Winter Range Whooping Crane Strategic Plan (#1521)

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Final Report

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INTRODUCTION

The Aransas National Wildlife Refuge and the area immediately surrounding it are the only known wintering habitat of the Aransas-Wood Buffalo population of Whooping Crane which is a federally endangered species. Reproductive success is directly tied to the landscape's ability to support a growing population. Whooping cranes rely on these coastal wetlands and tidal marshes to provide food and refuge. It is also where the birds select mates and establish lifelong pair bonds. The Gulf Coast of Texas is also home to a growing human population, which creates many use conflicts of the Whooping Crane.

The original U.S. Whooping Crane Recovery Plan was approved on January 23, 1980, with the first and second revisions approved December 23, 1986 and February 11, 1994, respectively. The Canadian Recovery Plan was originally approved December 4, 1987 and first revision approved June 1993. The International Whooping Crane Recovery Plan combined the overlapping goals and objectives of both Environment Canada and United State Fish and Wildlife Service and was written in 2005, and approved in 2007. Additional documents are also prepared by Environment Canada to satisfy a Recovery Strategy under Canada's Species at Risk Act. Separate plans are further developed in both countries at regional and state levels which tend to overlap with the international objectives and provide more region- and agency-species guidance.

During a continental-wide, year-long effort across Canada and United States, conservation action planning (CAP) process was undertaken in the breeding, migration, and wintering grounds of the Whooping Crane range. Key strategic actions were identified for early implementation in the wintering range that included identifying and mapping sufficient suitable Whooping Crane wintering habitat to allow use by at least 250 family groups and account for the potential habitat loss due to sea level rise. This project has been completed and is used as an example of use of the CAP and Open Standards (OS) process here. The Wintering Whooping Crane Working Group ("Wintering Working Group") has begun work on this component of the strategic work plan, and believes that a comprehensive plan is necessary to capitalize on a diversity of opportunities to implement strategies that would continue the recovery of this species The Wintering Working Group has developed an outline to form the basic outline of this plan that would include: Habitat Protection (acquisition, conservation easement, policy changes), Habitat Management, Habitat Restoration, Monitoring & Maintenance (freshwater sources, prescribed burning invasive species control), Hydrologic Restoration, Freshwater Inflow Needs, and GIS Mapping Needs. Conservation professionals with expertise in these fields will be contributing to the plan development.

This project provided funding to hire a plan manager (E. Smith) to assist in gathering, synthesizing, and coordinating the development and completion of the *Winter Range Whooping Crane Strategic Plan.* During the time of approval of this project and the starting time, several advancements in crane conservation planning occurred at the International Crane Foundation (ICF). The author participated in a Conservation Measures Partnership (CMP) workshop hosted by ICF and funded by Disney World Wildlife Conservation Fund, primarily in the development of a CAP for the Siberian Crane. It was recommended that, although information can be

generated in textual forms for conservation plans, the use of a standardized process and associated modeling and reporting software would be more advantageous. To support this step, the first version of the *Winter Range Whoopng Crane Strategic Plan Version 1* funded by this project was generated. It is intended the effort to standardize this Plan using these processes and tools will streamline the process in the future and align with a larger effort to update the International Whooping Crane Recover Plan in the near future (W. Harrell, U.S. Whooping Crane Recovery Coordinator, pers. comm.). In addition, a Winter Working Group meeting in spring 2016 will be organized to further populate the information within the Plan to assist in developing alternative strategies in an ongoing Whooping Crane Population Viability Analysis. The overall intent and format of the chapter headings will be further developed in succeeding version of the Plan. Thus, the project objective of this CBBEP project was to develop a plan through available information and input from Winter Working Group members. This Plan will be used as a living document and information imported into the Miradi software to generate visual graphics and report updates as the Plan is populated with new information. The contractor, International Crane Foundation, and CBBEP contract was signed in January 2015 and the draft report developed and submitted in December 2015. The final report was submitted and approved in January 2016. Successive versions of this report will be authored by the Whooping Crane Winter Working Group.

METHODS OF APPROACH

Project Area

The Aransas-Wood Buffalo Population of Whooping Cranes represent the last wild flock of this endangered species in North America and the world (IWCRP 2007). Their entire range that is used annually terminates in the north around Wood Buffalo National Park, Northern Territories, Canada (breeding grounds) to around Aransas National Wildlife Refuge (ANWR), Texas, USA (wintering grounds). The geographic focus of this plan includes the ANWR and adjacent private lands in the San Antonio Bay system (Figure 1). More information describing the climate, habitat, and ecological requirements in the wintering grounds can be accessed in the International Whooping Crane Recovery Plan (CWS and USFWS 2007) with associated references (access at http://www.fwspubs.org/doi/suppl/10.3996/092012-JFWM-088/suppl_file/092012-jfwm-088r1-s09.pdf).

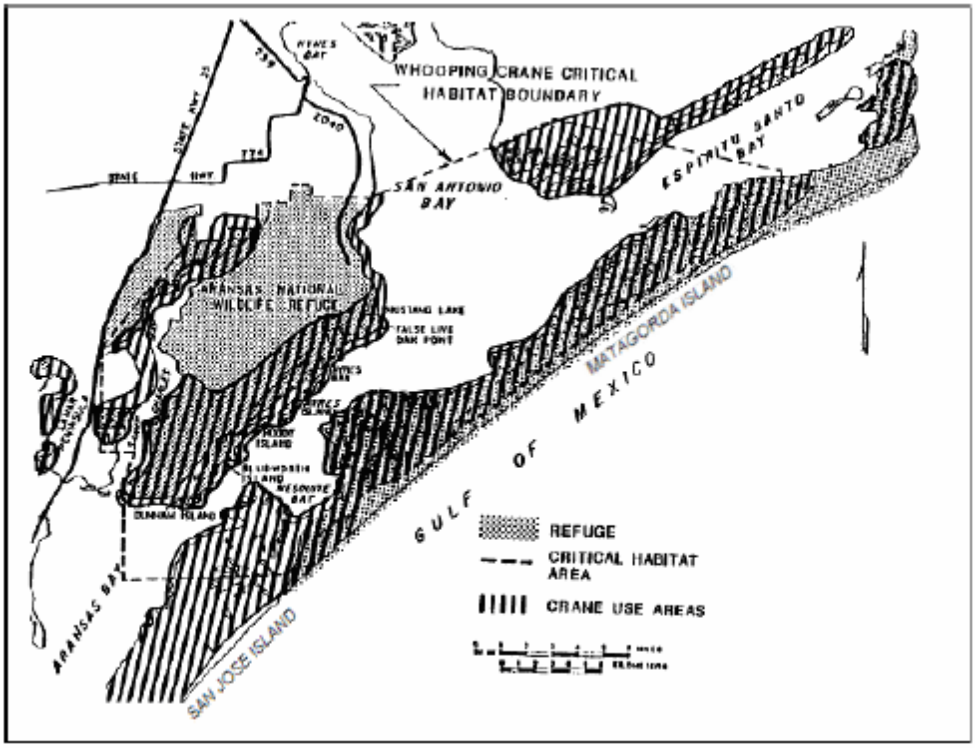

Figure 1. Wintering area of the Aransas Wood Buffalo Population, Aransas National Wildlife Refuge and Critical Habitat boundary on the Gulf of Mexico coast of Texas (from CWW and USFWS 2007).

Conservation Action Planning (CAP) Process

The CAP is a formalized process developed by The Nature Conservancy and designed to provide guidance to conservation planners, managers, and policy makers in developing specific strategies and associated measures of success. The ten steps of the CAP process can be described as an objective, consistent and transparent account of conservation actions and their intended

outcomes. The realized outcomes provide a measure of success and step to adapting the strategy to current conditions. More information can be accessed at http://www.conservationgateway.org/Pages/COL.aspx?Src=workspaces/cbdgateway/cap/index_html. The Nature Conservancy initiated the CAP process in mid-2000s, hosting workshops in the breeding, migration, and wintering grounds. Much of the work that was initiated in the wintering ground workshop was provided by TNC staff and formed the basis to develop this strategic plan.

Conservation Measures Partnership (CMP) and Open Standards (OS)
The CMP is comprised of a consortium of conservation organizations worldwide that primarily focus on biodiversity conservation within their goals. The desire to achieve tangible conservation results using standardized approaches provides a strong network for testing and improving these tools. The Nature Conservancy, US Fish and Wildlife (Wildlife Without Borders), National Audubon Society, Wildlife Conservation Society, and World Wildlife Fund are just some of the members and the program is funded by some very committed foundations. The International Crane Foundation is embarking on using CMP and OS to develop conservation plans for all 15 species of cranes, and focusing on the Siberian Crane and Whooping Crane at this point. More information can be accessed at: http://cmp-openstandards.org/ .

The OS process is the mechanism to implement the CMP and is constantly being revised and improved as conservations use and provide recommendations. It provides a structured approach to evaluation conservation actions and assist in collaboration among organizations with overlapping goals and objectives. The OS project management cycle provides the general five steps and can be adapted as pertinent to the project (Figure 2). In addition, because some implementation may be completed or currently underway, the process will probably not be linear. In this report version, the focus has been placed on standardizing information for use in the five steps. For more detailed information, access the complete manual at: http://cmp-openstandards.org/wp-content/uploads/2014/03/CMP-OS-V3-0-Final.pdf.

The information generated for conservations plans using OS process can all be imported into the Miradi Softeware program developed for this purpose. Miradi provides worksheets and databases for each step of the management cycles, provides all standardized classifications with the software, is excellent for visualizing data and linkages within a model format, and can generate reports as work progresses. The Winter Working Group evaluated this approach as the September workshop and agreed the software would be a good next step in organizing all the information within the plan. Therefore, many of the worksheets have been customized for the purpose of organizing data in a format consistent with uploading into Miradi when funds becomes available. More information on Miradi can be accessed at https://www.miradi.org/.

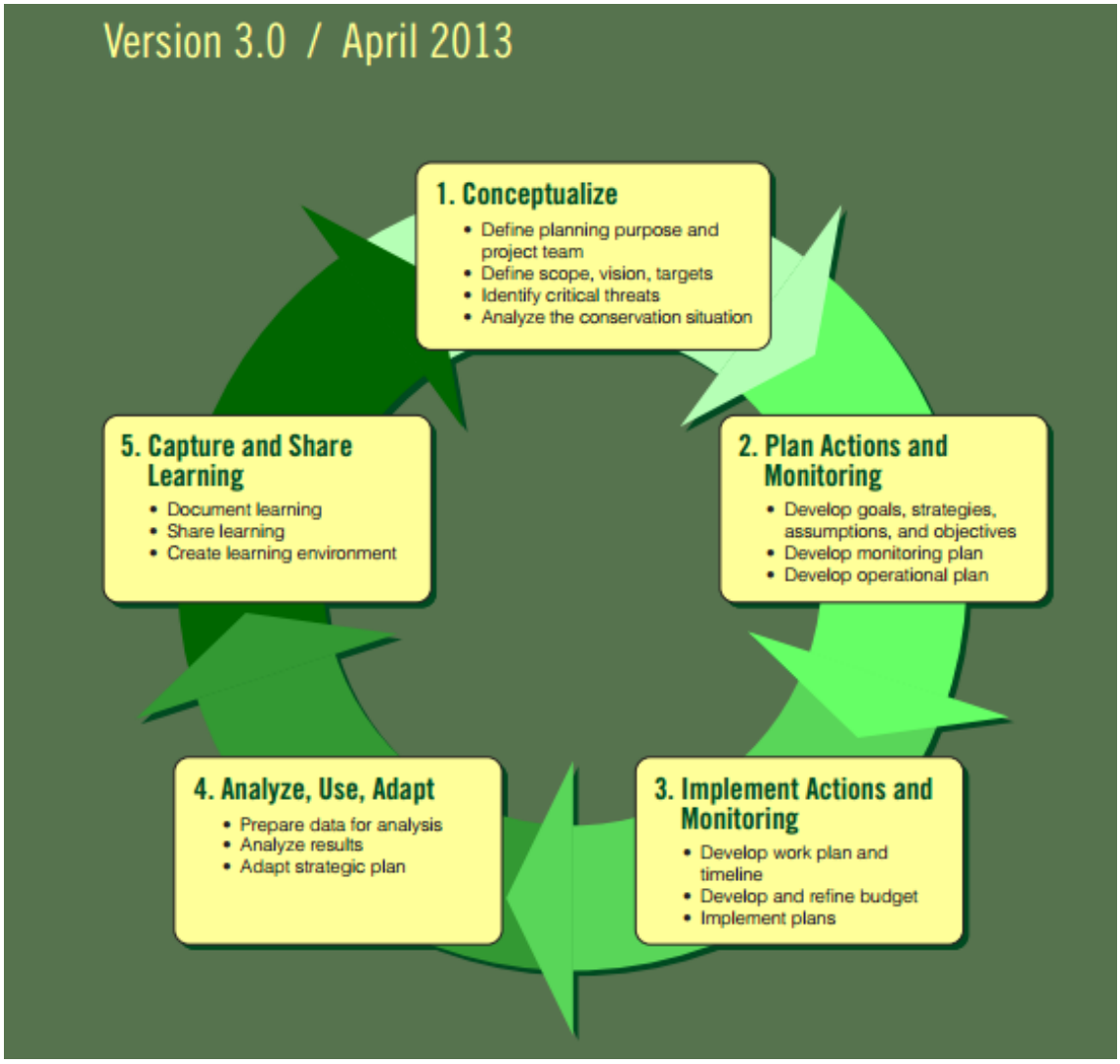

Figure 2. Conservation Measures Partnership project management cycle Version 3.0 that is the process followed in the winter strategic plan.

Step 1: Conceptualize

Define planning purpose and project team

The overall purpose of the developing a strategic plan specific to the wintering range of the AWB population was first promoted by the informal working group that formed following the initial CAP workshops in 2007. This CBBEP project evolved from those discussions within that group to consolidate information and actions that have been implemented or are in the planning stages by agencies, institutions, and nongovernmental representatives in the wintering range. Therefore, this step was already accomplished by using the Wintering Workgroup as the project team, project leader, and advisory members. The key factor that this process would bring

involved consolidating that information in a database and strategic plan that would evolve as threats were identified, actions implemented and future steps developed.

The contact list for previous working groups was used to generate an invitation list for a workshop in 2015. The list was comprised of 31 professionals in the natural resource conservation and management fields, and included four major groups: federal and state agencies, nongovernmental organizations (NGOs), and academic institutions. Federal agencies included USDA Natural Resource Conservation (2 individuals), US Fish & Wildlife – Refuge System (5), and Ecological Services (4). Texas Parks & Wildlife Department was the one state agency represented on the Winter Working Group with three individuals, and academic institutions were comprised of four universities including Texas A&M University-Corpus Christi, Sam Houston State University, Texas State University, and University of Texas Marine Science Institute with one individual each. The NGOs included Coastal Bend Bays & Estuaries Program, Inc. (2), Gulf Coast Bird Observatory (1), International Crane Foundation (2), Mission-Aransas National Estuarine Research Reserve (1), San Antonio Bay Foundation (1), San Antonio Bay Partnership (3), and The Nature Conservancy of Texas (3). Participants were asked to fill out a form to provide information of the entities' mission and involvement in Whooping Crane conservation and management, as well as that of the representative (Figure 3).

Define Scope, Vision, and Conservation Targets

The Winter Working Group convened for a workshop as one of the tasks within this project in September 2015 to define the project scope using historic, current and future maps and information for the AWB population along the coast of Texas. A vision statement was defined following the Open Standards (OS) process that the group agreed upon at that workshop. Information from the CAP 2007 process was used to guide the discussion of defining conservation targets. The group discussed the simplicity of separating the habitat type targets from population type targets.

Identify Critical Threats

The OS classification standards were also used to begin determining which threats may be impacting recovery efforts for the Whooping Crane in the wintering grounds. Since much information was located in different documents, an annotated threats classification table was developed for this project. Threats were grouped in 11 major groups (Residential & Commercial Development, Agriculture & Aquaculture, Energy Production & Mining, Transportation & Service Corridors, Biological Resource Use, Human Intrusions & Disturbance, Natural Systems Modification, Invasive & Problematic Species, Pathogens & Genes, Pollution, Geologic Events, and Climate Change. A brief list of threats was used for each group to first agree by consensus on each threat in 45 subclasses that could be applicable to Whooping Cranes in the wintering grounds, then ranked as 1-4 by the major groups. These rankings were combined into a summary sheet and compared to the rankings by the CAP 2007 group results.

WINTERING WHOOPING CRANE WINTERING GROUP PARTNERS

Meeting Location: Aransas National Wildlife Refuge Date: 11 September 2015

Type: NGO Type Name: International Crane Foundation

Division/Department: _____

Mission:

Location of Office (City): _____ **Program Coverage:** _____

Wintering Group Participant: _____

Title: _____ **Phone:** _____

Using Focus Areas listed below, list historical and current activities (how funded in parentheses) that directly affect Whooping Crane Conservation in the Wintering Range:

HP – Habitat Protection HMM – Habitat Monitoring & Maintenance HR - Habitat Restoration
HM - Habitat Management HyR - Hydrologic Restoration FWI – Freshwater Inflow
GM - *GIS Mapping*

Figure 3. Whooping Crane Winter Working Group information form used in September 2015 workshop.

Step 2: Plan Actions and Monitoring

Identifying Actions

The OS classification standards were also used to begin determining which actions have been, are being used, and may be used in the future to provide recovery benefits to the Whooping Crane. Since much information was located in different documents, an annotated actions classification table was developed for this project. A total of ten medium-level action groups (Land/Water Management, Species Management, Awareness Raising, Law Enforcement & Prosecution, Livelihood, Economic & Moral Incentives, Conservation Designation & Planning, Law & Policy, Research & Monitoring, Education & Training, and Institutional Development) within major action groups (Target Restoration/Stress Reduction, Behavioral Change / threat Reduction, and Enabling Actions) in the classification.

