THE GULF COAST PRAIRIES AND MARSHES ECOREGIONAL CONSERVATION PLAN

Gulf Coast Prairies and Marshes Ecoregional Planning Team

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PREPARED BY

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EXECUTIVE SUMMARY

The Gulf Coast Prairies and Marshes Ecoregion traverses 2 states and transcends an international border. Across the 24 million acres of this ecoregion, ecological processes and the species, communities, and systems they maintain have changed drastically since European settlement. The future harbors potentially greater impacts. Present estimates indicate that more than 1/3 of the combined population of Texas and Louisiana and over 70% of these states' industrial base, commerce, and jobs are located within 100 miles of the coastline. Every coastal county or parish supports intensive agriculture or grazing. In Mexico, while industrial and population pressures are less than those documented in the U.S., overfishing, water quality as well as quantity, and development pressures are present or imminent. Climate change, as indicated by sea level rise, is a key threat to this ecoregion (Twilley et al. 2001).

The Nature Conservancy (TNC) has historically been very involved in protecting coastal habitats in the GCP&M by means of habitat acquisition (e.g., 13 federal refuges, 5 state wildlife areas, various county, other land trust organization and TNC preserves). However, recent estimates indicate that just a fraction of the biodiversity in the ecoregion has been documented on these managed, public areas. The Gulf Coast Prairies and Marshes Ecoregional Plan is an effort to identify the most important remaining, viable conservation areas and determine how to best achieve lasting conservation results on the landscape. These sites are called portfolio conservation areas.

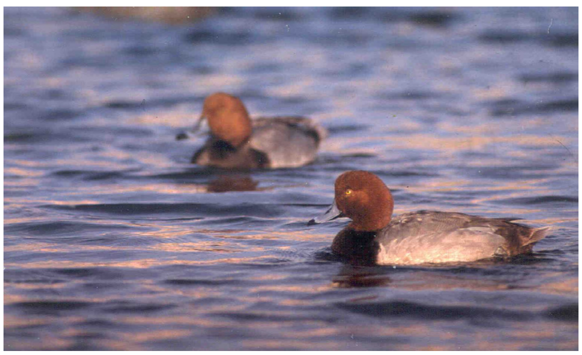
Within ecoregions, portfolio conservation areas are designed to conserve conservation elements, defined as all viable native community types and all viable vulnerable native species. Protecting one population of each element is seldom adequate for the long-term survival of most species, so the goal in ecoregional conservation plans is to design areas that will conserve multiple, viable or recoverable occurrences of elements. Protection of high-quality areas that simultaneously conserve multiple, unprotected elements are preferred conservation strategies. To fulfill conservation goals, we will also need to restore and maintain the ecosystem patterns and processes that species and communities need to survive.

The Nature Conservancy recognizes the complexity of the GCP&M not only in a biological context but also in a socioeconomic setting. Just as there are unique species of plants, animals, and plant communities within the region, so too are there unique population, economic, cultural, and social attributes. To meet our mission, we must frame our conservation action within the acceptable limits of each community in which we work. Within the GCP&M, if TNC is to be successful, we must facilitate the means by which humans can live productively and sustainably while conserving biological diversity.

Planning was initiated for the GCP&M in 1998. It was the first ecoregional planning effort launched in Texas. A total of 341 conservation elements were selected and 1,873 element occurrence records were used in the final selection of conservation areas within the portfolio. Eighty-six conservation areas were delineated. Conservation areas encompassed 36% of the ecoregion. Five conservation areas were selected in Mexico, 45 were selected in Louisiana, and 36 were selected in Texas. A total of 18 functional landscape scale sites were delineated. Functional landscapes are defined as areas where large numbers of ecological systems, communities, and species exist. Size of these areas is substantial (1,000,000 acres), landscape intactness must be high, and of course viability of elements should be good to excellent. An example of a functional landscape in the GCP&M is the Laguna Madre.

A critical challenge encountered during the planning process was the lack of data for many (51%) of our conservation elements and the lack of a natural heritage database for the Mexican portion of the ecoregion. A key, albeit tangential benefit of the planning effort, was the establishment of a Conservation Data Center by Pronature Noreste to develop heritage data in northeast Mexico. In addition, a complete outline of existing data gaps was developed to craft strategies for elevating our knowledge base prior to the next iteration of the plan. Also, the lack of clear planning standards proved to be a challenge in this planning effort.

Implementation of the plan has already actually begun based upon work carried out at Phase I sites and several areas defined in this plan. A special focus will be placed upon generating resources to put field project directors in place at the most highly ranked conservation areas or cluster of areas. Providing capacity for conservation partners in Mexico will be crucial to achieving plan success. Implementing a government relations strategic plan in the region will also be a key strategy in order to better leverage TNC resources with public funding tied to coastal wetland conservation, land acquisition, and habitat restoration. Finally, more thorough consideration of climate change (i.e., sea level rise) will be necessary during the next iteration of the plan.



Redhead ducks (*Aythya americana*) rely on seagrass beds in the Laguna Madre portion of the GCP&M. In 2000, over 1,100,000 redheads were estimated to be wintering along the coast of Texas and Mexico. Nearly 20,000 winter in the Chandeleur Sound of Louisiana.

CHAPTER 1

Ecoregional Planning in the Gulf Coast Prairies And Marshes

"In the end, our society will be defined not only by what we create but what we refuse to destroy." *John Sawhill*

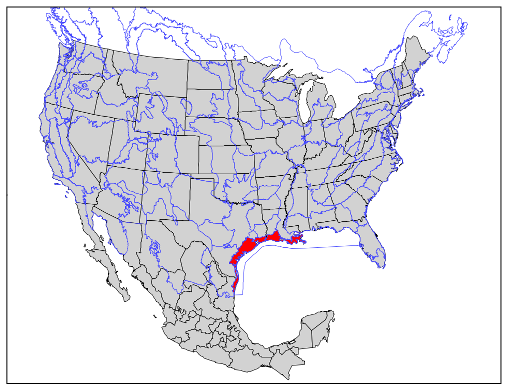
INTRODUCTION TO ECOREGIONAL PLANNING

In its 51 year history, The Nature Conservancy (TNC) has continually adapted and expanded its conservation strategies and methods to be more efficient and scientifically sound. Within the last 10 years, TNC has adopted a framework for conservation that places emphasis on the conservation of all communities and ecosystems (not just the rare ones), emphasizes conservation at multiple scales of biological organization, and recognizes the value of comprehensive biodiversity planning on ecoregional, rather than geopolitical lines. To aid in the analysis of biodiversity patterns at a landscape level, ecoregions have been identified as cohesive ecological units for conservation and management planning (Bailey 1998). Ecoregions are relatively large areas of land and water that contain geographically distinct assemblages of natural communities.

There are 80 ecoregions in the U.S. and 12 in Mexico, with 6 shared between the two countries. In each of these ecoregions, TNC is conducting ecoregional planning to identify the areas of highest biological significance. The Gulf Coast Prairies and Marshes represent the first effort by TNC to partner with Mexican conservationists to develop a bi-national ecoregional plan. Pronatura Noreste was our partner in this effort and played an invaluable role in the overall process.

The goal of ecoregion-based conservation is the design of portfolios of conservation areas that would collectively conserve the native species and habitats found in an ecoregion.

