WHERE WORDS AND SEEDS MEET:
AN ECOLOGICAL RESTORATION PROJECT
IN MATAGORDA COUNTY
COASTAL PRAIRIE

THESIS

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CHAPTER I

INTRODUCTION TO THE STUDY

All flesh is grass, and all the goodliness thereof is as the flower of the field.

ISAIAH 40:6

The thought of what once was here and now is gone will not leave me as long as I live. It is as though I walk knee deep in its absence.

WENDELL BERRY

Land and places in South Texas are intriguing. From tractor-wheel fences, crafted with a geometric canniness (see Figure 1), to turtle canning factories of the late 1800s (Stephens 1962, 29), the Coastal Plain holds treasures within it that are unfamiliar to some Texans. One such story located in the Coastal Plain is that of the globally imperiled (Diamond et al. 1992; Grossman et al. 1994) coastal prairie ecosystem.

The research objective of this thesis is to analyze the details of an ecological restoration project in this ecosystem to determine the general baseline of coastal prairie restoration in Texas. This research is rooted in a perspective deeply concerned with the meaning of actions, language, and the ideals of restoration ecology. This approach is useful first because at present there exists no descriptive baseline of coastal prairie geography which could be labeled "environmental geography," no study of this ecosystem which analyzes human-environment interactions. Secondly, this research has

Figure 1 A fence in front of cropland in Matagorda County, Texas

Photograph by the author

merit because the coastal prairie is a vanishing ecosystem; yet as long as the land and the seedbank remain, there is a chance for it to persist. Another avenue is through conservation agendas, including ecological restoration. Therefore understanding the geography of the coastal prairie is essential to designing a sustainable restoration system. To that end, this study seeks to describe and analyze the interaction of social elements on the landscape of a coastal prairie ecological restoration project.

I would not care for coastal prairie as I do, nor have woken up to see its strange beauty, had I not crafted tunnels and fairy houses in bunches of little bluestem and other substantial clumps of grasses as an eight-year old. In the fields across from my house and that of my best friend's, halfway across the island, the little bluestem inflorescences and the gulf coast paspalum's smooth stems made adornments for playing fairies. We chased one another through these fields. These were patches of never-before-plowed grassland. Forgetting that we were just on the leeward side of the dunes of a barrier island, and therefore in an ecotone, it was possible to lose one's self in prairie, not knowing the ecological specifics. There were ant lions and field mice to observe. Examining the grasses which comprise it can show the subtle beauty of coastal prairie.

I believe we find our attachments to particular pieces of ground because the existence of a diversity of landscapes matters. If you ask enough questions of a place or find someone who already has done so, you'll eventually find that any ecosystem you inquire into deserves saving and has value at the most basic level—the fascination of its creation and strange beauty.

My attachment is not complicated; it resides in the feeling of home. There is wonder in the discovery of a grass that blooms purple-pink inflorescences (flowers). Although a landscape may not have an appeal that is immediately evident to a person, the place matters. The ecosystems that retain their character of pre-industrial development, even if they are hanging on by mere threads, need to be conserved. We are changing the surface of Earth so quickly now. Humans undoubtedly exert a disproportional force over the land's processes and will continue to do so, yet the places deserve and need saving. It is similar to the respect one shows elders. Ecological restoration melds this respect for land with real action. It presents a model for conservation that mimics nature. And although, Aldo Leopold was one of the first practitioners of restoration in the 1930s, restoration is still largely unknown to many people. Through restoration we have a chance to keep the ecosystem living. Coastal prairie is where I am from; it is where I first encountered details and lessons in the land. A patch of grassland does matter, although by no means is this the only landscape that has ever informed a life.

This paper records geographic research that I focused on Texas coastal prairie. The overarching research question is: What is the geography of coastal prairie restoration? The specific areas of inquiry are the human and physical factors that affect restoration in Texas coastal prairie, the ways social processes influence physical forms of restoration in a single case, and a focus on commodification of the restoration outcome. The value of understanding the geography of restoration is that it informs conservation acts with both a community perspective and a broad ecological perspective.