Information from the OS Threats and Actions classifications were combined for this project into a series of matrices by major threat level and sublevels as columns and the action levels by rows. These worksheets provide an opportunity to not only link threats with potential actions, but also to identify which threats and actions are being implemented with various members of the workgroup. Strategies from the CAP 2007 efforts were generated for all geographic goals including nesting, migration, and wintering grounds for the AWB population by each objective, actions, indicators and overall rank. While it is not in the scope of this project to achieve this step, the information will be helpful in framing the next steps for the Wintering Work Group.

One of the key purposes of adopting the CAP process for this strategic plan was not only to align and advance the work completed by the CAP 2007 but to ensure data are in the appropriate format that will be consistent with CMP Open Standards and to be imported into Miradi Software as funding is available. Therefore, worksheet templates were developed and organized by chapters including Habitat Protection, Habitat Management, Habitat Restoration and Creations, and Population Monitoring. Each worksheet includes the overall goal, objective, and strategy; then, within a matrix the direct threat is defined as a footnote followed by each major group and subgroup as a footnote to provide the user with all information needed from the OS classification definitions. The Results Chain information can be added to the worksheet as Actions by major classifications, followed by more detailed class levels for each objective defined. The steps needed to complete the strategy and by whom can be entered next on the worksheet. Finally, indicators will be developed to assess each objective, which when imported into Miradi Software will be the key information in the Report Updates.

Each step was presented to the Winter Working Group at the September workshop. As a starting point, four groups were provided with instructions and packages of colored index cards symbolizing all the components of developing chain of factors and results chain for a specific threat and associated strategy. Each group then provided a background and explanation of steps, projected timelines, and potential partners. This process will be used in future workshops to generate additional data for the strategic plan.

Finally, this process was used to show work underway for the Habitat Protection goals, objectives, and strategies. The strategy to "develop a spatial decision support tool to identify, track and guide conservation actions to protect Whooping Crane winter habitat" for the direct threat of "1. Residential & Commercial Development, 1.1 Housing & Urban Areas" using "6. Enabling Condition Actions, 6.4 Site/area planning & monitoring was developed. Additional information was generated in narrative form to provide context for the current conditions of the strategy, who is working on the actions, at what stage the projects are in, and recommendations to add to the information base to complete the strategies. Associated maps are included to show the spatial context of the where the strategies are being implemented.

Future conditions that may have an impact on habitat protection were also developed using the worksheets based on the strategy "develop a spatial decision support tool to identify, track and guide conservation actions to protect Whooping Crane winter habitat under sea-level rise scenarios" from the same direct threat and actions as above. In each strategy, colors indicating steps accomplished and those still underway provides the group with a quick assessment of the level of completion of the strategy and what work needs to be implemented. A narrative was also included providing results and associated maps and figures of the portions of the strategy completed, as well as recommendations for next steps. In addition, several quantitative, spatial metrics were defined that will improve decision-making on the locations of the habitat protection sites.

RESULTS AND DISCUSSION

Strategic plans necessarily are comprised of stated goals and objectives coupled with the appropriate steps to achieve them. However, a standardized approach to formatting the plan can organize information logically, identify missing gaps, cross-reference information with other plans, and provide metrics to measure outcomes and progress. In the field of biological conservation, a standardized approach facilitates information sharing, partnerships, and fund leveraging to achieve common goals. Our decision to follow the Conservation Measures Partnership, Open Standards (CMP 2004) is based upon the use of this framework by International Union for Conservation of Nature, The Nature Conservancy, International Crane Foundation and other organizations. Earlier workshops organized and implemented by The Nature Conservancy for the Aransas Wood Buffalo population of Whooping Cranes (TNC 2012) set the stage for this Wintering Grounds Whooping Crane Strategic Plan development.

Step 1: Conceptualize

Defining a Planning Purpose and Project Team

The Project Team was defined as the informal Wintering Work Group members who have been meeting annually for several years. The team is comprised of federal and state agencies, nongovernmental organizations, and academic institutions whose scope includes management and recovery of the endangered Whooping Crane. Tim Anderson, Private Lands Biologist, U.S. Fish & Wildlife Service, Corpus Christi Field Office, has consistently organized the annual meetings and promoted the formalization of developing a Winter Grounds Strategic Plan. Liz Smith, Whooping Crane Conservation Biologist and Director of the Texas Program for the International Crane Foundation provided match for her time in developing the first version of the Plan and advancing the information into the CMP Open Standards framework. This Plan constitutes a working document upon which the Wintering Work Group can continue to review, add to, and evaluate progress of conservation efforts in this sector of the AWB population's geographic range.

Defining Scope, Vision, and Conservation Targets. – The Wintering Work Group met in September 2015 at the Aransas National Wildlife Refuge to overview the CMP Open Standard process, and develop these primary components of the Strategic Plan (Figure 4). The following outputs will be refined in the final plan submitted in January 2016.

- Brief description of the project scope – defines the broad parameters of the project
- If appropriate, a map of the project area (GIS file or hand sketch)
- Vision statement for the project – the ultimate state or condition the project is working to achieve
- Selection of conservation targets, including a brief explanation of why were chosen, and if appropriate, a description and/or map showing each target's location. – specific biodiversity species, ecosystems, or ecological processes chosen to represent the overall biodiversity of a site or the focus of a thematic project
- Description of the status of each priority conservation target

Project Scope: Wintering Range of AWB Whooping Crane

Vision: Full Recovery of the AWB Whooping Crane Population

Conservation Target (Species-specific): AWB Whooping Crane

Goal: Achieve an interim population of 1,000 Whooping Cranes and 250 pair for downlisting

Conservation Target (Habitat/Ecosystem Specific): Texas Coastal Marsh and adjacent upland coastal prairie/palustrine marsh habitat

Goal: Protect and manage 125,000 ac Texas Coastal Marsh and 375,000 coastal prairie/palustrine habitat to support 1,000 AWB Whooping Cranes

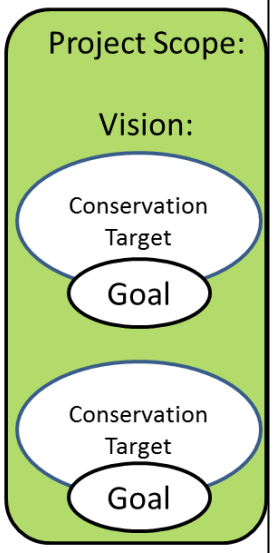

Figure 4. Scope, vision, and conservation target defined by Winter Working Group members at September 2015 meeting.

Identifying Critical Threats. – Preparation for this step included creating an annotated threats table for use in the workshop(s) and subsequent strategy development (Appendix A). A brief threats table and scoring sheet was used to identify those threats that are impacting the recovery of AWB Whooping Crane in the wintering range (Appendix B). The four groups participating in the September 2015 meeting independently discussed and each threat at the sublevel, then ranked (1 to 3) the threats at the primary level (Table 1). Of the 43 sublevel classification, at least one group identified 37 threats that have some impact. Of those, 12 were listed by all four groups, including: Housing & urban area development, Oil & gas drilling, Utility & service lines, Hunting & collecting terrestrial animals, Fishing & harvesting aquatic resources, Dams & water management/use, Invasive non-native/alien species plants & animals, Problematic native plants & animals, Garbage & solid waste, Ecosystem encroachment, Changes in temperature regimes, and Changes in precipitation & broad scale hydrological regimes. Seven of the eleven threats at the primary were ranked at least once by a group, and the following ranked highest among groups: Residential & Commercial Development, Invasive & Problematic Species, Pathogens & Genes, Climate Change, and Natural Systems Modifications. Ranking from the CAP (2012) process are also summarized, and generally align with the more recent evaluation. The following outputs will be refined in the final plan submitted in January 2016:

- *Identification of direct threats and if appropriate, a map showing the spatial footprint for each threat.*
- *Threat assessment (scope, extent, severity, permanence/irreversibility, urgency)*

Table 1. Threat classification ranking from Winter Working Group meeting in September 2015 and Conservation Action Plan winter workshop in 2009. All group ranks are listed in order (1-4) for major headings only.

Threats	All Group Ranks	1	2	3	4	CAP
1. Residential & Commercial Development	0,1,1,0					
1.1 Housing & urban areas		x	x	x	x	high
1.2 Commercial & industrial areas			x	x	x	high
1.3 Tourism & recreation areas			x	x	x	
2. Agriculture & Aquaculture						
2.1 Annual & perennial non-timber crops			x	x		
2.2 Wood & pulp plantations						
2.3 Livestock farming & ranching			x	x	x	
2.4 Marine & freshwater aquaculture		x				
3. Energy Production & Mining	0,0,0,1					
3.1 Oil & gas drilling		x	x	x	x	med
3.2 Mining & quarrying						
3.3 Renewable energy		x		x	x	
4. Transportation & Service Corridors	3,0,2,0					
4.1 Roads & railroads			x	x	x	
4.2 Utility & service lines		x	x	x	x	
4.3 Shipping lanes			x	x	x	high
4.4 Flight paths		x		x	x	
5. Biological Resource Use						
5.1 Hunting & collecting terrestrial animals		x	x	x	x	
5.2 Gathering terrestrial plants						
5.3 Logging & wood harvesting						
~~5.4 Valuation of / Payments for Ecosystems Services~~ (error in classification scheme)						
5.5 Fishing & harvesting aquatic resources		x	x	x	x	
6. Human Intrusions & Disturbance						
6.1 Recreational activities		x	x			Low
6.2 War, civil unrest & military exercises				x		
6.3 Work & other activities			x	x	x	
7. Natural Systems Modifications	0,0,2,1					
7.1 Fire & fire suppression			x	x	x	
7.2 Dams & water management/use		x	x	x	x	high

Threats	All Group Ranks	1	2	3	4	CAP
7.3 Other ecosystem modifications			x	x	x	
7.4 Removing/reducing human maintenance			x	x	x	
8. Invasive & Problematic Species, Pathogens & Genes	1,1,0,0					
8.1 Invasive non-native/alien species plants & animals		x	x	x	x	Med
8.2 Problematic native plants & animals		x	x	x	x	Med
8.3 Introduced genetic material		x				
8.4 Pathogens & microbes					x	
9. Pollution	0,0,2,0					
9.1 Household sewage & urban waste water			x	x	x	Med
9.2 Industrial & military effluents				x		Med
9.3 Agricultural & forestry effluents			x	x	x	Med
9.4 Garbage & solid waste		x	x	x	x	
9.5 Air-borne pollutants				x		
9.6 Excess energy				x		
10. Geological Events						
10.1 Volcanoes						
10.2 Earthquakes/tsunamis						
10.3 Avalanches/landslides						
11. Climate Change	2,1,0,3					*high
11.1 Ecosystem encroachment		x	x	x	x	
11.2 Changes in geochemical regimes				x		
11.3 Changes in temperature regimes		x	x	x	x	
11.4 Changes in precipitation & broad scale hydrological regimes		x	x	x	x	
11.5 Severe/extreme weather events		x		x	x	

*listed an indirect effect of "climate-influenced habitat modification"

Key threats for the entire range including wintering habitat were also summarized from CAP tables (CAP 2012) and common taxonomy updated to crosswalk actual threats defined by the winter workgroup in 2009 (Table 2). Dams and Water Management Use scored highest followed by Habitat Shifting & Alteration, Housing and Urban Areas, and Shipping Lanes scored as high.

Table 2. CAP 2007 threat ranking results with updated IUCN Threat classification for all range areas and crane biology.

Threats Across Targets	Common Taxonomy Threat Name (IUCN 2014)	Wintering Habitat	Winter Range Habitat Expansion	Migration Corridor Habitat (including staging	Habitat-Crane Breeding	Crane Biology Knowledge Gaps (4 geographies)	Overall Threat Rank
Project-specific threats		1	2	3	4	5	
water management and use	7.2 Dams & Water Management/Use	Very High	Very High	High	Low		Very High
climate influenced habitat modification	Habitat Shifting & Alteration (old)	High	Very High	High	Low		High
human development and infrastructure footprint	1.1 Housing & Urban Areas	High	Very High			Low	High
windfarms and powerlines	4.2 Utility & Service Lines		High	High		High	High
water pollution	9.2 Industrial & Military Effluents	Medium	High	High		Medium	High
invasive species	8.1 Invasive Non-Native/Alien Species Plants & Animals	Medium	High	High			High
intercoastal waterway management (wash, erosion()	4.3 Shipping Lanes	High	High				High
energy development (petroleum)	3.1 Oil & Gas Drilling	Medium	High				Medium
mining & Quarrying in staging/breeding grounds	3.2 Mining & Quarrying			High	Low		Medium
change in crops/cropping pattern	2.1 Annual & Perennial Non-Timber Crops			High			Medium
active human disturbance	6.1 Recreational Activities	Low		Medium		Low	Low
blue crab recruitment near wintering grounds	(none in TNC CAP 1) 5.5 Fishing & Harvesting Aquatic Resources					Medium	Low
lack of comprehensive wetland inventory through flyway	(none in TNC CAP 1)					Medium	Low
mortality and/or sub-lethal injury	8.2 Problematic Native Species (also other threats)					Medium	Low
wetland management incompatible to WHCR use (analysis needed)	7.3 Other Ecosystem Modifications					Low	Low
Threat Status for Targets and Project		Very High	Very High	Very High	Low	Medium	Very High

Step 2: Plan Actions and Monitoring

Identifying Actions. – A brief actions classification was developed to identify those actions that are positively affecting the recovery of AWB Whooping Crane in the wintering range (Appendix C).An annotated actions classification table was developed for use in workshops and planning (Appendix D). Individual worksheets were constructed as matrix tables by threat level and sublevels to be used by Winter Working Group members representing various conservation entities to identify their respective activities in relation to this Plan's scope, goals, and conservation targets (Appendix E). These data are then used to further develop concise strategies in response to direct and indirect threats with associated objectives, steps, timeline, and partners.

The Strategies defined with TNC Whooper CAP 1 process (2007) are listed for all areas within the nesting, migration, and wintering areas of the AWB population (Appendix F), organized by Objective with Strategic Actions with Steps, Indicators, and Overall Rank. Nesting and Migration information is included to review by Wintering Group for potential overlap and inclusion in the Wintering Strategic Plan. Wintering objectives and associated strategies will be realigned with updated CAP Actions and summary tables to be included in appropriate chapters in this Plan. Those actions that were designated with a High or Very High Rank will be expanded to include current information and strategies.

It is important to standardize the process for the wintering habitat of AWB Whooping Cranes, as well as update to current CMP Open Standards, and newer versions of Miradi Software. Individual worksheets organized by the threats classification were developed to standardize this information in a format consistent with CMP Open Standards and inclusion in Miradi Software at a later date (Appendix G). As the strategies and associated information are developed, these forms will be inserted into this Plan by chapter: Habitat Protection, Habitat Management, Habitat Restoration and Creation, and Population Monitoring.

Habitat Protection

The Whooping Crane Winter Working Group's habitat protection goal is to prevent terminal threats, such as incompatible development, from destroying Whooping Crane wintering habitat to the point that habitat adequate to winter 1,000 Whooping Crane would no longer be available under varisou sea-level rise scenarios. We estimate that accomplishing this goal will entail protecting Whooping Crane habitat threats, such as disturbance, woody encroachment, etc. will be addressed in the habitat management chapter.