Figure 1-1. Location of Gulf Coast Prairies and Marshes Ecoregion



The Ecoregional Planning Process

The first step in ecoregional-scale conservation is the development of a plan for each ecoregion that identifies the areas that must be conserved, managed, or restored to represent the entire diversity of the ecoregion in viable populations, communities, and ecosystems. Some conservation areas are already under conservation protection within state or federal refuges or wildlife management areas. The principal product of an ecoregional plan is a map of conservation areas, along with pertinent information on the elements (species, communities, assemblages) contained within these areas. Designation of conservation areas within the plan does not necessarily mean these areas will be purchased; rather, conservation strategies will focus on threats to conservation elements found on those areas and how to abate those threats.

The basic steps in ecoregional planning include:

1. Identifying species, communities, and ecological systems within the ecoregion as the building blocks of portfolio design. We call these species, communities, and ecological systems *conservation elements*;
2. Determining conservation goals for the number or amount of conservation elements that must be protected;
3. Assembling information on the quality and distribution of conservation elements; and,
4. Identifying a set of conservation areas that meets these goals for all conservation elements.

Throughout the planning process, the team remained vigilant in meeting or exceeding minimum standards identified in *Designing a Geography of Hope* (The Nature Conservancy, 2000).

THE GULF COAST PRAIRIES AND MARSHES

The Gulf Coast Prairies and Marshes Ecoregion (GCP&M) is a region of contrasts and commonalties. The region encompasses 2 countries, 2 states, 22 primary bays, 19 major rivers, and nearly 600 miles of shoreline. A rich and vast ecoregion, consisting of nearly 24 million acres, the GCP&M is characterized by great biodiversity. The number and types of birds in the ecoregion is among the greatest anywhere in the United States or Canada, and it is also renowned for its butterfly and reptile diversity. The region's productive bays and estuaries are virtual factories, producing fishes and shellfish upon which the people of the ecoregion depend economically, and which constitute important links in the food chain for many marine organisms. At the same time, the ecological diversity of the GCP&M faces drastic declines, with habitat loss and fragmentation posing some of the most serious threats to the ecoregion's biological health (Ricketts et al. 1999).

Immediate protection and restoration of the remaining habitat in the GCP&M is needed if we hope to abate the threats to ecological processes that drive both the region's productivity and its aesthetic attractiveness.

In terms of managed areas within the ecoregion, over 1.4 million acres (6% of the ecoregion) are managed by federal (53%), state (38.7%), and county, nongovernmental organizations and others (8.3%). These existing protected areas are critical to meeting overall conservation goals set for the ecoregions. Presently, there are no areas defined as managed areas in Mexico.

Pre-Settlement Landscape

Before European settlement, the GCP&M was composed of a mosaic of tallgrass coastal prairie, riparian bottomland hardwood forests, ephemeral freshwater wetlands, canebrake swamps, extensive coastal forests, chenier woodlands, freshwater tidal wetlands, brush mottes and corridors, barrier islands, estuaries, saltwater marshes, hypersaline lagoons, lomas and associated Tamaulipan Thornscrub habitats. This integrated matrix of habitat types combined to form one of the most productive and biologically rich ecosystems in the world (Briggs 1974, Smeins et al. 1991).

Coastal Prairies

Tallgrass coastal prairie, one of the endemic ecological systems of the ecoregion, is found along the coast of Texas and Louisiana. Similar in many ways to the tallgrass prairie of the Midwestern United States, coastal prairie is maintained by natural processes of fire and drought, which preclude woody species proceeding along the successional continuum and dominating the grasslands. In healthy coastal prairies, a diverse variety of wildflowers (nearly 1,000 plant species have been identified thus far) are found but are under constant threat from habitat fragmentation, exotic species, overgrazing and lack of fire.

Functional prairies and insects naturally go together. The result is a unique insect diversity including butterflies, dragonflies, and numerous species of bees, wasps, leafhoppers, ants, grasshoppers, beetles, and preying mantis. Many bird species rely upon remnant prairie habitat where more red-tailed hawks, northern harriers, white ibis, and white-faced ibis reside than in any other ecoregion of North America. There are also abundant numbers of waterfowl, wading birds, and shorebirds. One bird of particular concern (defined as a conservation element in the plan) is the Attwater's prairie chicken. Only 2 populations (< 50 birds) of this subspecies remain in the wild; a far cry from Vernon Bailey's account of Attwater's prairie chickens being the number one breeding bird in Texas coastal prairies (Bailey 1905).

Coastal prairie once occupied over nine million acres, but today substantially less than 1% remains. Estimates are that as little as 65,000 acres remain in Texas (Smeins et al. 1991), and very little prairie can be found in Louisiana – most along narrow strips of land near railroad right-of-ways (USFWS 1999). Nonetheless, these prairie remnants are critical sources of biodiversity and genetic material for the ecoregion and must be protected and managed properly.

Marshes

Coastal marshes are some of the most dynamic and productive ecological systems that exist. They provide food and shelter for numerous fish and wildlife species, and perform important roles in maintaining water quality and mitigating storm surges from the Gulf of Mexico. The abundant commercial and recreational fisheries along the coast also depend on marshes, as they provide the critical nursery and spawning ground for many species of finfish and shellfish. It is estimated that over 95% of marine species in the Gulf of Mexico rely on coastal marshes for their survival (USFWS 1998).

From the vast and expansive wetland systems of the Mississippi Delta region to the hypersaline lagoons and wind tidal flats of the Laguna Madre, the GCP&M represents a grand array of wetland systems. In Louisiana, deltaic, fluvial systems intergrade into expansive chenier plain wetlands continuing into the upper Texas coast. Salinities range from saline to brackish to intermediate to fresh.

As is the case nationally, wetland loss in the GCP&M has been dramatic. In Louisiana alone, which possesses 41% of the nation's coastal wetlands, 40 to 60 square miles of marshland disappear annually due to a variety of anthropogenic sources. By 2040, an area larger than Rhode Island will have been lost from Louisiana's coast (Gore 1992). In Texas, 4.1 million acres of wetlands existed in the mid 1950's. By 1992, an average annual net loss of 5,700 acres had occurred (Moulton et al. 1997). Freshwater wetlands have experienced the greatest loss overall (>30%). Most losses were attributed to subsidence (mostly induced by anthropomorphic sources [oil/gas extraction]), deepwater intrusion (a.k.a., channelization), agriculture, and urban/rural development. Although past losses have been dramatic, within the past 2 decades, annual wetland losses have declined by 80% (Dahl 2000). No data are available concerning wetland losses in Mexico.

Marine Environments

The northern Gulf of Mexico is a rich and productive subtropical environment that supports extensive wetland and seagrass habitats, oyster reefs, sponge and soft coral, marshes, mangroves, tidal flats, submerged freshwater grasses, and several distinctive species such as dwarf seahorse, Gulf sturgeon, diamondback terrapin, and fringed pipefish. Although there are several biologically outstanding bays along the coast of the GCP&M, one is unique. The Laguna Madre of Texas and Mexico is the only hypersaline lagoon in North America, and it is the largest of only five hypersaline lagoons in the world (Tunnell and Judd, 2002). Unlike other bays in the ecoregion, the evaporation rate in the Laguna exceeds the freshwater input, and the result is a shallow, salty body of water bordered by barrier islands and home to species uniquely suited to its saline environment (Beck et al. 2000).

