, and other community-based efforts.

PROGRESS REPORT: 2005 – 2011 IMPLEMENTATION

Since Plan approval in 2006, conservation priority projects have been implemented across the state, to the extent funding, time and human resources have been available. While TPWD does not currently track *all* Action Plan implementation by funding sources other than SWG or by entities other than TPWD, there is a running list on the TPWD website to summarize known TCAP implementation projects funded by SWG, federal and state Landowner Incentive Programs, and Horned Lizard License Plate state conservation grants. There are others funds and projects -- federal Endangered Species Act Section 6 funds, NRCS conservation and forestry title Farm Bill programs, and other private grants also used for Action Plan implementation; however, there is currently no centralized tracking system for these projects and cooperators to capture progress on the Plan goals. *Starting in spring 2013, TPWD will begin reporting Action Plan project information online through the USFWS Wildlife and Sportfish Restoration Program Tracking and Reporting Actions for the Conservation of Species (TRACS) system, currently in development; check the TCAP website for more details to follow.*

TPWD Wildlife Diversity Program and conservation partners agree that implementation efforts with these limited state-available funding sources over the last 5 years accomplished only a fraction of the priorities outlined in the 2005 Plan. And, because multiple partners and project leads implement actions from the Plan, input gathered in the revision consistently point to the need to improve project and

conservation action tracking. Conservation project development, progress, achievements and accountability are discussed further in the *Measuring Progress* section.

UNDERSTANDING CHANGE TO SOLVE PROBLEMS

Change – and understanding that change in a certain context – takes time, sometimes generations. Many land and water resources managers, planners, researchers, policy makers, and advocates work daily to understand our natural resources, how or why they change (positively and negatively) and how our conservation efforts affect that change over different time frames. This document taps into their expertise to define conservation needs, develop the best approaches to solve problems, form partnerships, and promote best management practices.

It is impossible (and impractical) to fully understand or know every need and/or contribution of a species or population for/to a habitat. We must move forward with our conservation practice, not paralyzed by a lack of understanding, but rather using the *best information we have now*, documenting our work well, and sharing lessons learned so that we may learn from each other's experiences. To accomplish this, the actions presented in this handbook recommend using a “theory of change” to measure effectiveness and share that information with others (AFWA TWW 2011).

The way people work and play in, live on, and move through Texas affects how conservation providers do all of these things. So, it's important to not only understand natural resources' needs and how they change with our actions, but also people's needs, attitudes and behaviors. External forces – such as natural disasters, cultural shifts, economy, catastrophic events at our own hand, climate change – and our responses to those forces have also impacted the issues we consider in conservation decision-making in ways we hadn't envisioned five or ten years ago.

The TCAP handbooks take 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.

SETTING PRIORITIES

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 taps into a broad network of conservation service providers, natural resources managers, alliances and working groups, other conservation plans, 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.**

TCAP DEVELOPMENT

TPWD employed an Action Plan Coordinator for this revision as a gathering point for input from the conservation community, stakeholders and the public. The Coordinator is responsible for soliciting, compiling, organizing and distributing this content. TPWD is the Plan steward, responsible for encouraging ongoing implementation and revision. TPWD has led and compiled this revision, engaging stakeholders and the public in this effort. This document (**Overview**) along with the **Statewide/Multi-Region handbook** and **11 Ecoregion handbooks form the TCAP.**

“MAJOR REVISION” AND TIMELINES

USFWS and the AFWA guidance defines a “major revision” as changes to two or more of the Eight Elements, including addition or deletion of SGCN, updated threats assessment (e.g. adding climate change), changes in conservation actions or prioritization of those actions. The 2012 Plan update

constitutes a “major” revision under this definition; therefore, TPWD notified USFWS by letter and received a response in December 2010.

TPWD delayed revision delivery to the summer of 2011 so that the Plan could reflect several national efforts which are shaping Action Plans and enhancing their reporting and communication values: Measuring the Effectiveness of State Wildlife Grants (and other conservation actions) (AFWA TWW 2011) and the USFWS Wildlife and Sport Fish Restoration (WSFR) Program Tracking and Reporting on Actions for Conservation of Species (TRACS) web-tool development (*in progress* through federal fiscal year 2013). USFWS revision guidance and 2010 – 2011 USFWS and TPWD correspondence is posted on the TPWD TCAP website.

2005 PLAN REVIEW

The Plan Coordinator gathered comments on content, organization, and implementation across the state between 2009 – 2011 through conversations with ecologists and researchers, outreach to land use planners, participation in conferences and working groups, presentations to resource managers’ professional societies, ecoregional workshops across the state, emails and surveys.

Several common threads for change emerged to improve the Plan:

- Update planning regions to mesh with several other conservation planning efforts, but don’t prioritize ecoregions (there are partners and priorities in every ecoregion);
- Organize Plan around updated regions, meshing terrestrial and aquatic issues where possible;
- Include rare plants and plant communities;
- Update and sort SGCN lists by taxa and ecoregion as well as compile a statewide list;
- Be more specific about what issues affect what regions;
- Define action types and craft specific activities to benefit populations and habitats at scales relevant to need (e.g. some actions need to benefit localized populations, some actions need to affect many regions);
- Broaden the types and scope of actions (not just research, monitoring, urban education, and regional actions);
- Provide distinct chapters for multi-region conservation issues – climate change, surface and groundwater quality and quantity (including instream flow), energy production and transmission, non-native invasive species, land use changes and demographic shifts;
- Provide ecoregional conservation practitioners contacts and information on best practices resources for their areas where available; and,
- Encourage adaptive conservation practice and strategic habitat conservation – including evaluation/monitoring the effectiveness of our actions to achieve conservation goals and sharing lessons learned (CMP 2010, USFWS and USGS 2006, AFWA TWW 2011) .

Through this input and review of practical conservation planning approaches (TNC and WWF 2006 - 2009, Baydack et al. 1999, Sanderson et al. 2002, IUCN 2008, IUCN – CMP 2008a, IUCN – CMP 2008b, Salzer and Salafsky 2006, Salafsky et. al. 2008, CMP 2007, CMP 2008, AFWA TWW 2010 and 2011), the Plan Coordinator revised the organization and framework. This framework was further revised through ecoregion workshops, surveys and public input.

TARGETED OUTREACH

To engage ecologists, land stewards, agencies and organizations with natural resource management missions, conservation service providers, researchers, environmental advocates, regulators and policy makers, a very large initial contact list (over 1000 members) was compiled from previous plan participants’ lists and the *natural* resource sectors of the Texas Conservation and Recreation Forum list, a TPWD Land and Water Plan stakeholder-building tool. Many additional contacts were added through the Plan Coordinator’s network, conference and workshop participants, and interest generated at early presentations.

The draft proposed changes from the 2005 Plan review were distributed to a subset of this larger list, targeting conservation practitioners in the field. Through 2009, feedback from the field, presentations and other contacts helped hone the framework and the information distributed at ecoregional workshops in 2010 (see *Conservation Workshops* section). During this time, it became apparent that many contacts functioned in more than one region.

The much larger contact list was honed to nearly 600 individuals from over 100 organizations to create Core Ecoregion Teams, a Core Statewide/Multi-regional Team, and a broad Notification List to encourage intensive review during the public review period. This is a different approach than the Wildlife Diversity Conference method identified in the 2005 Plan. While the 2004 Conference was informational, this approach targets specific audiences to enhance potential *community-based* conservation action and broadened participation outside of TPWD. Additionally, this approach helped hone actions to appropriate scales by the people most interested in particular issues and most involved in project management. This was the first phase of the revision content development.

Core Ecoregion Teams are composed of terrestrial and/or aquatic species and system experts (biologists, ecologists, land stewards and managers, restoration specialists, etc.) in their ecoregions. Members understand their area's natural resources and systems, potential threats, ongoing efforts to address conservation issues (policy, partnerships, initiatives, projects), and urgent needs. A concerted effort was made to include representatives from existing conservation planning teams (e.g. Joint Ventures, Landscape Conservation Cooperatives, Natural Resources Conservation Service programs, TPWD Ecosystem Teams, TNC ecoregional planning teams). See also *Conservation Workshops in Ecoregions* section.

The **Core Statewide/Multi-region Team** is composed of experts in a particular broad-scale resource and/or issue (e.g. migratory corridors, climate change, invasive species, riparian areas, environmental water flows, wind and/or solar power, international conservation relationships) and/or have a working understanding of policy, partnerships and initiatives that currently or could potentially address landscape-scale, multi-region issues.

The **Notification List** is a compilation of the ecoregion teams, statewide team, plus regional resource-related professionals and advocacy groups, private landowners and landowner group representatives (e.g. agricultural producer organizations, co-ops, land trusts, water trusts), policy makers and regulators who are considered "hubs" to other conservation-interested networks and whose *potential participation in TCAP implementation will be very important*. These participants have an understanding of the social, political, and resource issues in their areas which may affect successful community-based implementation. Their reviews are specifically solicited during the Public Review period as an important practical filter ("reality check"); this notification encourages

Eco-What?

Throughout this document there are several terms which look similar and are related:

Ecoregion

A large area of land or water that contains a geographically distinct set of natural communities that

- share a large majority of their species and ecological dynamics;
- share similar environmental conditions; and
- interact ecologically in ways that are critical for their long-term persistence

Ecoregion boundaries are created by people to identify and categorize a set of factors for collaborative conservation planning.

Ecological Drainage Unit

A type of "ecoregion," this is a group of watersheds that share a common zoogeographic history, physiographic and climatic characteristics, and therefore likely have a distinct set of freshwater assemblages and habitats. EDUs are delineated as *groups of 8-digit US Geological Survey Hydrologic Unit watersheds (HUCs)*. Because EDUs are based on HUC boundaries, there is a certain topographic/drainage boundary that is less subject to interpretation than ecoregions.

Ecosystem

Community of organisms interacting with one another and with chemical and physical factors (e.g. sunlight, rainfall, soil nutrients, climate, salinity) in their environment; these are indistinct "boundaries" (e.g. the relationship between riparian zones and the river).

Ecological System

In the last ten years, there has been a shift in the way landscape ecologists talk about and map plant communities. Starting with NatureServe's broad [Ecological Systems](#), TPWD and partner ecologists have honed those to finer scales and to include influencing factors – development, soils, geology, water. These are the [Texas ecological mapping systems](#) – data to help land managers at a scale that's meaningful to the landowner and resource –specific goals.

them and their friends/colleagues to “get the word out” and participate during the Public review opportunity. See *Public Review* section.

Over two years, lists changed as initial members changed roles, organizations, or interest level and/or new members were identified. The Core Teams and Notifications list was finalized in May 2011 and is found on the TCAP webpage.

CONSERVATION WORKSHOPS IN ECOREGIONS

Ecoregions and Ecological Drainage Units

In the 2005 Plan, terrestrial planning regions were used, based on Gould et al. (1960) ecoregion boundaries. Aquatic and coastal planning was separate, based on major river and coastal basins (USGS 1991). Within the plan, ecoregions were prioritized (Tier I, II and III) based on the TPWD Land and Water Plan (TPWD 2005b), for reasons beyond natural resources conservation (included cultural, social and recreational needs and opportunities).

Stakeholders expressed concern during this revision process that *each* ecoregion has conservation needs, partners and opportunities which are high priority. Additionally, terrestrial, aquatic and coastal conservation issues and resources are frequently linked. In this edition of the Plan, *ecoregions* will not be prioritized and the aquatic-terrestrial-coastal resources will be related in each regional handbook where appropriate.

The 2005 Plan identified updating the statewide vegetation map as a high priority to facilitate improved conservation planning and resources management. In response, TPWD and partners committed a significant amount of SWG and other funding through 2012 to support the Ecological Systems Classification and Mapping Project (TPWD et. al. 2005 - *in progress*). This mapping project is discussed further in the Statewide handbook; future proposed high priority applications of the data are discussed in the Statewide and Ecoregion handbooks.

Ecoregion boundaries (Figure 1) form the foundation of the ecological systems mapping. As the mapped ecological systems are completed, conservation workgroups will be able to take advantage of this data to identify priority areas where they can best collaborate and standardize some communication across agencies and organizations. The ecoregion boundaries in Figure 1 are based on the 2007-2011 work of federal and state natural resources management agencies and non-governmental partners (Griffith et. al. 2007, North American Commission for Environmental Cooperation 2011). Because of the importance of the Ecological Systems project and its relevance to many conservation issues in Texas, the ecoregion boundaries for the project are the ones used for the Plan revision.

Two of the ecoregions *names* have been modified from the Griffith et. al. work for this Plan to mesh better with other conservation planning efforts in the state and across political boundaries:

- coastal (*Gulf Coast Prairies and Marshes*) and
- easternmost (*Western Gulf Coastal Plain*).

The ecoregion map can be downloaded as a PDF and GIS file data can be obtained from Texas Parks and Wildlife Department through the TPWD GIS Lab. Throughout TCAP documents, acronyms are used instead of the full ecoregion names (Table 1).

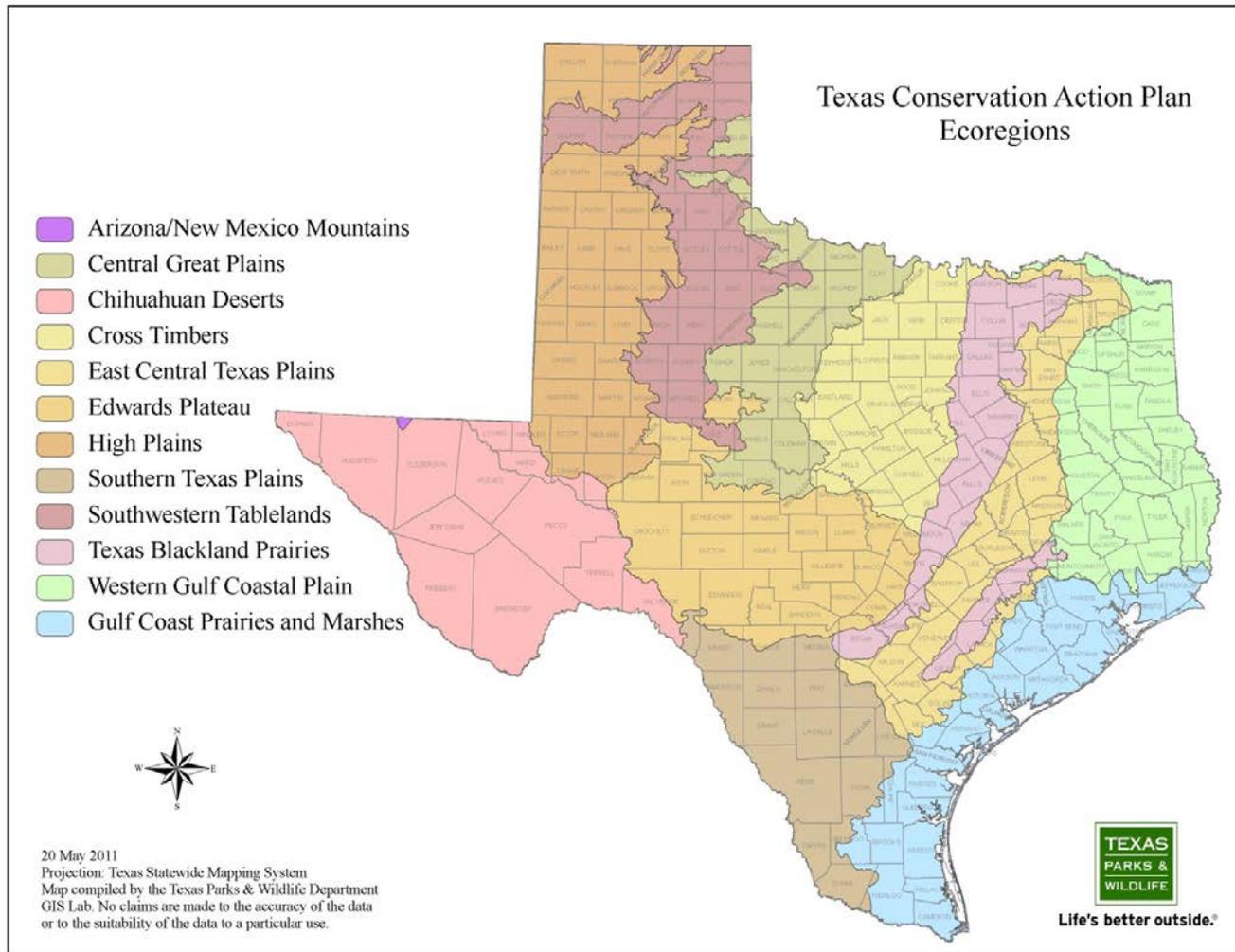
To better address the aquatic and coastal relationships in ecoregions, Ecological Drainage Units (EDU) used by the National Fish Habitat Action Plan (Esselman et. al. 2010) have been cross-walked with the ecoregions (Figure 2). Each ecoregion handbook relates the ecoregion to appropriate EDU(s), ecologically significant stream segments, lakes and other water resources. *Maps are presented again in the Statewide/Multi-region Handbook for reference. In each Ecoregion Handbook, the relevant ecoregion and EDU maps are displayed.*

The 2012 Action Plan uses these revised planning units to enable Texas conservation practitioners to document their varying scales of action using a common language across state and regional borders.