A primary focus on habitat protection will achieve the overall Goal: *Protect and manage winter range habitat in Texas to support a fully recovered AWB Whooping Crane population* and the associated Habitat/Ecosystem Specific Objective: *Protect and manage at least 125,000 acres of Texas coastal marsh and 300,000 acres of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Cranes by 20XX (TBD).* The first quantitative step to determine how much existing habitat is available around the core wintering habitat of AWB Whooping Crane entails implementing the following strategy:

STRATEGY: Develop a spatial decision support tool to identify, track and guide conservation actions to protect WHCR winter habitat

CHAIN OF FACTORS			
Direct Threat[a]	**Indirect Threat**	**Opportunity**	**Strategy**
1. Residential & Commercial Development[a]			
1.1 Housing & Urban Areas[b]			
RESULTS CHAIN			
6. Enabling Condition Actions[c]			
6.4 Site/area planning & monitoring[d]			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
A spatial (GIS) decision support tool is created for assessment and planning and monitoring progress	A spatial (GIS) decision support tool is created for assessment and planning and monitoring progress	Identify current protected/unprotected WHCR habitat areas are identified	WHCR winter habitat is identified and quantified within general winter range boundaries and unprotected areas are identified for conservation action
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Develop a spatial decision support tool that identifies and quantifies all protected areas in the current wintering range by 2014	Define spatial coverage of wintering WHCR habitat by land use/land cover, proximity of cover types, extent with available WHCR survey data by 2014	Construct a spatial layer in model that identifies and describes current protected areas by location, landowner, type of conservation strategy, and extent by 2014	Identify where WHCR winter habitat is located in the winter range, where habitat has been protected, where protection is needed, identify funding/opportunity to protect 125,000 ac of coastal marsh and

			300,000 ac coastal prairie/marsh by 20XX
Steps	**Steps**	**Steps**	**Steps**
1 Develop a spatial support tool in GIS with available data that incorporates wetland, aquatic, and upland habitats in current and adjacent winter range	1 Identify and assign use ranks to land use/land cover types to define habitat for wintering WHCR and parameterize habitat type model	1 Request spatial data from agencies and organizations who have land holdings and easements within the current and adjacent winter range	1
Action from LCC to partners (ICF, GCBO, TAMU-CC, MANERR) (FWS-I&M)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from
2 Refine model with new, updated land cover data	2 Construct spatial map with ranked habitat use types for current and adjacent winter range	2 Construct spatial layer that can be updated in model and quantify extent by type and landowner	2
Action from FWS-I&M, TPW, TAMUG, ICF, TAMU-CC	Action from LCC to partners (ICF, GCBO, TAMU-CC, MANERR) (FWS-I&M)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from
3	3	3 Update model as land is conserved and provide updated maps and spatial information to conservation partners	3
Action from	Action from	Action from ICF and FWS	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] human settlements or other non-agricultural land uses with a substantial footprint
[b] human cities, towns, and settlements including non-housing development typically integrated with housing; ex. urban areas, suburbs, villages, vacation homes, shopping areas, offices, schools, hospitals
[c] actions to legally or formally protect sites and/or species
[d] general planning and monitoring of public or private parks, reserves and other protected areas (roughly equivalent to IUCN Categories I-VI); ex. Developing a site plan, conducting monitoring or adaptive management

Current Conditions. - At least two separate efforts to quantify the amount of available habitat in the wintering range at which the Aransas National Wildlife Refuge Complex is at the core were initiated and one study completed with data available in 2014 (Smith et al. 2014). The entire report can be accessed at http://gulfcoastprairielcc.org/science/science-projects/studying-the-effects-of-sea-level-rise-in-coastal-texas/ and GIS data downloaded at http://gcplcc.databasin.org/galleries/a07c7fc35c2845adb635e14c33b8b2ca . The project area

encompassed three coastal basins, and extended inland to a elevational limit that would be impacted by a hypothetical Category 5 tropical storm making landfall in the center of the winter range. The GIS dataset that was composited from three sources to obtain the best upland, wetland, and aquatic habitat types was used to determine that ~91,000 acres of estuarine marsh were currently available as potential habitat for wintering Whooping Cranes, and coastal prairie and palustrine marsh adjacent to the coast (Figure 5). According to these estimates, insufficient amounts of estuarine marsh are available within the project's study area; in order to ensure that enough habitat is available for the downlisting goal, the study area will need to be expanded to additional coastal basins to the southwest and northeast of Texas. A separate study has been initiated and data are being refined that includes a larger project area, and preliminary results indicated that potential estuarine and adjacent coastal prairie/palustrine marsh are currently available for potential use by wintering AWB Whooping Cranes as their population numbers increase (Metzger et al. 2014).

To address the amount of existing habitat that is currently protected,in the former study (Smith et al. 2014) quantified that about 24,000 acres are under some type of protection mechanism (permanent acquisition by a conservation entity, or permanent conservation easement) (Figure 6). Since the completion of the project, an additional 3,000 acres have been secured as well as announcement of a significant conservation acquisition in Matagorda Bay System that will add another ~6,000 acres from funding provided by the RESTORE Act projects. Much of the protected lands are within contiguous blocks on the Aransas National Wildlife Refuge, although a significant amount of current use is located on adjacent barrier habitat (Figure 7).

To ensure the data used are best available, several recommendations have been made to refine the habitat models and ensure the available habitat are in optimum condition (Smith et al. 2014):

- Groundtruth the estuarine marsh classes to define high (irregularly flooded) and low (regularly flooded) habitat to improve accuracy of habitat type classes
- Groundtruth bay bathymetry data to improve accuracy of shallow bay habitat type classes
- Groundtruth the grassland classes to differentiate between native (heterogeneous prairie species) and managed (monoculture species) habitat to improve accuracy of habitat type classes
- Groundtruth the palustrine water modifiers to determine wetland bathymetry for prioritizing enhancement sites for dietary drinking water for wintering Whooping Cranes

Continued maintenance and updating of the conserved lands layers will be necessary to ensure up-to-date accounting for use as quantitative strategy indicator metric.

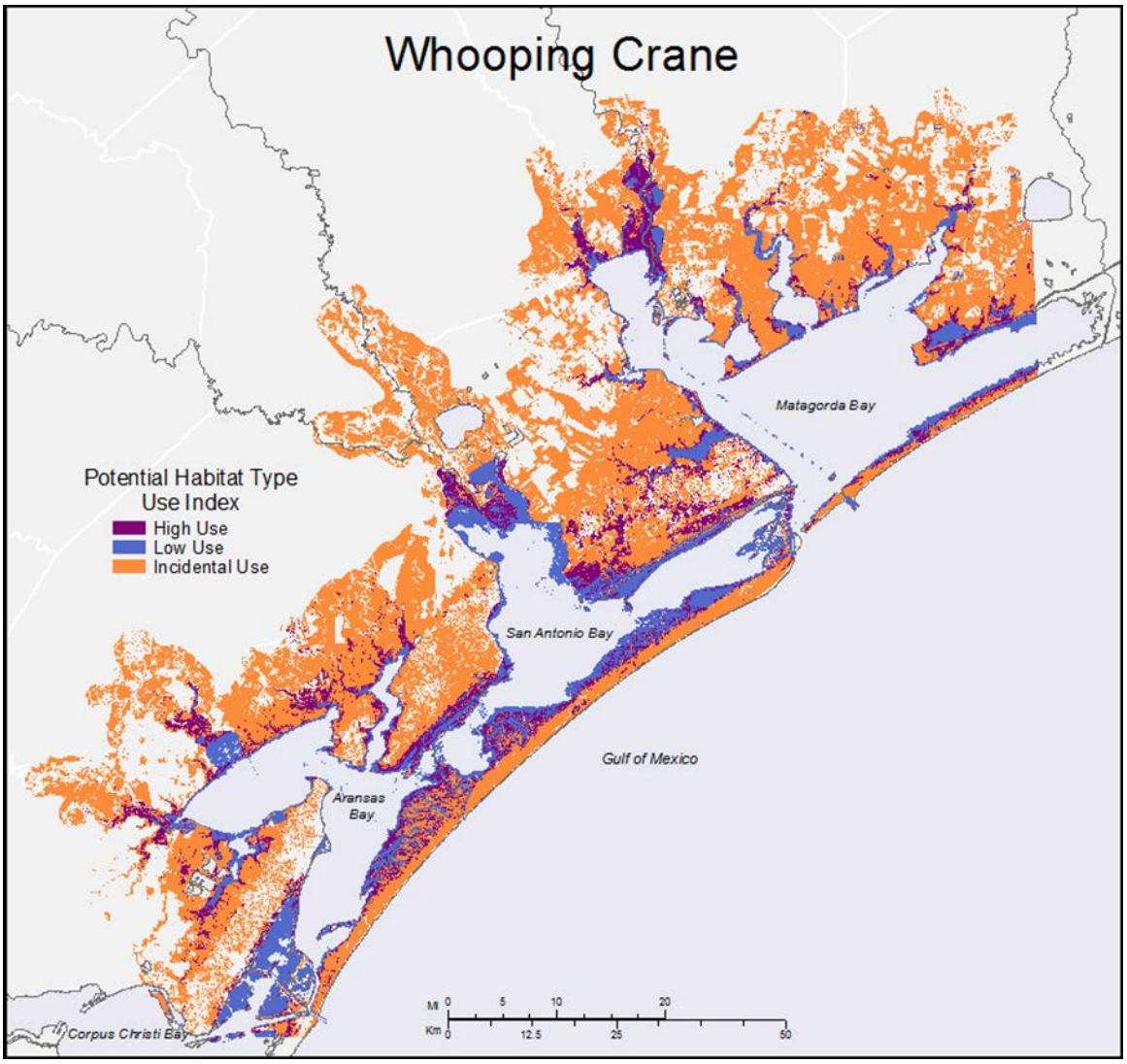

Figure 5. Potential habitat available for wintering Whooping Cranes delineated by High (primarily estuarine vegetated marsh and flats), Low (primarily shallow seagrass and unvegetated bottom), and Incidental (primarily coastal prairie, palustrine marsh) Use categories (Smith et al. 2014).

Ducks Unlimited (Wetlands America Trust)
Guadalupe-Blanco River Trust
Mission National Estuarine Research Reserve
Natural Resource Conservation Service
Texas Parks & Wildlife Department
The Nature Conservancy
US Fish and Wildlife Service

Protected lands were identified using online data from the Nature Conservancy, National Gap Analysis Program (USGS), and Natural Resource Conservation Service (USDA) as well as data provided by US Fish & Wildlife Service, Texas Parks & Wildlife Department and the Coastal Bend Bays & Estuaries Program

Adapted from Smith, E.H. et al. 2014. Employing the Conservation Design Approach on Sea-Level Rise Impacts on Coastal Avian Habitats along the Central Texas Coast

#	Name	Manager	Acres
1	Fennessey Ranch	Mission-Aransas NERR	3,458
2	Welder Flats	Natural Resources Conservation Service	12,280
3	Big Tree Ranch	Texas Parks & Wildlife Department	79
4	GBRT Preserve	Guadalupe-Blanco River Trust	143
5	GBRT Preserve	Guadalupe-Blanco River Trust	616
6	GBRT Preserve	Guadalupe-Blanco River Trust	18
7	GBRT Preserve	Guadalupe-Blanco River Trust	18
8	Guadalupe Delta GBRT	Guadalupe-Blanco River Trust	70
9	Mad Island Marsh Preserve	The Nature Conservancy	6,976
10	Guadalupe Delta Wildlife Management Area	Texas Parks & Wildlife Department	5,993
11	Mad Island Wildlife Management Area	Texas Parks & Wildlife Department	7,172
12	Goose Island State Park	Texas Parks & Wildlife Department	233
13	McFaddin WRP	Natural Resources Conservation Service	4,849
14	Aransas National Wildlife Refuge	US Fish & Wildlife Service	114,815
15	Redfish Point Joint Venture	Ducks Unlimited (Wetlands America Trust)	87
16	Mad Island DU	Ducks Unlimited (Wetlands America Trust)	164
17	Aransas Complex - Johnson Ranch	The Nature Conservancy	517
18	Welder Flats	The Nature Conservancy	2,124
19	Holiday Beach	Coastal Bend Bays & Estuaries Program	178
20	Powderhorn Ranch	Texas Parks & Wildlife Foundation	17,351
21-23	Guadalupe Delta WRP	Natural Resources Conservation Service	681
24-27	Guadalupe Delta WRP	Natural Resources Conservation Service	798
		Total Protected Land	178,620

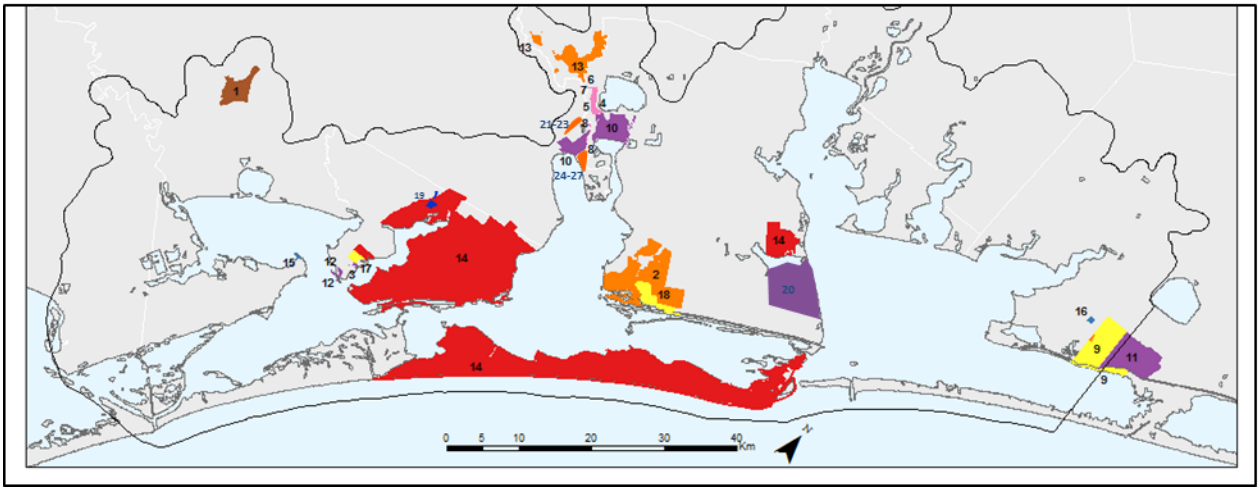

Figure 6. Conserved lands within the wintering range of Whooping Crane by end of 2015 (updated from Smith et al. 2014).

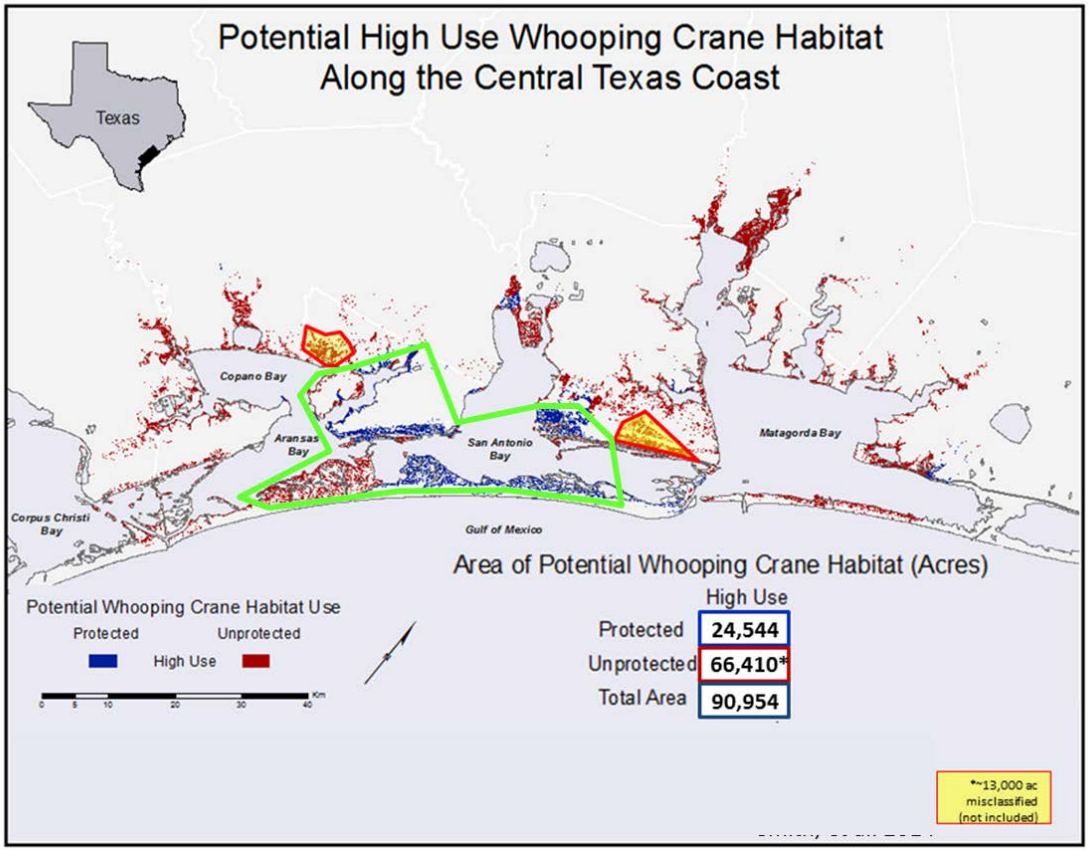

Figure 7. Areas of high use habitat types that could be potentially used by Whooping Cranes (Smith et al. 2014). An additional 3,000 acres have been conserved in 2014-2015.