Coastal marine environments in the Gulf Coast Prairies and Marshes ecoregion are ecologically inseparable from the terrestrial and freshwater environments on which this plan focuses. Thus, to complement this ecoregional plan, the Conservancy developed a marine-based plan in 2000, focusing on identification of estuarine areas of biological significance in the Northern Gulf of Mexico. The results of the Northern Gulf of Mexico ecoregional plan are briefly included in this document, although the methods used are not elaborated here. More details on the marine ecoregional effort can be found in: Beck et. al. 2000. *Identification of priority sites for conservation in the Northern Gulf of Mexico: an ecoregional plan.*

Humans in the GCP&M

Human inhabitants have always been drawn to the Gulf of Mexico. Nomadic native peoples took advantage of the bounty of food resources, such as oysters, shrimp, fish, alligators, and birds available in the nearshore waters and coastal prairies (Ricklis 1997). Today, the attraction is fueled by industrial development and distribution, business infrastructure, agricultural production, tourism and the appeal of a coastal lifestyle with associated recreational and aesthetic attributes.

Although certain areas of the ecoregion are sparsely populated, other areas, such as Houston, the fourth largest city in the U.S., and Harris County, the second most populous county in the U.S., locally impact biodiversity. On a somewhat larger scale, the ecoregion supports the world's second largest petrochemical complex and some of the United States' busiest port facilities (USFWS 2000). In Texas, more than 1/3 of the state's population lives within 100 miles of the coast. If current trends continue, another 1.2 million people will relocate to the coastal zone by 2005 (Texas Environmental Center 1996).

The Gulf Coast Prairies and Marshes ecoregion encompasses nearly 24 million acres of ecological diversity.

Alteration of the Landscape

The ecoregion has been transformed dramatically since the early 1900's. Freshwater wetlands have been reduced by 30% (Moulton 1997), coastal forests have been cleared and fragmented (Lange 1996), the chenier woodlands of the upper Texas coast are essentially gone (Gosselink et al. 1979), and less than 2% of the tallgrass coastal prairie remains (Smeins et al. 1991). Remaining representative pieces of most habitat types are generally small, fragmented, and degraded in some way (i.e., exotic plants, disrupted hydrology, overgrazing, channelization). Large landholdings are also becoming less common due to inheritance tax and developmental pressures. However, in the Laguna Madre portion of the GCP&M, large landholdings are the norm.

Sea-level rise is one of the most frequently predicted effects of global climate change, despite the uncertainty about exactly how and when the earth's climate will respond to the proliferation of greenhouse gases in the atmosphere. Even a slight increase in sea level could have devastating effects in the Gulf Coast Prairies and Marshes. Many coastal areas lie below 5 feet (the 5-foot, or 1.5 meter, contour line is the lowest elevation that can be consistently illustrated over large regions with available digital data) (Titus and Richman 2001). At Grand Isle, Louisiana, sea level is rising by over 3' per century, and is predicted to rise by almost another 5' by the year 2100. Even a 1-3' increase in sea level could submerge 70% of Louisiana's remaining salt marshes. Freshwater marshes far inland may convert to brackish or salt marshes due to saltwater

intrusion (Twilley et al. 2001). These impacts could be exacerbated by anthropogenic (from oil/gas withdrawals) subsidence, sinking of land faster than sedimentation can build it up. This threat is already occurring in coastal areas of the GCP&M, especially in Louisiana (EPA 1997). In Louisiana and Texas alone, the cumulative costs to protect the coast from a 20-inch sea level rise by replenishing beaches with sand is projected to be between $6.8 and $19.6 billion (EPA 1997).

Within the next 100 years, sea level rise is expected to severely impact the Gulf Coast Prairies and Marshes Ecoregion and obviously affect select species/communities, such as this reddish egret (white phase). Future conservation action must take into account this potential and design the conservation portfolio accordingly. For this iteration of the plan, tools, capacity, and time to integrate sea level rise were not available.

CHAPTER 2

Element Selection, Goals, Distribution, and Viability

CONSERVATION ELEMENTS

The goal of ecoregion-based planning is the design of portfolios that capture species, communities, and ecological systems within conservation areas to ensure adequate genetic representation and long-term viability. Because it is impractical to plan for *all* the species and communities representative of an ecoregion, a subset of species and communities, called conservation elements, was selected to represent biological diversity in the GCP&M. In addition, elements are chosen based upon the fact they are considered rare, threatened, or in a state of rapid decline (also see Appendix F). Conservation elements are the building blocks of ecoregional planning. They are the plants, animals, natural communities, and systems around which the Conservancy designs portfolios of conservation areas. Conservation elements were selected by teams of zoologists, botanists, and ecologists (see Appendix B, *Planning Team Structure*). By analyzing Natural Heritage databases, searching literature and museum collections, and holding expert workshops, the teams developed lists of natural communities and plant and animal species occurring within the Gulf Coast Prairies and Marshes. In all, 127 animals, 101 plants, and 113 natural terrestrial communities were identified as conservation elements. In addition, 27 freshwater systems were identified as conservation elements in the ecoregion (see Appendix H), and 20 estuarine or marine-area elements were identified. Waterbird colonies, grassland bird guilds, gulf beaches, mangrove wetlands, neotropical migrant bird fallout habitat, gulf beaches and dunes, and resaca wetlands were selected as non-species elements. The team felt that these assemblages/unique systems were so important that they should be singled out for consideration. See Appendix F for element selection criteria and Appendix I for lists of conservation elements.

What are natural communities?

Natural terrestrial communities are plant assemblages that repeat across the landscape and are described by a combination of dominant and diagnostic plant species and significant environmental conditions.

Communities – both terrestrial and freshwater -- are building blocks of conservation in and of themselves, but they also act as coarse filters, habitat for the suite of biodiversity that resides in the community, including common species not individually included as conservation elements.

Geographic Distribution of Elements

Geographic distribution of elements is important when setting goals (Table 2-1). Representation across the ecoregion is vital for attaining adequate element goals for the portfolio while

Table 2-1. Geographic distribution definitions

Endemic elements occur exclusively in the ecoregion.

Limited elements occur predominantly in one or two ecoregions, but may also occur in a few adjacent ecoregions.

Peripheral elements are more commonly found in other ecoregions; generally less than 10% of the element's total distribution is in the ecoregion of interest.

Widespread elements occur within the ecoregion and in many other ecoregions.

Disjunct elements have populations geographically isolated from those of other ecoregions.

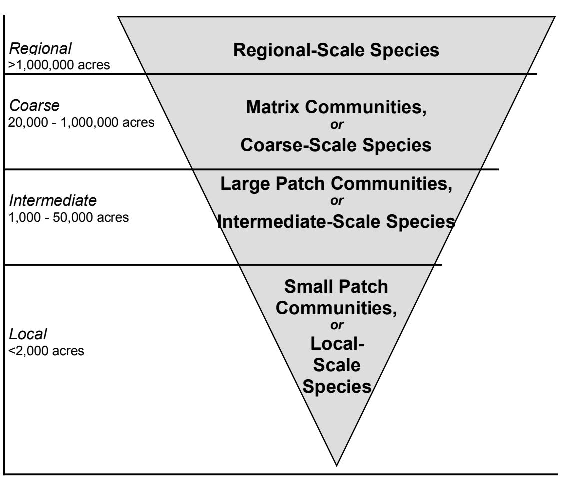
considering rangewide distributions. Special focus must be directed towards capturing endemic or restricted species/communities. In contrast, goals for widespread species/communities can be less stringent. Each of the 341 terrestrial community, animal, and plant conservation elements was labeled with its appropriate geographic distribution: endemic, limited, peripheral, widespread, or disjunct (see Table 2-1).