Table 1. Ecoregion Name Abbreviations (alphabetical order)

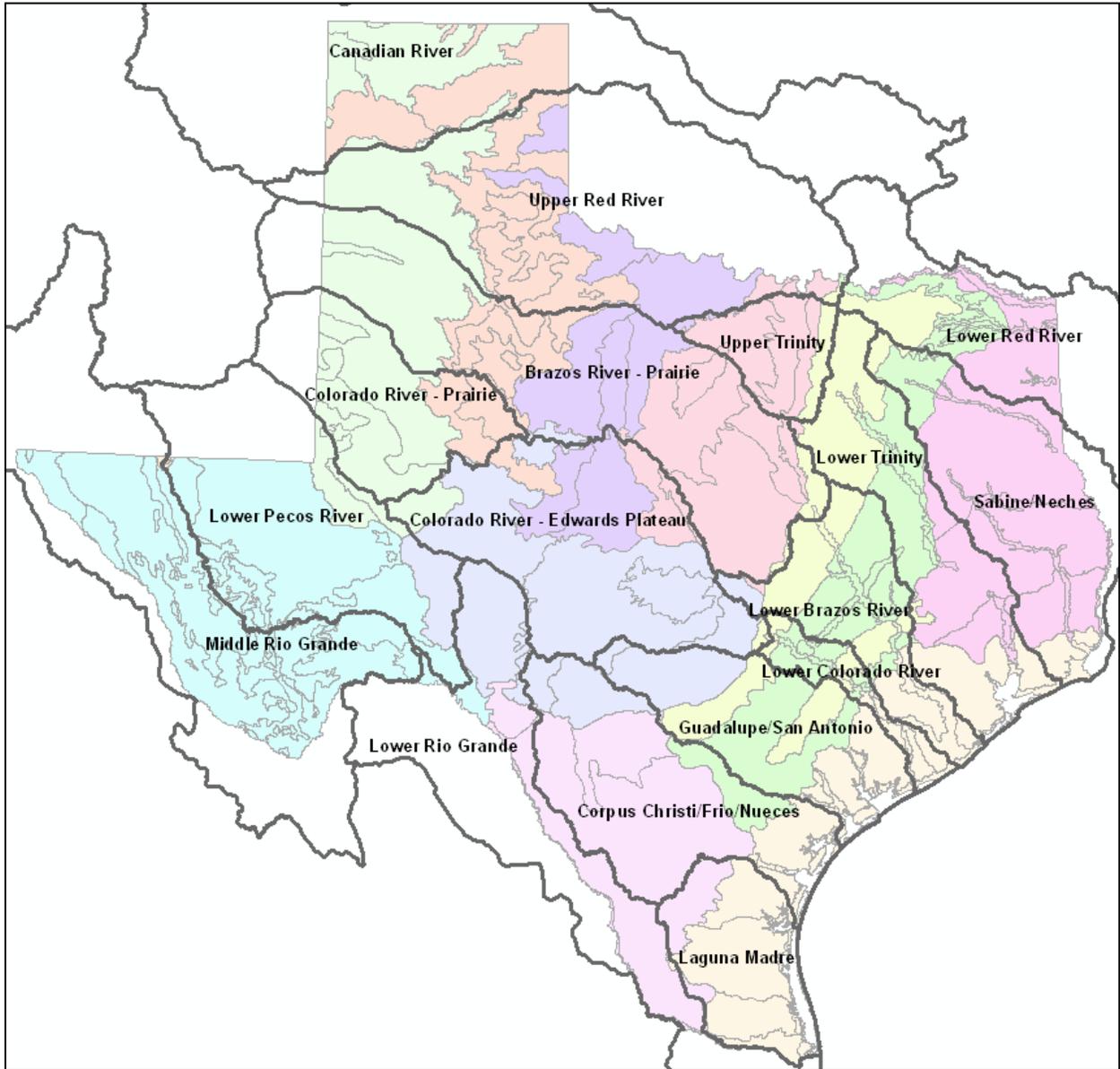
Ecoregion Name	Ecoregion Abbreviation (acronym)
Arizona – New Mexico Mountains	AZNM
Central Great Plains	CGPL
Chihuahuan Desert	CHIH
Cross Timbers	CRTB
East Central Texas Plains	ECPL
Edwards Plateau	EDPT
Gulf Coast Prairies and Marshes	GCPM
High Plains	HIPL
South Texas Plains	STPL
Southwestern Tablelands	SWTB
Texas Blackland Prairies	TBPR
Western Gulf Coastal Plains	WGCP

Figure 1. Ecoregions with County Boundaries and Names



Source information from Griffith et. al. 2007

Figure 2. Ecological Drainage Units (labeled) with Ecoregions



Source information from Esselman et. al. 2010

Maps compiled by Texas Parks and Wildlife Department, 2011. No claims are made to accuracy or suitability for a particular use.

Workshops

A focused effort to gather local knowledge across the state in person was conducted in a second phase of content development through nine ecoregional workshops, March through June 2010 (Table 2). Conservation field biologists, planners, ecologists, educators, land and water trusts, researchers and others who work in the conservation field were invited from nearly 200 local, regional, state, and federal agencies, organizations, working groups, colleges and universities to address terrestrial, aquatic and coastal/marine resources.

Participants in these workshops discussed the proposed new SGCN lists, important habitat types, threats to conservation, and the framework for this revision. Participants proposed additions and deletions to the SGCN lists and provided valuable input to further understanding of local conservation problems and solutions, all discussed in the Ecoregion handbooks.

The Gulf Coast Prairies and Marshes (GCPM) workshop was split into three at the request of local practitioners who approach resource issues differently in the upper, middle, and lower coastal regions:

- Upper – Sabine Lake, Galveston Bay
- Mid -- Matagorda Bay, San Antonio Bay, Aransas Bay, Corpus Christi Bay, Upper Laguna Madre
- Lower – Lower Laguna Madre

Several ecoregions were combined for these workshops because there seemed to be logical overlap in conservation practices and colleagues in these ecoregions and travel resources needed to be used as efficiently as possible. Combined ecoregions' workshops include the following:

- South Texas Plains (STPL) + lower GCPM
- Chihuahuan Desert (CHIH) + Arizona/New Mexico Mountains (AZNM)
- High Plains (HIPL) + Southwest Tablelands (SWTB);
- Central Great Plains (CGPL) + Cross Timbers (CRTB)
- Texas Blackland Prairies (TBPR) + East Central Texas Plains (ECPL)

The Edwards Plateau (EDPT) and West Gulf Coastal Plains (WGCP, also known as the "Pineywoods") were stand-alone meetings.

Table 2. Core Ecoregion Workshops for TCAP Input, in chronological order

Date (2010)	Ecoregions	Location	Participants' Affiliations <i>Note: many more were invited than participated</i>
Mar 17 - 18	WGCP	Tyler Nature Center	TPWD Wildlife, Inland Fisheries, State Parks, GIS, Coastal Fisheries; Lower Mississippi Joint Venture (Western Gulf Coastal Plain subregion), Texas Forest Service, USFWS Clear Lake, The Nature Conservancy, Stephen F. Austin State University, University of Texas at Tyler
Mar 24 - 25	CHIH, AZNM	Kokernut Lodge (Alpine)	TPWD Wildlife, Inland Fisheries, GIS; Pecos Water Trust; National Park Service; The Nature Conservancy; Chihuahuan Desert Research Institute; Rio Grande Joint Venture; Bat Conservation International/Texas Speleological Survey; Ladybird Johnson Wildflower Center; Angelo State University; Sul Ross State University
Mar 29 - 30	CRTB, CGPL	Fort Worth Nature Center	TPWD Wildlife, GIS, Inland Fisheries; Fort Worth Nature Center; USFWS Arlington; Oaks & Prairies Joint Venture; Connemara Conservancy; The Nature Conservancy
Mar 31 - Apr 1	TBPR, ECPL	TPWD Gus Engeling WMA (near Palestine)	TPWD Wildlife, Inland Fisheries; Oaks & Prairies Joint Venture; Connemara Conservancy; USFWS Arlington
Apr 19 - 20	EDPT	Texas Tech Llano River Campus (Junction)	TPWD Wildlife, Inland Fisheries, GIS; The Nature Conservancy; Cibolo Nature Center; Environmental Defense; Texas Forest Service; Texas Tech University; Lower Colorado River Authority; Bat Conservation International/Texas Speleological Survey
Apr 29 - 30	Upper GCPM	TPWD Marine Research Center (Dickinson)	TPWD Wildlife, Inland Fisheries, Coastal Fisheries, GIS; USFWS Corpus Christi; Ducks Unlimited; US Geological Survey
May 6 - 7	Mid GCPM	Texas A&M University Harte Research Center (Corpus Christi)	TPWD Wildlife, Coastal Fisheries, State Parks, GIS; USFWS (Louisiana)/Gulf Coast Joint Venture/Gulf Coastal Plains Landscape Conservation Cooperative; AFWA Teaming With Wildlife Program; US Geological Survey; Ducks Unlimited; Harte Research Institute; Texas A&M University Corpus Christi; Center for Coastal Studies; USFWS Corpus Christi
May 11 - 12	Lower GCPM, STPL	Rio Grande Valley Holiday Inn Express (Weslaco)	TPWD Wildlife, Coastal Fisheries, State Parks, GIS; The Nature Conservancy; USFWS Refuges; University of Texas Pan Am; Texas A&M University Kingsville; Texas A&M University West Texas; Ducks Unlimited
May 20 - 21	HIPL, SWTB	USDA Plant Stress and Water Conservation Center (Lubbock)	TPWD Wildlife, GIS; Playa Lakes Joint Venture; USFWS Partners Program and Refuges

POST-WORKSHOP FOLLOW-UP SURVEYS

The delay between workshops ending June 2010 and follow-up surveys in April 2011 allowed time for the Coordinator to compile workshop input and participate directly in national conservation planning efforts on habitat framework (in progress), conservation action effectiveness measures, and conservation project tracking. Surveys were designed to identify and fill the gaps in information not received at the workshops related to habitats, issues, and conservation actions.

A Reviewers' Guide and two surveys were distributed to Core Ecoregion Teams, Core Statewide/Multi-region Team, and others in April 2011 (Table 3). The Reviewers' Guide contained much the same background content as this Overview, plus the revised SGCN lists and the framework and workshop input related to habitats, issues and conservation actions. Surveys requested input on habitats, issues and conservation actions. Originally, the surveys were to close on April 26, 2011; however, based on phone and email requests, the surveys remained open until May 7, 2011. Information received by email covering the same content as requested through the survey came from 14 respondents.

There is a bit of overlap among adjacent ecoregion distribution lists and among the Statewide/Multi-region and Ecoregion distribution lists, although duplication was limited to the extent possible without leaving someone out of areas they particularly requested or are known to work in. By eliminating duplicates from all lists and counting each contact only once, the total in all Core Team lists is **approximately 550 people** (accounting for drop-outs, changes, additions) **to whom the survey was distributed**. The Notification List is not included in this tally. See also *Public Review* section.

Total participation in the surveys, plus the information received through email covering the same content was only **15 percent** of the people to whom the survey was distributed (**not** counting duplicates: total last column Table 3 divided by 550 x 100). A few surveys were started, area selected, but the remainder of the survey questions were blank or included text such as "sdafsdffsdff" which did not provide useful information. Participation in the extension period seemed to capture only about another 1% of invitees, but content was substantial and filled some information gaps.

Survey input was compiled and has been incorporated into the Plan handbooks. Because of low participation, this input is by *no means* the entirety of the Plan; however, it provided some guidance about issues and habitats that needed further investigation. In the next revision, the Coordinator recommends that the draft documents be compiled after workshops and distributed with a request for review, multiple avenues for comments (email inbox, survey, webform) and for a longer review period.

Table 3. Core Team Participation in Follow-Up Surveys

Core Team* <i>alphabetical order</i>	Number of Individuals in the Core Team Distribution List <i>(includes overlaps/duplicates)</i>	Number of Respondents Who Opened the Survey	Number of Respondents who Completed Survey and/or Provided Input through Email
CHIH - AZNM	42	10	6
CRTB - CGPL	42	8	4
EDPT	51	15	4
GCPM (Upper, Mid and Lower)	111	21	13
HIPL – SWTB	44	6	4
STPL	46	11	9
TBPR – ECPL	74	16	7
WGCP	68	6	3
State/Multi- region	195	24	36

PUBLIC REVIEW

Input from the workshops, surveys, national conservation planning efforts, and other sources was compiled into the handbooks – this Overview, the Statewide/Multi-region, and 11 Ecoregions – all posted on the TCAP webpage. Additional supporting information including SGCN lists, habitat and issues descriptions, maps and NatureServe’s Ecological System descriptions were also posted to the website.

All TCAP documents for public review were posted online by June 6, 2011. A public survey, posted at the same time and open until July 8, 2011, was posted on the TPWD website to collect focused comments on habitats, issues and conservation actions in the posted documents. Review requests during this period were emailed to more than 550 contacts in Core Teams, Notification lists, Texas Conservation and Recreation Forum lists and announced through TPWD media outlets, social media, and web pages.

Most comments were directed at statewide or multi-region issues, with less than 50% of respondents choosing to provide input on specific ecoregions.

Respondents chose the following top ten habitats needing attention (with percentage of respondents choosing that habitat type):

Creeks	Grassland	Woodland	Riparian	Savanna	Developed	Lakes	Aquifer	Freshwater	Agriculture
67.4%	46.5%	41.9%	39.5%	27.9%	25.6%	25.6%	25.6%	20.9%	20.9%

Saltwater and Bays followed about 6 percentage points behind freshwater and agriculture. Other habitats received less than 10% of the responses

Respondents chose the following top ten conservation issues needing attention (with percentage of respondents choosing that issue):

Invasive Species	Ground Water	Surface Water	Urban Impact	Ranch Managmt	Inadeq. Policies, Rules	Farm Managmt	Pests	Native Problem Species	Lack of Info
65.1%	39.5%	37.2%	37.2%	34.9%	32.6%	27.9%	23.3%	20.9%	16.3%

Timber Management, Oil and Gas Production and Delivery, Transportation, and Power Generation followed about 6 percentage points behind Problematic Native Species and Pests. Other issues received less than 15% of the responses

USFWS REGION 2 FINAL APPROVAL

Final draft handbooks were edited and compiled into a collection as the 2011 Draft Texas Conservation Action Plan and delivered to USFWS Region 2 in Albuquerque, New Mexico, in August 2011. USFWS Regional Review Team (RRT) reviewed the TCAP Roadmap related to the Eight Required Elements for Action Plans and the major changes (next section in this document: *2011 Content and Changes*) between the two Action Plan versions (2005, 2012). See USFWS 2006 and USFWS and AFWA 2007 for information about the Eight Elements and the RRT review points. USFWS RRT provided a comment document to TPWD in 2012, which the Coordinator then used to address their concerns. The RRT comment document and TPWD responses are posted to the TCAP website supporting documents.

NEXT REVIEW/REVISION

All Action Plans are to be reviewed and/or revised no later than 2015. Building on the framework laid out in the 2011/2012 revision, the TCAP will be reviewed and updated in FY15. The process will be similar, potentially with greater drive by the Ecoregions’ teams to guide content, and the public participation process will have a longer timeframe to allow for better involvement.

2012 CONTENT AND CHANGES

The Texas Plan Coordinator reviewed the 2005 Plan priorities, organization and implementation progress with stakeholders from October 2008 through April 2011 to determine if and how the 2005 Plan could be more accessible, useful to conservation practitioners in the field, and adaptable as new information becomes available. Changes were made to organization, access, and various concepts in content: planning regions, SGCN, habitats, issues, and actions.

ORGANIZATION AND ACCESS

The 2005 Plan compiled a great deal of background information in four large volumes with varying detail and focus. The revised TCAP provides a more segmented, user-friendly guide for local, regional and cross-regional conservation action. Changes have been made to the presentation and distribution of the TCAP.

Presentation and access to the TCAP has changed from four large volumes into several smaller functional handbooks, all available and searchable on the internet:

- **Overview** (this document) compiles all of the background and revision process information;
- **Statewide/Multi-region** addresses large and emerging conservation issues where cooperation across regional boundaries would be most beneficial; and,
- **11 Ecoregions** identify common ground for local conservation practitioners - areas where missions may overlap for greater conservation benefit, effectiveness and funding – in specific regions – without having to download or search the entire document.

RELATIONSHIP TO OTHER CONSERVATION PLANS

Other Planning Boundaries

Some conservation efforts in Texas use boundaries or names that are different from those in Figures 1 and 2. For instance, TPWD's 2010 Land & Water Resources Conservation and Recreation Plan strategic regions are based on combined river and coastal basins. Other agency and NGO conservation efforts may join the ecoregions into larger or smaller units, cross state or national boundaries, or create completely different boundaries.

While the ecoregion boundaries selected for this Plan revision relate to several current conservation efforts, it's important for all Texas conservation planners and practitioners to be able to easily see their own relationship to this Plan. Table 4 presents a "translation" among the ecoregion boundaries for the TCAP and other terrestrial and aquatic boundaries used in conservation work in Texas. The table is not comprehensive, but is representative. Resources used for this crosswalk are cited in each column. Connections can be made to enhance partnership opportunities on conservation actions in the handbooks.

Other Conservation Plans and Programs

Information in the TCAP directly **contributes to and draws from** conservation efforts across the state. There are specific referenced intersections in each handbook. See also the *Resources and References* section at the end of this handbook.