Future Conditions. - Sea-level rise is an ongoing phenomenon worldwide and is affecting coastal environments at varying rates that are dependent upon local and regional processes. While most emphasis has targeted the impacts to built communities, less focus has been directed on changes that sea-level rise will have on natural communities and shifts in coastal habitats and ecosystems. Within the wintering range of AWB Whooping Cranes, average sea-level as measured at the Rockport, Texas, gauge has riseon 4.6 mm/year since 1948, due to a combination of absolute sea-level rise and local land subsidence (Montagna et al. 2007, Snay et al. 2007). The project sea-level rise from 2000 to 2100 is estimated to be between 0.46 to 0.87 m (Montagna et al. 2007). Whooping crane wintering habitats are being affected not just from estuarine marsh loss but also habitat loss that is continuing to occur as low-lying uplands are developed, precluding the ability of estuarine habitats to develop as sea levels rise. The next quantitative step to determine how much habitat will be available as sea-levels rise within the current and future wintering habitat of AWB Whooping Crane entails implementing the following strategy:

STRATEGY: Develop a spatial decision support tool to identify, track and guide conservation actions to protect WHCR winter habitat under sea-level rise scenarios

CHAIN OF FACTORS			
Direct Threat[a]	**Indirect Threat**	**Opportunity**	**Strategy**
1. Residential & Commercial Development[a]			
1.1 Housing & Urban Areas[b]			
RESULTS CHAIN			
6. Enabling Condition Actions[c]			
6.4 Site/area planning & monitoring[d]			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
A spatial (GIS) decision support tool that models sea-level rise impacts on habitat is created	A spatial (GIS) decision support tool is created for identify future locations of potential wintering habitat for conservation prioritization	Identify current protected/unprotected WHCR habitat areas are identified	Future WHCR winter habitat is identified and quantified within general winter range boundaries and unprotected areas are identified for conservation action
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Develop a spatial decision support tool that quantifies changes in potential habitat availability from sea-level rise by 2014	Quantify spatial coverage of wintering WHCR habitat by land use/land cover, proximity of cover types, in relation to gains and losses of habitat under 1-m and 2-m sea-level rise scenarios	Using a spatial layer in model that identifies and describes current protected areas by location, landowner, type of conservation strategy, and extent in current habitat strategy identify where new wintering habitat will be protected/unprotected by 2014	Identify where WHCR winter habitat will be located in the winter range as sea levels rise, where habitat has been protected, where protection is needed, identify funding/opportunity to protect 125,000 ac of coastal marsh and 300,000 ac coastal prairie/marsh by 20XX
Steps	**Steps**	**Steps**	**Steps**
1 Develop a spatial support tool in GIS using Sea Level Affecting Marshes model that incorporates wetland, aquatic, and upland habitats in current and adjacent winter range	1 Use model output to identify areas where substantial future habitat for wintering cranes will be located	1 Using spatial data from agencies and organizations who have land holdings and easements within the current and adjacent winter range overlay new habitat areas from sea-level rise models	1
Action from LCC to partners (ICF, GCBO, TAMU-CC, MANERR) (FWS-I&M)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from
2 Refine model with new, updated land cover data	2 Construct spatial map with ranked habitat use	2 Construct spatial layer showing future wintering	2

and more detailed elevation data	types for current and adjacent winter range	that can be updated in model and quantify extent by type and landowner	
Action from FWS-I&M, TPW, TAMUG, ICF, TAMU-CC	Action from LCC to partners (ICF, GCBO, TAMU-CC, MANERR) (FWS-I&M)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from
3	3	3 Update model as land is conserved and provide updated maps and spatial information to conservation partners	3
Action from	Action from	Action from ICF and FWS	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] human settlements or other non-agricultural land uses with a substantial footprint
[b] human cities, towns, and settlements including non-housing development typically integrated with housing; ex. urban areas, suburbs, villages, vacation homes, shopping areas, offices, schools, hospitals
[c] actions to legally or formally protect sites and/or species
[d] general planning and monitoring of public or private parks, reserves and other protected areas (roughly equivalent to IUCN Categories I-VI); ex. Developing a site plan, conducting monitoring or adaptive management

At least two separate efforts have been initiated to quantify the amount of habitat that will potentially remain in the wintering range modeling the changes that may occur under various sea-level rise scenarios and one study was completed with data available in 2014 (Smith et al. 2014). The entire report can be accessed at http://gulfcoastprairielcc.org/science/science-projects/studying-the-effects-of-sea-level-rise-in-coastal-texas/ and GIS data downloaded at http://gcplcc.databasin.org/galleries/a07c7fc35c2845adb635e14c33b8b2ca . The project area encompassed three coastal basins, and extended inland to an elevational limit that would be impacted by a hypothetical Category 5 tropical storm making landfall in the center of the winter range.

Under a projected sea level rise of 1 m (3 ft), loss of about 50% is predicted for coastal marsh habitat in project area; at 2 m (6 ft), about 25% is regained through additional flooding of low-lying areas (Figure 8). Habitat losses are evident on the barrier islands under lower sea-level rise scenarios (Figure 9). Key areas can be defined where potential habitat occurs in initial conditions and potential habitat for Whooping Cranes shift along an elevational gradient.

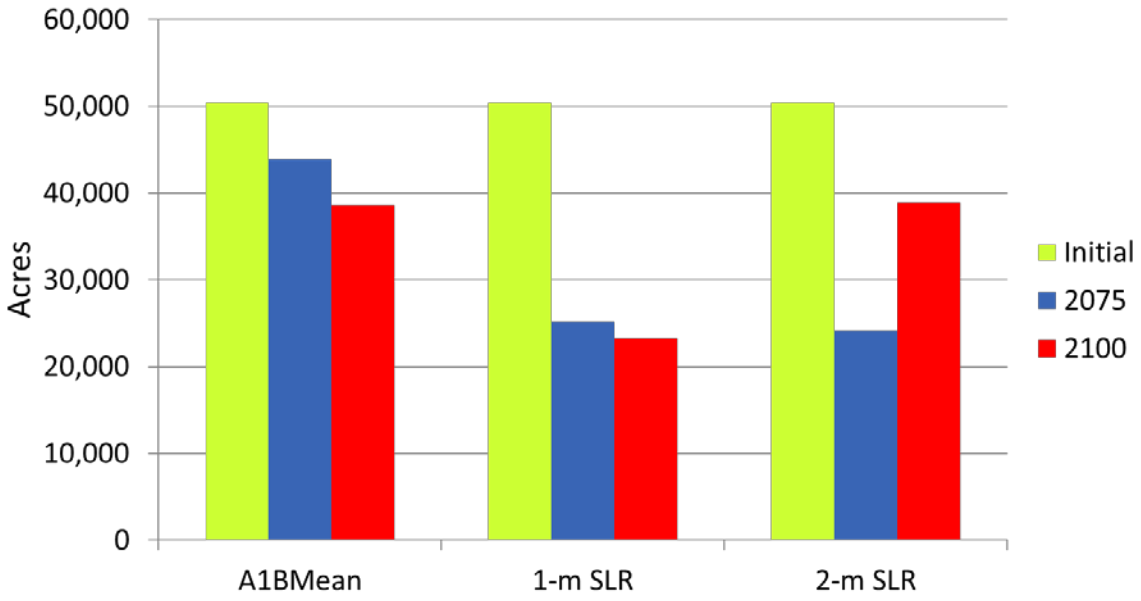

Figure 8. Changes in high-use (primarily estuarine marsh and flats) in response to various sea-level rise scenarios in the wintering range of AWB Whooping Crane (Smith et al. 2014); A1BMean corresponds to 0.37-m SLR.

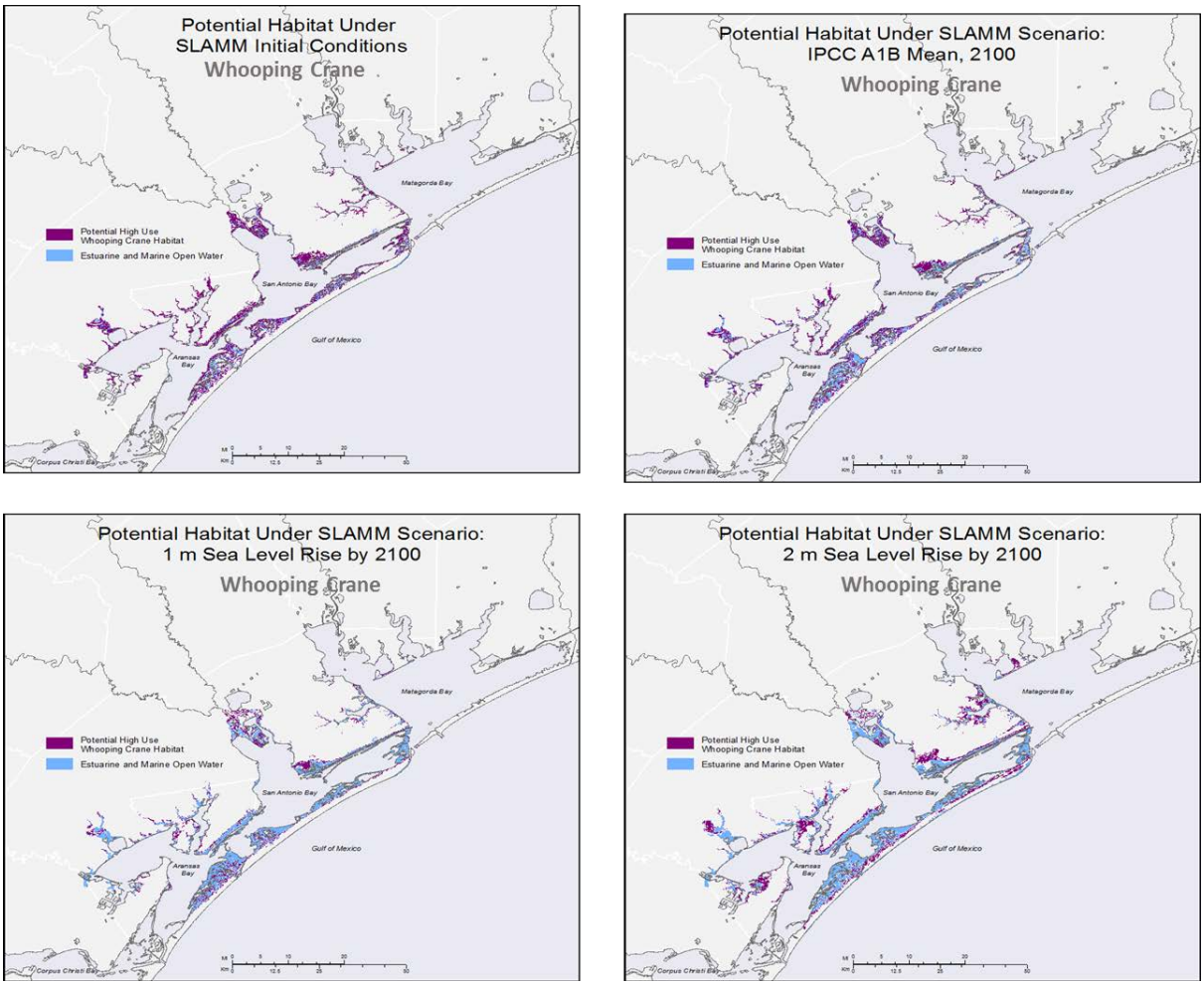

Figure 9. Changes in habitat availability for wintering Whooping Cranes under three sea-level rise scenarios (Smith et al. 2014).

To ensure the data used are best available, several recommendations have been made to refine the sea-level rise models condition (Smith et al. 2014):

- Groundtruth the estuarine marsh classes to define high (irregularly flooded) and low (regularly flooded) habitat to improve accuracy of habitat type classes
- Groundtruth bay bathymetry data to improve accuracy of shallow bay habitat type classes
- Develop more accurate elevation data that improves sub-meter measurements

Continued maintenance and updating of the conserved lands layers will be necessary to ensure up-to-date accounting for use as quantitative strategy indicator metric.

Habitat Prioritization. - Several factors should be considered when evaluating where conservation areas should be focused. Developing habitat use metrics based on crane use, behavior, and social organization is also critical. Cultivating ongoing dialogues with private landowners whose lands have been identified as supporting or potentially supporting wintering Whooping Cranes is also essential. The location of potential habitat on the coastal landscape and its proximity to potential threats is very important to consider as well. The following approaches have been recommended to develop a strategic approach to Whooping Crane habitat protection (T. Anderson, pers. comm.):

- Crane use – prioritize protecting wintering habitat with the most crane use
- Patch size – prioritize protecting the largest wintering habitat and potential habitat patches
- Proximity to other habitat/potential habitat patches – prioritize protecting wintering habitat and potential habitat patches closest to largest protected wintering habitat and potential habitat patches with highest crane use
- Distance from fresh water - prioritize protecting wintering habitat and potential habitat patches closest to fresh water sources for use by Whooping Cranes during drought periods
- Distance from disturbance – prioritize wintering habitat and potential wintering habitat patches farthest from disturbance sources
- Development threat – prioritize protecting wintering habitat and potential habitat patches development threatens most immanently
- Ownership Fragmentation – prioritize protecting wintering habitat and potential habitat patches with least fragmented ownership. One such approach could be to consider a habitat patch with fewer owners per area unit to be less ownership-fragmented.
- Protection Cost – prioritize protecting wintering habitat and potential habitat patches with the lowest cost-per-acre
- Habitat management cost – prioritize protecting wintering habitat and potential habitat patches with the lowest management cost-per-acre. For example, how can habitat management (restoration, enhancement, and maintenance) costs be estimated as a metric

RECOMMENDATIONS

Following the customized processes, classifications, and forms developed within this report, the Whooping Crane Winter Working Group can meet virtually or in groups to input information into the forms, identify gaps, and coordinate efforts in a more efficient manner. In the beginning, a facilitator may be necessary to handle the technical aspects of the data entry to prevent the new process from limiting productivity. So many examples around the world in the conservation community are using the these approaches and recommend the start-up time needed. This project has achieved many of those challenges, as well as provided training for one of the Winter Working Group members (E. Smith) to help facilitate the process and train a volunteer or intern to assist members.

Several avenues are available to mine information and data from to populate the next version of the Plan, including: Whooping Crane International Recovery Plan, state plans, agency initiatives, and nongovernmental organization work plans. In addition, strategies that have been completed can be imported as well to develop a historic timeline, which is helpful when judging relative successes, time already expended to achieve success and the funding provided to support the strategies. The information within the plan can be used to develop new proposals, collaboration on related strategies, and identification of research and monitoring needs for science-based decisions.

A virtual location to house the succeeding versions of the Plan is necessary to maintain a "living document" status. The International Recovery Team should be updated on the Plan to help them make decisions and recommendations to agencies. Finally, many of the strategies require extensive input from local citizens and governments, special interest groups, and policy makers. An entire section within the CMP guidance documents provides guidance documents to integrate the societal components, with an emphasis on human wellbeing, ecosystem services, and key relationship. For more information, access the CMP website at: http://www.conservationmeasures.org/ for the *Addressing Social Results and Human Wellbeing Targets in Conservation Projects* Draft Guidance document.

Appendix A. Threats classification http://cmp-openstandards.org/beta-versions-of-the-iucn-cmp-threats-and-actions-classifications-available/

1. Residential & Commercial Development		human settlements or other non-agricultural land uses with a substantial footprint
1.1 Housing & urban areas		human cities, towns, and settlements including non-housing development typically integrated with housing
1.2 Commercial & industrial areas		factories and other commercial centers
1.3 Tourism & recreation areas		tourism and recreation sites with a substantial footprint
2. Agriculture & Aquaculture		threats from farming and ranching as a result of agricultural expansion, intensification or practices; includes silviculture, mariculture and aquaculture
2.1 Annual & perennial non-timber crops		crops planted for food, fodder, fiber, fuel, or other uses
2.2 Wood & pulp plantations		stands of trees planted for timber or fiber outside of natural forests, often with non-native species
2.3 Livestock farming & ranching		domestic terrestrial animals raised in one location on farmed or non-local resources (farming); also domestic or semi-domesticated animals allowed to roam in the wild and supported by natural habitats (ranching)
2.4 Marine & freshwater aquaculture		aquatic animals raised in one location on farmed or non-local resources; also hatchery fish allowed to roam in the wild
3. Energy Production & Mining		threats from production of non-biological resources
3.1 Oil & gas drilling		exploring for, developing, and producing petroleum and other liquid hydrocarbons
3.2 Mining & quarrying		exploring for, developing, and producing minerals and rocks
3.3 Renewable energy		exploring, developing, and producing renewable energy
4. Transportation & Service Corridors		threats from long, narrow transport corridors and the vehicles that use them including associated wildlife mortality
4.1 Roads & railroads		surface transport on roadways and dedicated tracks
4.2 Utility & service lines		transport of energy & resources
4.3 Shipping lanes		transport on and in freshwater and ocean waterways
4.4 Flight paths		air and space transport

Commented [cm1]: urban areas, suburbs, villages, vacation homes, shopping areas, offices, schools, hospitals

Commented [cm2]: manufacturing plants, shopping centers, office parks, military bases, power plants, train & ship yards, airports

Commented [cm3]: ski areas, golf courses, beach resorts, cricket fields, county parks, campgrounds

Commented [cm4]: farms, household swidden plots, plantations, orchards, vineyards, mixed agroforestry systems

Commented [cm5]: teak or eucalyptus plantations, silviculture, christmas tree farms

Commented [cm6]: cattle feed lots, dairy farms, cattle ranching, chicken farms, goat, camel, or yak herding

Commented [cm7]: shrimp or fin fish aquaculture, fish ponds on farms, hatchery salmon, seeded shellfish beds, artificial algal beds

Commented [cm8]: oil wells, deep sea natural gas drilling

Commented [cm9]: coal mines, alluvial gold panning, gold mines, rock quarries, coral mining, deep sea nodules, guano harvesting

Commented [cm10]: geothermal power production, solar farms, wind farms (including birds or bats flying into windmills), tidal farms

Commented [cm11]: highways, secondary roads, logging roads, bridges & causeways, road kill, fencing associated with roads, railroads

Commented [cm12]: electrical & phone wires, aqueducts, oil & gas pipelines, electrocution of wildlife

Commented [cm13]: dredging, canals, shipping lanes, ships running into whales, wakes from cargo ships

Commented [cm14]: flight paths, jets impacting birds

5. Biological Resource Use		threats from consumptive use of "wild" biological resources including deliberate and unintentional harvesting effects; also persecution or control of specific species
5.1 Hunting & collecting terrestrial animals		killing or trapping terrestrial wild animals or animal products for commercial, recreation, subsistence, research or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch
5.2 Gathering terrestrial plants		harvesting plants, fungi, and other non-timber/non-animal products for commercial, recreation, subsistence, research or cultural purposes, or for control reasons
5.3 Logging & wood harvesting		harvesting trees and other woody vegetation for timber, fiber, or fuel
5.4 Valuation of / Payments for Ecosystems Services		Using direct or indirect payments or ascribing economic value to change behaviors and attitudes
5.5 Fishing & harvesting aquatic resources		harvesting aquatic wild animals or plants for commercial, recreation, subsistence, research, or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch
6. Human Intrusions & Disturbance		threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources
6.1 Recreational activities		people spending time in nature or traveling in vehicles outside of established transport corridors, usually for recreational reasons
6.2 War, civil unrest & military exercises		Actions by formal or paramilitary forces without a permanent footprint
6.3 Work & other activities		People spending time in or traveling in natural environments for reasons other than recreation or military activities
7. Natural Systems Modifications		threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare
7.1 Fire & fire suppression		fire suppression to protect homes, inappropriate fire management, escaped agricultural fires, arson, campfires, fires for hunting
7.2 Dams & water management/use		changing water flow patterns from their natural range of variation either