Attributing conservation elements with their appropriate geographical distribution helped technical teams determine elements to include and exclude. For instance, *endemic* species and communities were selected as elements, since their conservation is entirely dependent on efforts in the single ecoregion in which they are found. Expert opinion largely determined decisions on whether to include or exclude species, communities, and coarse level elements (e.g., grassland bird guild).

Spatial Pattern of Elements

Like geographic distribution, each conservation element has a characteristic spatial pattern (Appendix L; Figure 2-1). Spatial pattern refers to the typical range in area of a species or natural community. Four spatial patterns were used to describe the conservation elements in the GCP&M: local, intermediate, coarse, and regional.

Figure 2-1. Ecological spatial scale diagram (from Poiani et al. 2000).



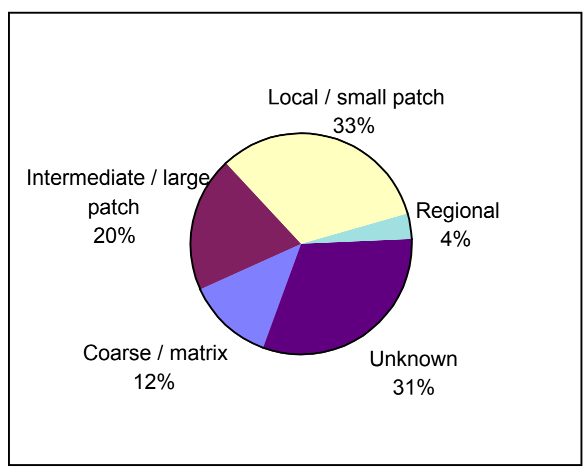
CONSERVATION GOALS

Conservation goals set the number of viable occurrences required to sustain a conservation element in the ecoregion and across its range. Although it is impossible to say with certainty the exact number or distribution of any species or community type that will ensure its persistence in the face of climatic or other environmental changes, conservation goals provide guidance as to "How much is enough?"

Species

Conservation goals for plants and animal species were based on the number of populations needed to conserve the element across its range. Default conservation goals developed by the Southern Resource Office of The Nature Conservancy were assigned to each element based on the global ranking of the element and its geographic distribution (see Appendix N; The Nature Conservancy 1999) (see Appendix J for information on global ranking). In some cases, goals were adjusted based on expert opinion. If federal recovery plans were available for a listed endangered species, guidelines suggested therein were taken into account.

Figure 2-2. Spatial scale of conservation targets



Terrestrial Communities

Like species, conservation goals for natural communities were derived based on the number of occurrences needed for long-term viability as well as their distribution in the ecoregion. In addition, the spatial pattern of communities was used in setting goals for terrestrial communities (see inset). As for species elements, default goals were used as preliminary guidance for establishing conservation goals. Based upon the assumption that large and small patch communities may harbor a disproportionately large amount of the biodiversity in an ecoregion, the conservation goals for patch communities were set higher than for matrix communities.

Spatial Pattern Definitions

Matrix Communities: Matrix communities are the dominant or historically dominant habitat in the ecoregion, occurring in patches of greater than 10,000 acres. These communities are defined by widespread physical gradients, such as elevation, precipitation, and temperature, across broad areas. As a result, viable areas selected for these elements tend to be among the largest.

Large Patch Communities: Large patch communities typically formed blocks of 2,000 to 10,000 acres within the above matrix. Viable sites for large patch communities are typically large enough to also support small patch community types and many species.

Small Patch and Linear Communities: Small patch and linear communities tend to be geographically discrete -- less than 2,000 acres in size -- and have been traditionally sustained by local and specific physical factors and environmental regimes processes such as microclimatic variability. Thus, small patch and linear community viability requirements may be met at areas too small for large patch and matrix types.

Freshwater Communities

Numerical goals for representation of aquatic systems were stratified across watershed units called Ecological Drainage Units (EDUs) (see Appendix D). EDUs are broad-scale watershed units with similar patterns of zoogeography, connectivity, climate, and hydrologic characteristics. The use of EDUs as stratification units ensured that all intra-ecoregional variation in species pools was accounted for when representing biotic assemblages with physical variables.

The conservation goal for freshwater aquatic systems was one example of each large river system and two examples of each small stream system in each EDU. All examples were required to meet a minimum length, based on the requirements of the expected biotic components of the communities to be represented by the aquatic system. Thus, the minimum length is greater for large rivers than for smaller streams. Minimum lengths for inclusion were 1 km for stream elements and 20 km for river elements.

VIABILITY

In the context of ecoregional conservation, viability is the likelihood that a conservation element or its component occurrences (e.g., a specific population) will be maintained over a given period of time. This concept is of prime importance if ecoregional plans are to be assembled in such a way that the Conservancy will meet its conservation goals in a given ecoregion.

Factors of size, condition, and landscape context (also known as EO Rank Specifications/Specs) were evaluated to judge the viability of each element occurrence. In cases where EO Rank Specs had not been developed, viability rankings were based on the educated guesses of experts.

Viable occurrences were given one of three rankings, in descending order of predicted viability: I (Irreplaceable), R (Recommended), or V (Viable). These ranks influenced portfolio design; for example, all I ranked occurrences were examined for inclusion in the portfolio before other occurrences, since they had the highest predicted viability and represented the best chances of conserving an occurrence of a conservation element. In other words, "I" ranked occurrences are the most viable occurrences in the portfolio and were deemed as being irreplaceable. Occurrences ranked N (Not Viable) or U (Unknown) were not considered during portfolio design. Occurrences with U ranking will become priorities for inventory (see Appendix M for more information on viability ranks). Although viability ranking criteria varied for Heritage programs in Texas and Louisiana, the IRV ranking method created a level playing field for all occurrence viabilitity ranking by using the exact same criteria in combination with expert and Heritage staff input.

Freshwater Systems

After lengthy expert review, the viability of aquatic systems in the GCP&M was not explicitly considered. Only freshwater systems present in portfolio areas *already selected on the basis of viable terrestrial elements* became part of the ecoregional portfolio. When possible, experts were consulted as to whether or not these aquatic system occurrences represented viable examples, but expert validation was unavailable for most aquatic system occurrences. Site conservation planning teams are encouraged to consult experts before including aquatic systems in the future plans. The next iteration of the GCP&M plan must address this gap in assessing freshwater aquatic elements in the region.

MEXICO TEAM TARGET SELECTION

There was a great focus in working with our partners in Mexico to provide orientation to ecoregional conservation planning and developing the appropriate support, financial and otherwise. The team was successful in conducting an Experts' Workshop and refining a conservation target list for the Mexican portion of the ecoregion. However, we experienced difficulty in melding the existing target lists for Texas/Louisiana with that of Mexico. In addition, investing more time, effort, and financial resources at the initiation of target list development in the future will be critical to avoiding the difficulties we experienced in this process. Overall, the Mexico Team incorporated the main concepts of Geography of Hope very well and advanced their conservation planning capacity tremendously.

Tallgrass coastal prairie once occupied nearly 8 million acres of the GCP&M ecoregion. Now less than 2% remains. Primary threats include overgrazing, exotic invasion (Chinese tallow [*Triadica sebiferum*]), lack of fire, and conversion to tame pasture.