To describe the nature of the geography of remnant coastal prairies is to describe a geography of extinction. The endangered ecosystem faces habitat fragmentation, edge effects, and genetic bottlenecks. To describe the nature of the geography of coastal prairie restoration in *Texas* is to describe the mechanism and process of a conservation management act rooted in *hope.*

The thesis is organized into six chapters. Chapter two follows the introduction with a review of the relevant literature. Chapter three describes the research methodology. In Chapter four, I discuss the specific case of Mad Island. The fifth chapter contains the results and analysis of the research questions. Chapter six contains the conclusion with recommendations for ecological restoration.

CHAPTER II

LITERATURE REVIEW

The complexity of coastal prairie ecological restoration, combined with the breadth of geography and the examination of social processes affecting the outcome of ecological restoration on the land, necessitates a broad and comprehensive literature review. The first section of this chapter includes a sketch of the framework of environmental geography and an overview of the state of Texas land ethics. The second section discusses the origins and processes of the social aspects of conservation in Texas and how this cultural climate interacts with coastal prairie, pushing the ecosystem toward extinction. The third section reviews basic ideas of restoration ecology including the idealistic essence composing it and the fluid character of restoration ecology language [a sketch of semantics].

Geography and the Texas coastal prairie

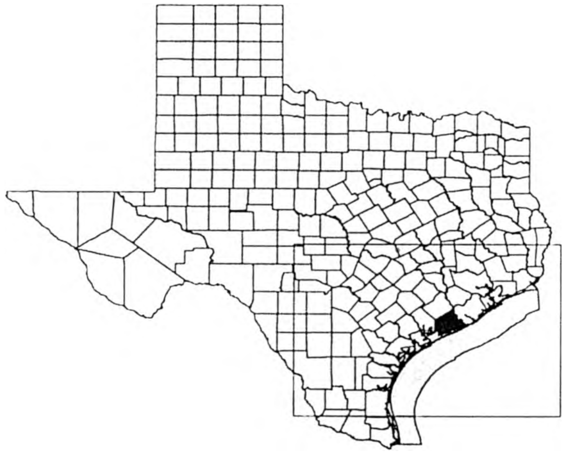
Threatened remnant habitats are among the most critical of habitat types to be restored. Land on the Texas coastal plain offers many opportunities for conservation management that emphasizes using nature as a model. Less than 1% of the coastal prairie in the United States remains in relatively pristine condition (Smeins et al. 1992).