Commented [cm15]: bushmeat hunting, trophy hunting, fur trapping, insect collecting, honey or bird nest hunting, predator control, pest control, persecution

Commented [cm16]: bushmeat hunting, trophy hunting, fur trapping, insect collecting, honey or bird nest hunting, predator control, pest control, persecution

Commented [cm17]: wild mushrooms, forage for stall fed animals, orchids, rattan, control of host plants to combat timber diseases

Commented [cm18]: clear cutting of hardwoods, selective commercial logging of ironwood, pulp operations, fuel wood collection, charcoal production

Commented [cm19]: Quid pro-quo payments for EcoServ., tax incentives for conservation, providing regulatory relief, valuation of flood control services

Commented [cm20]: trawling, blast fishing, spear fishing, shellfish harvesting, whaling, seal hunting, turtle egg collection, live coral collection, seaweed collection

Commented [cm21]: off-road vehicles, motorboats, jet-skis, snowmobiles, ultralight planes, dive boats, whale watching, mountain bikes, hikers, birdwatchers, skiers, pets in rec areas, temporary campsites, caving, rock-climbing

Commented [cm22]: armed conflict, mine fields, tanks & other military vehicles, training exercises & ranges, defoliation, munitions testing

Commented [cm23]: law enforcement, drug smugglers, illegal immigrants, species research, vandalism

Commented [cm24]: fire suppression to protect homes, inappropriate fire management, escaped agricultural fires, arson, campfires, fires for hunting

		deliberately or as a result of other activities
7.3 Other ecosystem modifications		other actions that convert or degrade habitat in service of "managing" natural systems to improve human welfare
7.4 Removing/reducing human maintenance		Absence or reduction of current or historical maintenance regimes important for key ecological attributes. Includes regimes historically maintained by protected area staff, farmers and ranchers, indigenous peoples, private landowners, or any other resource manager.
8. Invasive & Problematic Species, Pathogens & Genes		threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance or virulence
8.1 Invasive non-native/alien species plants & animals		harmful plants and animals not originally found within the ecosystem(s) in question and directly or indirectly introduced and spread into it by human activities
8.2 Problematic native plants & animals		harmful plants and animals that are originally found within the ecosystem(s) in question, but have become "out-of-balance" or "released" directly or indirectly due to human activities
8.3 Introduced genetic material		human altered or transported organisms or genes
8.4 Pathogens & microbes		Harmful native and non-native agents that cause disease or illness to a host, including bacteria, viruses, prions, fungi, and other microorganisms
9. Pollution		Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources
9.1 Household sewage & urban waste water		water-borne sewage and non-point runoff from housing and urban areas that include nutrients, toxic chemicals and/or sediments
9.2 Industrial & military effluents		water-borne pollutants from industrial and military sources including mining, energy production, and other resource extraction industries that include nutrients, toxic chemicals and/or sediments
9.3 Agricultural & forestry effluents		water-borne pollutants from agricultural, silivicultural, and aquaculture systems that include

Commented [cm25]: dam construction, dam operations, sediment control, change in salt regime, wetland filling for mosquito control, levees and dikes, surface water diversion, groundwater pumping, channelization, artificial lakes

Commented [cm26]: land reclamation projects, rip-rap along shoreline, mowing grass, tree thinning in parks, beach construction, removal of snags from streams

Commented [cm27]: lack of mowing of meadows, reduction in controlled burns, lack of indigenous management of key ecosystems, ceasing supplemental feeding of condors

Commented [cm28]: feral horses, household pets, zebra mussels, Miconia tree, introduction of species for biocontrol

Commented [cm29]: overabundant native deer, overabundant algae due to loss of native grazing fish, plague affecting rodents, invasive grasses

Commented [cm30]: pesticide resistant crops, hatchery salmon, restoration projects using non-local seed stock, genetically modified insects for biocontrol, genetically modified trees, genetically modified salmon

Commented [cm31]: plague affecting rodents, Dutch elm disease or chestnut blight, Chytrid fungus affecting amphibians outside of Africa

Commented [cm32]: discharge from municipal waste treatment plants, leaking septic systems, untreated sewage, outhouses, oil or sediment from roads, fertilizers and pesticides from lawns and golf-courses, road salt

Commented [cm33]: toxic chemicals from factories, illegal dumping of chemicals, mine tailings, arsenic from gold mining, leakage from fuel tanks, PCBs in river sediments

		nutrients, toxic chemicals and/or sediments including the effects of these pollutants on the site where they are applied
9.4 Garbage & solid waste		rubbish and other solid materials including those that entangle wildlife
9.5 Air-borne pollutants		atmospheric pollutants from point and nonpoint sources
9.6 Excess energy		inputs of heat, sound, or light that disturb wildlife or ecosystems
10. Geological Events		threats from catastrophic geological events
10.1 Volcanoes		volcanic events
10.2 Earthquakes/tsunamis		earthquakes and associated events
10.3 Avalanches/landslides		avalanches or landslides
10.4 Financing Conservation		Raising and providing funds for conservation work
11. Climate Change		change in climate patterns (e.g., those resulting from increased atmospheric greenhouse gases like CO2) and/or events outside the natural range of variation that could wipe out a vulnerable species or ecosystem
11.1 Ecosystem encroachment		large-scale effects of ecosystems shifting and impinging on other species and ecosystems.
11.2 Changes in geochemical regimes		broad-scale changes in the geochemical conditions of ecosystems including ocean acidification
11.3 Changes in temperature regimes		broad-scale changes in temperature mean, variability, seasonality, and extremes, including changes in temperature extremes, increased average summer temperature, and decreased minimum winter/spring temperature
11.4 Changes in precipitation & broad scale hydrological regimes		broad-scale changes in precipitation mean, variability, seasonality, and extremes, including decreased or increased precipitation, changes in timing of precipitation, changes in form of precipitation (e.g., snow vs rain; snowcover and snowpack where applicable), changes in evapotranspiration rates and hydrological cycles, and droughts and floods
11.5 Severe/extreme weather events		changes in frequency, timing and/or intensity of storms as well as severe weather events that threaten targets that have lost resilience

Commented [cm34]: nutrient loading from fertilizer run-off, herbicide run-off, manure from feedlots, nutrients from aquaculture, soil erosion

Commented [cm35]: municipal waste, litter from cars, flotsam & jetsam from recreational boats, waste that entangles wildlife, construction debris

Commented [cm36]: acid rain, smog from vehicle emissions, excess nitrogen deposition, radioactive fallout, wind dispersion of pollutants or sediments from farm fields, smoke from forest fires or wood stoves

Commented [cm37]: noise from highways or airplanes, sonar from submarines that disturbs whales, heated water from power plants, lamps attracting insects, beach lights disorienting turtles, atmospheric radiation from ozone holes

Commented [cm38]: eruptions, emissions of volcanic gasses

Commented [cm39]: earthquakes, tsunamis

Commented [cm40]: avalanches, landslides, mudslides

Commented [cm41]: private foundations, government grants, bi- & multi-lateral donor projects, corporate philathropy, national debt-for-nature swaps

Commented [cm42]: sea level rise (inundation of shoreline ecosystems, drowning of coral reefs), desertification (sand dune encroachment)

Commented [cm43]: ocean acidification, changes in atmospheric CO2 affecting plant growth, loss of sediment leading to broad-scale subsidence

Commented [cm44]: heat waves, cold spells, oceanic temperature changes, melting of glaciers/sea ice

Commented [cm45]: droughts, changes in timing of rains, loss of snowcover, increased severity of floods

Commented [cm46]: thunderstorms, tropical storms, hurricanes, cyclones, tornadoes, hailstorms, ice storms or blizzards, dust storms, erosion of beaches during storms

Appendix B. Threats Classification Worksheet

Threats	
1. Residential & Commercial Development	
1.1 Housing & urban areas	
1.2 Commercial & industrial areas	
1.3 Tourism & recreation areas	
2. Agriculture & Aquaculture	
2.1 Annual & perennial non-timber crops	
2.2 Wood & pulp plantations	
2.3 Livestock farming & ranching	
2.4 Marine & freshwater aquaculture	
3. Energy Production & Mining	
3.1 Oil & gas drilling	
3.2 Mining & quarrying	
3.3 Renewable energy	
4. Transportation & Service Corridors	
4.1 Roads & railroads	
4.2 Utility & service lines	
4.3 Shipping lanes	
4.4 Flight paths	
5. Biological Resource Use	
5.1 Hunting & collecting terrestrial animals	
5.2 Gathering terrestrial plants	
5.3 Logging & wood harvesting	
5.4 Valuation of / Payments for Ecosystems Services	
5.5 Fishing & harvesting aquatic resources	
6. Human Intrusions & Disturbance	
6.1 Recreational activities	
6.2 War, civil unrest & military exercises	
6.3 Work & other activities	
7. Natural Systems Modifications	
7.1 Fire & fire suppression	
7.2 Dams & water management/use	
7.3 Other ecosystem modifications	
7.4 Removing/reducing human maintenance	
8. Invasive & Problematic Species, Pathogens & Genes	
8.1 Invasive non-native/alien species plants & animals	
8.2 Problematic native plants & animals	
8.3 Introduced genetic material	

8.4 Pathogens & microbes	
9. Pollution	
9.1 Household sewage & urban waste water	
9.2 Industrial & military effluents	
9.3 Agricultural & forestry effluents	
9.4 Garbage & solid waste	
9.5 Air-borne pollutants	
9.6 Excess energy	
10. Geological Events	
10.1 Volcanoes	
10.2 Earthquakes/tsunamis	
10.3 Avalanches/landslides	
10.4 Financing Conservation	
11. Climate Change	
11.1 Ecosystem encroachment	
11.2 Changes in geochemical regimes	
11.3 Changes in temperature regimes	
11.4 Changes in precipitation & broad scale hydrological regimes	
11.5 Severe/extreme weather events	

Appendix C. Action Classification http://cmp-openstandards.org/beta-versions-of-the-iucn-cmp-threats-and-actions-classifications-available/

A. TARGET RESTORATION / STRESS REDUCTION ACTIONS	
1. Land/Water Management	
1.1 Site/Area Stewardship	
1.2 Ecosystem & Natural Process (Re)Creation	
2. Species Management	
2.1 Species Stewardship	
2.2 Species Re-Introduction & Translocation	
2.3 Ex-Situ Conservation	
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS	
3. Awareness Raising	
3.1 Outreach & Communications	
3.2 Protests & Civil Disobedience	
4. Law Enforcement & Prosecution	
4.1 Detection & Arrest	
4.2 Criminal Prosecution & Conviction	
4.3 Non-Criminal Compliance Enforcement	
5. Livelihood, Economic & Moral Incentives	
5.1 Linked Enterprises & Livelihoods	
5.2 Substitution & Alternative Livelihoods	
5.3 Market Forces	
5.4 Valuation of / Payments for Ecosystems Services	
5.5 Non-Monetary Values	
C. ENABLING CONDITION ACTIONS	
6. Conservation Designation & Planning	
6.1 Site / Area Protection	
6.2 Easements & Resource Rights	
6.3 Land/Water Use Planning & Zoning	
6.4 Site/Area Planning & Monitoring	
6.5.Site Infrastructure	
6.6 Species Designation, Planning & Monitoring	
7. Law & Policy	
7.1 Legislation	
7.2 Policies & Regulations	
7.3 Private Sector Standards & Codes	
7.4 Compliance & Enforcement Capacity	
8. Research & Monitoring	
8.1 Basic Research & Status Monitoring	
8.2 Effectiveness Monitoring / Adaptive Management	
9. Education & Training	
9.1 Formal Training	
9.2 Training & Capacity Development	
10. Institutional Development	
10.1 Organizational Management & Administration	

10.2 Institutional & Civil Society Development	
10.3 Alliance & Partnership Development	
10.4 Financing Conservation	

Appendix C. Action Classification http://cmp-openstandards.org/beta-versions-of-the-iucn-cmp-threats-and-actions-classifications-available/

A. TARGET RESTORATION / STRESS REDUCTION ACTIONS	
1. Land/Water Management	
1.1 Site/Area Stewardship	
1.2 Ecosystem & Natural Process (Re)Creation	
2. Species Management	
2.1 Species Stewardship	
2.2 Species Re-Introduction & Translocation	
2.3 Ex-Situ Conservation	
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS	
3. Awareness Raising	
3.1 Outreach & Communications	
3.2 Protests & Civil Disobedience	
4. Law Enforcement & Prosecution	
4.1 Detection & Arrest	
4.2 Criminal Prosecution & Conviction	
4.3 Non-Criminal Compliance Enforcement	
5. Livelihood, Economic & Moral Incentives	
5.1 Linked Enterprises & Livelihoods	
5.2 Substitution & Alternative Livelihoods	
5.3 Market Forces	
5.4 Valuation of / Payments for Ecosystems Services	
5.5 Non-Monetary Values	
C. ENABLING CONDITION ACTIONS	
6. Conservation Designation & Planning	
6.1 Site / Area Protection	
6.2 Easements & Resource Rights	
6.3 Land/Water Use Planning & Zoning	
6.4 Site/Area Planning & Monitoring	
6.5.Site Infrastructure	
6.6 Species Designation, Planning & Monitoring	
7. Conservation Designation & Planning	
7.1 Legislation	
7.2 Policies & Regulations	
7.3 Private Sector Standards & Codes	
7.4 Compliance & Enforcement Capacity	
8. Research & Monitoring	
8.1 Basic Research & Status Monitoring	
8.2 Effectiveness Monitoring / Adaptive Management	
9. Education & Training	
9.1 Formal Training	
9.2 Training & Capacity Development	
10. Institutional Development	
10.1 Organizational Management & Administration	

10.2 Institutional & Civil Society Development	
10.3 Alliance & Partnership Development	
10.4 Financing Conservation	

Appendix D. Actions classification http://cmp-openstandards.org/beta-versions-of-the-iucn-cmp-threats-and-actions-classifications-available/

A. TARGET RESTORATION / STRESS REDUCTION ACTIONS		Actions to directly restore a target or mitigate a stress
1. Land/Water Management		Actions directed at conserving or restoring sites, ecosystems (=habitats) and the wider environment
1.1 Site/Area Stewardship		Enhancing viability/mitigating stresses for sites and/or ecosystem targets
1.2 Ecosystem & Natural Process (Re)Creation		Restoring missing or severely degraded ecosystems and ecosystem function, especially on a large scale
2. Species Management		Actions directed at conserving or restoring specific species
2.1 Species Stewardship		Enhancing viability/mitigating stress to specific species targets within their current range
2.2 Species Re-Introduction & Translocation		Re-introducing species to places where they formally occurred or to suitable future habitat or benign introductions of species to an ecosystem
2.3 Ex-Situ Conservation		Protecting biodiversity out of its native habitats with the aim of ultimately restoring to these habitats
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS		Actions to get people to stop direct threats or continue/increase positive behaviors
3. Awareness Raising		Actions designed to make people aware of key issues, thus leading to behavior change
3.1 Outreach & Communications		Promoting desired behavioral change by providing information through various media and other channels
3.2 Protests & Civil Disobedience		Promoting desired behavioral change by conducting protests or other confrontational means
4. Law Enforcement & Prosecution		Monitoring and enforcing compliance with existing laws,

Commented [cm1]: cutting invasive vines off trees, liming acid lakes, cleaning up oil spills, routine maintenance in a protected area, use of traditional management practices by indigenous peoples

Commented [cm2]: Restoring water flow, connectivityprescribed fire, creating forest corridors, prairie re-creation, replanting mangroves, coral reef restoration, breeching levees, dam removal, taxon substitution to restore ecological functions

Commented [cm3]: Clutch manipulation, supplemental feeding, management of game species (blue crabs?)