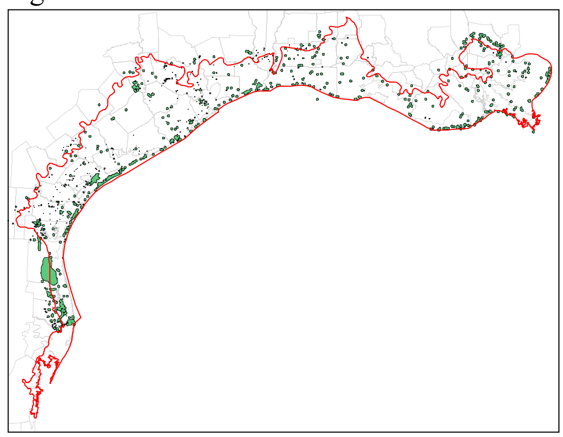
CHAPTER 3

The Ecoregional Portfolio Design

PORTFOLIO DESIGN

Using information gathered during the data assembly and assessment phase of the project, the planning team met in October 1999, in Port Aransas, Texas. Our ultimate objective was to assemble a portfolio of conservation areas. The resulting portfolio was subsequently refined and finalized by the technical teams. The ecoregion was stratified (Mississippi Delta, Chenier Plain, Texas Bays and Marshes, Hypersaline Lagoon) into ecologically based subunits based upon rainfall, soils, and geology. However, the team decided not to tie goal setting to specific subunits due to lack of data and distinct distribution variation from north to south.

Figure 3-1. Proto-Sites in GCP&M.



Phase One – Proto-Sites

To focus portfolio assembly on areas of high biological significance, element occurrences were mapped in GIS and buffered at various sizes according to their assigned spatial scale (i.e., local scale plant [*Chloris texensis*] 0.5 km; also, see Appendix O). Occurrences in close proximity were merged into proto-sites (see Figure 3-1 and Appendix O). Proto-sites served to draw attention to areas in the ecoregion that have a high density of viable element occurrences. Thus, evaluation of proto-sites for inclusion in the portfolio began with those proto-sites containing viable matrix community occurrences.

Irreplaceable (I rank) occurrences were those determined by experts (TNC, Heritage Program personnel, others) as being critically imperiled; if excluded, they would be lost. Recommended occurrences were defined as being more common but still critically important. If there were fewer occurrences than the goal set, all viable occurrences were included in the portfolio. For G4-G5 species and communities, occurrences were required to have an Element Occurrence rank of A or B to be included in the portfolio (also see Appendix M). As they were included in the portfolio, boundaries of the proto-sites containing matrix communities were adjusted to reflect the landscape requirements of embedded species and communities. In addition, boundaries of proto-sites were redrawn to reflect actual conditions on the landscape, rather than their default buffer shapes.

Natural community-based proto-sites were added to the portfolio until all viable examples of communities were added (along with any associated fine-filter elements embedded in the proto-sites), or until the conservation goal for each community was met with the best and most viable community occurrences. Subsequently, proto-sites without any viable community occurrences but containing animal and plant elements for which the conservation goal had not been met by proto-sites previously selected, were considered for inclusion in the portfolio.

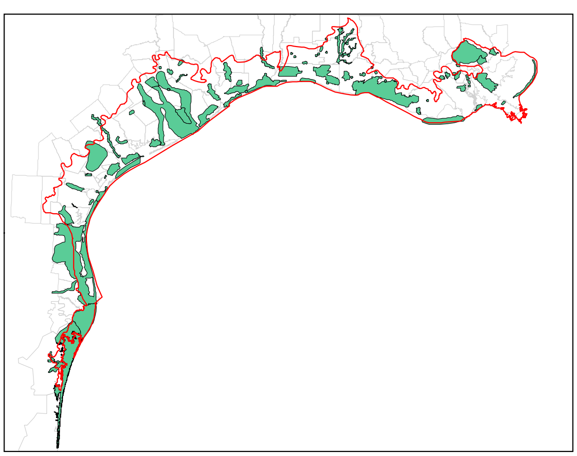
Phase Two – Portfolio Review

Terrestrial Conservation Areas

The portfolio developed from the proto-site evaluation was reviewed and revised by the technical teams to ensure that all appropriate element occurrences had been incorporated into the portfolio. Viable occurrences possessed heritage ranks of A-C and had to be dated from 1980 or later, or confirmed by technical team members as being viable. Highly viable occurrences had EO ranks of A or B. Occurrences were labeled "Not Viable" if it was known that the occurrence was not viable or it no longer existed. Non-viable (N-ranked) occurrences were not selected at any point in the portfolio selection process.

All technical team members and several outside experts were involved in the manual process of delineating areas. Viable occurrences not incorporated in Phase One that were necessary to meet conservation goals were added to the portfolio, and conservation area boundaries were changed if necessary. This period of element inclusion was built in to the process to account for record development during a protracted "data mining" stage. Sources included museum records, data from an expert workshop in Mexico, partners, and select experts. Admittedly, this was not the most efficient approach but was mandated due to deadlines set for completing the plan.

Figure 3-2. Phase Two of Portfolio Design: Terrestrial Conservation Areas



This phase of portfolio design also provided technical teams an opportunity to identify data gaps for each conservation element. Remedying data gaps will become inventory priorities and a key implementation strategy (Appendix S).

Freshwater Conservation Areas

Although it is well known that freshwater inflows into the bays and estuaries of the Gulf of Mexico are crucial for the maintenance and functioning of productive marine systems, the biological diversity of contributing streams was not completely assessed for this planning effort. Only 4 freshwater species elements were identified as elements in the ecoregion.

However, a lack of understanding about the biological diversity of freshwater systems in the ecoregion should not imply that these systems are unimportant. Thus, as a means to begin developing an understanding of freshwater systems in the ecoregion, a classification and gap analysis were performed for the freshwater systems encompassed in terrestrial conservation areas.

A region-specific, physically-based model was developed by consulting literature and regional experts to determine the most important key abiotic and biotic variables that distinguish natural aquatic communities in lotic systems. The model was applied in a Geographic Information System (GIS) using digital data layers to represent key variables. Using this model, distinct classes of each variable were developed to identify unique combinations, called Aquatic Ecological Systems (hereafter "aquatic systems"). Each aquatic system represented a different pattern of physical settings thought to contain a distinct set of biological communities and was therefore a distinct conservation element. Stream size, gradient, hydrologic regime, water chemistry, and salinity were identified as the most important physical variables that distinguish natural aquatic communities in lotic systems in the GCP&M.

Aquatic systems captured in terrestrial-based portfolio areas were evaluated based on the variables mentioned above. Because time did not allow for a detailed GIS analysis of watershed quality or a meeting of regional experts, only two portfolio areas were delineated based solely on aquatic systems. Most aquatic systems were integrated into existing portfolio sites by noting which aquatic systems were represented by streams existing within terrestrial portfolio areas. In order to satisfy an occurrence for reaching a system goal, a "captured" stream reach must have been of sufficient length to represent the minimum required for that system type. Descriptions of the aquatic systems can be found in Appendix H, Table H-1. Subsequently, a gap analysis was completed to determine which freshwater systems met their conservation goals, and which were not represented in any conservation area. While this method of identifying freshwater systems is sufficient as a first step to understanding coastal freshwater systems in the ecoregion, greater attention should be paid in subsequent iterations of the ecoregional plan to identify which freshwater systems are of highest quality and support the greatest biodiversity, rather than relying on high-quality terrestrial areas to indicate high quality freshwater systems. However, we feel confident that the majority of freshwater elements are adequately addressed by this plan based upon present data and knowledge.