Table 4. Crosswalk of Conservation Planning Boundaries (approximate)

Note: Table is formatted 11" by 17", landscape orientation

2010 TCAP *	2005 TXWAP (Gould 1960)	The Nature Conservancy Terrestrial Ecoregions (1999)	Ecological Drainage Units (Watersheds) From the National Fish Habitat Action Plan <i>TX = Southeast Aquatic Resources Partnership and Desert Fish Habitat Partnership</i> (AFWA 2006, National 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)
Chihuahuan Desert (CHIH) and Arizona/New Mexico Mountains (AZNM)	Trans-Pecos	Chihuahuan Desert (24) and Arizona – New Mexico Mountains (21)	Lower Pecos River Middle Rio Grande/Bravo Lower Rio Grande/Bravo	Rio Grande JV Chihuahuan Desert BCR	Desert	Trans Pecos – Rio Grande (1)	Western Range and Irrigated Region: <i>Southern Desertic Basins, Plains and Mountains (42)</i> Western Great Plains Range and Irrigated Region: <i>Central New Mexico Highlands (70C)</i> Central Great Plains Winter Wheat and Range Region: <i>Southern High Plains Southwest (77D)</i> Southwest Plateaus and Plains Range and Cotton Region: <i>Edwards Plateau Western Part (81A), Southern Edwards Plateau (81D), Western Rio Grande Plain (83B)</i>	Trans Pecos
High Plains (HIPL)	High Plains	Southern Shortgrass Prairie (28), Central Shortgrass Prairie (27), Chihuahuan Desert (24)	Upper Red River Brazos River – Prairie Canadian River Colorado River – Prairie Colorado River – Ed Plateau Lower Pecos River	Playa Lakes JV Shortgrass Prairie BCR	Great Plains	Trans Pecos – Rio Grande (1) Colorado Upper (5a) Brazos Upper (6a) Plains Rivers (10)	Central Great Plains Winter Wheat and Range Region: <i>Southern High Plains, North (77A), Southern High Plains Northwest (77B), Southern High Plains South (77C), Southern High Plains Southwest (77D)</i> Western Great Plains Range and Irrigated Region: <i>Upper Pecos River Valley (70B)</i> Southwest Plateaus and Plains Range and Cotton Region: <i>Edwards Plateau Western (81A)</i>	High Plains
Southwestern Tablelands (SWTB)	Rolling Plains	Southern Shortgrass Prairie (28), Central Mixed Grass Prairie (33), Central Shortgrass Prairie (27)	Upper Red River Brazos River – Prairie Canadian River Colorado River – Prairie Colorado River – Ed Plateau	Playa Lakes JV Shortgrass Prairie BCR Central Mixed Grass Prairie BCR	Great Plains	Colorado Upper (5a) Brazos Upper (6a) Plains Rivers (10)	Western Range and Irrigated Region: <i>Canadian River Plains and Valleys (70A), Upper Pecos River Valley (70B)</i> Central Great Plains Winter Wheat and Range Region: <i>Southern High Plains, Northern (77A), Southern High Plains Breaks (77E), Central Red Rolling Plains Western (78B) and Central Red Rolling Plains Eastern (78C)</i>	Rolling Plains
Central Great Plains (CGPL)	part of Cross Timbers and Prairies and part of Rolling Plains	Southern Shortgrass Prairie (28) and Central Mixed Grass Prairie (33)	Brazos River – Prairie Colorado River – Ed Plateau Upper Red River Upper Trinity	Playa Lakes JV Central Mixed Grass Prairie BCR	Great Plains	Colorado Upper (5a) Brazos Upper (6a) Plains Rivers (10)	Central Great Plains Winter Wheat and Range Region: <i>Rolling Limestone Prairie (78A), Central Red Rolling Plains Eastern and Western (78C and B), Central Red Rolling Prairies (80A), Texas North Central Prairies(80B)</i> Southwest Plateaus and Plains Range and Cotton Region: <i>Edwards Plateau Central (81B)</i>	Rolling Plains
Cross Timbers (CRTB)	Cross Timbers and Prairies	Cross Timbers and Southern Tallgrass Prairie (32)	Brazos River – Prairie Lower Brazos River Colorado River – Ed Plateau Upper Red River Upper Trinity Lower Trinity	Oaks and Prairies JV Oaks and Prairies BCR Edwards Plateau BCR	Gulf Coast Prairie	Colorado Upper (5a) Colorado Lower (5b) Brazos Upper (6a) Trinity – San Jacinto (7) Plains Rivers (10)	Central Great Plains Winter Wheat and Range Region: <i>Central Red Rolling Prairies (80A), Texas North Central Prairies (80B)</i> Southwestern Prairies Cotton and Forage Region: <i>West Cross Timbers (84B), East Cross Timbers (84C), Grand Prairie (85)</i> Southwest Plateaus and Plains Range and Cotton Region: <i>Edwards Plateau Eastern (81C)</i>	Oak Woods and Prairies and Blackland Prairie

2010 TCAP *	2005 TXWAP (Gould 1960)	The Nature Conservancy Terrestrial Ecoregions (1999)	Ecological Drainage Units (<i>Watersheds</i>) From the National Fish Habitat Action Plan <i>TX = Southeast Aquatic Resources Partnership and Desert Fish Habitat Partnership</i> (AFWA 2006, National 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)
Edwards Plateau (EDPT)	Edwards Plateau	Edwards Plateau (29)	Brazos River – Prairie Colorado River – Ed Plateau Colorado River – Prairie Corpus Christi – Frio – Nueces Guadalupe – San Antonio Lower Brazos River Lower Rio Grande/Bravo	Oaks and Prairies JV Edwards Plateau BCR	Gulf Coast Prairie	Trans Pecos – Rio Grande (1) Nueces Coastal Bend (3) Guadalupe – San Antonio (4) Colorado Upper (5a) Colorado Lower (5b) Brazos Upper (6a)	Southwest Plateaus and Plains Range and Cotton Region: <i>Edwards Plateau Western Part (81A), Edwards Plateau Central Part (81B), Edwards Plateau Eastern Part (81C), Texas Central Basin (82A), Northern Rio Grande Plain (83A)</i>	Edwards Plateau and Llano Uplift
Texas Blackland Prairies (TBPR)	Blackland Prairie	Cross Timbers and Southern Tallgrass Prairie (32)	Brazos River – Prairie Colorado River – Ed Plateau Guadalupe – San Antonio Lower Brazos Lower Trinity Lower Colorado Lower Red Sabine – Neches Upper Red Upper Trinity	Oaks and Prairies JV Oaks and Prairies BCR	Gulf Coast Prairie	Guadalupe – San Antonio (4) Colorado Lower (5b) Brazos Lower (6b) Brazos Upper (6a) Trinity – San Jacinto (7) Deep East Texas (8) Northeast Texas (9) Plains Rivers (10)	Southwestern Prairies Cotton and Forage Region: <i>East Cross Timbers (84C), Texas Blackland Prairie Northern (86A), Texas Blackland Prairie South (86B)</i> Southwest Plateaus and Plains Range and Cotton Region: <i>Northern Rio Grande Plain (83A)</i>	Blackland Prairie
East Central Texas Plains (ECPL)	Post Oak Savanna	Cross Timbers and Southern Tallgrass Prairie (32)	Corpus Christi – Frio – Nueces Guadalupe – San Antonio Lower Brazos Lower Colorado Lower Red Lower Trinity Sabine – Neches Upper Red	Oaks and Prairies JV Oaks and Prairies BCR	Gulf Coast Prairie	Nueces Coastal Bend (3) Guadalupe – San Antonio (4) Colorado Lower (5b) Brazos Lower (6b) Trinity – San Jacinto (7) Deep East Texas (8) Northeast Texas (9) Plains Rivers (10)	Southwest Plateaus and Plains Range and Cotton Region: <i>Northern Rio Grande Plain (83A)</i> Southwestern Prairies Forage and Cotton Region: <i>Texas Claypan Area Southern (87A), Texas Claypan Area Northern Part (87B)</i> South Atlantic and Gulf Coast Cash Crops, Forest, and Livestock Region: <i>Western Coastal Plain (133B)</i>	Oak Woods and Prairies
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: <i>Western Coastal Plain (133B)</i> Atlantic and Gulf Coast Lowland Forest and Crop Region: <i>Western Gulf Coast Flatwoods (152B)</i>	Pineywoods

2010 TCAP *	2005 TXWAP (Gould 1960)	The Nature Conservancy Terrestrial Ecoregions (1999)	Ecological Drainage Units (<i>Watersheds</i>) From the National Fish Habitat Action Plan <i>TX = Southeast Aquatic Resources Partnership and Desert Fish Habitat Partnership</i> (AFWA 2006, National 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)
Southern Texas Plains (STPL)	South Texas Plains	Tamaulipan Thorn Scrub (30)	Corpus Christi – Frio – Nueces Guadalupe – San Antonio Laguna Madre Lower Rio Grande/Bravo	Rio Grande JV Gulf Coast JV Tamaulipan Brushlands BCR	Gulf Coast Prairie	Trans Pecos – Rio Grande (1) South Texas Rio Grande (2) Nueces Coastal Bend (3)	Southwest Plateaus and Plains Range and Cotton Region: <i>Edwards Plateau Western (81A), Northern Rio Grande Plain (83A), Western Rio Grande Plain (83B), Central Rio Grande Plain (83C), Lower Rio Grande Plain (83D)</i>	South Texas Brush Country
Gulf Coast Prairies and Marshes (GCPM)	Gulf Coast Prairies and Marshes	Gulf Coast Prairies and Marshes (31) and Tamaulipan Thornscrub (30)	Corpus Christi – Frio – Nueces Guadalupe – San Antonio Laguna Madre Lower Brazos Lower Colorado Lower Rio Grande/Bravo Sabine – Neches	Rio Grande JV Gulf Coast JV Gulf Coast Prairie BCR	Gulf Coast Prairie	South Texas Rio Grande (2) Nueces Coastal Bend (3) Guadalupe – San Antonio (4) Colorado Lower (5b) Brazos Lower (6b) Trinity – San Jacinto (7) Deep East Texas (8)	Southwest Plateaus and Plains Range and Cotton Region: <i>Lower Rio Grande Plain (83D), Sandsheet Prairie (83E)</i> Atlantic and Gulf Coast Lowland Forest and Crop Region: <i>Gulf Coast Prairies (150A), Gulf Coast Saline Prairies (150B), Gulf Coast Marsh (151)</i>	Gulf Coast Prairies and Marshes and Coastal Sand Plain

Note: This information was current at the time of document production; no claims are made to the accuracy of this crosswalk or its suitability for any other particular use.

SPECIES AND RARE COMMUNITIES OF GREATEST CONSERVATION NEED

While most conservation work in Texas is done at the habitat level to address issues and threats, Action Plans' stated primary purpose is to improve and sustain populations and prevent the need to list species as federally or state threatened or endangered. The **Species of Greatest Conservation Need (SGCN)** list, one of the Eight Required Elements in all states' Action Plans, is the starting point.

The first Texas SGCN list (TPWD 2005) was compiled by TPWD biologists with statewide collaboration among experts, supported by citable references where available, and contained 888 species. The list did not include plants or rare plant communities because these elements are not eligible for SWG funding.

Because Action Plans can be implemented with any conservation funding source, not just SWG, the TCAP Final SGCN and Rare Communities lists now include plants, plant communities and coastal/marine species. A comprehensive data review and expert collaboration led to many changes. Additionally, the lists more consistently include state and federally listed species to encourage documentation and recovery efforts that could lead to delisting.

The lists represent at-risk species and communities which can benefit from broader habitat actions as well as those whose populations need specific attention.

SGCN List Review Kick-off

The SGCN lists constructed for the 2005 Action Plan provided a basis for the 2012 revised lists. The approach for the revision focused on available information and other planning efforts. Biologists from TPWD's Texas Natural Diversity Database (TXNDD), Wildlife Diversity Rare Species Program, special projects coordinators from four core resources divisions (Wildlife, Inland Fisheries, and Coastal Fisheries, and State Parks) and the Plan Coordinator met in 2009 to discuss the SGCN process. It was determined that taxa team leads from TPWD core resource divisions would **review existing lists and data sources**, **convene expert panels** for most taxa, rely on **NatureServe ranks** (see *Status and Ranks* below) where possible, and **identify repeatable selection criteria** for future reference (see *Information Sources and Taxa Teams' Rationales*).

Status and Ranks

Each species (except for estuarine, bay and marine fishes) has a NatureServe calculated state and global conservation rank, which accounts for abundance, stability and threats (NatureServe 2009). While NatureServe criteria do not solely focus on numbers of a particular species, they can help document baseline and trend of species distribution, abundance, decline, threats, and conservation. Because of this tool's utility for multiple taxa and its use on landscape scales crossing political boundaries, NatureServe rankings are the primary method of incorporating declining and rare species to address in the Plan. Additionally, several species have federal and/or state listing (endangered, threatened, candidate) status (USFWS 2010a, USFWS 2010b, TPWD 2009). State and federal listed species are included in the SGCN list.

Many of the taxa teams took this opportunity to review the NatureServe ranks for proposed SGCN. Several of the ranks in the SGCN and Rare Communities lists may differ from those in the NatureServe database online; these changes are "proposed", supporting information has been documented in our affiliate database (TXNDD), and will be updated with NatureServe through their review and approval process. Species' listing status and rarity ranks (key, Table 5) were reviewed, and in some instances revised, by taxa teams, experts across the state, conservation working groups and ecoregional workshop participants.

Table 5. Listing Status and NatureServe Ranks Key

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

RANK	DEFINITION
STATE or FEDERAL LISTING STATUS	
LE	Federally endangered species or population.
LT	Federally threatened species or population.
C	Federal Candidate
SAT	Treated as threatened due to similarity of appearance to a species which is federally listed such that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
PT	Proposed Threatened
PDL	Proposed DOWlisting/Proposed Delisting
E	State endangered species or population.
T	State threatened species or population.
CONSERVATION (Vulnerability or Rarity) RANKING	
(G) GLOBAL Conservation Status Rank	
GX	Presumed Extinct (species) — Not located despite intensive searches and virtually no likelihood of rediscovery.
	Eliminated (ecological communities) — Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	Possibly Extinct (species) — Missing; known from only historical occurrences but still some hope of rediscovery.
	Presumed Eliminated — (Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut Forest.
G1	Critically Imperiled — At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	Imperiled — At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	Vulnerable — At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	Apparently Secure — Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	Secure — Common; widespread and abundant.
(S) Subnational or STATE Conservation Status Rank	
SX	Presumed Extirpated — Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
SH	Possibly Extirpated (Historical) — Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
S1	Critically Imperiled — Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

RANK	DEFINITION
S2	Imperiled — Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3	Vulnerable — Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	Apparently Secure — Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	Secure — Common, widespread, and abundant in the nation or state/province.
SNR	Unranked — Nation or state/province conservation status not yet assessed.
SU	Unrankable — Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	Secure — Common, widespread, and abundant in the nation or state/province.
Rank Qualifiers	
?	Inexact Numeric Rank—Denotes inexact numeric rank (e.g., G2?)
Q	Questionable taxonomy—Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.
Intraspecific Taxon Conservation Status Ranks	
<i>Intraspecific taxa refer to subspecies, varieties and other designations below the level of the species. Intraspecific taxon status ranks (T-ranks) apply to plants and animal species only; these T-ranks do not apply to ecological communities.</i>	
T#	Intraspecific Taxon (trinomial)—The status of intraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole—for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under the U.S. Endangered Species Act, may be considered an intraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status. At this time, the T rank is not used for ecological communities.
Variant Ranks	
G#G# or S#S#	Range Rank—A numeric range rank (e.g., G2G3 or S2S3) is used to indicate the range of uncertainty in the status of a species or community. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).
GU	Unrankable—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express uncertainty, or a range rank (e.g., G2G3) is used to delineate the limits (range) of uncertainty.
GNR	Unranked—Global rank not yet assessed.
Not Provided	Species is known to occur in this nation or state/province. Contact the relevant natural heritage program for assigned conservation status.
Breeding Status Qualifiers	
B	Breeding—Conservation status refers to the breeding population of the species in the nation or state/province.
N	Nonbreeding—Conservation status refers to the non-breeding population of the species in the nation or state/province.

Sources: TXNDD 2009 - present, NatureServe 2009

Information Sources and Taxa Teams' Rationales

Coordinators from the TPWD Wildlife Diversity, Inland Fisheries, and Coastal Fisheries Programs communicated with their cohorts and experts across the state to review the 2005 SGCN lists and the following information/accounts:

- listed Federal threatened and endangered species in Texas (USFWS 2010a);
- documented Federal candidates in Texas (USFWS 2010b);
- listed State threatened and endangered species (TPWD TXNDD 2009 - 2012);
- known plant and animal endemic species (pers comm. TPWD TXNDD and expert taxa teams);
- select species and communities documented in the TXNDD (2010) – such as those contained within “rookeries”, “bat roosts/hibernacula”, or “colonial” categories;
- species documented in Texas as globally and/or state “vulnerable,” “imperiled” or “critically imperiled” (e.g. with ranks of G3S3 or rarer) (NatureServe 2009); and,
- species which subject matter experts consulted for this process agreed should be included.

The “expert consultations” resulted in several species added to the SGCN list where NatureServe ranks appear to be stable (e.g. S5 or G5). Texas is a hotspot for migratory birds, overwintering waterfowl, and breeding colonial birds (e.g. reddish egret); we are responsible for a significant portion of such population(s), but only for a limited time in any year. As well, Texas has a few segregated populations of some larger landscape species which are relatively stable across the entirety of their range, but in Texas are not faring well (e.g. pronghorn) or may need to be monitored more regularly to detect changing conservation conditions (e.g. bats which could be affected by white-nose syndrome if it appears in Texas). These species show up in the SGCN list with NatureServe ranks higher than G3 or S3; more information is needed to ascertain the true nature of the threat and/or appropriate recovery actions.

In addition to the above-listed sources, several teams defined taxa-specific criteria and recognized professional resources to enhance the list defensibility and ability to replicate the process for future updates. Some of these resources were updated between the draft submittal to USFWS Regional Review Team and the final submittal and publication to ensure appropriate taxonomy or status (new candidates, new federal listings) at the time of publication:

Mammals

Mammalogists identified species for which population status and ecology information was lacking, species showed significant population declines in recent years through published accounts and research reports, or are particularly vulnerable to a little-understood threat (e.g. windpower effects, *Geomyces destructans* and white-nose syndrome in bats, *haemonchus* parasite in pronghorn) (W.B. Davis and D.J. Schmidly 1994 and 1997, Bat Conservation International 2010).

*Editor’s Note: TPWD lost the Wildlife Diversity Program statewide rare species mammalogist position prior to completion of this Plan; this coordinator position is key to reviewing the NatureServe ranks and updating species’ status, refining research to identify distribution and conservation gaps, and implement conservation actions (especially for small mammals).

Marine Mammals

TPWD Coastal Fisheries Special Projects Coordinator consulted with coastal and marine experts to review and provide information on marine mammals in the Gulf of Mexico. Marine mammal status and the laws/protective actions that manage and conserve them are monitored primarily by the NOAA NMFS. Primarily, the species on the SGCN list are those which NOAA NMFS deems of

management, protection or other conservation interest (NOAA NMFS SFSDC - Office of Protected Resources 2010-2011; Brant and Jones 2005, Wynne and Schwartz 1999).

Reptiles and Amphibians

Herpetologists selected several species for rank updates where new information was available, re-ranked using the NatureServe ranking calculator, and updated the TXNDD for future reference. They included species which recent research suggests are commercially exploited and species for which more information is needed to better assess status (Werler and Dixon 2000, Dixon 2000; *Editor's Note: Dixon 2013 now available*).

Marine Reptiles (Sea Turtles)

TPWD Coastal Fisheries Special Projects Coordinator consulted with coastal and marine experts to review and provide information on marine turtles in the Gulf of Mexico. In the Gulf of Mexico, marine turtle status and the laws/protective actions that manage and conserve them are monitored primarily by the NOAA NMFS. Primarily, the species on the SGCN list are those which NOAA NMFS deems of management, protection or other conservation interest (NOAA NMFS SFSDC - Office of Protected Resources 2011; Wynne and Schwartz 1999).

Birds

Ornithologists and representatives from the bird conservation community (Joint Ventures, Partners in Flight, Audubon) applied the following additional criteria:

- omitted species considered “in review” by the Texas Bird Records Committee (2010);
- omitted species not currently proven to occur in Texas;
- included all S1 – S3 species that are not ranked G5;
- used T scores instead of G scores where appropriate; and
- included highest ranked priority bird species which occur on at least two Joint Venture priority bird lists for Bird Conservation Regions which intersect Texas: Shortgrass Prairie, Central Mixed-grass Prairie, Edwards Plateau, Oaks and Prairies, West Gulf Coastal Plain/Ouachitas, Chihuahuan Desert, Tamaulipan Brushlands, and Gulf Coast Prairie (North American Bird Conservation Initiative 2004).

For additional taxonomy and status information, the group referred to current standard practice resources (Poole 2005, Cornell Lab of Ornithology *n.d.*, American Ornithologists' Union 2008 - 2010).