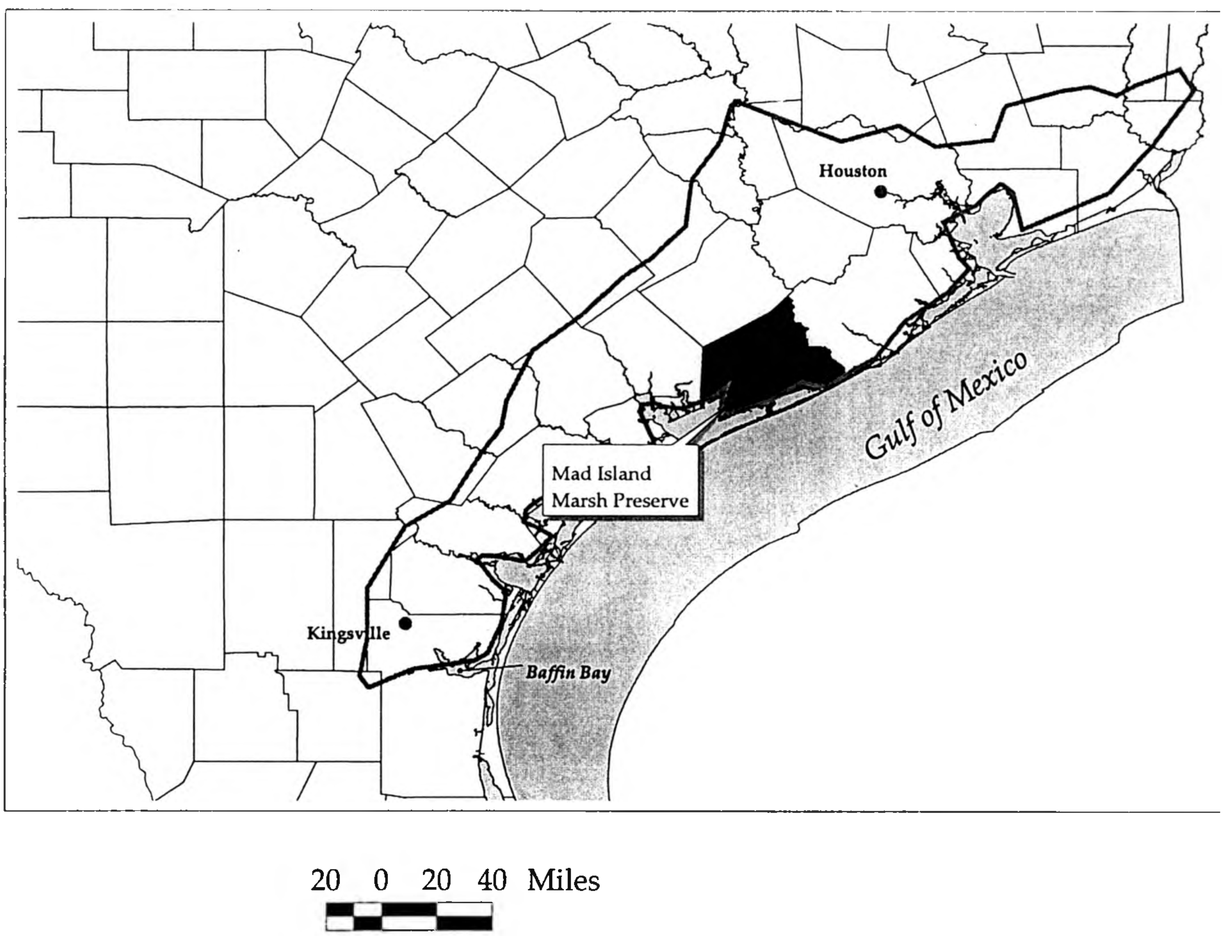
A narrow strip along the Texas coast of the Gulf of Mexico once supported what is thought to have been a nearly continuous grassland. Figure 2 shows the historical range of the coastal prairie. Curving along the Gulf Coast from Lafayette, Louisiana to Kingsville, Texas, the prairie stretched inland 40 to 160 km (Smeins et al. 1992, 269). Upon landing on the Texas coast, early explorers such as Cabeza de Vaca encountered a sea of grass with few trees (Box 1961; Johnston 1963; Dodd 1968; Smeins et al. 1992). Frequent fires, soil conditions, and the absence of sustained overgrazing were responsible for the grassland's lack of woody-species encroachment (Archer 1989; Smeins et al. 1992).

Several ecologists have described and collected vegetation in this strip of grassland bordering the Gulf Coast (Clover 1937; Johnston 1955; Diamond and Smeins 1984; McLendon 1991). In vegetation studies of Texas, researchers define the southern boundary of the coastal prairie to be near Baffin Bay, based on the particular physiographic features of soil associations, the width of the prairie's spread inland, and grass species present (Johnston 1955, Smeins et al. 1992). The ecological association of coastal prairie is defined on the basis of the vegetation present (See Table 1). The first four grass species listed in the table are the four dominants of the Tallgrass Prairie. The coastal prairie is divided into upper and lower prairies based on differences in soil and climate (Diamond and Smeins 1984, 321). The divide occurs roughly along the San Antonio River, between Calhoun and Refugio counties. It is generally accepted that the upper coastal prairie forms a continuum with the Texas prairies to the north (Blackland Prairie, Fort Worth Prairie, Fayette Prairie and San Antonio Prairie) and with the Tallgrass Prairie of the mid-continent (Risser et al. 1981, 11; Diamond and Smeins 1985, 307). The upper

Figure 2

Location of Texas Coastal Prairie





coastal prairie receives more precipitation. The lower coastal prairie is situated in the area also known as the Coastal Bend because of the form of the Texas coastline. Because natural landscape processes are dynamic, the boundary of historical coastal prairie is approximate. Fire is one of the major processes that maintained the fluidity implied by the line of approximation (Jim Grace, pers. comm., 2001).