Marine Conservation Areas

Marine and estuarine portfolio conservation areas were incorporated in the GCP&M portfolio from the suite of conservation areas identified in the Northern Gulf of Mexico ecoregional plan (Beck et al. 2000). The Northern Gulf of Mexico ecoregional plan identified 23 estuarine or marine sites, with 8 high priority conservation areas, and 15 lower priority areas. Most of the marine areas identified in the NGOM plan are adjacent to, or overlap, terrestrial or freshwater conservation areas identified in the GCP&M plan (see Figure 3-4, Table 3-1). Where conservation areas overlap, the resulting landscape should be considered an integrated conservation area that includes all components of diversity within the larger land and seascape.

Ecological processes integrally link the bays and estuaries of the northern Gulf of Mexico to the surrounding terrestrial and aquatic environments. Conservation in select parts of these landscape-scale sites will benefit biodiversity across multiple scales, and this connectivity must be recognized and used in development of conservation strategies. Ultimately our understanding of this connectivity will improve the chances for successful conservation of seamless biodiversity throughout the GCP&M and Northern Gulf.

CONSERVATION AREAS IN THE ECOREGIONAL PORTFOLIO – A SUMMARY

The conservation design resulted in a portfolio of 86 conservation areas, which represents concentrations of biodiversity within the GCP&M (see portfolio map and list of areas in Figure 3-3 or Appendix E). Conservation areas in the ecoregional portfolio ***do not*** necessarily represent areas where The Nature Conservancy, or its partners, are going to actively acquire habitat. The scope and scale of this plan makes it clear that conservation of biological diversity in the ecoregion will be dependent upon the cooperation and participation of many stakeholders. These will include private landowners, industry, government, as well as non-profit conservation organizations – and that the tools of conservation will range from continued good land stewardship and protection of waters where elements currently occur, to more permanent protection tools, such as conservation easements and land acquisition.

Evaluating the Portfolio

Several assessments were conducted to critically evaluate the conservation implications of the portfolio. The analyses performed included assessments of conservation goals met, biological richness, site functionality, and critical threats to biodiversity in the portfolio conservation areas. In spite of considering nearly 1,900 element occurrence records and generating additional records during expert consultation, data were lacking for numerous species and communities. This was especially true for the Mexican portion of the ecoregion.

In addition to the identification of areas of high biological significance (in other words, the map of the portfolio of conservation areas), a valuable outcome of ecoregional planning is the elucidation of data gaps. Before the next iteration of planning for the GCP&M, it will be crucial that vast data gaps be filled in order to increase the robustness of the conservation area portfolio. Of particular concern are gaps related to plant species and community types. Species with regular monitoring methodologies in place or possessing threatened/endangered status most readily met goals (e.g., piping plover, waterbird rookeries, Kemp's Ridley sea turtle).

Restoration is a crucial activity that will be necessary to implement on a large scale if we are to be successful at implementing this plan. Exotic species, overgrazing, lack of fire, and hydrological disturbance are just a few examples of impacts upon species and communities that can be reversed through proper restoration techniques. However, a comprehensive analysis of restoration necessary to sustain or allow reintroduction of lost species/communities was not incorporated into this plan. Conservation area plans (see Figure 3-6) must develop restoration strategies where necessary.

Managed areas in relation to the portfolio

As mentioned earlier, 5.9% of the GCP&M is designated as protected or managed lands. The U.S. Fish and Wildlife Service and National Park Service are the 2 primary agencies with management responsibilities. Relative to the portfolio, there is an overlap between Conservancy designated conservation areas and existing protected areas of 12.1%. The breakdown by ownership category within this overlap is as follows: federal (USFWS, NPS) – 64.6%, state (Louisiana Wildlife and Fisheries, Texas Parks and Wildlife Department, Texas General Land Office) – 31.2% and county/NGO's – 4.1%. The Conservancy presently owns and manages 30,791 acres within the ecoregion or just 0.36% of the entire portfolio. Needless to say, a focus on working with private landowners will be critical to the success of this plan since 87.9% of the portfolio lies within private lands.

Barrier islands can be found along the entire marine portion of the GCP&M. Some are heavily developed (Galveston Island) while others are presently in fairly intact condition (Padre Island, Complejo los Rabones-el Baril e Islas de Barrera). In Louisiana, the Chandeleur Island has been severely impacted by recent hurricanes and sea level rise.

Fig 3-3. Portfolio of the Gulf Coast Prairies and Marshes Ecoregion. *(See Appendix E for a larger version of this map.)*

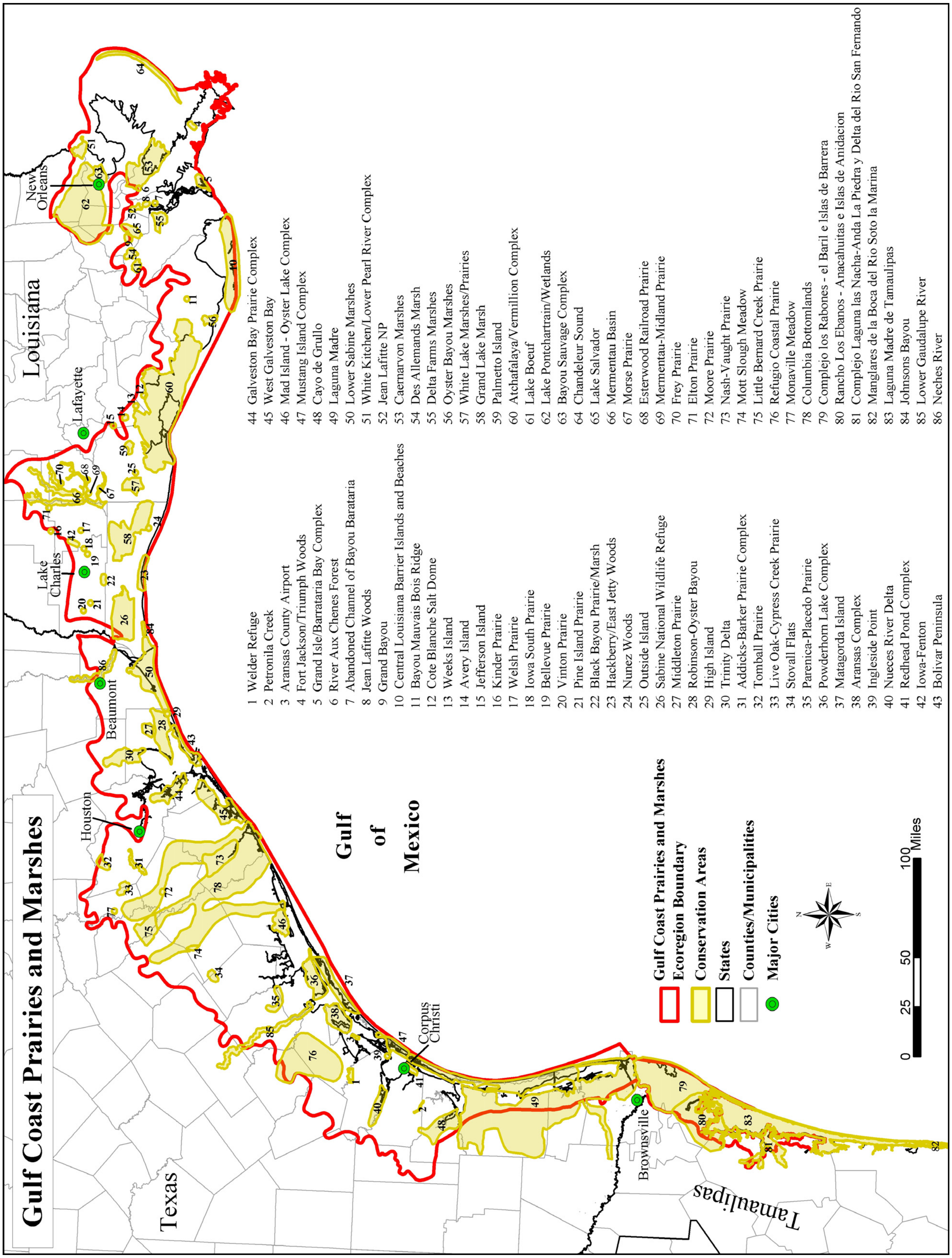


Fig 3-4. Overlap of the GCP&M portfolio conservation areas and Northern Gulf of Mexico (NGOM) marine conservation areas. *(Also see Table 3-1.)*