Freshwater Fishes

NatureServe ranking worksheets were not updated for this exercise by this team. Rare fishes experts from the TPWD Inland Fisheries teams and their research colleagues around the state collaborated to review the 2005 SGCN list and update the current list to reflect the state of new information. Information on rare fishes in Texas was obtained from TPWD's Heart of the Hills (HOH) Fisheries Science Center, River Studies Program, Watershed Policy and Water Resources (Springs) teams. Additional resources included *Freshwater Fishes of Texas: A Field Guide* (Thomas, Bonner and Whiteside 2007) and the companion Texas State University-sponsored website (2009 - 2011); the *Ichthyology Collection* (University of Texas at Austin, Texas Natural Science Center, Texas Natural History Collections 2010); and *Fishes of Texas* online database (University of Texas at Austin, Texas Natural Science Center, Texas Natural History Collections 2009 - 2010) (companion to the UT Austin *Ichthyology Collection* and serving content from the *Freshwater Fishes of Texas*).

Estuary, Bay and Marine Fishes

TPWD Coastal Fisheries researchers, specialists in rare species, coastal ecosystem team leads and the special projects manager coordinated to review and revise primarily the estuary and bay fishes SGCN list based on the latest information from their data collection efforts and standard practice resources (Hoese and Moore 1998, Fowler et. al. - IUCN/SSC Shark Specialist Group 2005). Many of the rare marine fishes are managed in federal partnership with the NOAA NMFS and most status work for pelagic species is conducted by that federal agency (NOAA NMFS SFSDC 2011). Notably, NatureServe ranks are not available (therefore not used in this ranking process) in most instances except for a few federally listed species and those of particular local interest (e.g. some indicator species).

Plants and Plant Communities

TPWD rare species botanists and communities specialist held workshops with other rare plant experts from the Ladybird Johnson Wildflower Center, The Nature Conservancy of Texas, and research institutions during the annual Texas Plant Conservation Conference to review the existing, well-maintained *Rare Plants of Texas* list (Poole et. al. 2010). In addition, some of this group reviewed the companion *Rare Plants of Texas* book (Poole et. al. 2007) to focus the SGCN list on species which have the potential to quickly become endangered throughout a significant part of their limited geographic ranges. Natural community types ranked G2G3 and S2S3 and rarer are included. Resources for taxonomy and nomenclature were many (Correll and Johnston 1979; Gould 1975; Jones, Wipff, and Montgomery 1997; Johnston 1990; Vines 2004; Comer et. al. 2003; and TPWD et. al. *in progress*).

Invertebrates

Individual invertebrate biologists and ecologists are typically each very focused on one order or a subset of a particular order; therefore, to provide sufficient information for the SGCN list, many, *many* resources were consulted by the various experts participating on the review panel. This exhaustive list of secondary sources is not included here. Led by the TPWD Diversity Program Invertebrates Specialist, a team identified the following criteria to hone the list of nearly 30,000 known Texas invertebrate species:

- previously established, documented G1-G2 rank
- locally endemic to a geographically discrete region of Texas
- exhibit a known dependency upon discrete, threatened habitat types (e.g. springs and spring-fed water bodies, karst, native grasslands, coastal marsh), and/or
- experienced a documented reduction in range.

This team also reviewed and updated most of the NatureServe ranking worksheets for this process, for species where Texas is the lead steward for NatureServe status updates. Additional resources were also reviewed for specific invertebrate categories: freshwater mussels (Howells, Neck and Murray 1996; Burlakova et. al. 2011; Texas Mussel Group 2010); karst and cave invertebrates (Culver et. al. 2000, USFWS 2011); butterflies and moths (Opler et. al. 2012); aquatic and water-dependent invertebrates (Ziser 2011, Abbot 2010); and other invertebrates (Quinn 2010, Iowa State University Entomology 2003 – 2012).

Core Ecoregion Teams' Reviews and Expert Taxa Team Responses

New SGCN and Rare Communities lists compiled were then reviewed in the Core Ecoregion Team workshops (see *Conservation Workshops in Ecoregions*). Proposed additions to and deletions from the workshop discussions, along with the participants' rationale, were considered by taxa teams, reviewed in the context of current literature and other resources; responses were provided with the follow-up

surveys and review request to Core Ecoregion Teams and the Core Statewide/Multi-region Team. These deliberations were not taken lightly; many proposals were accepted and many more identified needs for new research and publication of existing information.

Final SGCN and Rare Communities Lists

Species included in the Final SGCN and Final Rare Communities lists are supported by current science, rankings in the Texas Natural Diversity Database (TXNDD), peer-reviewed references and/or other dependable, accessible source documentation, and expert opinion. The revised SGCN and Rare Communities lists are substantial and representative of conservation targets needing attention in this Plan. The lists are very large, not easily printed or incorporated into this document; therefore, they are presented as downloadable, sortable Microsoft Excel spreadsheets online at:

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

Each of the above workbooks contains an overall statewide compiled list (first tab at the bottom of the workbook) and eleven additional sorted by ecoregion (ecoregion tabs at the bottom of the workbook). SGCN lists are also sorted by:

Mammals	Bay and Estuary Fishes	Invertebrates
Birds	Marine Fishes	Plants
Reptiles and Amphibians	Marine Reptiles	Plant Communities
Freshwater Fishes	Marine Mammals	

SGCN – Compiled: Statewide, Sorted by Ecoregions

This revised complete includes common names, scientific names, federal and state status, global and state ranks, ecoregion occurrence, and other notes. This list is sorted by taxa rows and ecoregion columns (ecoregion acronyms match those in Table 1). Rare Communities are listed in a separate worksheet as the information provided by the expert panel was slightly different.

Most taxa are presented alphabetically by scientific name; however, birds are presented in phylogenetic order at the request of the bird taxa team. The Notes section of the list provides links to references for known distribution, habitats, and life history, plus a few other notes about endemism and habitats, as available at the time of this plan's revision. These lists reflect the additions and deletions which were proposed in workshops, much of which was accepted by the taxa teams after extensive review

Rare Plant Communities – Compiled: Statewide, Sorted by Ecoregions

Rare plant communities were not included as a focus in the 2005 Plan, although several were discussed in each ecoregion section. In the 2012 Plan, rare communities are a foundation element considered equal to SGCN and conservation actions are defined to address these communities' needs.

The rare communities have been related to the NatureServe Ecological Systems and TPWD Ecological Systems Mapping Project data (also called Texas Vegetation Community Mapping Project), where this information is available (NatureServe n.d., TPWD et. al. 2005 – *in progress*). This is an ongoing process, using the most current information and data available (see *Habitat* section).

HABITAT

Defining habitats for SGCN is also a required element of the Plan. All SGCN have lifecycle requirements which need to be better understood and/or conserved in a way that supports healthy, resilient populations. And, all SGCN contribute in some way to the systems in which they occur. If it was only important to know about *individuals* of species, we could put representatives in zoos, 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.**

It is impossible to fully understand or know every need and/or contribution of a species or population; however, conservation usually starts with a better understanding of and actions to protect or improve **sufficient physical place(s) with specific conditions** (e.g. acres of a particular vegetation community or habitat mosaic, specific water quality or flow within a particular river system).

In this Plan, **“habitats” are these physical places** – places where we need to work as a conservation community. *Specific conditions* (the quality of those places) and *other needs* (such as more information, better communication) will be further discussed in the *Issues* and *Actions* sections.

Broad Habitat Types and Definitions

The definitions of natural and manmade habitat types in Table 6 help categorize and report on place-specific actions in each ecoregion. These types and definitions used for coarse sorting are based on discussions with the Wildlife Habitat Policy Research Program working group (National Council for Science and the Environment 2010), and ongoing work with the USFWS Wildlife and Sportfish Restoration Program TRACS development team (2008 – *in progress*), National Fish Habitat Action Plan (Esselman et. al. 2010), state fish and wildlife management agencies, and conservation organizations. A few changes have been made to accommodate requests from ecoregion teams.

A first sorting of actions at this coarse scale will aid communication and information-sharing across organizational, regional, state, and international boundaries – “Forest” in Texas is different from “Forest” in Georgia or “Forest” in Oregon; however, there may be common activities and lessons that could be shared by conservation practitioners working in this broader habitat type across regions. Use of this system will be further emphasized in future project tracking through USFWS TRACS and/or other conservation delivery tracking such as ConPro, Conservation Registry, HabITS, Miradi, Biotics 4 and 5, DataBasin, or NatureServe Explorer Web Service. For more information about these tracking tools, see *Appendix IV* in the Effectiveness Measures document (AFWA TWW 2011).

Ecological Systems are not a new concept in professional vegetation ecology circles, but this is not a concept that has percolated through **all** field networks. In the last six years, Texas ecologists have begun to shift how they talk about and map plant communities. The “series level” communities discussed in the 2005 Plan are still good descriptions; however, Ecological Systems and the Ecological Mapping Units used in the Texas Vegetation Community Mapping Project are more current and will provide greater utility (NatureServe n.d., TPWD et. al. 2005 – *in progress*).

Habitats provide a species or community with the **specific physical location and conditions** needed to survive and thrive. Habitats covered in this plan are directly related to SGCN and Rare Communities. These may include terrestrial and/or aquatic vegetation communities; a particular watershed, waterbody or stream segment; water flow, level or quality thresholds; particular geologic substrates (e.g. limestone, granite, sands) or formations (e.g. karst, caves), species host, etc.



Table 6. Broad Habitat Types and Definitions

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

HABITAT TYPES	DEFINITIONS
NATURAL AND SEMI-NATURAL TYPES	These broad habitat types will assist with “roll-up” reporting of conservation actions across statewide, multi-state, regional and national systems, most of which use different finer-scale habitat classifications
Barren/Sparse Vegetation <i>See also Coastal</i>	Desert playa, badlands, volcanic ash beds, talus slopes, cliff faces, rocky outcrops, <i>inland</i> dunes <i>Note: Playas are shallow, mostly ephemeral wetlands that may function as grassland habitat when dry, according to workshop biologists; if more often wet than dry, or if wetland vegetation or soil characteristics persist or are important to the ecological function, then habitat should be captured in wetland categories.</i>
Desert Scrub	Cool desert scrub, cool desert steppe, warm desert scrub, warm desert steppe
Grassland	Temperate grasslands, prairie, montane, meadow
Shrubland	Temperate chaparral, shrubland and shrub steppe; successional herbaceous/shrubland
Savanna/Open Woodland	Open to broadly open tree canopy; grass dominated understory; deciduous, evergreen or mixed
Woodland	Variable, non-closed canopy; typically non-grass dominated understory; deciduous, evergreen or mixed
Forest <i>See also Riparian and Wetlands</i>	Closed canopy; deciduous, evergreen, and mixed Excludes riparian, forested wetland and bottomland hardwoods - see 1) <i>Freshwater Wetland</i> and/or 2) <i>Riparian</i> <i>Note: Riparian, forested wetland and bottomland hardwood habitat types are recognized as distinctly different from surrounding lands because of unique soil and vegetation characteristics <u>strongly influenced</u> by water and the influence those types have on the health of aquatic systems. They are separated from this category to emphasize that connectivity to water resources and contributions to aquatic system function.</i>
Riparian	<u>River- or creek-dependent</u> habitats which rely on periodic flooding/flushing, sub-irrigated substrates, and other influences of the ephemeral or perennial rivers/creeks to which they are adjacent: floodplains, wet woodlands, gallery riverine forests, oxbows; swamps, vegetated islands
Riverine	Perennial or ephemeral river, stream, creek headwater and <i>in-stream</i> habitats (e.g. riffle, glide, pool, plunge; may include substrate descriptions such as mud, silt, gravel, cobble, bedrock, woody/vegetation inputs, etc.). <i>See also USFWS 2009c</i>

HABITAT TYPES	DEFINITIONS
Lacustrine See also <i>Freshwater Wetland</i> and <i>Saltwater Wetland</i>	Freshwater and saline/salt lake environments – natural and manmade ponds, lakes, reservoirs – which are <u>managed primarily for natural resources conservation</u> , but may also have contact recreation and/or aesthetic objectives; typically these sites have deepwater and shallow-water habitats. <i>Note: these are different from "cultural aquatic habitats" which are managed primarily for human uses – commercial, stock, or industrial purposes – and do not have conservation management objectives in their primary purpose</i>
Freshwater Wetland	Freshwater-dependent <u>non-riverine</u> habitats, which rely on filling, flushing, and irrigated substrates caused by rain, runoff, groundwater, and/or perched water tables; includes their hydrophilic vegetation: swamps, bog, fen, freshwater marsh, non-desert playa, wet prairie, wet meadow, <i>surface expressions of groundwater</i> (seeps, springs, cienegas), vernal pools, tinajas, interdunal wetlands
Saltwater Wetland	Brackish, saline or saltwater-dependent habitats: Brackish marsh, salt marsh, saline springs, shallow saline groundwater swales, saline or salt shallow pools
Estuary/Estuarine	Area where fresh water from rivers and streams mixes with salt water from the Gulf of Mexico <i>Note: While "estuaries" do not occur in all ecoregions, the river systems within many ecoregions eventually flow to the estuaries and bays of the Gulf of Mexico; therefore, conservation actions in ecoregions crafted for riverine systems should continue to support instream flows and estuary/bay health</i>
Coastal See also <i>Barren/Sparse Vegetation</i> and <i>Saltwater Wetland</i>	Beach and shoreline, dunes (shoreline and barrier island, but not including inland dunes), intertidal "flats" – rocky, mud, sand, wind, algal
Marine	Subtidal (e.g. <i>sea grass beds</i>), shallow (e.g. <i>submerged sand or mud substrates</i>) and deepwater Gulf of Mexico habitats (<i>non-estuarine, non-marsh such as natural reefs, rocky bottoms, or muddy bottoms</i>)
Aquifer	Saturated, permeable geologic formation (whole or in part) under the ground surface (<i>Edwards, Ogallala, Trinity, Carrizo – Wilcox, etc.</i>)
Caves/Karst	Dry or wet solution-formed shelters, grottos, caves, sinkholes, crevices, karst, fractures, fissures

HABITAT TYPES	DEFINITIONS
CULTURAL (Human-Created) TYPES	These habitat types are human-created, anthropogenic, not necessarily “desired ecological condition;” primary purpose is not to mimic or replace native, natural habitats, but could contribute to the natural community in positive ways (e.g. migratory stopovers, alternative food sources, travel corridors) and/or negative ways (e.g. loss of native natural habitat, predator conduit, chemical sink, physical hazard). These sites may provide significant and necessary habitats; however, they would not be preferred over natural habitats that serve the same and/or better function
Agricultural	Cleared or altered natural areas to produce food, fiber, or fuel; typically includes row crops, non-native or "improved" pasture, woody crops (e.g. vineyard, orchard, plantation). <i>Note: native or mostly native rangeland or pasture can be categorized under other “desired future condition” landscapes such as grassland/prairie, woodland, shrubland, savanna</i>
Developed	Most “developed” sites are considered “issues” rather than “habitats” although some SGCN choose to use these; consider only those sites which are known to provide suitable/important habitats for SGCN or need to be addressed to prevent stress on SGCN populations and habitats.
Developed: Urban/Suburban/Rural	Areas occupied by humans; a concentration of buildings, infrastructure and population <u>Examples:</u> city or county parks that function as important migratory bird stopovers, open space or riparian corridors through town which function like a stepping stone to important habitat outside of the metropolitan area, some golf courses, gravel rooftops used by plovers for nesting, green rooftops used by invertebrates, native landscapes if demonstrated to be important to SGCN.
Developed: Industrial	Human-made, but not human-living <u>Examples:</u> mines, quarries, power generation sites, drilling pads/well sites, refineries, oil platforms
Developed: Rights of Way	Linear development <u>Examples:</u> highways, roadways, bridges, culverts (e.g. bat roosts, swallow colonies, amphibian passages, etc.), groomed/managed trails, pipelines, communications corridors, transmission lines
Cultural Aquatic	Water/aquatic habitats <u>not</u> managed primarily for aquatic life or wildlife, recreation, or aesthetics <u>Examples:</u> community water supply reservoirs, agricultural irrigation pond/ditch, livestock watering stock ponds, industrial use cooling ponds, stormwater containment, flood control reservoirs, wastewater treatment ponds, shipping channels and managed transportation waterways
Artificial Refugia	Purposeful human-built replication of natural/native systems/habitats with the intention to create <u>surrogate habitats</u> following loss or severe impact to natural/native habitats – not the same as restored natural/native habitat and not the same as human structures used opportunistically by SGCN (e.g. culverts or bridges for bats)

Habitat Types in the Statewide/Multi-region Handbook

The habitats covered and described in the Statewide/Multi-region Handbook are those which affect an area larger than one ecoregion and require cooperation across ecoregions, state boundaries, and/or perhaps international boundaries. These broader habitat types are also tied to some of the broader issues (see *Issues* section). The workshops, surveys and other comments helped hone these lists.

Broad Statewide/Multi-region habitat categories addressed in TCAP include the following:

- Water Resources: Surface and Groundwater, including wetlands, springs, aquifers
- Riparian Zones and Floodplains
- Grasslands, including prairies
- Wildlife and Fisheries Corridors and Migration Stopovers
- Gulf of Mexico and associated bays and estuaries

Some of the broader habitats also have ecoregional or ecological drainage unit contexts which will be addressed in ecoregion handbooks where applicable; for example:

- The Upper Red River ecological drainage unit for surface water resources has a relationship to the Oklahoma Action Plan and Southeast Aquatic Resources Partnership, where habitats and resource needs have been identified, and this EDU intersects several Texas terrestrial ecoregions (HIPL, SWTB, CGPL, CRTB, TBPR, ECPL, and WGCP);
- Riparian management is a statewide need, with best management and restoration practices that may vary across all ecoregions;
- Migratory bird stopover habitat along various species' pathways may have critical junctures or patches of importance within a specific ecoregion;
- Unprotected by regulation, "isolated" wetlands conservation is a statewide issue, but may have particular significance to playas in the High Plains and bogs in east Texas.

Habitat Types in Ecoregion Handbooks

Each Ecoregion Handbook contains a list of specific habitat types and ecological systems, sorted by the broader types in Table 6, which are important to SGCN. Many of the conservation actions in the handbooks are directly related to these habitats. The content for these lists was compiled from workshop participants' input, NatureServe Ecological Systems sorted by Texas ecoregions, rare communities lists, work in progress by the Texas Ecological Systems Mapping Project, and the 2005 Action Plan. All habitats in the state are not necessarily included – this is meant to be a **priority list to define those areas in most need of our conservation attention**.