Table 1. Grasses of the upper coastal prairie

COMMON NAME	BOTANICAL NAME
little bluestem	*Schizachyrium scoparium*
big bluestem	*Andropogon gerardii*
Indian grass	*Sorghastrum nutans*
switchgrass	*Panicum virgatum*
tall dropseed	*Sporobolus asper*
brownseed paspalum	*Paspalum plicatulum*
Texas wintergrass	*Nasella leucotricha*

Soil associations make the region geographically distinctive (Clover 1937; Küchler 1964; Omernik 1987; Diamond and Fulbright 1990). The coastal prairie is also noteworthy for being a region of connectivity, linking the moist woodlands of East Texas with the Tamaulipan brushland of northeastern Mexico and extreme South Texas, allowing for an exchange of terrestrial fauna within the regions (Blair 1950, 96). The rich waxy black soils drew farmers to plow and practice tillage agriculture here. Tillage agriculture gradually transitions to grazing along an east-west gradient in the coastal prairie region. This land use transition is based on increased rainfall to the east and increased aridity to the west.

Coastal prairie ecological studies have concentrated on general descriptions, vegetation analyses within single associations, and ecological affinities with related prairies. Fire suppression, overgrazing, and intensive agricultural, urban, and industrial development account for the dearth of remaining coastal prairie. Similarly, lack of fire and poor grazing practices are causes for the decimation of prairie in the Great Plains of the United States (Leach and Givnish 1996). Less than 1% of the original 3.8 million hectares of coastal prairie grassland remain today (Smeins et al. 1992, 270). These studies have not examined the environmental geography of restored coastal prairie sites or of coastal prairie restoration in Texas in general.

Mima mounds and *gilgai* are two topographic distinctions of coastal prairie. Mima mounds or pimple mounds are soil mounds up to 1 meter high, with a radius 2–5 meters (Grace, Allain, and Allen 2000). The mounds are found in sandy soils, and are not yet fully understood (Smeins et al. 1992). Gilgai are topographic features of microdepressions and microknolls (Diamond and Smeins 1985, 296). Both are thought to be linked to diversity of vegetation distribution and prevalence (Smeins et al. 1992). Gilgai or buffalo wallows, also called hog wallows, are caused in part by the shrink-swell character of clay soils and are in turn thought to be interconnected with some variation in vegetation. Grace, Allain, and Allen's research (2000) suggests that topography is integral to coastal prairie ecology. He recommends that restorationists restore topographic variability (Grace, Allain, and Allen 2000, 14), in such ways as to create mima mounds, due to the features' interconnectedness and correlation to vegetation diversity. If the unique topographic features of coastal prairie are not restored as well, the restoration project is not fully achieving its potential: it is incomplete.

Geography and Ecological Restoration

Research from the 1960s to the present has little to say about the environmental geographic factors that affect ecological restoration. Minimal theoretical information has been published about the cultural and environmental geography of ecological restoration sites, perhaps due to the newness of the science of restoration ecology. Although many scholars have discussed the philosophy and meaning of restoration (Jordan 1984, 1990, 1997, and 2000; Higgs 1991; Angermeier and Karr 1994; Berger 1995; Hull and Robertson 2000; Katz 2000; Light 2000), restoration *ecology* is normative in that it describes how things should be and then manipulates landscapes to fit the preconceived idea. While restoration ecology is based in rigorous science, and it arguably is rigorous science, it is far removed from a positivist, objective paradigm. The decision to manage land in certain ways is based in subjective value judgments; when one restores nature to a certain successional state, one is choosing the referent state of nature. Hull and Robertson accurately state, "There exists no single ecologically optimum or naturally best environmental condition that can serve as an objective, unequivocal goal for ecological restoration projects(2000, 98)." Any serious discussion of the meaning of restoration ecology acknowledges the role language plays in all disciplines, including science. Ecosystems are human constructions as objects of meaning—they do not exist other than in human interpretation, and as such, it is inevitable that they harbor human values in these interpretations (Hull and Robertson 2000, 106). The vagaries of language are further discussed later in this chapter.

Except for Grace, Allain, and Allen (2000), few scholars discuss ecological restoration in conjunction with the coastal prairie. However, there are a handful of notable restoration projects taking place in the ecosystem. Bill Neiman of Native American Seed and Neiman Environments Incorporated restored 220 acres of coastal prairie—called Duralde Prairie—at Lacassine National Wildlife Refuge in Louisiana (pers. comm., 2001). Neiman's is one of coastal prairie restoration's best known successes. The Houston Coastal Center and Armand Bayou Nature Center also feature robust coastal prairie restoration projects. The low profile of coastal prairie ecological restorations may be related to differences in definitions of restoration and to private landowners' desires for privacy. During the data gathering process, I learned about the Coastal Prairie Restoration Initiative. This cooperative effort assists interested private landowners in conserving or restoring coastal prairie. In other studies on restoration experiments, it is rare to note any environmental geographical (man-land) analysis of restoration efforts. From this deficit we might infer that this area, the ideological underpinnings of restoration, specifically, how closely the process meets ecological goals, how societal constructs like commodification fit in, and how the concept of restoration has been applied, deserve closer study.