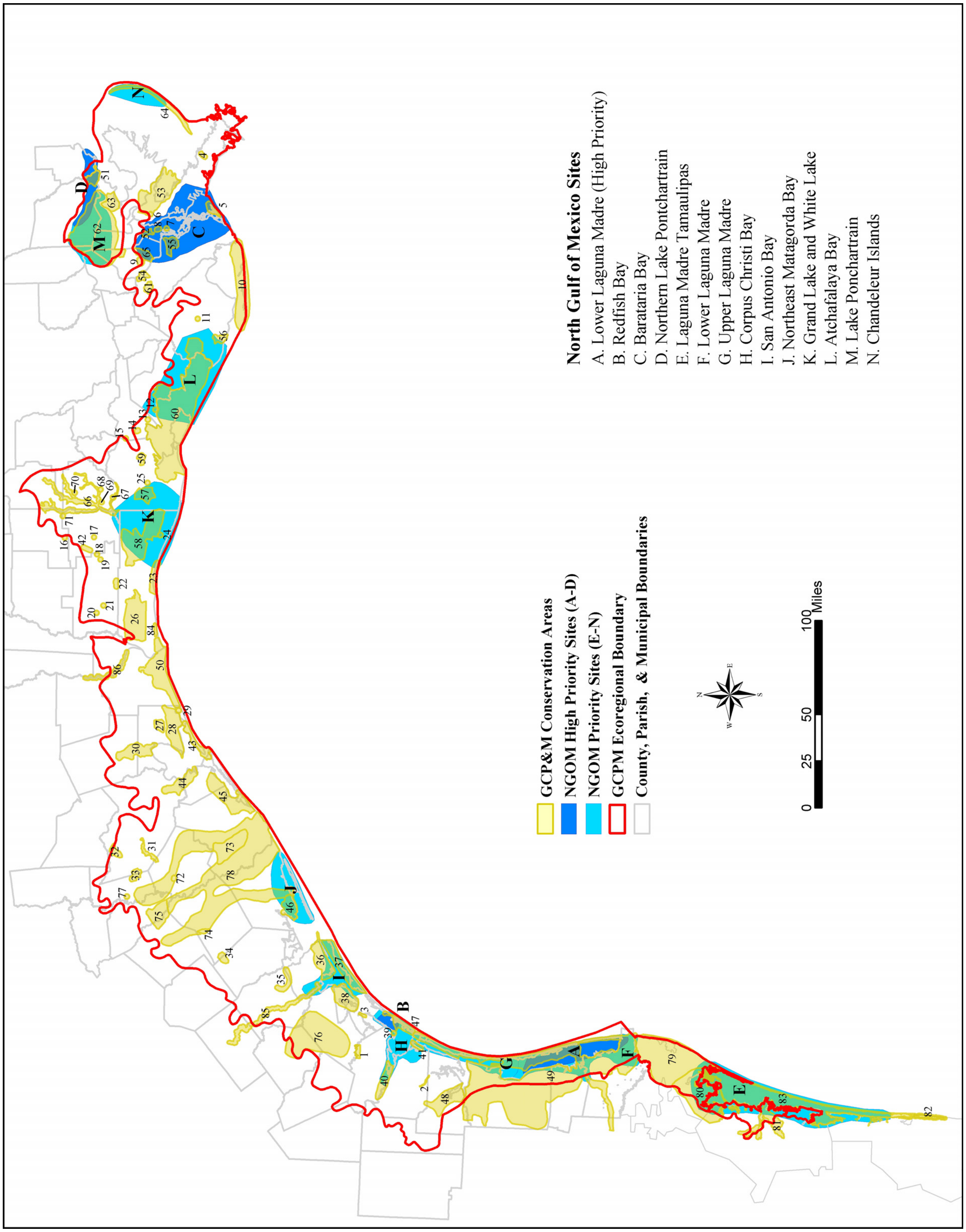


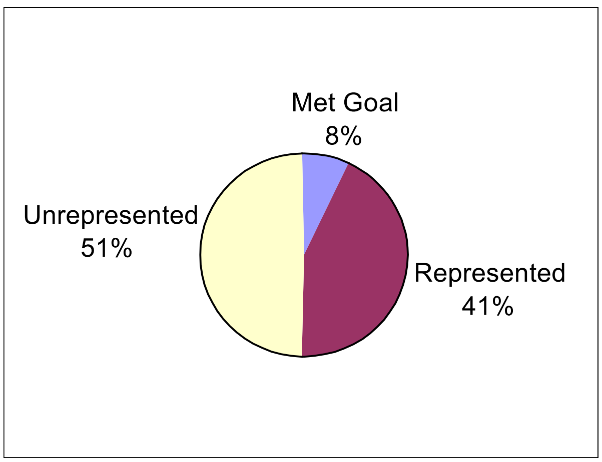
Table 3-1. GCP&M ecoregion conservation areas that overlap with marine sites identified by Beck et al. 2000.

Marine Conservation Areas	Adjacent or Overlapping Terrestrial Conservation Areas
High Priority Marine Areas	
(A) Lower Laguna Madre	(49) Laguna Madre
(B) Redfish Bay (part of Corpus Christi Bay)	(39) Ingleside Point (47) Mustang Island Complex
(C) Barataria Bay	(5) Grand Isle / Barataria Bay Complex (7) Abandoned Channel of Bayou Barataria (8) Jean Lafitte Woods (52) Jean Lafitte National Park (55) Delta Farms Marshes (65) Lake Salvador
(D) N. Lake Pontchartrain to N. Lake Borgne	(51) White Kitchen / Lower Pearl River Complex (62) Lake Ponchartrain / Wetlands
Priority Marine Areas	
(E) Laguna Madre de Tamaulipas	(79) Complejo los Rabones – el Baril e Islas de Barrera (80) Rancho los Ebanos – Anacahuitas e Islas de Anidacion (81) Complejo Laguna las Nacha – Anda la Piedra y Delta del Rio San Fernando (83) Laguna Madre de Tamaulipas
(F) Lower Laguna Madre	(49) Laguna Madre
(G) Upper Laguna Madre	(41) Redhead Pond Complex (47) Mustang Island Complex (49) Laguna Madre
(H) Corpus Christi Bay	(39) Ingleside Point (40) Nueces River Delta (41) Redhead Pond Complex (47) Mustang Island Complex (49) Laguna Madre
(I) San Antonio Bay	(36) Powderhorn Lake Complex (37) Matagorda Island (38) Aransas Complex (85) Lower Guadalupe River
(J) Northeast Matagorda Bay	(46) Mad Island – Oyster Lake Complex (78) Columbia Bottomlands
(K) Grand Lake and White Lake	(23) Hackberry / East Jetty Woods (24) Nunez Woods (25) Outside Island (57) White Lake Marshes / Prairies (58) Grand Lake Marsh (66) Mermentau Basin
(L) Atchafalaya Bay	(12) Cote Blanche Salt Dome (56) Oyster Bayou Marshes (60) Atchafalaya / Vermillion Complex
(M) Lake Ponchartrain	(51) White Kitchen / Lower Pearl River Complex (62) Lake Ponchartrain / Wetlands
(N) Chandeleur Islands	(64) Chandeleur Sound

Success at Meeting Conservation Goals

The portfolio of 86 conservation areas represents 889 individual viable occurrences of plant, animal, and community elements and 36% of the GCP&M ecoregion. Each of the elements had a conservation goal, i.e an estimated number and distribution of populations of that element that will ensure its long-term persistence in the ecoregion (see Appendix I). Whether conservation goals are met through portfolio design is a primary measure of success of the conservation design. Primarily due to lack of data, we were unable to meet design goals for most elements. As shown in Figure 3-5, "represented" refers to those elements that have actual occurrence data in the portfolio, and "unrepresented" is that portion of elements with no occurrence data at all. Out of a total of 341 conservation elements, 26 met their conservation goals.