Some of Texas's SGCN populations and rare communities are located in small, fine-scale habitats (e.g. bogs, fens, sand hills, barren ground clearings) which are embedded in a larger-scale types (e.g. Riparian: Red River Large Floodplain Forest, Grassland: Western Great Plains Shortgrass Prairie, Riverine: Upper Brazos).

When considering where to take action, think about the places where SGCN populations and rare communities occur and their needs are or could be well-met for the long term. **These places in good to best condition would be the "desired ecological condition" – natural systems in "good working order."** Places already in this condition are good candidates for protection actions; places with potential to be in this condition are good candidates for restoration actions.

ISSUES

This section is usually called “Threats” in most conservation documents; however, consider that some SGCN populations and their habitats are

- **naturally rare** with somewhat stable, but very small, populations perhaps due to extremely specialized habitats, geographic or genetic isolation, or slower reproductive rates (e.g. invertebrates isolated in karst environments, bog or fen plant communities within larger forest contexts, rare plants located only on desert “sky islands”) – these may not be currently “threatened” by an external influence but are still vulnerable to decline, episodic events, or unforeseen threats;
- **rare because of impacts/threats** to their needs or existence (e.g. certain kinds of fencing inhibits pronghorn natural movement patterns and genetic diversity, sand and gravel mining may reduce water quality for freshwater mussels, wind power generation adversely affects lesser prairie chickens lekking behavior, transmission line corridors fragment golden-cheeked warbler habitat and provide parasitism opportunities for brown-headed cowbirds, land use may interrupt riparian corridor, unregulated turtles are highly prized food items in some cultures); or,
- **both** inherently rare *and* potentially threatened by impacts (e.g. blind catfish in the Edwards Aquifer is known only from a few sites and the seventh-most populous urban area in the nation relies solely on that habitat for their municipal and commercial water).

There are **impacts and conditions** which may negatively affect the status and resiliency of SGCN populations, rare communities, and the habitats on which they depend. These issues can include **direct or indirect harm** (e.g. inappropriate mining reclamation which directly reseeds with or indirectly provides an opportunity for non-native invasive vegetation; streambed gravel removal that directly removes spawning habitat or essential cover 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, land managers working at cross-purposes, lack of funding)

Interestingly, an issue in one area may be solution in another (e.g. wind energy development has certain impacts to birds and bats; however, wind power generation is a positive emerging energy alternative that may help reduce negative issues associated with climate change).

Not all environmental issues are addressed in these documents. The issues covered in the TCAP are those which Plan participants and other conservation plans have tied to the decline of SGCN and/or their habitats. For instance, poor air quality was not discussed to have a cause-and-effect link to the decline of SGCN or their habitats; however, poor air quality may have a direct link to climate change. One of the climate change effects which can be reasonably documented or confirmed is relative sea level rise and ocean acidification which can adversely affect our coastal and marine resources; therefore, the issue we will directly discuss is climate change, not air quality.



Broad Issues Types and Definitions

Issues (Table 7) were identified by participants in ecoregional conservation workshops, follow-up surveys, and other conservation planning documents. Definitions for these categories came out of the workshops, the IUCN – Conservation Measures Partnership Standard Classification of Conservation Threats (IUCN-CMP 2008a), National Fish Habitat Partnership supporting information (Esselman et. al. 2010 and 2011) discussions during the development of Measuring the Effectiveness of State Wildlife Grants (AFWA TWW 2011), and state fish and wildlife agencies' reviews of the Effectiveness Measures work products. Use of this system will be further emphasized in future project tracking through USFWS TRACS and/or other conservation delivery tracking such as ConPro, Conservation Registry, HABITS, Miradi, Biotics 4 and 5, DataBasin, or NatureServe Explorer Web Service. For more information about these tracking tools, see *Appendix IV* in the Effectiveness Measures document (AFWA TWW 2011).

Habitat fragmentation and habitat loss, including wildland 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. The issues covered in the TCAP attempt to present more of the specific causes, provide appropriate context for the issues, and target our actions.

Table 7. Broad Issues Categories

Note: Table is formatted 11" x 17", landscape orientation. **Specific Issues and Impacts** are discussed in the Statewide/Multi-region and Ecoregion handbooks; not all issues are "problems" in all areas.

General Issue	Description of Impacts <i>Specific Issues will be explained more fully in each handbook if relevant</i>	Examples <i>These are just a few examples. See handbooks for more detail.</i>
Invasive Species	Non-native invasive and native problematic terrestrial and aquatic species which invade natural sites and compete for resources (food, water, space, pollinators, shelter, colonization or breeding areas, etc.) to the exclusion of native, healthy species, communities and systems	<u>Non-native</u> : salt cedar, zebra mussels, Chinese tallow, Old World grasses, exotic ungulates, feral pigs <u>Native problematic</u> : mesquite or juniper invading grassland sites where naturally they should not occur, under-harvested over-productive native wildlife, predacious introduced game fishes, golden alga (<i>Prymnesium parvum</i>)
Pests, Parasites, Pathogens	Disease vectors, voracious destructive feeders, or species which take nutrients to the detriment of the host species; in many instances, the issues presented for this plan are pests, parasites, or pathogens out of their native element and invasive OR are out of balance with their natural host due to exacerbating factors (some not well understood) and only recently problematic.	<u>Pests</u> : <i>Cactoblastus</i> moth on prickly pear <u>Parasites</u> : <i>Haemonchus</i> in pronghorn <u>Pathogens</u> : <i>Geomyces destructans</i> fungus and resulting White-nose Syndrome (WNS) in bats
Introduced Genetic Material	Genetic material which competes with native genetic material and can dilute population genetics, long-term population health, and may threatened a species with permanent hybridization or extinction	Congeneric introduced fishes such as some <i>Gambusia</i> sp. Non-local varieties (cultivar) vegetation and seed sources used in restoration Genetically modified insects for integrated pest management
Power Development and Transmission	<p>Power Development and Generation</p> <p><u>Wind</u>: turbine siting on high ridges in migratory bird corridors can cause direct mortality; operations near bird and bat flight and feeding can cause barotrauma</p> <p><u>Solar or PV array</u>: large areas of vegetation removal and ongoing "bare ground" maintenance, some with high water use</p> <p><u>Coal fired plant</u>: water use; emissions which may contribute to climate change</p> <p><u>Nuclear plant</u>: water use</p> <p><u>Hydroelectric Dam</u>: frequency, seasonality, and amount of water released through/over dam out of sync with naturally occurring flows and floods adversely affecting instream habitats and fauna, plus river-adjacent vegetation (see also <i>Water Development, Management and Distribution</i>); barriers to aquatic species passage and/or dispersal</p> <p><u>Biofuels/Biomass Crops</u>: conversion of diverse native habitats to expansive monotypic stands, some with copious water usage</p> <p>Power Delivery/Transmission and Operations</p> <p><u>Substation</u>: large acreage footprint of impervious cover which can collect water and attract small birds, mammals, reptiles and amphibians to potential electrocution hazard</p> <p><u>Transmission and Distribution Lines</u>: New or upgrade to existing towers/poles, lines and road networks from many types of generation sources and substations are required to serve Texas growing population. Long, linear wide clearings cross-country primarily through undeveloped areas: fragments large blocks of habitat, creates edge opportunities for parasites and predators, habitat loss and invasive species opportunities related to ongoing maintenance</p>	<p>See <i>Ecoregion Handbooks</i> for more specifics.</p> <p><u>Wind</u>: turbine "farms"; Competitive Renewable Energy Zones (CREZ) targeting certain areas with high wind potential in the High Plains, west and central Texas, plus the potential for non-CREZ sites in the Gulf of Mexico and elsewhere.</p> <p><u>Biofuels</u>: certain row crops, switchgrass, other herbaceous monocultures, "whole tree" utilization, algae</p> <p><i>Power Generation in Texas does not include tidal or wave generation as this power type has not been an issue in the Gulf of Mexico.</i></p> <p><u>Transmission and Distribution</u> line development through areas of karst, aquatic, or undeveloped habitat blocks; typically, natural resources are not considered a primary constraint to routing or development.</p>

General Issue	Description of Impacts <i>Specific Issues will be explained more fully in each handbook if relevant</i>	Examples <i>These are just a few examples. See handbooks for more detail.</i>
Oil and Natural Gas Production and Delivery	<p>Because these industries are evident in many ecoregions, there are different impacts to different habitats from desert grasslands to marine and coastal environments. Many of these habitats do not recover quickly or ever, without intensive appropriate reclamation.</p> <p>In addition to direct species and habitat loss and habitat fragmentation, activities may have secondary adverse effects such as invasive species introductions, disruption of daily and seasonal activities for fossorial animals (small mammals, reptiles, ground-foraging and ground-nesting birds), light and noise during night operations which impact daily bat foraging and seasonal bird migrations, mortality from road network traffic, potential and realized impacts to water resources from spills, extraction chemicals, saltwater injection and a lack of knowledge about the drilling material or equipment behaviors in certain substrates, acid deposition from flaring, and resource contamination or mortality from lack of appropriate spill response.</p>	<p><u>Production</u>: seismic exploration; extraction site development and operations (including roadways, pumping and pad sites); hydraulic fracturing (“fracing” or “fracking”); offshore marine rig placement and operations.</p> <p><u>Transmission/Delivery and Storage</u>: network of gathering stations, marine to coastal and interior pipelines; salt domes</p> <p><u>Reclamation</u>: lack of site-appropriate recovery with native seed or vegetation sources, establishment timeframes, or stewardship through recovery period</p>
Mining	<p>Extractive use of naturally occurring materials for building materials, road base, commercial and industrial uses, power production, and other uses. Excludes oil and gas – separate category – see above.</p> <p>Aside from direct removal of some substrates important to species and habitat health (riparian cover, gravel in and adjacent to streams, coastal sands and oyster beds), may include impacts to surface and groundwater resources’ quality (lack of stormwater controls, substrate disturbance increases turbidity, wastewater and other chemical discharge or spills) and amounts/flow (unregulated uses, diversions and dewatering for direct use in mining operations). Equipment may also create spill hazards.</p> <p>Reclamation insufficient to recover area to pre-mining habitat quality and usefulness for species; impacts include invasive species, soil horizon disturbance causing change in soil chemistry, and water loss.</p>	<p>Sand and Gravel – upland and river</p> <p>Coastal Sands,</p> <p>Caliche</p> <p>Gypsum</p> <p>Bentonite</p> <p>Lignite</p> <p>Oyster Shell</p>
Timber Production and Management	<p>Many timber operations replace native species- and age-diverse stands with monotypic single-aged stands which provide lower quality or unsuitable habitat for some wildlife species. Inconsistent application of existing or incompatible/inadequate voluntary Forestry Best Management Practices (BMPs) contribute to the degradation of terrestrial and aquatic natural resources in and adjacent to such timber production areas. Recent changes in timber company ownership have, in some instances, shifted stewardship goals and opportunities, natural resources investment potential, and fragmented remaining stands. Timber managed on public lands and private lands can be managed to accommodate many terrestrial and aquatic wildlife needs, while still being profitable.</p>	<p>Voluntary BMP application on approximately 92% of Texas’ estimated 12 million acres of timberland (Texas Forest Service 2008), primarily on individual/family forest lands, TIMOs (timber investment management organizations) and REITs (real estate investment trusts)</p> <p>Whole tree utilization “biofuel” farms</p> <p>Short-term fast-growth timber for pulp and other processed wood products at the expense of the potential in slower-growth natural timber-producing systems (e.g. shortleaf and longleaf pine savanna)</p> <p>Complete removal of bottomland hardwood systems replaced with commercial timber and other agriculture operations</p>
Communications Infrastructure	<p>Most communications infrastructure impacts are minimal and/or go through some kind of environmental review for impacts to species; however, line installation typically follows road right-of-way and these areas may not receive full coordination (assumed to be impacted already). Industry is not required to reclaim construction sites with native vegetation or back to pre-construction condition, contributing to invasive species and direct habitat loss. Towers can cause bird mortality and confusion during migration.</p>	<p>Radio masts, antennas/aerials, telecommunications towers (cell, television, other)</p> <p>Distribution lines, including fiber optic, cable – above and below ground</p>
Transportation	<p>Transportation infrastructure serves an ever-growing demand to convey goods and services to urban centers, commercial points of trade, and all sites in-between. Without better planning, design and mitigation, new and expanded infrastructure contributes directly to terrestrial, aquatic, coastal and marine habitat loss, fragmentation, disruption of daily and seasonal movements, species mortality due to strikes or inappropriate passages, invasive species, stormwater runoff and water quality degradation.</p>	<p>New and existing roads, bridges over waterways, and associated right-of-way</p> <p>Navigation channels (e.g. Sabine-Neches or the Gulf Intracoastal Water Way)</p> <p>Ever-increasingly large and more frequent shipping vessels</p>

General Issue	Description of Impacts <i>Specific Issues will be explained more fully in each handbook if relevant</i>	Examples <i>These are just a few examples. See handbooks for more detail.</i>
Water Development, Management and Distribution/Use	<p>Water planning and use have been, are and always will be hot topics in Texas. Both surface and ground water resources support SGCN and important habitats, from springs to riparian zones to bays and estuaries. Most waters in Texas are managed by political boundaries –Water Planning Regions, counties, River Authorities, Groundwater Districts – and natural resources are not first and foremost in the decisions made by these entities or the processes they employ.</p> <p>With the exception of sole source drinking water aquifers and jurisdictional wetlands, few waters have clear conservation frameworks; and, even those two categories have limitations in regulation, compliance and enforcement which potentially adversely affect them and the SGCN which rely on them.</p> <p>From identification of important sites to planning the use of water resources in Texas, there are opportunities for more comprehensive and inclusive consideration of natural resources needs, which would go a long way to providing water for the needs of people and wildlife.</p>	<p><u>Surface Water Planning and Distribution</u>: Natural resources not well-defined or required as a "constraint" in Regional Water Planning (RWP) processes; natural resource professionals are not consistently involved in RWP processes</p> <p><u>Reservoir Construction and Operation</u>: Site selection on ecologically important waterways (e.g. Neches); development "footprint" for dam, reservoir, operations and human development around the site contributes to other natural resources management issues (effluent releases, feral animals, direct loss of habitat through building or inundation); Timing/Periodicity/Intensity of Water Releases from Dam do not match with natural flooding or flow regimes; ineffective or insufficient mitigation (cannot "replace" bottomland hardwoods); water quality and quantity impacts <i>in</i> reservoir.</p> <p><u>Ground Water Planning and Distribution</u>: Groundwater Districting applied by political boundary, rather than aquifer boundary; therefore some aquifers have several districts, some have none. Few regional or state natural resources professionals with wildlife and fisheries management involved in planning or management decisions. Lack of complete and consistent extraction accounting (regulated and unregulated, permitted and unpermitted, what's available v. what's extracted) across political boundaries</p> <p><u>Other Water Source Developments, Technologies, and Strategies</u></p> <p>Interbasin Transfers (both surface and groundwater), desalination and chloride removal operations, treatment wetlands, water conservation measures and outreach, subsidized use and cost structures for water customers</p> <p>"Desired Future Condition" frequently does not consider "Desired Ecological Condition"</p>
Land and Water Management – FARM	<p>This issue refers to working lands in agricultural production – cultivated, cleared, non-timber, non-rangeland, primarily for the purposes of food [row crop, orchard, vineyard, or concentrated animal feeding operation (CAFO)]. <i>Biofuel, timber, and range livestock production are covered under other categories.</i></p> <p>Land ownership fragmentation is an issue in both farming and ranching; however for most wildlife and fish resources, smaller, more-diversified farms appear to be better than larger commercial operations. With farms, what we do on the land appears to be more important in conservation than how large the site is.</p> <p>Incentive programs for farming landowners are in some areas incompatible with wildlife conservation goals, and may also be insufficiently funded to compete with agricultural incomes.</p> <p>Inappropriate fertilizer, herbicide, fungicide or pesticide application, feeding and manure containment/disposal, and lack of stormwater controls combine to adversely affect terrestrial and aquatic natural systems. Runoff from these areas can contribute to impaired water quality, aquatic life impacts, and riparian zone loss.</p> <p>Unsustainable irrigation practices exacerbate poor surface and groundwater management, depletion, and loss.</p> <p>Loss of natural sites to cultivation is also an issue; but conversely loss of agricultural sites (which provide wildlife habitat for some SGCN) to urban development is also an issue.</p> <p>Small road and other "rough" access development installed across ephemeral or perennial water sources (e.g. low water crossings, bridges, culverts, driveways) which can degrade stream habitats, fish passage and genetic exchange, water quality and quantity.</p>	<p>Large industrial farm and feedlot operations typically take more land out of habitat potential, except for those species which rely on ag lands during migration (some hawk, mountain plover), because the emphasis is on maximizing profit rather than the diverse uses of a family site (woodlot, recreation, hunting, heritage) which may contribute to habitat values.</p> <p>Landowner/land management soil and water conservation programs may incentivize inappropriate fencerow/windrow planting, brush removal, and water development: invasive and non-native grasses are promoted, brush removal may not be appropriately implemented, and water development may include damming natural creeks and springs, drilling groundwater wells</p> <p>Incentives for farmland operators to retain wildlife and fisheries habitats frequently do not encourage long term, permanent, or reliable beneficial actions in "regional conservation accounting" because management and conversion incentives are insufficient overall and not responsive enough to compete with cyclic ag market fluctuations.</p> <p>CAFOs and croplands without adequate stormwater runoff controls on certain topographies allow excess nutrients and chemicals to runoff into area waterways</p> <p>Herbicide or pesticide overspray from farm management may adversely impact adjacent native habitats and species, in particular amphibians and invertebrates</p>