Many projects managing land in the Texas coastal prairie have been undertaken, including work at the National Wildlife Refuges along the Gulf Coast. However, as Jim Bergan writes (1999, 309), these national wildlife refuges have not focused on coastal prairie in their efforts, "Priorities for protection were related to waterfowl protection and conservation, not tallgrass coastal prairie preservation. The best coastal prairie in existence occurs on private land." Some ranches, such as the Kenedy Ranch near Kingsville and preserves such as Mad Island Marsh Preserve, are managed with ecologically informed methods including prescribed burns and rotational grazing.

Restoration's terminology

The language we use to describe many things in life matters. Likewise, in restoration ecology, interpretations of our words matter. However, unlike *atom* in chemistry and *integer* in mathematics, the language of nature can have imprecise and conflicting definitions (Hull and Robertson 2000). "Nature", "health", "integrity" do not always describe the same concept to every single ecologist. But what exactly is intended by the word *restoration*? We do not certify sites as restored, the way, for example, that wildlife habitats and organic farms can be certified and given a placard. Restoration ecology is young enough as a discipline that the exact definition is still fluid and subject to discussion. Table 2 offers sketches of five definitions with varying nuances. Generally all ecological restoration projects share the intention to improve land health [*health*, like *ecosystem*, *restoration*, and *integrity* are imprecise words with porous meanings]. However health and integrity of the land are usually foremost in the mind of the restorationist, or theoretically should be. William Jordan is a philosopher and a spokesperson for restoration ecology. His introductory words in the first issue of the journal *Restoration & Management Notes* summarize the intention embedded in *restoration*: we "will deal only with the development and management of communities that are native or at least ecologically appropriate to their site…." and "thus we will deal with restoration of prairies or wetlands for aesthetic or experimental purposes, or as part of a habitat or watershed improvement program, but not with the management of rangeland for forage production." (Jordan 1984, 1).

Since 1996, the Society for Ecological Restoration (SER) has defined ecological restoration in this way:

> Ecological restoration is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices.

Notice the porous, slippery language. Integrity, recovery, processes, practices...there is ample space for multiple interpretations when using these words.

Table 2 Facets of the definition of ecological restoration

To produce a self-sustaining system as similar as possible to the native biota.	Angermeier and Karr 1994
The process of restoring human–disturbed ecosystems to earlier un-degraded forms, the active reconstruction of [neo-]pristine ecosystems that study and mimic natural patterns.	Merchant 1992
Restoration…. seeks a greater understanding of existence.. the art of restoration is finely balanced between mind and body, thought and sweat.	Dodge 1990
Restoration gives humans a role in nature's work and blurs a radical distinction between nature and man while also providing a ground on which differences between the two can be negotiated.	Jordan 1997
The intentional return of an ecosystem to a close approximation of its condition prior to disturbance.	Berger 1995

Merchant's use of the term "pristine" seems an unreachable, if not oxymoronic semantic choice, when used in conjunction with "[ecological] reconstruction." Therefore Dr. David Stea suggests the term "neo-pristine" as a more accurate substitution (pers. comm., October 2001).

With the latitude in language, a stricter definition for restoration was necessary for this study. Thus for the purpose of this thesis, the word restoration intends to mean: "a property that emulates natural processes in its management in an attempt to perpetuate coastal prairie." Specifically, management can include differing and combined regimes of fire management, herbicides or other removal of exotic plant species, revegetation of prairie grasslands, and grazing regimes that promote prairie.

Geography, restoration, and culture

Critics accuse restoration ecology of reinforcing human control over nature (Elguea, 2001). The question of whether humans are separate from nature is essential to the development of the practice of restoration ecology. Some thinkers fear that restoration is conservation's enemy, while other thinkers insist that the restored ecosystem will never be the authentic one it strives to be. The argument can be simplified to 1) fear of a human-centered world where people are deemed powerful enough to re-create reality; and 2) that restoration ecology is a way of believing that technology can control or fix natural processes (Katz 2000). This logic assumes man to be separate from nature. We alter reality, however, with every action we execute.