Figure 3-5. Conservation target goal summary.



Within the 86 conservation areas in the portfolio, 27 different aquatic systems types are represented. GCP&M aquatic system elements represent only those systems that are exclusively freshwater or have a limited brackish/saline component. The aquatic systems in the GCP&M are described in detail in Appendix H.

Functionality

Although all portfolio sites should be functional, not all sites will be functional landscapes. Of the 86 conservation areas in the Gulf Coast Prairies and Marshes, 18 (21%) meet the definition of a functional landscape (See Appendix R, Table R-1). It is difficult to gauge if this functionality figure is high or low due to inconsistent reporting standards for other coastal ecoregions. Ecoregional planning represents a shift away from conservation based only on rarity to setting priorities based upon ecological systems and landscape-level concepts. A particular emphasis is placed upon conserving *functional landscapes*. A functional landscape conserves elements at several spatial scales (e.g., matrix/large patch communities *and* coarse/intermediate/local-scale elements). More importantly, functional landscapes are of sufficient size to enable and endure environmental processes which naturally impact the functional landscape, such as hurricanes, flooding, and fire. In other words, functional landscapes (e.g., Laguna Madre, White Kitchen/Lower Pearl River) are designed with change in mind. By conserving ecosystem-level environmental processes, the landscapes and the elements of biodiversity within them will be more likely to persist through time (Poiani and Richter 1999).

In contrast to a *functional landscape*, a *functional site* aims to conserve a small number of elements at only one or two spatial scales. Although they are not necessarily easy to conserve, elements are relatively few and often share similar sustaining ecological processes (e.g., fire-dependent prairie plants and butterflies; a wetland and its rare species; assemblages of rare fish). It must be stressed that even though these areas are smaller, they can possess high levels of biodiversity that contribute as much or more towards portfolio goals as do functional landscapes.

The attention to functional conservation areas is intended to improve the efficiency and effectiveness of conservation work. Functional landscapes typically provide more habitat, greater habitat diversity, and larger populations of species. Because of their complex and comprehensive environmental gradients, they also offer greater protection against global climate change (Twilley et al. 2001). This is particularly important in the GCP&M ecoregion where sea level rise and subsidence are critical processes. Yet, functional landscapes are also exponentially more complex, and understanding as well as measuring conservation success within them requires substantial resources.

Data Gaps

Data gaps are the pieces of knowledge considered vital to producing a complete ecoregional plan, but which, for reasons of time or availability of the information, the planning team was unable to incorporate. Several types of data gaps were documented by the planning team, such as those involving the existence of viable populations of elements of conservation concern, and those involving the ecoregional planning process itself. In addition, incomplete occurrence records prevented incorporation of some data into the assembly process. Half of our elements were not linked to actual occurrence data. In some cases, records were more than 20 years old, and thus were not used in the assembly analysis.

In the Gulf Coast Prairies and Marshes, our data gaps are significant. For instance, the planning team had no knowledge of any existing, viable populations of Runyon's water willow (*Justicia runyonnii*) or Cagle's Map Turtle (*Graptemys caglei*). In addition, natural community data were lacking for many of the associations and eco-groups. As indicated previously, the conservation goal was met for only 27 of the 356 elements. There are several valid reasons for this, ranging from insufficient inventory to the naturally low abundance of the elements. In Texas, Natural Heritage inventories have been conducted primarily upon public lands. The Texas Conservation Data Center has undertaken several private land initiatives to focus upon potential occurrences of conservation elements. Collaboration and partnerships with private landowners, universities, and other ecologists will be crucial in addressing the data gap issue.

Please refer to Appendix S for a list of data gaps and information about assisting the Conservancy in filling data gaps in the ecoregion. However, in spite of the need for more data, we feel the GCP&M portfolio captures the majority of biodiversity in the ecoregion.

NEXT STEPS

While there is an inherent focus on large, functional landscapes within the GCP&M, we must be diligent in protecting biodiversity at local and intermediate scales. Conservation approaches by other management and conservation agencies and organizations, as well as private landowners, will undoubtedly enhance biodiversity conservation beyond that which is laid out in this plan. Moreover, it is impossible for the Conservancy alone to accomplish all that is called for in this ecoregional conservation plan. It is imperative, then, for the Conservancy and all stakeholders to work cooperatively to protect the biodiversity of the Gulf Coast Prairies and Marshes. Fulfillment of this lofty goal, however, will require a great amount of understanding, cooperation, resources (financial and otherwise), and time. This plan should serve as an important blueprint to guide those cooperative ventures.

The Nature Conservancy cannot act in isolation. In order to develop and implement conservation, public and private partnerships need to be established that will utilize limited financial resources and lands available for conservation in a coordinated and effective manner. Innovation, collaboration, community-based conservation and development of new partnerships, especially in Mexico, will be critical to successful implementation of this plan for the Gulf Coast Prairies and Marshes Ecoregion.

As outlined in the conservation process (Figure 3-6), the next major task is to carry out conservation area planning for all 86 portfolio areas. Conservation area planning is based on the detailed analysis of stresses and the sources of these stresses to the health of all conservation elements found in each particular area. Discrete and tangible strategies to alleviate the stresses are then developed and described. These plans are developed with partners and experts who have intimate experience and knowledge of the area. Staff from The Nature Conservancy and conservation partners will implement each conservation area plan in a coordinated fashion.

Measuring success of conservation actions taken as outlined by each conservation area plan is a critical step in our process. The effectiveness of strategies in abating key threats to the health of conservation targets will dictate how much or how little conservation area plans are changed and adapted to changing conditions. The entire process is iterative. Ecoregional plans will be revised every 3-5 years or whenever enough new data becomes available and the planning team feels another iteration is warranted. These basic criteria hold true for conservation area plans as well. Setting well-founded standards for measuring success will be a major key to achieving lasting tangible results within the Gulf Coast Prairies and Marshes Ecoregion.

Coastal plain backswamp/slough floodplain forests with high quality stands of baldcypress (*Taxodium distichum*) are a high priority conservation element within the GCP&M ecoregion. Louisiana harbors the best representation of this habitat in the ecoregion.

Figure 3-6. The conservation approach of The Nature Conservancy. Ecoregional planning is the first step in the iterative approach.

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The Kemp's Ridley sea turtle (*Lepidochelys kempii*) is found within the GCP&M ecoregion throughout its annual cycle. Protection of nesting areas (e.g., Padre Island) and foraging habitat (e.g., Sabine Pass) will be critical in maintaining their recovery.