General Issue	Description of Impacts <i>Specific Issues will be explained more fully in each handbook if relevant</i>	Examples <i>These are just a few examples. See handbooks for more detail.</i>
Land and Water Management – RANCH	<p>This issue refers to working lands in range-based livestock production – partially or wholly managed for livestock forage for sheep, goats, cattle, and exotic hoofstock. <i>Biofuel, timber, rowcrop, orchard, vineyard, and CAFO production are covered under other categories.</i></p> <p>Land ownership fragmentation is an issue in both farming and ranching. Larger contiguous ranches with diverse, well-managed native grazing and browsing forage tend to provide better benefits to wildlife and fish resources. Smaller fragmented sites typically imply more development, diverse goals/intentions, and various levels of management capacity, not all favorable to wild resources. Loss of natural sites to clearing for ranching operations is an issue; but conversely loss of larger range sites which can provide wildlife habitat for some SGCN to urban/suburban development is also a big conservation issue.</p> <p>Some incentive programs (e.g. reseeding, replanting) and alternative incomes (e.g. mineral development, hunting operations) for ranch/range landowners are in <i>some areas</i> are incompatible with wildlife conservation goals</p> <p>Some incentive programs (e.g. riparian buffers, wildlife habitat development and long-term set-asides, conservation easements) may be insufficiently funded to compete with livestock incomes, may not be advertised enough or structured in a way to be compatible with landowner needs, or conservation practitioners need more training to implement them well.</p> <p>Poor historic or currently unsustainable grazing or wildlife management practices exacerbate non-native and native invasive species, slow natural vegetation recovery, ability to apply current beneficial land practices, and poor surface and groundwater management.</p> <p>Small road and other “rough” access development installed across ephemeral or perennial water sources (e.g. low water crossings, bridges, culverts, driveways) which can degrade stream habitats, fish passage and genetic exchange, water quality and quantity.</p>	<p>Subdivision of larger ranches into smaller parcels, many without enough acreage <i>by themselves</i> to contribute meaningfully to regional conservation needs or qualify for available incentives for wildlife or fisheries conservation actions</p> <p>Incompatible stocking practices – too many animal units for the native forage to support dictated by tax structure not an agricultural professional; not enough or inappropriate recovery or vegetation management on historically overgrazed sites; or insufficiently managed or unmanaged exotic hoofstock (whether intentionally introduced or not, for hunting and other recreation), unmanaged private and public wildlife resources behind high game fences</p> <p>Promotion of exotic grasses for livestock forage</p> <p>Brush clearing and other vegetation removal on inappropriate or sensitive sites (headwaters, canyons, riparian areas) without regard to slope, aspect, vegetation community potential, and recovery objectives</p> <p>Some water resource development – damming natural waterways, springs, seeps; pond construction and stocking in inappropriate sites where altered hydrology and/or invasive species can be a problem for native species.</p> <p>Fire suppression and lack of site-appropriate, well-planned/managed prescribed fire</p>
Land and Water Management – MUNICIPAL, LOCAL GOVERNMENT, URBAN/SUBURBAN, DEVELOPED AREAS	<p>Impacts associated with this issue are typically assumed to be direct loss of native habitats to clearing and pavement – housing, shopping, industrial, commercial, waste disposal, etc. While these are real impacts, the indirect and cumulative effects of development are far-reaching.</p> <p>Urban and suburban populations have different views about land management and different impacts on the remaining open space within their borders as well as the resources outside of those jurisdictions.</p> <p>Growing populations’ water use and needs, effluent releases, impervious cover and stormwater controls, non-attainment status (clean Air Act quality requirements and thresholds), zoning and planning related to controlling “sprawl” and setting aside open space (type, quality, location) all affect natural resources in and around these areas.</p>	<p>Lack of zoning and planning can contribute to urban “sprawl” which affects how much habitat is directly lost to housing, transportation corridors, and other infrastructure development, as well as indirectly potentially affecting air quality in more vehicle miles traveled.</p> <p>Impervious cover and inadequate stormwater controls adversely affect surface and groundwater resources and the species dependent on these resources.</p> <p>Rivers, creeks, and streams in urban areas are typically manipulated and/or “armored” to convey floodwaters faster, removing important riparian and instream habitats and depleting natural water quality controls.</p> <p>Populations’ water needs contribute to loss and degradation of aquatic, riparian and upland habitats in areas where new reservoirs are proposed for water supply; water quality issues where wastewater effluent treatment systems are insufficient prior to release to native waters</p> <p>Permitting thresholds typically are insufficient to trigger adequate mitigation for most developments, especially those which impact nonjurisdictional wetlands and unregulated habitats like prairies, riparian zones, bottomlands, native shrublands, mature forests</p> <p>Diminishing availability of Potential Conservation Opportunities</p>

General Issue	Description of Impacts <i>Specific Issues will be explained more fully in each handbook if relevant</i>	Examples <i>These are just a few examples. See handbooks for more detail.</i>
Land and Water Management – RECREATION AND CONSERVATION	<p>Not all “public” or “managed” lands have identified explicit conservation objectives or ways to contribute to conservation goals in the region. Lack of long-range conservation planning and/or collaboration among land managers in the region may prevent full conservation potential of these sites.</p> <p>Lack of information about site-appropriate management (resource and/or region specific best practices) may not be readily available to or affordable by all public and private open space managers.</p> <p>Some recreation and/or conservation lands are limited in their management by adjacent land uses</p>	<p>Lack of invasive species knowledge, mapping, control and/or eradication practices</p> <p>Inappropriate recreational uses or locations for those uses near sensitive resources – driving in springfed substrates, horseback or mountain biking activities near aquatic resources or highly erodible slopes, fishing too close to nesting islands, human disturbance near rookeries or bat maternity colonies</p> <p>Best Management Practices may not be known for some resources</p> <p>Lack of connectivity among public lands and/or private lands known to be managed for conservation</p> <p>Natural Areas needing management near housing developments may have unique challenges with feral animals, fear of prescribed fire, “protection” vs. “management” perceptions</p> <p>Land managers in one ecoregion or area of an ecoregion may not be aware of all conservation or recreation lands (e.g. land trusts and other privately held sites in a network of public lands) although they could benefit from pooling their expertise, interest and resources.</p>
Border Protection	<p>Border security structures and operations cause direct habitat loss through clearing along the Rio Grande/Rio Bravo and create barriers to daily and seasonal movements of riparian-dependent, ground-dwelling and/or large-ranging-mammals, reptiles, and birds; can create a barrier to genetic diversity and fragment larger stable populations into smaller unstable populations; create opportunities for artificially enhanced predation; contributes to direct roadway mortality; and accelerates soil loss and degrades water quality.</p>	<p>Border fence</p> <p>Extensive network of roadways and levees</p> <p>Grading and dragging</p> <p>Night operations</p> <p>Human disturbance</p>
Lack of Information and Resources	<p>In many instances, little is known about SGCN and their habitats distribution, needs, or causes for decline. This is because Texas is predominantly privately-held and very little research occurs on private lands. Additionally, the data which is available to conservation planners may be widespread across many sources, not all of which are known (decentralized) and not all of which are compatible (different data standards). And, there is some data which may be publicly held, but cannot be shared.</p> <p>Additionally, on the public side, an increasingly urban population with urban-centric thinking may be unaware of some of the issues in their region, how those issues are important at a personal level, and how to participate in the solution. Outreach and education has not always targeted the “right audience with the right message” to achieve conservation results specific to an area.</p>	<p>Lack of Data (amount, type)</p> <p>Insufficient or ineffectual data sharing among natural resources professionals</p> <p>“Public” (individual, community) disconnection from natural resources</p> <p>Inadequate understanding of available or widely-accepted conservation Best Management Practices</p> <p>Lack of targeted and/or ethnically-specific outreach</p>
Inadequate Policies, Guidelines, Rules or Regulations, and lack of Enforcement of Existing Rules and Regulations	<p>Voluntary guidelines or voluntary compliance can be a helpful conservation lever, if appropriately developed, rolled out with intention, and applied.</p> <p>While regulation is not always the answer to a conservation issue, it can be helpful in cases where voluntary compliance or voluntary guidelines have proven to be insufficient, where a need can be documented.</p> <p>Regulation, best management practices, permitting, and guidelines for various types of wildlife management, collection or harvest; aquatic resources protection; and water development and distribution have <i>in some areas</i> not been applied effectively due to lack of funding, or enforcement resources, lack of understanding or clear benefits, or lack of political will.</p> <p>Some regulations are simply insufficient to deal with emerging conservation issues or problems that have come to light in regulatory loopholes</p>	<p>Poaching, Permitting Avoidance and Violations, sale of prohibited species, insufficient lists of prohibited species</p> <p>Unregulated or inadequately regulated wetlands (e.g. non-jurisdictional, isolated)</p> <p>Out of date Best Management Practices which have not incorporated the latest defensible science or appear to be arbitrary in setting thresholds</p> <p>Lack of community-based natural resources management and enforcement partnerships</p> <p>See also <i>Water Development, Management and Distribution/Use</i></p>

General Issue	Description of Impacts <i>Specific Issues will be explained more fully in each handbook if relevant</i>	Examples <i>These are just a few examples. See handbooks for more detail.</i>
Human Disturbance	This is the direct disturbance/harassment of wildlife or fish resources which can adversely affect their breeding, feeding or sheltering abilities.	<p>Off-road vehicle use in streams,</p> <p>Approaching wildlife too closely in breeding or resting areas (e.g. rookeries, hibernacula, nesting colonies on barrier and spoil islands) which can cause flushing, leaving eggs or young vulnerable to predators, or waking during hibernation, which uses valuable stored resources</p> <p>Using non-targeted means of take or harvest (e.g. bycatch, indiscriminate substances into crevices) which can affect an entire system's worth of species and may adversely affect future habitat suitability in that area</p>
Other Broad Cross-Cutting Issues	Several issues affect many of the other previously mentioned issues, either in our ability to understand or act.	<p><u>Economy</u> – working lands markets; public support for conservation through bonds, referendums, public program funding; and, cyclicly available grant funding – drives much of what we can do to protect resources and how we engage willing partners to affect conservation on a meaningful scale.</p> <p><u>Population growth, urbanization, and shifting demographics</u> affect where we need to work, how to deliver the conservation message, and what partners might be best to help tackle a problem.</p> <p><u>Climate change</u> is one of the emerging conservation issues which may affect many resources across the state – sea level rise, ocean acidification, temperature and precipitation shifts, further isolation and change of already isolated habitats or species.</p> <p><u>Episodic Natural and Man-made Disasters</u> such as tornadoes, hurricanes, flooding and large oil spills have an impact on natural resources as they do on human resources; our ability to understand the impact potential, long-term change, and the resiliency of natural systems is important to deal with these as they occur.</p>

Table Sources: ecoregion workshops, surveys of ecoregion teams and the public, ABJ 2009, AFWA 2006, CTE 2011, Esselman et. al. 2010 and 2011, ICOET 1996 – 2009, NWF and LSCSC 2011, SECO 2009, SECO 2011, TFS 2008, TFS 2011, USDA ERS 2007, USDA ERS 2011; see also compiled TCAP Resources and References online.

Issues in the Statewide/Multi-region Handbook

For the most part, the Statewide/Multi-region issues are those which affect an area larger than one ecoregion and require cooperation across ecoregions, state boundaries, and/or perhaps international boundaries. Several of these larger issues are directly related to the larger habitat types discussed in the previous section and/or may be “emerging” conservation issues – those which have appeared or significantly amplified in the last few years since the 2005 Plan. Conservation actions in the handbooks are aimed at reducing the negative effects of these issues at various scales. The workshops, surveys and other comments helped hone these lists.

Statewide/Multi-region issues addressed in TCAP include the following:

- Water Development, Management and Distribution
- Invasive Species
- Energy Production and Delivery
- Demographic Shifts and , Growth
- Climate Change
- Conservation Practices: Communication, Corridors, Management, Funding

Some of the broader issues also have ecoregional contexts; for example:

- climate change effects to rising sea levels or ocean acidification in the Gulf Coast Prairies and Marshes ecoregion;
- population growth in Dallas and proposed reservoir construction to meet water demand affects instream flows, riparian conservation, and habitat connectivity in ecoregions downstream;
- Competitive Renewable Energy Zones defined for the state’s preferred wind power development areas has specific effects at the generation sites and in power delivery to urban areas, affecting resources in the High Plains, Chihuahuan Desert, and Edwards Plateau.

These and others will be addressed where applicable.

Issues in Ecoregion Handbooks

Each Ecoregion Handbook contains a list of specific issues, sorted by the broader types presented in Table 7. Issues included in the handbooks are those directly related to SGCN, rare communities and the habitats on which they depend in that region.

ACTIONS

To this point, this Overview has covered the individual elements that guide actions:

- **Species and Communities** – specific populations which are declining or at-risk;
- **Habitats** – physical places where we need to work; and
- **Issues** – direct harm or basic gaps which negatively affect our ability to improve SGCN populations and rare communities in their best contexts.

Actions are the heart of the Plan. Actions state what we need to work on, where, and why (what problem we can solve). Actions should lay out how that work contributes to a *specific desired effect* – progress and eventual success. Conservation actions in the handbooks are aimed at reducing or eliminating the negative effects of issues at various scales.

Action Types and Definitions

Actions are sorted into 12 categories and defined in Table 8. These were derived from discussions in Plan workshops, the IUCN-Conservation Measures Partnership’s Standard Classification of Conservation Actions (IUCN-CMP 2008b), Watershed Restoration Principles (Williams et. al. 1997), National Fish Habitat Action Plan components (Esselman et.al. 2010), Southeast Aquatic Habitat Plan (SARP 2009 – 2011), Measuring the Effectiveness of State Wildlife Grants (AFWA TWW, 2011), and input from state and fish and wildlife agencies, conservation organizations, and the USFWS Wildlife and Sport Fish Restoration Program who helped develop and review the Effectiveness Measures. Use of this system will be further emphasized in future project tracking through USFWS TRACS and/or other conservation delivery tracking such as ConPro, Conservation Registry, HabITS, Miradi, Biotics 4 (new version in progress), DataBasin, or NatureServe Explorer Web Service. For more information about these tracking tools, see *Appendix IV* in the Effectiveness Measures document (AFWA 2011).

The list is *not* meant to be exhaustive, but rather represents the most common actions and will likely need to be improved over time. “Stakeholder involvement” and “Incentive Programs” are conservation actions which were considered for this list; however, it was determined that these actions are most often *components of other actions* – we do not do these as stand-alone actions, but rather to help implement other conservation actions. That said, those definitions are included at the end of the Actions table because they are frequently used tools.

Conservation actions are crafted at various appropriate scales – overall goals and stepwise progress, regional and local actions – to eventually restore or protect populations and/or relieve adverse effects of issues.

Actions were developed by Core Ecoregion Teams, Core Statewide/Multi-region Team, peer reviewers, other stakeholders and the public. People who work on these affected resources and live in these regions know the resources, opportunities, and issues best and care deeply about the outcomes.

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 or rare community.

During participation processes, Conservation Actions were requested that would identify:

- goals for stable, resilient SGCN populations, rare communities, and/or the habitats on which they depend (conservation targets and what “success” looks like);
- where the most important work needs to occur and what problems need to be solved;

- partners who are already working or could work on a particular issue (existing or new networks, working groups, advisors, peers, landowner cooperatives or individuals); and,
- *effective* project criteria – stepping stones to achieve the goals and share information.

That said, it was important to encourage participation and not let a lack of information completely paralyze the desire to act: *“Don’t let the perfect be the enemy of the good”* (Nick Salafsky *pers comm*). The lists of actions in this Plan are a guide. See also *Measuring Progress*.

Where possible, actions should provide the following information – where these are not defined in the text of the handbooks, these criteria, coupled with those laid out in the AFWA Effectiveness Measures, provide a strong basis for project development and implementation and should be used for more detailed project definition:

- **Action Description** – type, proposed activities, description of how to make progress toward or completely meet the Conservation Goal
- **Conservation Target(s)** – SGCN populations, assemblages of SGCN, and/or rare communities that will directly benefit from the action
- **Conservation Goal** – the overarching conservation outcome(s) such as number of stable populations, number of individuals that constitute stable community, acres of habitat conserved that would reduce a threat, percentage of agencies implementing a best management practice, target audiences reached/behaviors changed, *etc.*) that this action contributes to or resolves, including sources (e.g. other conservation plan) that support this information
- **Timeline for Goal and Action** – overall goal timeline and optimal timeline for a particular contributing (e.g. by 2025, in six months, in three breeding cycles, before city expands ETJ in 2014)
- **Habitat(s) Types** – broad and finer scale categories
- **Issue(s)** – specific issues which the Action would help alleviate/solve
- **Target areas** – where the action needs to take place – specific watersheds, counties, network of public or private lands, mountain range, canyon, soil or geologic substrates, stream segments, adjacent to ..., connectivity with ... (*specific land owners are not named in any actions without their explicit permission*) – and, why here (best opportunity for protection, best opportunity for restoration, largest contiguous area for ..., best connection to other target sites, ...)
- **Partners** – stakeholders, those affected by the issue, and/or project leaders who are currently working on the issue, could work on the issue (most knowledge, previous efforts, connectivity with the site, community-based, etc.)
- **Supporting Information** (if known) – management plan, working group guidance, peer-reviewed documentation, methodology, best management practice, etc. that needs to be used to support this effort
- **Monitoring** – evaluation points and elements to provide evidence that action leads to a reduction of impacts and/or an improvement in conservation target(s); sharing lessons learned.

Actions in the Statewide/Multi-region Handbook

Actions in the Statewide/Multi-region handbook are aimed at broader issues which affect an area larger than one ecoregion and require cooperation across ecoregions, state boundaries, and/or perhaps international boundaries.

Actions in Ecoregion Handbooks

Each Ecoregion Handbook contains a list of specific actions, sorted by the broader types. Actions included in the handbooks are those directly related to SGCN, rare communities and the habitats on which they depend in that region.