Commented [cm4]: WHCR re-intro programs

Commented [cm5]: Captive breeding for re-introduction and gene preservation

Commented [cm6]: Press briefings, web blogs, puppet shows, envi. Education for kids, community campaigns

		policies & regulations, and standards & codes at all levels
4.1 Detection & Arrest		Detecting and/or directly stopping violations of existing laws, policies / regulations and standards / legal codes
4.2 Criminal Prosecution & Conviction		Ensuring sanctions for violations of existing laws, policies / regulations and standards / legal codes
4.3 Non-Criminal Compliance Enforcement		Threatening or bringing non-criminal legal action to get individuals, organizations, or firms to change behavior
5. Livelihood, Economic & Moral Incentives		Actions using livelihood, economic and moral incentives to directly influence behavior or to change attitudes that then lead to behavioral change
5.1 Linked Enterprises & Livelihoods		Developing enterprises that directly depend on the maintenance of natural resources or provide substitute livelihoods as a means of changing behaviors and attitudes
5.2 Substitution & Alternative Livelihoods		Promoting alternative products and services that substitute for environmentally damaging ones
5.3 Market Forces		Using market mechanisms to change behaviors and attitudes
5.4 Valuation of / Payments for Ecosystems Services		Using direct or indirect payments or ascribing economic value to change behaviors and attitudes
5.5 Non-Monetary Values		Using intangible and moral values to change behaviors and attitudes
C. ENABLING CONDITION ACTIONS		Actions that create the conditions necessary for other conservation efforts to suceed
6. Conservation Designation & Planning		Actions to legally or formally protect sites and /or species
6.1 Site / Area Protection		Legally or formally establishing or expanding private or public parks, reserves, and other protected areas roughly equivalent to IUCN Categories I-VI
6.2 Easements & Resource Rights		Legally or formally establishing protection or easements of some specific aspect of the resource on public or private lands outside of IUCN Categories I-VI
6.3 Land/Water Use Planning & Zoning		Legally or formally designating land or water uses
6.4 Site/Area Planning & Monitoring		General planning and monitoring of public or private parks, reserves and

Commented [cm7]: Patrolling protected areas

Commented [cm8]: Followups to ensure violators are fully punished

Commented [cm9]: Suing an agency to enforce a policy, a company to stop illegal logging, citing homeowners for violations, agency review of policies or projects

Commented [cm10]: Training locals to be ecotourism guides

Commented [cm11]: Farmed instead of wild harvests, Viagra for rhino horn, recycling, training poachers for factory jobs, wetland mitigation, wetland banking

Commented [cm12]: Commodity cert. systems, corporate engagement, boycotts, cap-and-trade markets for CO2 emissions

Commented [cm13]: Quid pro-quo payments for EcoServ., tax incentives for conservation, providing regulatory relief, valuation of flood control services

Commented [cm14]: Developing religious arguments for conservation, linking conservation to human health

Commented [cm15]: National parks, town wildlife sanctuaries, private reserves, tribally owned hunting grounds

Commented [cm16]: easements, securing development rights, water/instream flow rights, securing resource tenure rights for local communities

Commented [cm17]: land use planning, designating go/no go areas, wild & scenic river designation

		other protected areas (roughly equivalent to IUCN Categoires I-VI)
6.5. Site Infrastructure		Creating and maintaing the physical infrastructure for protected areas and other conservation sites
6.6 Species Designation, Planning & Monitoring		General designation and management of specific plant and animal populations of concern
7. Conservation Designation & Planning		Actions to develop, change, and influence formal legislation, regulations, and voluntary standards
7.1 Legislation		Actions to develop, change, and influence formal legislation, regulations, and voluntary standards
7.2 Policies & Regulations		Making, implementing, changing, influencing, or providing input into policies and regulations affecting the implementation of laws and codes at all levels: international, national, state/provincial, local/community, tribal, private
7.3 Private Sector Standards & Codes		Setting, implementing, changing, influencing, or providing input into voluntary standards & professional codes that govern private sector practice
7.4 Compliance & Enforcement Capacity		Monitoring and enforcing compliance with laws, policies & regulations, and standards & codes at all levels
8. Research & Monitoring		Basic and applied research to support conservation work
8.1 Basic Research & Status Monitoring		Basic research related to conservation
8.2 Effectiveness Monitoring / Adaptive Management		Asessment of and learning about the effectiveness of strategies
9. Education & Training		Enhancing knowledge and skills of specific inviduals
9.1 Formal Training		Enhancing knowledge and skills of students in a formal degree program
9.2 Training & Capacity Development		Enhancing knowledge, skills and information exchange for practitioners, stakeholders, and other relevant individuals in structured settings outside of degree programs
10. Institutional Development		Creating the institutions needed to support conservation work

Commented [cm18]: developing a site plan, conducting monitoring or adaptive management

Commented [cm19]: creating guard posts, fences, roads, recreational areas

Commented [cm20]: developing specific species mangement plans, conducting monitoring of species

Commented [cm21]: GLOBAL: promoting conventions on biodiversity, wildlife trade laws like CITES
NATIONAL: work for or against government laws such as the US Endangered Species Act, influencing legislative appropriations
STATE/PROVINCIAL: state ballot initiatives, providing data to state policy makers, developing pollution permitting systems, dam relicensing
MUNICIPAL: countryside laws, species protection laws, hunting bans
TRIBAL: tribal laws

Commented [cm22]: input into agency plans regulating certain species or resources, working with local governments or communities to implement zoning regulations; promoting sustainable harvest of timber on state forest lands

Commented [cm23]: Industry agreements, Conservation Measures Partnership (CMP) Open Standards

Commented [cm24]: setting up courts, improving courts, strengthening police forces, monitoring efforts

Commented [cm25]: research on an endangered species, ecological research, research on effects of climate change

Commented [cm26]: applied research on specific strategies, developing learning networks, developing standard classifications

Commented [cm27]: public schools, colleges & universities, continuing education

Commented [cm28]: workshops or training courses in proscribed fire, coaching project teams, writing how-to manuals for project managers, stakeholder education on specific issues, elders sharing traditional ecological knowledge

10.1 Organizational Management & Administration		hiring and managing staff for protected areas or conservation agencies
10.2 Institutional & Civil Society Development		Creating or providing non-financial support & capacity building for non-profits, government agencies, communities, and for-profits
10.3 Alliance & Partnership Development		Forming and facilitating partnerships, alliances, and networks of organizations
10.4 Financing Conservation		Raising and providing funds for conservation work

Commented [cm29]: creating new local land trusts, providing circuit riders to help develop organizational capacity

Commented [cm30]: meetings & conferences, country networks, Conservation Measures Partnership (CMP), stakeholder engagement

Commented [cm31]: private foundations, government grants, bi- & multi-lateral donor projects, corporate philathropy, national debt-for-nature swaps

Appendix E. Worksheets for identifying actions that have been implemented, are currently being implemented, and/or plan to be implemented by an entity to reduce the threats associated with recovering the Aransas-Wood Buffalo population of the endangered Whooping Crane in their wintering range along the Texas Coast, USA.

THREAT: 1. Residential & Commercial Development	1.1 Housing & urban areas	1.2 Commercial & industrial areas	1.3 Tourism & recreation areas
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS			
1. Land/Water Management			
1.1 Site/Area Stewardship			
1.2 Ecosystem & Natural Process (Re)Creation			
2. Species Management			
2.1 Species Stewardship			
2.2 Species Re-Introduction & Translocation			
2.3 Ex-Situ Conservation			
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS			
3. Awareness Raising			
3.1 Outreach & Communications			
3.2 Protests & Civil Disobedience			
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest			
4.2 Criminal Prosecution & Conviction			
4.3 Non-Criminal Compliance Enforcement			
5. Livelihood, Economic & Moral Incentives			
5.1 Linked Enterprises & Livelihoods			
5.2 Substitution & Alternative Livelihoods			
5.3 Market Forces			
5.4 Valuation of / Payments for Ecosystems Services			
5.5 Non-Monetary Values			
C. ENABLING CONDITION ACTIONS			
6. Conservation Designation & Planning			
6.1 Site / Area Protection			
6.2 Easements & Resource Rights			
6.3 Land/Water Use Planning & Zoning			
6.4 Site/Area Planning & Monitoring			
6.5 Site Infrastructure			
6.6 Species Designation, Planning & Monitoring			
7. Conservation Designation & Planning			
7.1 Legislation			
7.2 Policies & Regulations			
7.3 Private Sector Standards & Codes			
7.4 Compliance & Enforcement Capacity			
8. Research & Monitoring			
8.1 Basic Research & Status Monitoring			
8.2 Effectiveness Monitoring / Adaptive Management			
9. Education & Training			
9.1 Formal Training			
9.2 Training & Capacity Development			
10. Institutional Development			
10.1 Organizational Management & Administration			
10.2 Institutional & Civil Society Development			
10.3 Alliance & Partnership Development			
10.4 Financing Conservation			

THREAT: 2. Agriculture & Aquaculture	2.1 Annual & perennial non-timber crops	2.2 Wood & pulp plantations	2.3 Livestock farming & ranching	2.4 Marine & freshwater aquaculture
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS				
1. Land/Water Management				
1.1 Site/Area Stewardship				
1.2 Ecosystem & Natural Process (Re)Creation				
2. Species Management				
2.1 Species Stewardship				
2.2 Species Re-Introduction & Translocation				
2.3 Ex-Situ Conservation				
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS				
3. Awareness Raising				
3.1 Outreach & Communications				
3.2 Protests & Civil Disobedience				
4. Law Enforcement & Prosecution				
4.1 Detection & Arrest				
4.2 Criminal Prosecution & Conviction				
4.3 Non-Criminal Compliance Enforcement				
5. Livelihood, Economic & Moral Incentives				
5.1 Linked Enterprises & Livelihoods				
5.2 Substitution & Alternative Livelihoods				
5.3 Market Forces				
5.4 Valuation of / Payments for Ecosystems Services				
5.5 Non-Monetary Values				
C. ENABLING CONDITION ACTIONS				
6. Conservation Designation & Planning				
6.1 Site / Area Protection				
6.2 Easements & Resource Rights				
6.3 Land/Water Use Planning & Zoning				
6.4 Site/Area Planning & Monitoring				
6.5 Site Infrastructure				
6.6 Species Designation, Planning & Monitoring				
7. Conservation Designation & Planning				
7.1 Legislation				
7.2 Policies & Regulations				
7.3 Private Sector Standards & Codes				
7.4 Compliance & Enforcement Capacity				
8. Research & Monitoring				
8.1 Basic Research & Status Monitoring				
8.2 Effectiveness Monitoring / Adaptive Management				
9. Education & Training				
9.1 Formal Training				
9.2 Training & Capacity Development				
10. Institutional Development				
10.1 Organizational Management & Administration				
10.2 Institutional & Civil Society Development				
10.3 Alliance & Partnership Development				
10.4 Financing Conservation				

THREAT: 3. Energy Production & Mining	3.1 Oil & gas drilling	3.2 Mining & Quarrying	3.3 Renewable energy
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS			
1. Land/Water Management			
1.1 Site/Area Stewardship			
1.2 Ecosystem & Natural Process (Re)Creation			
2. Species Management			
2.1 Species Stewardship			
2.2 Species Re-Introduction & Translocation			
2.3 Ex-Situ Conservation			
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS			
3. Awareness Raising			
3.1 Outreach & Communications			
3.2 Protests & Civil Disobedience			
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest			
4.2 Criminal Prosecution & Conviction			
4.3 Non-Criminal Compliance Enforcement			
5. Livelihood, Economic & Moral Incentives			
5.1 Linked Enterprises & Livelihoods			
5.2 Substitution & Alternative Livelihoods			
5.3 Market Forces			
5.4 Valuation of / Payments for Ecosystems Services			
5.5 Non-Monetary Values			
C. ENABLING CONDITION ACTIONS			
6. Conservation Designation & Planning			
6.1 Site / Area Protection			
6.2 Easements & Resource Rights			
6.3 Land/Water Use Planning & Zoning			
6.4 Site/Area Planning & Monitoring			
6.5 Site Infrastructure			
6.6 Species Designation, Planning & Monitoring			
7. Conservation Designation & Planning			
7.1 Legislation			
7.2 Policies & Regulations			
7.3 Private Sector Standards & Codes			
7.4 Compliance & Enforcement Capacity			
8. Research & Monitoring			
8.1 Basic Research & Status Monitoring			
8.2 Effectiveness Monitoring / Adaptive Management			
9. Education & Training			
9.1 Formal Training			
9.2 Training & Capacity Development			
10. Institutional Development			
10.1 Organizational Management & Administration			
10.2 Institutional & Civil Society Development			
10.3 Alliance & Partnership Development			
10.4 Financing Conservation			

THREAT: 4. Transportation & Service Corridors	4.1 Roads & railroads	4.2 Utility & Service Lines	4.3 Shipping Lanes	4.4 Flight paths
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS				
1. Land/Water Management				
1.1 Site/Area Stewardship				
1.2 Ecosystem & Natural Process (Re)Creation				
2. Species Management				
2.1 Species Stewardship				
2.2 Species Re-Introduction & Translocation				
2.3 Ex-Situ Conservation				
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS				
3. Awareness Raising				
3.1 Outreach & Communications				
3.2 Protests & Civil Disobedience				
4. Law Enforcement & Prosecution				
4.1 Detection & Arrest				
4.2 Criminal Prosecution & Conviction				
4.3 Non-Criminal Compliance Enforcement				
5. Livelihood, Economic & Moral Incentives				
5.1 Linked Enterprises & Livelihoods				
5.2 Substitution & Alternative Livelihoods				
5.3 Market Forces				
5.4 Valuation of / Payments for Ecosystems Services				
5.5 Non-Monetary Values				
C. ENABLING CONDITION ACTIONS				
6. Conservation Designation & Planning				
6.1 Site / Area Protection				
6.2 Easements & Resource Rights				
6.3 Land/Water Use Planning & Zoning				
6.4 Site/Area Planning & Monitoring				
6.5 Site Infrastructure				
6.6 Species Designation, Planning & Monitoring				
7. Conservation Designation & Planning				
7.1 Legislation				
7.2 Policies & Regulations				
7.3 Private Sector Standards & Codes				
7.4 Compliance & Enforcement Capacity				
8. Research & Monitoring				
8.1 Basic Research & Status Monitoring				
8.2 Effectiveness Monitoring / Adaptive Management				
9. Education & Training				
9.1 Formal Training				
9.2 Training & Capacity Development				
10. Institutional Development				
10.1 Organizational Management & Administration				
10.2 Institutional & Civil Society Development				
10.3 Alliance & Partnership Development				
10.4 Financing Conservation				

THREAT: 5. Biological Resource Use	5.1 Hunting & collecting terrestrial animals	5.2 Gathering terrestrial plants	5.3 Logging & wood harvesting	5.4 Valuation of / payments for ecosystem services	5.5 Fishing & harvesting aquatic resources
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS					
1. Land/Water Management					
1.1 Site/Area Stewardship					
1.2 Ecosystem & Natural Process (Re)Creation					
2. Species Management					
2.1 Species Stewardship					
2.2 Species Re-Introduction & Translocation					
2.3 Ex-Situ Conservation					
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS					
3. Awareness Raising					
3.1 Outreach & Communications					
3.2 Protests & Civil Disobedience					
4. Law Enforcement & Prosecution					
4.1 Detection & Arrest					
4.2 Criminal Prosecution & Conviction					
4.3 Non-Criminal Compliance Enforcement					
5. Livelihood, Economic & Moral Incentives					
5.1 Linked Enterprises & Livelihoods					
5.2 Substitution & Alternative Livelihoods					
5.3 Market Forces					
5.4 Valuation of / Payments for Ecosystems Services					
5.5 Non-Monetary Values					
C. ENABLING CONDITION ACTIONS					
6. Conservation Designation & Planning					
6.1 Site / Area Protection					
6.2 Easements & Resource Rights					
6.3 Land/Water Use Planning & Zoning					
6.4 Site/Area Planning & Monitoring					
6.5 Site Infrastructure					
6.6 Species Designation, Planning & Monitoring					
7. Conservation Designation & Planning					
7.1 Legislation					
7.2 Policies & Regulations					
7.3 Private Sector Standards & Codes					
7.4 Compliance & Enforcement Capacity					
8. Research & Monitoring					
8.1 Basic Research & Status Monitoring					
8.2 Effectiveness Monitoring / Adaptive Management					
9. Education & Training					
9.1 Formal Training					
9.2 Training & Capacity Development					
10. Institutional Development					
10.1 Organizational Management & Administration					
10.2 Institutional & Civil Society Development					
10.3 Alliance & Partnership Development					
10.4 Financing Conservation					

THREAT: 6. Human Intrusions & Disturbance	6.1 Recreational activities	6.2 War, civil unrest & military exercises	6.3 Work & other activities
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS			
1. Land/Water Management			
1.1 Site/Area Stewardship			
1.2 Ecosystem & Natural Process (Re)Creation			
2. Species Management			
2.1 Species Stewardship			
2.2 Species Re-Introduction & Translocation			
2.3 Ex-Situ Conservation			
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS			
3. Awareness Raising			
3.1 Outreach & Communications			
3.2 Protests & Civil Disobedience			
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest			
4.2 Criminal Prosecution & Conviction			
4.3 Non-Criminal Compliance Enforcement			
5. Livelihood, Economic & Moral Incentives			
5.1 Linked Enterprises & Livelihoods			
5.2 Substitution & Alternative Livelihoods			
5.3 Market Forces			
5.4 Valuation of / Payments for Ecosystems Services			
5.5 Non-Monetary Values			
C. ENABLING CONDITION ACTIONS			
6. Conservation Designation & Planning			
6.1 Site / Area Protection			
6.2 Easements & Resource Rights			
6.3 Land/Water Use Planning & Zoning			
6.4 Site/Area Planning & Monitoring			
6.5 Site Infrastructure			
6.6 Species Designation, Planning & Monitoring			
7. Conservation Designation & Planning			
7.1 Legislation			
7.2 Policies & Regulations			
7.3 Private Sector Standards & Codes			
7.4 Compliance & Enforcement Capacity			
8. Research & Monitoring			
8.1 Basic Research & Status Monitoring			
8.2 Effectiveness Monitoring / Adaptive Management			
9. Education & Training			
9.1 Formal Training			
9.2 Training & Capacity Development			
10. Institutional Development			
10.1 Organizational Management & Administration			
10.2 Institutional & Civil Society Development			
10.3 Alliance & Partnership Development			
10.4 Financing Conservation			