Table 8. Conservation Actions, Definitions and Examples

Note: See also Measuring Progress section. Table is formatted 8-1/2" x 11", landscape orientation

Conservation Action	Definition	Examples
Direct management of natural resources	Stewardship of terrestrial and aquatic species, habitats and/or natural processes to maintain populations or restore ecological functions.	Conduct controlled burns Manage invasive species Remove dams and other barriers
Species restoration	Reintroduction, relocation or stocking of native animals or plants or translocation of animals to an area where they are not currently found.	Translocate/breed in captivity black-footed ferrets to establish new populations in suitable habitat Restore mussel assemblages to historically occupied stream stretches
Creation of new habitat	The creation or establishment of <i>new</i> habitats, including necessary natural processes, habitat structures, and biotic components, to mitigate loss of ecological functions elsewhere.	Establish prairie communities where crop land currently exists The creation of new breeding habitat for gopher frog reintroduction and due to a climate adaptation strategy and recovery plan
Acquisition / Easement / Lease	Protection of land or water real property or rights through fee title acquisition, permanent easement, lease, contract, or a related means.	Purchase land in a corridor connecting a Wildlife Management Area and a National Wildlife Refuge A perpetual easement restricting land conversion and development is placed on a remnant tall grass prairie A 20-year term contract is placed on a privately-owned Pennsylvania wet meadow for protection and recovery of bog turtles
Conservation area designation	Designation of a site or landscape as having unique and important value to wildlife with or without legal protections.	Designate an area as an Important Bird Area Designate an area as an Important Reptile/Amphibian Area Add an area to a State Natural Area registry

Conservation Action	Definition	Examples
Environmental review	Review of agency and private sector policies, projects and plans (primarily related to development and potential adverse impacts to natural resources) to help ensure potential impacts to fish and wildlife are avoided, minimized and/or compensated/mitigated.	<p>Review of proposed new landfill siting alternatives to recommend which alternative(s) will least impact natural resources immediately (direct) and over time (indirect, cumulative); and where mitigation activities and dollars would be best spent to compensate for unavoidable resource impacts.</p> <p>Review new highway route alternatives and make recommendations for resource protection from planning through implementation.</p> <p>Review of new road salt application policy to ensure timing, periodicity, and intensity avoid or limit potential impacts to natural resources.</p>
Management planning	Development of management plans for species, habitats and natural processes.	<p>Develop a management plan for</p> <ul style="list-style-type: none"> • migration corridors • watershed management and system health • longleaf pine system sustainability • native endangered mussel protection and long-term recovery
Land use planning	Leading or participating in land use planning for rural, urban, or agricultural lands.	<p>Develop county-wide zoning plans</p> <p>Participate in workgroup regarding low impact development siting</p> <p>Develop city plan for implementing best management practices for stormwater management</p>

Conservation Action	Definition	Examples
Training & technical assistance	<p><u>Training</u> is skills development for professionals, key stakeholders, or others to facilitate needed management activities and techniques.” It does not include training that is minor or routine component of implementing another action. It usually includes certification or apprenticeship of some sort.</p> <p>It is <i>not the same as information delivery (education or outreach)</i>, although training could lead to an education or outreach conservation action for threat reduction.</p> <p><u>Technical Assistance</u> is tangible, practical support (skills, knowledge, recommendations) delivered by experts to professionals or key stakeholders for the purpose of helping them implement specific conservation actions.</p>	<p>Provide training for agency staff in reptile and amphibian assessment techniques</p> <p>Provide classroom training in elements of prescribed fire qualifications (e.g. planning, tool familiarity, weather) to resource professionals who will eventually take “next steps” to become site-based Fire Operators and Leaders (e.g. Crew Leaders, Burn Bosses)</p> <p>Provide qualified prescribed fire operators with “apprenticeship” in field skills (e.g. leading crews, ignition, fire management, safety and emergency response) leading toward Fire Leader (Burn Boss) certification or qualification</p> <p>Provide technical assistance in successful techniques to assess (field surveys, boundary document reading, conservation value rapid assessment), write successful terms and conditions, and monitor (timeframes, techniques, etc.) a conservation easement</p> <p>Provide technical assistance in the form of one-on-one engineering consultation for dam removal</p>
Data Collection / Analysis / Management	<p>Collecting data about species and habitats and the threats to them to fill information needs; includes compilation, management, synthesis, analysis, and reporting of spatial and nonspatial data.</p>	<p>Gather data on the Shenandoah salamander to define current distribution, survey methodologies and understand habitat use, and threats</p> <p>Conduct surveys & genetic assessments of three North American minnow SGCNs to determine baseline population data to assist in the establishment of conservation units</p>

Conservation Action	Definition	Examples
Education	Actions or efforts to increase knowledge or understanding and encourage practices in support of SGCN conservation through instruction or distribution of materials or to provide general information in response to inquiries from the public or partners about SGCN conservation programs, actions, or activities. Includes both formal (classroom) and non-formal education efforts.	<p>Implement a timber rattlesnake educational program that includes developing educational materials, conducting workshops on conservation efforts, and conducting habitat management demonstration tours to NGO's interested in implementing timber rattlesnake conservation projects</p> <p>Conduct outreach to landowners to implement land management practices to benefit species</p> <p>Providing decision makers with data about pollution impacts on at-risk aquatic species to help them set water quality standards for key water bodies</p>
* Incentives	Development and delivery of economic incentives to private landowners to influence responsible stewardship of land/water and specific species	<p>Tax breaks</p> <p>Stewardship payments to landowners (doing the right thing, continue to do the right thing)</p> <p>Management infrastructure & practices incentives (\$ to build a fence, infrastructure, delay hayfield)</p> <p>Restoration incentives (\$ to restore wetland)</p> <p>Regulatory streamlining</p> <p>Technical assistance</p>
* Stakeholder Involvement	Engaging state and federal agencies, tribal entities, the NGO community and other partners to achieve shared objectives and broader coordination across overlapping areas.	<p>Establish decision making processes with state agencies</p> <p>Outreach with tribal governments</p> <p>Convene an advisory committee to assist with implementation of a State Wildlife Action Plan</p>

** "Stakeholder involvement" and "Incentive Programs" are conservation actions which were considered in the original list of Actions; however, these actions are most often components of other actions – we do not do these as stand-alone actions, but rather to help implement other conservation actions. That said, they are listed and defined here because they are frequently used tools.*

Content for this table was excerpted from AFWA TWW (2011)

MEASURING PROGRESS

It has become increasingly important to determine if the work we do on a *daily* basis is actually leading to the overall conservation outcomes we desire – **restoration, recovery, sustainability, 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.

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, in this edition, measures of success are identified where possible and specifically encouraged in future project development. To that end, the toolkit in *Measuring the Effectiveness of State Wildlife Grants (AFWA TWW 2011)* is **strongly recommended** to define projects, target audiences and partners, identify desired step-wise intermediate results, and collect the “right” data to report our conservation achievements.

Full-cycle management from the *Open Standards of Conservation Practice (CMP 2007 and 2008)* needs to be applied to all actions. Well-crafted monitoring and evaluation (cost effective, answers key questions) informs management and allows conservation practitioners to “course-correct” as necessary for effective conservation (Salzer and Salafsky 2006). This kind of reflection is necessary, albeit not currently widely written into project plans. It is critical to document measures, progress and success, to learn from our work, share lessons learned, and educate future conservation practitioners.

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



RESOURCES AND REFERENCES

CITED REFERENCES IN THIS DOCUMENT

- Abbot, J.C. 2010. Odonata Central: The Past, Present and Future. *Argia* 22(4). See also the companion online resource: www.odonatacentral.org (accessed 2008 – 2012).
- American Ornithologists' Union (AOU) North American Classification Committee. 2008 - 2011. Checklist of North American birds, 7th edition and its supplements. <http://www.aou.org/checklist/north/index.php> (accessed 2008 - 2012)
- Association of Fish and Wildlife Agencies (AFWA). 2006. National Fish Habitat Action Plan. http://www.fishhabitat.org/documents/plan/National_Fish_Habitat_Action_Plan.pdf (accessed November 2009).
- Association of Fish and Wildlife Agencies (AFWA) Teaming with Wildlife (TWW). 2010. Measuring the Effectiveness of Conservation Actions Phase I Report (*precursor to 2011 Final Report*). [http://www.teaming.com/pdf/AFWA%20Effectiveness%20Measures%20Report-Phase%20I-FINAL%20\(9-%202010\).pdf](http://www.teaming.com/pdf/AFWA%20Effectiveness%20Measures%20Report-Phase%20I-FINAL%20(9-%202010).pdf) (last accessed Feb 2011).
- Association of Fish and Wildlife Agencies (AFWA) Teaming with Wildlife (TWW). 2011. Measuring the Effectiveness of State Wildlife Grants: Final Report April 2011. http://www.fishwildlife.org/files/Effectiveness-Measures-Report_2011.pdf
- Austin Business Journal (ABJ). 2009. *Texas has high no. of fast-growing counties* (Friday, March 27, 2009). http://austin.bizjournals.com/austin/stories/2009/03/23/daily61.html?ed=2009-03-27&ana=e_du_pub (accessed 30 March 2009).
- Bat Conservation International (BCI). 2010. Species Profiles (Texas subset). <http://www.batcon.org/index.php/all-about-bats/species-profiles.html> (accessed 2010).
- Baydack, R.K., H. Campa III, and J.B. Haufler (eds.). 1999. Practical approaches to the conservation of biological diversity. Island Press, Washington D.C. and Covelo CA. 313 pp.
- Brant, J.G. and C. Jones. 2005. Annotated Checklist of Marine Mammals in Texas. Museum of Texas Tech University, Occasional Papers Issue 244. Lubbock, Texas.
- Burlakova, L. E., A. Y. Karatayev, V. A. Karatayev, M. E. May, D. L. Bennett and M. J. Cook. 2011. Biogeography and conservation of freshwater mussels (Bivalvia:Unionidae) in Texas: patterns of diversity and threats. *Diversity and Distributions*: 1-15.
- Center for Transportation and the Environment (CTE). 2011. Wildlife, Fisheries and Transportation Gateway. <http://itre.ncsu.edu/CTE/gateway/home.asp> (accessed 2011). North Carolina State University, Raleigh, NC 27695.
- Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, Virginia
- Conservation Measures Partnership (CMP). 2007, 2010. Open Standards for the Practice of Conservation, v. 1 (2007) and 2 (2010). http://www.conservationmeasures.org/wp-content/uploads/2010/04/CMP_Open_Standards_Version_2.0.pdf (accessed 2009 – 2011).
- Conservation Measures Partnership (CMP). 2008. Standards for Project Management. <http://www.conservationmeasures.org/initiatives/standards-for-project-management> (accessed 2010 – 2011).

- Cornell Lab of Ornithology, The. *n.d.* All about birds (online resource).
http://allaboutbirds.org/guide/browse_tax.aspx (accessed 2008 - 2011).
- Correll, D.S. and M.C Johnston. 1979. Manual of the Vascular Plants of Texas. The University of Texas at Dallas, Richardson, Texas.
- Culver, D.C., L.L. Master, M.C. Christman, and H.H. Hobbs III. 2000. Obligate cave fauna of the 48 contiguous United States. *Conservation Biology* 14(2): 386-401.
- Davis, W.B. and D.J. Schmidly. 1994 and 1997. The Mammals of Texas. Texas Tech University and Texas Parks and Wildlife Department (Nongame and Urban Program). Lubbock and Austin, Texas.
<http://www.nsrl.ttu.edu/tmot1/Default.htm> (accessed 2010).
- Dixon, J.R. 2000. Amphibians and Reptiles of Texas, with keys, taxonomic synopses, bibliography, and distribution maps. Texas A&M University Press, College Station, Texas. 421 pgs. [*Editor's Note: more recent version in January 2013 with updated taxonomic information and distribution maps*]
- Esselman, P.C., D.M. Infante, L. Wang, D. Wu, A. Cooper, and W.W. Taylor. 2010. An initial assessment of relative landscape disturbance levels for river fish habitats of the conterminous United States.
http://www.nbii.gov/far/nfhap/data/NFHAP_Initial_Assessment_Report_Esselman_etal_2010.pdf
 (accessed 2010 – 2011). *Editor's note: the NBII portal is offline as of 30 September 2012; please see <http://ecosystems.usgs.gov/fishhabitat/> and <http://fishhabitat.org/resources>*
- Esselman, P.C., D.M. Infante, L. Wang, D. Wu, A. Cooper, and W.W. Taylor. 2011. An Index of Cumulative Disturbance to River Fish Habitats of the Conterminous United States from Landscape Anthropogenic Activities. *Ecological Restoration* Vol. 29(1–2): 133-151.
- Fowler, S.L., Cavanagh, R.D., Camhi, M., Burgess, G.H., Cailliet, G.M., Fordham, S.V., Simpfendorfer, C.A. and Musick, J.A. (comp. and ed.). 2005. Sharks, Rays and Chimaeras: The Status of the Chondrichthyan Fishes, Status Survey. IUCN/SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. x + 461 pp.
- Gould, F.W. 1975. The Grasses of Texas. Texas A & M University Press, College Station.
- Gould, F.W., G.O. Hoffman, and C.A. Rechenthin. 1960. Vegetational Areas of Texas. Texas Agricultural Experiment Station Leaflet 492. Texas A&M University, College Station TX.
http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_mp_e0100_1070ac_24.pdf
 (accessed October 2008).
- Griffith, G., S.A. Bryce, J.M. Omernik, J.A. Comstock, A.C. Rogers, B. Harrison, S.L. Hatch and D. Bezanson. 2007. Ecoregions of Texas (report and maps). R.S. Geological Survey, Reston VA.
ftp://ftp.epa.gov/wed/ecoregions/tx/TXeco_Jan08_v8_Cmprsd.pdf (report) and
http://www.epa.gov/wed/pages/ecoregions/tx_eco.htm (maps) (accessed May 2009).
- Hoese, H.D. and R.H. Moore. 1998. Fishes of the Gulf of Mexico: Texas, Louisiana, and Adjacent Waters, 2nd ed. Texas A&M University Press, College Station, Texas. 422 pgs.
- Howells, R. G., R. W. Neck and H. D. Murray. 1996. Freshwater Mussels of Texas. Texas Parks and Wildlife Press, Austin, Texas.
- International Conference on Ecology and Transportation (ICOET). Past Conference Proceedings 1996 – 2009 (available every two years). <http://www.icoet.net/index.asp> (accessed 2010 and 2011).
- International Union for the Conservation of Nature and Natural Resources (IUCN), Species Survival Commission. 2008. Strategic planning for species conservation: an overview. Version 1.0. Gland, Switzerland: IUCN. 22pp.

- International Union for the Conservation of Nature and Natural Resources and the Conservation Measures Partnership (IUCN – CMP). 2008a. Standard Classification of Conservation Threats. <http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy> (accessed 2010).
- International Union for the Conservation of Nature and Natural Resources and the Conservation Measures Partnership (IUCN – CMP). 2008b. Standard Classification of Conservation Actions. <http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/actions-taxonomy> (accessed 2010).
- Iowa State University Entomology. 2003 – 2012. Bug Guide: Identification, Images, and Information for Insects, Spiders and Their Kin For the United States and Canada (an online resource). www.bugguide.net (accessed 2008 – 2012).
- Johnston, M.C. 1990. The Vascular Plants of Texas: A List Updating the Manual of the Vascular Plants of Texas, 2nd Edition. Marshall C. Johnston, Austin, Texas.
- Jones, S.D., J.K. Wipff, and P.M. Montgomery. 1997. Vascular Plants of Texas: A Comprehensive Checklist including Synonymy; Bibliography, and Index. University of Texas Press, Austin.
- LBJ School of Public Affairs. 1978. Preserving Texas' Natural Heritage. Policy Research Project Report 31. University of Texas at Austin, Austin TX.
- National Biological Information Infrastructure (NBII), U.S. Geological Service, and the National Fish Habitat Partnership. 2011. National Fish Habitat Action Plan Data Viewer/Mapper: Risk of Current Habitat Degradation for Stream and Coastal Fish Habitats in the United States. <http://www.nbii.gov/far/nfhap/> (accessed 2011). *Editor's note: the NBII portal is offline as of 30 September 2012; please see <http://ecosystems.usgs.gov/fishhabitat/>*
- National Council on Science and the Environment. 2010. Our Nation's Wildlife Habitats: completing an integrated system for conserving habitat values and benefits in a changing world. http://ncseonline.org/CMS400Example/uploadedFiles/03_NEW_SITE/3_Solutions/WHPRP/WHP RP%20Synthesis%20Report.pdf (accessed 2010).
- National Fish Habitat Board. 2010. Through a Fish's Eye: The Status of Fish Habitats in the United States 2010. Association of Fish and Wildlife Agencies, Washington D.C. 68 pp. <http://www.habitat.noaa.gov/pdf/fishhabitatreport.pdf> (accessed 2010 - 2011).
- National Fish Habitat Partnership. 2009. Fish Habitat Partnerships (map). http://fishhabitat.org/images/M_images/New_NFHAP_Maps_2009/nfhap_fhp_and_cand_map_09_1.pdf (accessed November 2009). Produced October 2009, revised as part of the National Fish Habitat Action Plan.
- National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), Southeast Fisheries Science Data Center (SEFSDC) Office of Protected Resources. 2010 – 2011. *Marine Mammal Stock Assessment Reports*. <http://www.nmfs.noaa.gov/pr/sars/> (accessed 2009 – 2011).
- National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), Southeast Fisheries Science Data Center (SEFSDC) - Office of Protected Resources. 2011. Protection of Sea Turtles: Species Accounts. <http://www.sefsc.noaa.gov/species/turtles/> (accessed 2011).

- National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), Southeast Fisheries Science Data Center (SFSDC). 2011. Sharks researched and managed by the SEFSC. <http://www.sefsc.noaa.gov/species/sharks/> (accessed 2011).
- National Wildlife Federation and Lone Star Chapter of the Sierra Club. 2009 – 2011. Texas Water Matters (website portal to many water issues, publications, and forums). <http://www.texaswatermatters.org/> (accessed 2010 and 2011).
- Natural Resources Conservation Service (NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. ftp://ftp-fc.sc.egov.usda.gov/NSSC/Ag_Handbook_296_low.pdf (accessed November 2009). Produced by the US Department of Agriculture NRCS, Handbook 296.
- NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application], s.v. "Texas". Version 7.1, last updated February 6, 2009. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer> (accessed: July 22, 2009).
- NatureServe. *n.d.* Terrestrial Ecological Systems of the United States (Get Data portal). <http://www.natureserve.org/getData/USecologyData.jsp> (accessed 2009 - 2011).
- North American Bird Conservation Initiative (NABCI-US). 2004. Bird Conservation Regions (BCRs) (interactive map). <http://www.nabci-us.org/map.html> (accessed October 2009).
- North American Commission for Environmental Cooperation. 2011. Level III North American Terrestrial Ecoregions: United States Descriptions (*section prepared by G. Griffith*). http://www.cec.org/Storage/133/15860_QA07.30-32_NP_NA_Terrestrial_Ecoregions_Level_3_Final-2june11.pdf (accessed draft 2010, final 2011).
- Opler, P.A., K. Lotts, and T. Naberhaus, coordinators. 2012. Butterflies and Moths of North America. <http://www.butterfliesandmoths.org/> (accessed 2012).
- Poole, A. (Editor). 2005. The Birds of North America Online: <http://bna.birds.cornell.edu/BNA/>. Cornell Laboratory of Ornithology, Ithaca, New York.
- Poole, J.M., J.R. Singhurst, W.R. Carr. 2010. A List of the Rare Plants of Texas. December 2010 Edition (*regularly updated, typically 1 – 3 years*). Wildlife Diversity Program, Texas Parks and Wildlife Department and Texas Conservation Data Center, The Nature Conservancy of Texas. Austin and San Antonio, Texas. http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_rp_w7000_1142.pdf (accessed 2010).
- Poole, J.M., W.R. Carr, D.M. Price and J.R. Singhurst. 2007. Rare Plants of Texas. Texas A&M University Press, College Station. 640 pgs.
- Quinn, M. 2010. Texas Entomology (an online resource). www.texasento.net (accessed 2010 – 2012).
- Salafsky, N., D. Salzer, A.J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S.H.M. Butchart, B. Collen, N. Cox, L.L. Master, S. O'Connor, and D. Wilkie. 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. *Conservation Biology* 22:897–911. http://www.iucnredlist.org/documents/Salafsky_et_al_2008_Unified_Classifications_of_Threats_and_Actions.pdf (accessed 2009, 2012).
- 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.