THREAT: 7. Natural Systems Modifications	7.1 Fire & fire suppression	7.2 Dams & water management use	7.3 Other ecosystem modifications	7.4 Other ecosystem modifications
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS				
1. Land/Water Management				
1.1 Site/Area Stewardship				
1.2 Ecosystem & Natural Process (Re)Creation				
2. Species Management				
2.1 Species Stewardship				
2.2 Species Re-Introduction & Translocation				
2.3 Ex-Situ Conservation				
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS				
3. Awareness Raising				
3.1 Outreach & Communications				
3.2 Protests & Civil Disobedience				
4. Law Enforcement & Prosecution				
4.1 Detection & Arrest				
4.2 Criminal Prosecution & Conviction				
4.3 Non-Criminal Compliance Enforcement				
5. Livelihood, Economic & Moral Incentives				
5.1 Linked Enterprises & Livelihoods				
5.2 Substitution & Alternative Livelihoods				
5.3 Market Forces				
5.4 Valuation of / Payments for Ecosystems Services				
5.5 Non-Monetary Values				
C. ENABLING CONDITION ACTIONS				
6. Conservation Designation & Planning				
6.1 Site / Area Protection				
6.2 Easements & Resource Rights				
6.3 Land/Water Use Planning & Zoning				
6.4 Site/Area Planning & Monitoring				
6.5 Site Infrastructure				
6.6 Species Designation, Planning & Monitoring				
7. Conservation Designation & Planning				
7.1 Legislation				
7.2 Policies & Regulations				
7.3 Private Sector Standards & Codes				
7.4 Compliance & Enforcement Capacity				
8. Research & Monitoring				
8.1 Basic Research & Status Monitoring				
8.2 Effectiveness Monitoring / Adaptive Management				
9. Education & Training				
9.1 Formal Training				
9.2 Training & Capacity Development				
10. Institutional Development				
10.1 Organizational Management & Administration				
10.2 Institutional & Civil Society Development				
10.3 Alliance & Partnership Development				
10.4 Financing Conservation				

THREAT: 8. Invasive & Problematic Species, Pathogens & Genes	8.1 Invasive non-native/ alien species plants & animals	8.2 Problematic native plants & animals	8.3 Introduced genetic material	8.4 Pathogens & Microbes
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS				
1. Land/Water Management				
1.1 Site/Area Stewardship				
1.2 Ecosystem & Natural Process (Re)Creation				
2. Species Management				
2.1 Species Stewardship				
2.2 Species Re-Introduction & Translocation				
2.3 Ex-Situ Conservation				
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS				
3. Awareness Raising				
3.1 Outreach & Communications				
3.2 Protests & Civil Disobedience				
4. Law Enforcement & Prosecution				
4.1 Detection & Arrest				
4.2 Criminal Prosecution & Conviction				
4.3 Non-Criminal Compliance Enforcement				
5. Livelihood, Economic & Moral Incentives				
5.1 Linked Enterprises & Livelihoods				
5.2 Substitution & Alternative Livelihoods				
5.3 Market Forces				
5.4 Valuation of / Payments for Ecosystems Services				
5.5 Non-Monetary Values				
C. ENABLING CONDITION ACTIONS				
6. Conservation Designation & Planning				
6.1 Site / Area Protection				
6.2 Easements & Resource Rights				
6.3 Land/Water Use Planning & Zoning				
6.4 Site/Area Planning & Monitoring				
6.5 Site Infrastructure				
6.6 Species Designation, Planning & Monitoring				
7. Conservation Designation & Planning				
7.1 Legislation				
7.2 Policies & Regulations				
7.3 Private Sector Standards & Codes				
7.4 Compliance & Enforcement Capacity				
8. Research & Monitoring				
8.1 Basic Research & Status Monitoring				
8.2 Effectiveness Monitoring / Adaptive Management				
9. Education & Training				
9.1 Formal Training				
9.2 Training & Capacity Development				
10. Institutional Development				
10.1 Organizational Management & Administration				
10.2 Institutional & Civil Society Development				
10.3 Alliance & Partnership Development				
10.4 Financing Conservation				

THREAT: 9. Pollution	9.1 House-hold sewage & urban waste water	9.2 Indus-trial & military effluents	9.3 Agricul-tural & forestry effluents	9.4 Garbage & solid waste	9.5 Air-borne pollutants	9.6 Excess energy
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS						
1. Land/Water Management						
1.1 Site/Area Stewardship						
1.2 Ecosystem & Natural Process (Re)Creation						
2. Species Management						
2.1 Species Stewardship						
2.2 Species Re-Introduction & Translocation						
2.3 Ex-Situ Conservation						
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS						
3. Awareness Raising						
3.1 Outreach & Communications						
3.2 Protests & Civil Disobedience						
4. Law Enforcement & Prosecution						
4.1 Detection & Arrest						
4.2 Criminal Prosecution & Conviction						
4.3 Non-Criminal Compliance Enforcement						
5. Livelihood, Economic & Moral Incentives						
5.1 Linked Enterprises & Livelihoods						
5.2 Substitution & Alternative Livelihoods						
5.3 Market Forces						
5.4 Valuation of / Payments for Ecosystems Services						
5.5 Non-Monetary Values						
C. ENABLING CONDITION ACTIONS						
6. Conservation Designation & Planning						
6.1 Site / Area Protection						
6.2 Easements & Resource Rights						
6.3 Land/Water Use Planning & Zoning						
6.4 Site/Area Planning & Monitoring						
6.5 Site Infrastructure						
6.6 Species Designation, Planning & Monitoring						
7. Conservation Designation & Planning						
7.1 Legislation						
7.2 Policies & Regulations						
7.3 Private Sector Standards & Codes						
7.4 Compliance & Enforcement Capacity						
8. Research & Monitoring						
8.1 Basic Research & Status Monitoring						
8.2 Effectiveness Monitoring / Adaptive Management						
9. Education & Training						
9.1 Formal Training						
9.2 Training & Capacity Development						
10. Institutional Development						
10.1 Organizational Management & Administration						
10.2 Institutional & Civil Society Development						
10.3 Alliance & Partnership Development						
10.4 Financing Conservation						

THREAT: 10. Geological Events	10.1 Volcanoes	10.2 Earthquakes / tsunamis	10.3 Avalanches / landslides
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS			
1. Land/Water Management			
1.1 Site/Area Stewardship			
1.2 Ecosystem & Natural Process (Re)Creation			
2. Species Management			
2.1 Species Stewardship			
2.2 Species Re-Introduction & Translocation			
2.3 Ex-Situ Conservation			
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS			
3. Awareness Raising			
3.1 Outreach & Communications			
3.2 Protests & Civil Disobedience			
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest			
4.2 Criminal Prosecution & Conviction			
4.3 Non-Criminal Compliance Enforcement			
5. Livelihood, Economic & Moral Incentives			
5.1 Linked Enterprises & Livelihoods			
5.2 Substitution & Alternative Livelihoods			
5.3 Market Forces			
5.4 Valuation of / Payments for Ecosystems Services			
5.5 Non-Monetary Values			
C. ENABLING CONDITION ACTIONS			
6. Conservation Designation & Planning			
6.1 Site / Area Protection			
6.2 Easements & Resource Rights			
6.3 Land/Water Use Planning & Zoning			
6.4 Site/Area Planning & Monitoring			
6.5 Site Infrastructure			
6.6 Species Designation, Planning & Monitoring			
7. Conservation Designation & Planning			
7.1 Legislation			
7.2 Policies & Regulations			
7.3 Private Sector Standards & Codes			
7.4 Compliance & Enforcement Capacity			
8. Research & Monitoring			
8.1 Basic Research & Status Monitoring			
8.2 Effectiveness Monitoring / Adaptive Management			
9. Education & Training			
9.1 Formal Training			
9.2 Training & Capacity Development			
10. Institutional Development			
10.1 Organizational Management & Administration			
10.2 Institutional & Civil Society Development			
10.3 Alliance & Partnership Development			
10.4 Financing Conservation			

THREAT: 11. Climate Change	11.1 Ecosystem encroach-ment	11.2 Changes in geochemical regimes	11.3 Changes in temperature regimes	11.4 Changes in precipitation & broad scale hydrological regimes	11.5 Severe/ extreme weather events
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS					
1. Land/Water Management					
1.1 Site/Area Stewardship					
1.2 Ecosystem & Natural Process (Re)Creation					
2. Species Management					
2.1 Species Stewardship					
2.2 Species Re-Introduction & Translocation					
2.3 Ex-Situ Conservation					
B. BEHAVIORAL CHANGE / THREAT REDUCTION ACTIONS					
3. Awareness Raising					
3.1 Outreach & Communications					
3.2 Protests & Civil Disobedience					
4. Law Enforcement & Prosecution					
4.1 Detection & Arrest					
4.2 Criminal Prosecution & Conviction					
4.3 Non-Criminal Compliance Enforcement					
5. Livelihood, Economic & Moral Incentives					
5.1 Linked Enterprises & Livelihoods					
5.2 Substitution & Alternative Livelihoods					
5.3 Market Forces					
5.4 Valuation of / Payments for Ecosystems Services					
5.5 Non-Monetary Values					
C. ENABLING CONDITION ACTIONS					
6. Conservation Designation & Planning					
6.1 Site / Area Protection					
6.2 Easements & Resource Rights					
6.3 Land/Water Use Planning & Zoning					
6.4 Site/Area Planning & Monitoring					
6.5 Site Infrastructure					
6.6 Species Designation, Planning & Monitoring					
7. Conservation Designation & Planning					
7.1 Legislation					
7.2 Policies & Regulations					
7.3 Private Sector Standards & Codes					
7.4 Compliance & Enforcement Capacity					
8. Research & Monitoring					
8.1 Basic Research & Status Monitoring					
8.2 Effectiveness Monitoring / Adaptive Management					
9. Education & Training					
9.1 Formal Training					
9.2 Training & Capacity Development					
10. Institutional Development					
10.1 Organizational Management & Administration					
10.2 Institutional & Civil Society Development					
10.3 Alliance & Partnership Development					
10.4 Financing Conservation					

Appendix F. CAP strategies for all AWB range (nesting, migration, wintering) (CAP 2012)

#	Objectives, Strategic Actions with Steps, and Indicators	Overall Rank
Objective	**Migration - Staging: Ensure that wetland buffers are intact and secured near major staging wetlands in areas identified as Critical Habitat within Saskatchewan by 2012.**	
Strategic action	Prioritize buffer areas near staging lakes/wetlands which have been identified in 1. as having the greatest needs or best opportunities for securement within 1 years as well.	-
Strategic action	Between 2010 to 2012 work with various federal procurement and non-government organizations (i.e. NC) to secure vulnerable buffers via conservation easements or purchase.	-
Objective	**Migration Rank 1 Objective: By 2015, identify and map frequently used stopover sites along migration corridor, and develop strategy to protect these sites**	
Strategic action	Work Collaboratively with regulatory agencies, industry, and stakeholders to effectively site wind power projects and associated infrastructure.	-
Strategic action	Coordinate with all states and provinces within the migration corridor to identify, map and develop conservation plans for all priority stop-over sites.	-
Objective	**Migration Rank 1 Objective: By 2017, determine sources of mortality along migration corridor and identify strategies to abate sources of loss.**	
Strategic action	Locate mortality events from telemetry data and determine causes of mortality.	-
Objective	**Migration: Ensure adequate number of upland feeding sites within 1 km of all 8 areas identified as critical habitat within the main staging region of Saskatchewan by 2013.**	
Strategic action	ID land tenure and land use in buffer areas around major staging lake in 8 critical habitat areas in Sask. within 1 year.	-
Strategic action	Identify land tenure and land use for all core habitat staging areas to within 1 km of traditional roost sites within 1 year.	-
Strategic action	Interview all farmers to assess crop plans for future years in core habitat staging areas to determine areas with sustainable acreage of barley or other suitable crane foods within 1Km.	-
Strategic action	Prioritize areas where sustainable acreages of food crops are in short supply for crop management strategies in year 1 and 2.	-
Strategic action	Between 2010-2012 offer incentive to farmers to plant barley or other suitable crane foods in identified above.	-
Objective	**Migration: By 2015 all migratory game hunters will be able to ID WH within WC staging Area.**	
Strategic action	Include WC awareness info with the purchase of Provincial game bird license and federal game bird hunting permit.	-

Strategic action	Design study to determine diet and identify prey items.	-
Strategic action	Find funding and resources to implement diet/prey items study.	-
Objective	**Migration: By 2015 develop and implement an awareness campaign regarding regulations and penalties connected to harrassment/taking of whooping cranes in staging/stop over areas.**	
Objective	**Migration: Understand and reudce injury/mortality related to electrical power generatoin and transmission (including wind energy development).**	
Strategic action	ID potential conflicts on landscape. Work with stakeholders/ APLIC (Avian Power Line Interface Committee) to determine most effective/cost effective measures (i.e. burying, deflectors, realignment).	-
Strategic action	Develop defensible map which identifies potential and appropriate habitats, territories, size, and potential impacts for the entire project area.	Very High
Strategic action	Coordinate with USFWS staff on Wind Energy Habitat Conservation Plan (Wind HCP)	-
Strategic action	Engage TNC trustees involved Wind Energy companies dialog about: 1. Basic concerns; 2. Key areas map to discuss compatibility/conflict.	-
Strategic action	Work w/utilities to implement measures	-
Strategic action	Use telemetry research to guide additional research.	-
Objective	**Nesting Rank 1 objective: by 2014 ensure that a watershed baseline is established and maintained in conjunction with the breeding grounds at current level or better.**	
Strategic action	With conservation partners, create a comprehensive map of extent of staging area.	-
Strategic action	Determine watershed integrity baseline for current expanse of breeding grounds	-
Objective	**Nesting: By 2015, ensure the long-term viability and protection of all water sources associated with whooping crane nesting areas in Canada.**	
Indicator	Develop 2nd Suite of threat specific WQ parameters	
Objective	**Nesting: Determine the number of productive territories that can be supported at WC nest areas by 2012.**	
Objective	**OVERARCHING PROJECT OBJECTIVE: understand prioritize and address the strategic actions required to create and/or manage critical habitat for at least 1,000 birds by the year 2025**	

Strategic action	No prop zone – expand primitive boat zones. Compile bay/use data to create SOU/economic biologic framework – give baseline of information.	-
Strategic action	Permit buyout	-
Strategic action	Insurance for areas in/near crane territories (FEMA, Texas Windstorm Insurance Association) Big GAP – conservation doesn't work with insurance corporations.	-
Strategic action	Get recovery team to establish recovery goal (e.g. > 5,000 birds) or other "team" for purpose of strategy (?)	-
Strategic action	Establish Texas Coastal alliance w/diverse stakeholder's w/interest in marshes etc (insurance rec and commercial fishing).	-
Strategic action	Fed money comes without rags if it/siting compiles with "map"	-
Strategic action	"Coalition" lobbies for reg/funding/exec order changes - maybe HCP	-
Strategic action	Short term – Whooping Crane science/research needs for USFWS LCC (science support need) proposal.	-
Objective	**Wintering Rank 1 Objective: By 2015, ensure adequate hydrological flows supply fresh water to Copano, San Antonio, Matagorda and other bays within wintering habitat range.**	
Strategic action	Participate in the Environmental flows allocation process through the Texas Water Plan Bay-Basin Expert Science Team (BBEST) to guarantee sufficient flow volumes and timing for estuarine productivity.	-
Objective	**Wintering Rank 1 Objective: By, 2013, identify and map sufficient suitable whooping crane wintering habitat for use by at least 250 family groups and account for habitat loss due to sea level rise; by 2014 develop plan to protect identified areas**	
Strategic action	Create a comprehensive map of potential wintering range with conservation partners	-
Objective	**Wintering: By 2017 reduce prop scar impacts to sea grass beds between Aransas Guadalupe – San Antonio estuary by > 75%**	
Strategic action	Better understand crab use of grass	-
Strategic action	Channel marking make better and then enforcement – Stay on the Trail Campaign – map desired channel	-
Strategic action	Create Sea Grass Experiment	-
Strategic action	Determine how much and where	-

Strategic action	Reduce time/take of Blue Crab	-
Indicator	Ratio of Wetland types occupied	
Objective	**Wintering: By 2020 Establish opportunity/ability to maintain hydrograph in Current Condition.**	
Strategic action	Obtain New Studies (for USFWS EIS) using rigorous peer review research on fresh water inflows to maintain food availability.	-
Strategic action	By 20__ (check schedule) Complete ONGOING studies on water withdrawals (SA #1) going on.	-
Objective	**Wintering: Eliminate Commercial Harvest at Aransas NWR by 2012**	
Strategic action	Study: movement limitation, Control study – closing efforts on crabs	-
Strategic action	Partner to co-manage with Industry	-
Strategic action	Request in to push out 300 feet and support it.	-
Strategic action	Convince TPWD to eliminate harvest.	-
Strategic action	Determine process	-
Strategic action	Update fish management plan	-
Objective	**Wintering: Increase Emergent and submergent vegetation in crane salt marsh by 25% by 2015.**	
Strategic action	Determine current condition - viability	-
Strategic action	Eliminate boat traffic in salt marsh – through regulation USFWS, State, and County	-
Strategic action	Partner with GCJV	-
Strategic action	Water Control/Marsh Management	-
Objective	**Wintering: Maintain positive working relationship with relevant organizations in relationship to spills. Contain and prevent – create plan.**	
Objective	**Wintering: No FEMA flood insurance issued in active/potential Whooping Crane habitat in next 1-5 years**	
Strategic action	Evaluate/Access insurance efforts in Miss., Louisiana etc. and appropriate in Texas	-

Strategic action	Expand COBRA (coastal Barrier ….) Boundaries to include potential/active whooping water range	-
Strategic action	Coastal resources for resiliency mapped (include Whooping Crane) to show critical areas/extent	-
Strategic action	Protect land in key areas (easement, acquisition)	-
Strategic action	Get FEMA and USFWS to coordinate Whooping Crane and insurance policies	-
Strategic action	Change issue of insurance rates low (subsidized) for developers	-
Strategic action	Open Cedar Bayou Passage	-

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)

Appendix G. Strategy worksheets for Conservation Target AWB Whooping Crane Wintering Range: Habitat/Ecosystem Specific

Project Scope: Wintering Range of AWB Whooping Crane

Vision: Full Recovery of the AWB Whooping Crane Population

Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)

GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

STRATEGY: Develop a spatial decision support tool to identify, track and guide conservation actions to protect WHCR winter habitat

CHAIN OF FACTORS			
Direct Threat[a]	**Indirect Threat**	**Opportunity**	**Strategy**
1. Residential & Commercial Development[a]			
1.1 Housing & Urban Areas[b]			
RESULTS CHAIN			
Add Action Classification A-C			
Add Action Classification 1-6			
Add Action Classification X.1-5			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2			2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)	

[a] human settlements or other non-agricultural land uses with a substantial footprint

[b] human cities, towns, and settlements including non-housing development typically integrated with housing; ex. urban areas, suburbs, villages, vacation homes, shopping areas, offices, schools, hospitals

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)

GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

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STRATEGY: Develop a spatial decision support tool to identify, track and guide conservation actions to protect WHCR winter habitat

CHAIN OF FACTORS			
Direct Threat[a]	**Indirect Threat**	**Opportunity**	**Strategy**
1. Residential & Commercial Development[a]			
1.1 Housing & Urban Areas[b]			
RESULTS CHAIN			
6. Enabling Condition Actions[c]			
6.4 Site/area planning & monitoring[d]			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
A spatial (GIS) decision support tool is created for assessment and planning and monitoring progress	A spatial (GIS) decision support tool is created for assessment and planning and monitoring progress	Identify current protected/unprotected WHCR habitat areas are identified	WHCR winter habitat is identified and quantified within general winter range boundaries and unprotected areas are identified for conservation action
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Develop a spatial decision support tool that identifies and quantifies all protected areas in the current wintering range by 2014	Define spatial coverage of wintering WHCR habitat by land use/land cover, proximity of cover types, extent with available WHCR survey data by 2014	Construct a spatial layer in model that identifies and describes current protected areas by location, landowner, type of conservation strategy, and extent by 2014	Identify where WHCR winter habitat is located in the winter range, where habitat has been protected, where protection is needed, identify funding/opportunity to protect 125,000 ac of coastal marsh and 300,000 ac coastal prairie/marsh by 20XX

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)	
Steps	**Steps**	**Steps**	**Steps**
1 Develop a spatial support tool in GIS with available data that incorporates wetland, aquatic, and upland habitats in current and adjacent winter range	1 Identify and assign use ranks to land use/land cover types to define habitat for wintering WHCR and parameterize habitat type model	1 Request spatial data from agencies and organizations who have land holdings and easements within the current and adjacent winter range	1
Action from LCC to partners (ICF, GCBO, TAMU-CC, MANERR) (FWS-I&M)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from
2 Refine model with new, updated data	2 Construct spatial map with ranked habitat use types for current and adjacent winter range	2 Construct spatial layer that can be updated in model and quantify extent by type and landowner	2
Action from FWS-I&M, TPW, TAMUG, ICF, TAMU-CC	Action from LCC to partners (ICF, GCBO, TAMU-CC, MANERR) (FWS-I&M)	Action from LCC partners (ICF, GCBO, TAMU-CC, MANERR)	Action from
3	3	3 Update model as land is conserved and provide updated maps and spatial information to conservation partners	3
Action from	Action from	Action from ICF and FWS	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] human settlements or other non-agricultural land uses with a substantial footprint

[b] human cities, towns, and settlements including non-housing development typically integrated with housing; ex. urban areas, suburbs, villages, vacation homes, shopping areas, offices, schools, hospitals

[c] actions to legally or formally protect sites and/or species

[d] general planning and monitoring of public or private parks, reserves and other protected areas (roughly equivalent to IUCN Categories I-VI); ex. Developing a site plan, conducting monitoring or adaptive management

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)

GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
1. Residential & Commercial Development[a]			
1.2 Commercial & industrial areas[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] human settlements or other non-agricultural land uses with a substantial footprint

[b] factories and other commercial centers; ex. manufacturing plants, shopping centers, office parks, military bases, power plants, train & ship yards, airports

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)

GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
1. Residential & Commercial Development[a]			
1.3 Tourism & industrial areas[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] human settlements or other non-agricultural land uses with a substantial footprint

[b] ex. tourism and recreation sites with a substantial footprint ski areas, golf courses, beach resorts, cricket fields, county parks, campgrounds

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)

GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
2. Agriculture & Aquaculture[a]			
2.1 Annual & perennial non-timber crops[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from farming and ranching as a result of agricultural expansion, intensification or practices; includes silviculture, mariculture and aquaculture

[b] crops planted for food, fodder, fiber, fuel, or other uses; farms, household swidden plots, plantations, orchards, vineyards, mixed agroforestry systems

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GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
2. Agriculture & Aquaculture[a]			
2.3 Livestock farming & ranching[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from farming and ranching as a result of agricultural expansion, intensification or practices; includes silviculture, mariculture and aquaculture

[b] domestic terrestrial animals raised in one location on farmed or non-local resources (farming); also domestic or semi-domesticated animals allowed to roam in the wild and supported by natural habitats (ranching); ex. cattle feed lots, dairy farms, cattle ranching, chicken farms, goat, camel, or yak herding

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
3. Energy Production & Mining[a]			
3.1 Oil & gas drilling[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from production of non-biological resources

[b] exploring for, developing, and producing petroleum and other liquid hydrocarbons; ex. oil wells, deep sea natural gas drilling

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
3. Energy Production & Mining[a]			
3.3 Renewable energy[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from production of non-biological resources

[b] exploring, developing, and producing renewable energy; ex. geothermal power production, solar farms, wind farms (including birds or bats flying into windmills), tidal farms

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
4. Transportation & Service Corridors[a]			
4.1 Roads & railroads[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from long, narrow transport corridors and the vehicles that use them including associated wildlife mortality

[b] surface transport on roadways and dedicated tracks; ex. highways, secondary roads, logging roads, bridges & causeways, road kill, fencing associated with roads, railroads

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
4. Transportation & Service Corridors[a]			
4.2 Utility & service lines[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from long, narrow transport corridors and the vehicles that use them including associated wildlife mortality

[b] transport of energy & resources; ex. electrical & phone wires, aqueducts, oil & gas pipelines, electrocution of wildlife

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
4. Transportation & Service Corridors[a]			
4.3 Shipping lanes[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from long, narrow transport corridors and the vehicles that use them including associated wildlife mortality

[b] transport on and in freshwater and ocean waterways; ex. dredging, canals, shipping lanes, ships running into whales, wakes from cargo ships

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
4. Transportation & Service Corridors[a]			
4.4 Flight paths[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from long, narrow transport corridors and the vehicles that use them including associated wildlife mortality

[b] air and space transport; ex. flight paths, jets impacting birds

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
5. Biological Resource Use[a]			
5.1 Hunting & collecting terrestrial animals[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from consumptive use of "wild" biological resources including deliberate and unintentional harvesting effects; also persecution or control of specific species;

[b] killing or trapping terrestrial wild animals or animal products for commercial, recreation, subsistence, research or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch; ex. bushmeat hunting, trophy hunting, fur trapping, insect collecting, honey or bird nest hunting, predator control, pest control, persecution

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
5. Biological Resource Use[a]			
5.2 Gathering terrestrial plants[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from consumptive use of "wild" biological resources including deliberate and unintentional harvesting effects; also persecution or control of specific species;

[b] harvesting plants, fungi, and other non-timber/non-animal products for commercial, recreation, subsistence, research or cultural purposes, or for control reasons; ex. wild mushrooms, forage for stall fed animals, orchids, rattan, control of host plants to combat timber diseases

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
5. Biological Resource Use[a]			
5.5 Fishing & harvesting aquatic resources[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from consumptive use of "wild" biological resources including deliberate and unintentional harvesting effects; also persecution or control of specific species;

[b] harvesting aquatic wild animals or plants for commercial, recreation, subsistence, research, or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch; ex. trawling, blast fishing, spear fishing, shellfish harvesting, whaling, seal hunting, turtle egg collection, live coral collection, seaweed collection

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
6. Human Intrusions & Disturbance[a]			
6.1 Recreational activities[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources

[b] people spending time in nature or traveling in vehicles outside of established transport corridors, usually for recreational reasons; ex. off-road vehicles, motorboats, jet-skis, snowmobiles, ultralight planes, dive boats, whale watching, mountain bikes, hikers, birdwatchers, skiers, pets in rec areas, temporary campsites, caving, rock-climbing

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
6. Human Intrusions & Disturbance[a]			
6.2 War, civil unrest & military exercises[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources

[b] Actions by formal or paramilitary forces without a permanent footprint; ex. armed conflict, mine fields, tanks & other military vehicles, training exercises & ranges, defoliation, munitions testing

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
6. Human Intrusions & Disturbance[a]			
6.3 Work & other activities[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources

[b] People spending time in or traveling in natural environments for reasons other than recreation or military activities; ex. law enforcement, drug smugglers, illegal immigrants, species research, vandalism

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
7. Natural systems modifications[a]			
7.1 Fire & fire suppression[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare

[b] fire suppression to protect homes, inappropriate fire management, escaped agricultural fires, arson, campfires, fires for hunting; ex. fire suppression to protect homes, inappropriate fire management, escaped agricultural fires, arson, campfires, fires for hunting

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
7. Natural systems modifications[a]			
7.2 Dams & water management/use[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare

[b] changing water flow patterns from their natural range of variation either deliberately or as a result of other activities; ex. dam construction, dam operations, sediment control, change in salt regime, wetland filling for mosquito control, levees and dikes, surface water diversion, groundwater pumping, channelization, artificial lakes

Project Scope: Wintering Range of AWB Whooping Crane

Vision: Full Recovery of the AWB Whooping Crane Population

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
7. Natural systems modifications[a]			
7.3 Other ecosystem modifications[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare

[b] other actions that convert or degrade habitat in service of "managing" natural systems to improve human welfare; ex. land reclamation projects, rip-rap along shoreline, mowing grass, tree thinning in parks, beach construction, removal of snags from streams

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
7. Natural systems modifications[a]			
7.4 Removing/reducing human maintenance[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare

[b] Absence or reduction of current or historical maintenance regimes important for key ecological attributes. Includes regimes historically maintained by protected area staff, farmers and ranchers, indigenous peoples, private landowners, or any other resource manager; ex. lack of mowing of meadows, reduction in controlled burns, lack of indigenous management of key ecosystems, ceasing supplemental feeding of condors

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)

GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
8. Invasive & Problematic Species, Pathogens & Genes[a]			
8.1 Invasive non-native/alien species plants & animals[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance or virulence

[b] harmful plants and animals not originally found within the ecosystem(s) in question and directly or indirectly introduced and spread into it by human activities; ex. feral horses, household pets, zebra mussels, Miconia tree, introduction of species for biocontrol

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
8. Invasive & Problematic Species, Pathogens & Genes[a]			
8.2 Problematic native plants & animals[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance or virulence

[b] harmful plants and animals that are originally found within the ecosystem(s) in question, but have become "out-of-balance" or "released" directly or indirectly due to human activities; ex. overabundant native deer, overabundant algae due to loss of native grazing fish, plague affecting rodents, invasive grasses

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
8. Invasive & Problematic Species, Pathogens & Genes[a]			
8.3 Introduced genetic material[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance or virulence

[b] human altered or transported organisms or genes; ex. pesticide resistant crops, hatchery salmon, restoration projects using non-local seed stock, genetically modified insects for biocontrol, genetically modified trees, genetically modified salmon

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
8. Invasive & Problematic Species, Pathogens & Genes[a]			
8.4 Pathogens & microbes[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance or virulence

[b] Harmful native and non-native agents that cause disease or illness to a host, including bacteria, viruses, prions, fungi, and other microorganisms; ex. plague affecting rodents, Dutch elm disease or chestnut blight, Chytrid fungus affecting amphibians outside of Africa

Project Scope: Wintering Range of AWB Whooping Crane

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GOAL: Protect and manage wintering range habitat in Texas to support a fully recovered AWB Whooping Crane population

OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
9. Pollution[a]			
9.1 Household sewage & urban waste water[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources

[b] water-borne sewage and non-point runoff from housing and urban areas that include nutrients, toxic chemicals and/or sediments; ex. discharge from municipal waste treatment plants, leaking septic systems, untreated sewage, outhouses, oil or sediment from roads, fertilizers and pesticides from lawns and golf-courses, road salt

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
9. Pollution[a]			
9.2 Industrial & military effluents[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources
[b] water-borne pollutants from industrial and military sources including mining, energy production, and other resource extraction industries that include nutrients, toxic chemicals and/or sediments; ex. toxic chemicals from factories, illegal dumping of chemicals, mine tailings, arsenic from gold mining, leakage from fuel tanks, PCBs in river sediments

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
9. Pollution[a]			
9.3 Agricultural & forestry effluents[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources

[b] water-borne pollutants from agricultural, silivicultural, and aquaculture systems that include nutrients, toxic chemicals and/or sediments including the effects of these pollutants on the site where they are applied; ex. nutrient loading from fertilizer run-off, herbicide run-off, manure from feedlots, nutrients from aquaculture, soil erosion

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
9. Pollution[a]			
9.4 Garbage & solid waste[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources
[b] rubbish and other solid materials including those that entangle wildlife; ex. municipal waste, litter from cars, flotsam & jetsam from recreational boats, waste that entangles wildlife, construction debris

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
9. Pollution[a]			
9.5 Airborne pollutants[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources
[b] atmospheric pollutants from point and nonpoint sources; ex. acid rain, smog from vehicle emissions, excess nitrogen deposition, radioactive fallout, wind dispersion of pollutants or sediments from farm fields, smoke from forest fires or wood stoves

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
9. Pollution[a]			
9.6 Excess energy[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources
[b] inputs of heat, sound, or light that disturb wildlife or ecosystems; ex. noise from highways or airplanes, sonar from submarines that disturbs whales, heated water from power plants, lamps attracting insects, beach lights disorienting turtles, atmospheric radiation from ozone holes

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
11. Climate Change[a]			
11.1 Ecosystem encroachment[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] change in climate patterns (e.g., those resulting from increased atmospheric greenhouse gases like CO2) and/or events outside the natural range of variation that could wipe out a vulnerable species or ecosystem

[b] large-scale effects of ecosystems shifting and impinging on other species and ecosystems; ex. sea level rise (inundation of shoreline ecosystems, drowning of coral reefs), desertification (sand dune encroachment)

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
11. Climate Change[a]			
11.2 Changes in geochemical regimes[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] change in climate patterns (e.g., those resulting from increased atmospheric greenhouse gases like CO2) and/or events outside the natural range of variation that could wipe out a vulnerable species or ecosystem

[b] broad-scale changes in the geochemical conditions of ecosystems including ocean acidification; ex. ocean acidification, changes in atmospheric CO2 affecting plant growth, loss of sediment leading to broad-scale subsidence

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OBJECTIVE: Protect and manage at least 125,000 ac of Texas coastal marsh and 300,000 ac of coastal prairie/palustrine habitat in optimum condition to support 1,000 AWB Whooping Crane by 20XX

CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
11. Climate Change[a]			
11.3 Changes in temperature regimes[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] change in climate patterns (e.g., those resulting from increased atmospheric greenhouse gases like CO2) and/or events outside the natural range of variation that could wipe out a vulnerable species or ecosystem

[b] broad-scale changes in temperature mean, variability, seasonality, and extremes, including changes in temperature extremes, increased average summer temperature, and decreased minimum winter/spring temperature; ex. heat waves, cold spells, oceanic temperature changes, melting of glaciers/sea ice

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
11. Climate Change[a]			
11.4 Changes in precipitation & broad scale hydrological regimes[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] change in climate patterns (e.g., those resulting from increased atmospheric greenhouse gases like CO2) and/or events outside the natural range of variation that could wipe out a vulnerable species or ecosystem

[b] broad-scale changes in precipitation mean, variability, seasonality, and extremes, including decreased or increased precipitation, changes in timing of precipitation, changes in form of precipitation (e.g., snow vs rain; snowcover and snowpack where applicable), changes in evapotranspiration rates and hydrological cycles, and droughts and floods; ex. droughts, changes in timing of rains, loss of snowcover, increased severity of floods

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
11. Climate Change[a]			
11.5 Severe/ extreme weather event[b]			
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

[a] change in climate patterns (e.g., those resulting from increased atmospheric greenhouse gases like CO2) and/or events outside the natural range of variation that could wipe out a vulnerable species or ecosystem

[b] changes in frequency, timing and/or intensity of storms as well as severe weather events that threaten targets that have lost resilience; ex. thunderstorms, tropical storms, hurricanes, cyclones, tornadoes, hailstorms, ice storms or blizzards, dust storms, erosion of beaches during storms

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CHAIN OF FACTORS			
Direct Threat	**Indirect Threat**	**Opportunity**	**Strategy**
RESULTS CHAIN			
Intermediate Result 1	**Intermediate Result 2**	**Intermediate Result 3**	**Threat Reduction Result**
Objective 1	**Objective 2**	**Objective 3**	**Objective Overall**
Steps	**Steps**	**Steps**	**Steps**
1	1	1	1
Action from	Action from	Action from	Action from
2	2	2	2
Action from	Action from	Action from	Action from
3	3	3	3
Action from	Action from	Action from	Action from
4	4	4	4
Action from	Action from	Action from	Action from
5	5	5	5
Action from	Action from	Action from	Action from
Indicator	**Indicator**	**Indicator**	**Indicator**

Project Scope: Wintering Range of AWB Whooping Crane	Vision: Full Recovery of the AWB Whooping Crane Population	Conservation Target: AWB Whooping Crane Wintering Range (Habitat/ Ecosystem Specific)