- Sanderson, E.W., K.H. Redford, A. Vedder, P.B. Coppolillo, and S.E. Ward. 2002. A conceptual model for conservation planning based on landscape species requirements. *Landscape and Urban Planning* 58:41-56.
- Southeast Aquatic Resources Partnership (SARP). 2009. Southeast Aquatic Habitat Plan. <http://southeastaquatics.net/programs/southeast-aquatic-habitat-plan-sahp> (accessed 2009 - 2011)
- State Energy Conservation Office (SECO). 2009. Texas Renewable Portfolio Standard. http://www.seco.cpa.state.tx.us/re_rps-portfolio.htm (accessed July 2009). Texas Comptroller of Public Accounts, Austin TX.
- State Energy Conservation Office (SECO). 2011. Energy Sources. <http://seco.cpa.state.tx.us/energy-sources/> (accessed 2011). Texas Comptroller of Public Accounts, Austin TX.
- Teaming with Wildlife (TWW). 2008 – 2011, 2012. State Coalitions, State Wildlife Action Plans, Dedicated Funding for Wildlife. <http://www.teaming.com> (accessed December 2010, August 2012 *replaces earlier citation with new web information*).
- Texas Forest Service (TFS). 2008. Voluntary Forest Best Management Practices in East Texas. <http://texasforestservicetamu.edu/uploadedFiles/Sustainable/bmp/RD%207%20BMP%20Implementation%20Report%20-%20website.pdf> (accessed 2009).
- Texas Forest Service (TFS). 2010. Texas Statewide Forest Resource Strategy. <http://txforestservicetamu.edu/uploadedFiles/Sustainable/assessment/Texas%20Forest%20Resource%20Strategy.pdf> (accessed 2010 and 2011). College Station TX.
- Texas Forest Service (TFS). 2011. Stewardship (portal). <http://txforestservicetamu.edu/main/article.aspx?id=1180> (accessed 2010 and 2011). College Station TX.
- Texas Mussel Group. 2010. A resource for information on freshwater mussels in Texas. www.texasmussels.wordpress.com (accessed 2010 – 2012).
- Texas Parks and Wildlife Department (TPWD). 2005a. Texas Comprehensive Wildlife Conservation Strategy 2005 – 2010. http://www.tpwd.state.tx.us/publications/pwdpubs/pwd_pl_w7000_1187a/ (accessed 26 May 2009).
- Texas Parks and Wildlife Department (TPWD). 2005b. Land & Water Resources Conservation and Recreation Plan. http://www.tpwd.state.tx.us/publications/pwdpubs/pwd_pl_e0100_0867/ (accessed May 2009).
- Texas Parks and Wildlife Department (TPWD). 2007. Natural Resources Conservation Programs and Services for Texas Landowners. http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_1198.pdf (accessed 2010 and 2011). Austin TX.
- Texas Parks and Wildlife Department (TPWD). 2009 – present. Texas Natural Diversity Database – observations and element occurrence records for rare species.
- Texas Parks and Wildlife Department (TPWD). 2009. Endangered and threatened species list (last modified May 15, 2009, 8:27 a.m.). <http://www.tpwd.state.tx.us/huntwild/wild/species/endang/index.phtml> (accessed July 2009).
- Texas Parks and Wildlife Department (TPWD). 2010a. Presentation: Texas Legislature - Culture, Recreation and Tourism Committee (by John Davis, Wildlife Diversity Program).

- Texas Parks and Wildlife Department (TPWD). 2010b. Land & Water Resources Conservation and Recreation Plan. http://www.tpwd.state.tx.us/publications/nonpwdpubs/land_and_water_plan/ (accessed January 2010).
- Texas Parks and Wildlife Department (TPWD). *in progress, with other partners*. Plant Conservation Strategy. Austin, TX.
- Texas Parks and Wildlife Department, Missouri Resource Assessment Partnership (MoRAP), The Nature Conservancy of Texas, USDA Natural Resources Conservation Service, Texas Water Development Board, Texas Natural Resources Information System, Texas Forest Service, U.S. Forest Service, U.S. Fish and Wildlife Service, and NatureServe. 2005 – *in progress*. Ecological Systems Classification and Mapping Project, geographic information systems data, available in phases. Austin TX. <http://www.tpwd.state.tx.us/landwater/land/maps/gis/tescp/index.phtml> (accessed 2010).
- Texas State University River Systems Institute. 2009 – 2011. Freshwater Fishes of Texas: A Field Guide (online companion to the printed guide). <http://www.bio.txstate.edu/~tbonner/txfishes/> (accessed 2009 – 2011).
- The Nature Conservancy (TNC). 1999. Ecoregions and Divisions of the Lower 48 United States (map). <http://gis.tnc.org/data/MapbookWebsite/getimage.php?id=9> (accessed December 2009).
- The Nature Conservancy and World Wildlife Fund (TNC and WWF). 2006. Standards for Ecoregional Assessments and Biodiversity Visions (January 26, 2006). <http://conserveonline.org/workspaces/cbdgateway/era/index.html> (accessed 15 April 2009). The Nature Conservancy, Arlington VA.
- Thomas, C., T.H. Bonner and B.G. Whiteside. 2007. Freshwater Fishes of Texas: A Field Guide. Sponsored by The River Systems Institute at Texas State University, published by Texas A&M University Press. See also *Texas State University 2009-2011* entry.
- U.S. Department of Agriculture Economic Research Service. 2007. Measuring Rurality: What is Rural? (Briefing Room) <http://www.ers.usda.gov/Briefing/Rurality/WhatsRural/> (accessed 2010 and 2011). Washington D.C.
- U.S. Department of Agriculture Economic Research Service. 2011. State Fact Sheet: Texas. <http://www.ers.usda.gov/statefacts/tx.htm> (updated May 19, 2011; accessed 2010 and 2011). Washington D.C.
- U.S. Fish and Wildlife Service (USFWS) and Association of Fish and Wildlife Agencies (AFWA). 2007. Guidance for Wildlife Action Plan (Comprehensive Wildlife Conservation Strategy) Review and Revisions. <http://wsfrprograms.fws.gov/subpages/toolkitfiles/NAATgde.pdf> (accessed 2009). Issued July 12, 2007.
- U.S. Fish and Wildlife Service (USFWS). 2000. Eight Required Elements of State Wildlife Action Plans. FY 2001 Commerce, Justice, State and Related Agencies Appropriations Act. PL 106-553, codified USC 16(2000) 669(c). [http://www.fws.gov/r5fedaid/swg/TWW%20Working%20Group/3\)%20Eight%20Elements.pdf](http://www.fws.gov/r5fedaid/swg/TWW%20Working%20Group/3)%20Eight%20Elements.pdf) (accessed 2009).
- U.S. Fish and Wildlife Service (USFWS). 2006. National Advisory Acceptance Team (NAAT) Comprehensive Wildlife Conservation Strategy Review Summary for Texas. Received by TPWD, 14 February 2006.

- U.S. Fish and Wildlife Service (USFWS). 2007. Administrative Guidelines for State Wildlife Grants (effective January 1, 2007). FWS/AWSR-FA: 027804. <http://wsfprograms.fws.gov/subpages/toolkitfiles/swg2007.pdf> (accessed 2009). Issued October 18, 2006.
- U.S. Fish and Wildlife Service (USFWS). 2009a. U.S. Joint Ventures (map). (Division of Bird Habitat Conservation). <http://www.fws.gov/birdhabitat/JointVentures/Map.shtm> (accessed October 2009).
- U.S. Fish and Wildlife Service (USFWS). 2009b. Proposed Landscape Conservation Cooperatives FY2010, Coterminous United States (map). http://www.fws.gov/science/SHC/pdf/FWS_LCC_48.pdf (accessed December 2009). Produced by IRTM, Denver CO, December 2009.
- U.S. Fish and Wildlife Service (USFWS). 2009c. A System for Mapping Riparian Areas in the Western United States. 42 pgs. Division of Habitat and Resource Conservation, Branch of Resource Mapping and Support. Arlington, VA.
- U.S. Fish and Wildlife Service (USFWS). 2010a. Federally listed candidate, threatened and endangered species in Texas. <http://www.fws.gov/southwest/es/EndangeredSpecies/lists/ListSpecies.cfm> (accessed July 2009-2011).
- U.S. Fish and Wildlife Service (USFWS). 2010b. Species reports, s.v. "candidates". http://ecos.fws.gov/tess_public/pub/SpeciesReport.do?listingType=C&mapstatus=1 (accessed July 2009-2011).
- U.S. Fish and Wildlife Service (USFWS). 2011. Karst Invertebrate Habitat Guide. http://www.fws.gov/southwest/es/Documents/R2ES/Bexar_RP_Habitat_module.pdf (accessed 2011 - 2012).
- U.S. Fish and Wildlife Service (USFWS) Wildlife and Sportfish Restoration Program. 2008 – *in progress*. Tracking and Reporting Actions for the Conservation of Species (TRACS) system. *In development* – USFWS, state fish and wildlife agencies, nongovernmental organizations. Arlington, VA.
- U.S. Fish and Wildlife Service and U.S. Geological Survey (USFWS and USGS). 2006. Strategic Habitat Conservation: A Report from the National Ecological Assessment Team. http://training.fws.gov/EC/resources/shc/shc_finalrpt.pdf (accessed 2009).
- U.S. Geological Survey (USGS). 1991. Data Standard: Codes for the Identification of Hydrologic Units in the United States and the Caribbean Outlying Areas. U.S. Geological Survey Circular 878-A.
- University of Texas at Austin, Texas Natural Science Center, Texas Natural History Collections. 2010. Ichthyology Collection. Austin, Texas. <http://www.utexas.edu/tmm/tnhc/fish/index.html> (accessed 2009-2011).
- University of Texas at Austin, Texas Natural Science Center, Texas Natural History Collections. 2009-2011. Fishes of Texas database (online). <http://www.fishesoftexas.org/about> (accessed 2009 - 2011).
- Vines, R.A. 2004. Trees, Shrubs and Woody Vines of the Southwest. Blackburn Press.
- Werler, J. and J.R. Dixon. 2000. *Texas Snakes: Identification, Distribution, and Natural History*. University of Texas Press, Austin, Texas. 519 pgs.
- Williams, J.E., C.A. Wood, and M.P. Dombeck, eds. 1997. *Watershed Restoration: Principles and Practices*. American Fisheries Society, Bethesda, MD.

Wynne, K. and M. Schwartz. 1999. A Guide to Marine Mammals & Turtles of the U.S. Atlantic & Gulf of Mexico. Rhode Island Sea Grant, University of Rhode Island. 115 pgs.

Ziser, S. W. 2011. The Aquatic Invertebrates of Texas, an online "working list" (last updated 2011).
<http://www.austincc.edu/sziser/txaquaticinverts/> (accessed 2011-2012).

ADDITIONAL INTERNET RESOURCES

These sites provide additional information in support of the text in the Plan.

Category: Organization	Resource	Internet Page
Texas Conservation Action Plan (TCAP)	Home: All links available from this home page	http://www.tpwd.state.tx.us/landwater/land/tcap/
Texas Conservation Action Plan (TCAP)	SGCN List	http://www.tpwd.state.tx.us/landwater/land/tcap/documents/SGCN_alltaxa_2011.xls
Texas Conservation Action Plan (TCAP)	Rare Communities List	http://www.tpwd.state.tx.us/landwater/land/tcap/documents/RareCommunities_2011.xls
Texas Conservation Action Plan (TCAP)	Handbooks: Overview	http://www.tpwd.state.tx.us/landwater/land/tcap/handbooks.phtml
Texas Conservation Action Plan (TCAP)	Handbooks: Statewide	http://www.tpwd.state.tx.us/landwater/land/tcap/handbooks.phtml
Texas Conservation Action Plan (TCAP)	Handbooks: Ecoregions	http://www.tpwd.state.tx.us/landwater/land/tcap/handbooks.phtml
Texas Conservation Action Plan (TCAP)	Supporting Documents	http://www.tpwd.state.tx.us/landwater/land/tcap/documents/
SWAPs	States Adjacent to Texas	Louisiana http://www.wlf.louisiana.gov/sites/default/files/ldwf_favicon.ico Arkansas http://www.wildlifearkansas.com/strategy.html Oklahoma http://www.wildlifedepartment.com/CWCS.htm New Mexico http://www.wildlife.state.nm.us/conservation/comp_wildlife_cons_strategy/index.htm
SWAPs: general	Eight Required Elements	http://www.wildlifeactionplan.org/pdfs/eight_elements_handout.pdf
SWAPs: general	Links to plans in all states	http://www.wildlifeactionplans.org/
SWAPs: general	Revision Guidance	http://wsfrprograms.fws.gov/subpages/toolkitfiles/NAATgde.pdf
SWAPs: general	State Wildlife Action Plan Best Practices (2012)	<i>In development, check http://www.teaming.com in January 2013 for online publication</i>
Funding: Teaming with Wildlife	Coalition information	http://www.teaming.com http://www.teaming.com/pdf/Teaming_with_Wildlife_Full_Coalition_List.pdf
Funding: SWG	State Wildlife Grants	http://www.teaming.com/funding/state_wildlife_grants.html http://wsfrprograms.fws.gov/subpages/toolkitfiles/swg2007.pdf

Category: Organization	Resource	Internet Page
Funding: TPWD	Texas Horned Lizard License Plate Conservation Fund	http://www.conservationplate.org/lizard-redirect.phtml
Funding: USFWS	Wildlife and Sportfish Restoration Grant Programs, including SWG and Section 6	http://wsfrprograms.fws.gov/Subpages/AboutUs/AboutUs1.htm
Funding: USFWS	Partners for Fish and Wildlife Landowner Incentives	http://www.fws.gov/partners
Funding: NRCS	Farm Bill Programs in Texas	http://www.tx.nrcs.usda.gov/programs
Conservation Project Planning	Conservation Project Management	http://www.conservationmeasures.org/
Conservation Project Planning	Effectiveness Measures	http://www.fishwildlife.org/files/Effectiveness-Measures-Report_2011.pdf
Conservation Planning: NGO	North American Bird Conservation Initiative : Joint Ventures Map	http://www.nabci-us.org/jvmap.html
Conservation Planning: NGO	North American Bird Conservation Initiative: Joint Ventures and Plans	http://www.nabci-us.org/plans.htm
Conservation Planning: NGO	Partners In Flight: North American Land Bird Conservation Plan	http://www.partnersinflight.org/cont_plan/pif3_part2web.pdf
Conservation Planning: NGO	Partners In Flight: Tri-National Vision for Landbird Conservation	http://www.savingoursharedbirds.org/
Conservation Planning: NGO	Partners In Flight: State of the Birds Reports (2009, 2010, 2011)	http://www.stateofthebirds.org/
Conservation Planning: NGO	Xerces Society (invertebrates)	http://www.xerces.org/
Conservation Planning: NGO	The Nature Conservancy: Ecoregion Plans and Priority Site Maps	http://www.landscape.org/focus/understand/tnc_portfolio and http://conserveonline.org/workspaces/cbdgateway/era/reports/index.html
Conservation Planning: NGO	Texas Land Trust community plans, projects, contacts	http://www.texaslandtrustcouncil.org/
Conservation Planning: NGO	Ducks Unlimited – Texas Projects and Priorities	http://www.ducks.org/texas/texas-projects

Category: Organization	Resource	Internet Page
Conservation Planning: NGO	Environmental Defense – Texas Projects	http://www.edf.org/texas
Conservation Planning: Agency	Landscape Conservation Cooperatives: Texas LCCs (4)	http://www.doi.gov/lcc/index.cfm
Conservation Planning: Agency	Texas Forest Service Strategic Planning Documents	http://txforestservicetamu.edu/uploadedFiles/Sustainable/assessment/Texas%20Forest%20Resource%20Strategy.pdf <i>NOTE: new strategic documents expected in FY13 – search for Texas Forest Resource Strategy</i>
Conservation Planning: Agency	US Forest Service Strategic Planning Documents (Texas sites)	http://www.fs.usda.gov/wps/portal/fsinternet!/ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_Al8zPwhQoY6leDdGCqCPOBqwdLG-AAjgb6fh75uan6BdnZaY6OiooA1tkqlQ!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfMjAwMDAwMDBBODBPSEhWTjJNMDAwMDAwMDA!/?navtype=&cid=stelprdb5209352&navid=1301000000000000&pnavid=1300000000000000&ss=110813&position=Not%20Yet%20Determined.Html&ttype=detail&pname=National%20Forests%20and%20Grasslands%20in%20Texas-%20Planning
Conservation Planning: Agency	USFWS: Strategic Habitat Conservation	http://training.fws.gov/EC/resources/shc/shc_finalrpt.pdf
Conservation Planning: Agency	USFWS: Endangered Species Recovery Plans	http://www.fws.gov/endangered/species/recovery-plans.html
Conservation Planning: Agency	USFWS Landowner Toolkit Candidate Conservation Agreements Safe Harbor Agreements Habitat Conservation Plans (for incidental take permits) Conservation Banking	http://www.fws.gov/endangered/landowners/landowner-tools.html
TPWD: Resources	2008 Report: Sunset Advisory Commission on Texas Parks & Wildlife Department	http://www.tpwd.state.tx.us/publications/nonpwdpubs/media/tpwd_sunset_review.pdf
TPWD: Resources	Texas Wetlands Conservation Plan 1997	http://www.tpwd.state.tx.us/landwater/water/habitats/wetland/publications/conservation_plan.phtml
TPWD: Resources	Seagrass Conservation Plan for Texas 2000	http://www.tpwd.state.tx.us/landwater/water/habitats/seagrass/conservation.phtml
TPWD: Resources	Texas Shrimp Fishery: A Report to the Governor and 77th Legislature 2002	http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_rp_v3400_857.pdf
TPWD: Resources	Ecologically Significant Stream Segment Reports 2002 (as updated 2005)	http://www.tpwd.state.tx.us/landwater/water/enviroconcerns/water_quality/sigsegs/listofreports.phtml

Category: Organization	Resource	Internet Page
TPWD: Strategic Plan	Natural Agenda Strategic Plan	http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_a0900_0622_06_08.pdf
TPWD: Strategic Plan	Land & Water Resources Conservation and Recreation Plan 2010	http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_pl_e0100_867_land_water_plan_01_2010.pdf