And although restoration does address environmental problems from a solutions perspective, it does not legitimize or excuse environmental destruction (Berger 1995, 92). Jordan (1990, 20) places emphasis on restoration as a process over a product. The focus on the practice of ecological restoration opposes restoration focused on outcome (Higgs 1991, 102). An emphasis on product and outcome supports a paradigm that holds nature as a commodity. In this research, I use commodification as a point of inquiry in the two cases.

Bolstered by a prevalent and unquestioning faith in technology, the idea that man and nature are separate has become an accepted way of thinking for many people. Falling under a technological spell can lead us to forget that humans are a creation of and therefore contained within nature. Participation in restoration both requires and causes us to understand ecosystem processes more deeply.

Which ecosystem one is targeting, combined with the scale of the restoration effort, helps to determine site selection. In examining restoration at a landscape scale, it is recommended to restore complexes of wetlands instead of isolated wetlands (Galatowitsch, van der Valk, and Budelsky 1998, 139). Prairies, however, are more suited to isolated "postage stamp" parcel restoration than are other types of habitats. In comparison, it is easier to germinate and grow grasses and forbs than it is trees. In many ways, a prairie is a finely-textured community: it is possible to reproduce many of its attributes on areas as small as an acre (Jordan 1997). However, assuming we want prairies to persist in the world, it makes the most sense to manage for their sustainability from a broad systemic perspective—a landscape perspective.

Private Property

Landscape scale is a tenuous yardstick under which to operate and to simultaneously realize restoration success in a state such as Texas, where a large portion of land is in private property rather than under public ownership. The prevalence of private land ownership makes managing large areas of contiguous tracts for ecological restoration difficult. The issue of fauna—the animals of the landscape—relates to this point.

In Texas following European settlement, some fauna were displaced while other animal species were introduced. Obvious examples include increases in livestock (e.g. cattle, sheep), browsers (e.g. deer), and exotic species (e.g. nutria) combined with decreases in major predators (e.g. mountain lions, wolves, bears) and other megafauna (e.g. buffalo). For restoration to be achieved in a form most closely approximating neo-pristine, removal of some fauna and reintroduction of others would have to be undertaken.

As has been demonstrated, geographical analysis has not been a critical part of most research on restoration ecology. Some restoration studies demonstrate that monetary costs are so high that they must influence site selection (Cornett 2000). Other factors affecting site location are the availability of land and its appropriateness as a mitigation siting for the ecosystem being recovered (Zedler 1993; Longcore 1999). When factors affecting site location are not noted in a study, one can assume that finances or land availability may have been determinants to the site of restoration. We can be nearly certain that the site has undergone some sort of degradation and that a site to be restored is not pristine.

Cultural geographers believe and base their scientific practice on the concept that human processes create spatial forms. "There are no such things as purely spatial processes; there are only particular social processes operating over space" (Massey 1985, 11). This idea has in part guided this research. Geography is the blend of all the interactions in the various spheres of human life. I sought to identify the different factors determining the physical manifestation of restoration concepts. Initially I hypothesized that, like most ecological restoration projects, the most practical determinants of a restoration are monetary concerns, the availability of land, the extent of its degradation, and the appropriateness of the area to the stated restoration goal. The land use realities of Matagorda County necessitated consideration of the spatial pattern and flow of agricultural practice on the landscape.

Throughout the research, I remained grounded in the physical geography and ecology of the case's ecosystem. Precipitation and soil characteristics of texture and solum depth account for much of the natural vegetation variation in South Texas (McLendon 1991, 13). Position within topography influences the vegetation association (Grace, Allain, and Allen 2000, 114). The literature in conjunction with my two years' field experience assures me that topography, soil characteristics, the land use of surrounding parcels, and the restoration sites' past land use histories are important factors in determining restoration geography. For the restoration result to be most authentic (most clearly true to achieving the processes of the original ecosystem), then it would be important to consider the distribution of wild and domestic fauna.

CHAPTER III

RESEARCH METHOD

I utilized a case study approach to address the research questions key to the geography of coastal prairie ecological restoration:

- What physical and human factors affect coastal prairie restoration?
- How do social processes influence the physical forms and results of coastal prairie restoration?
- In what specific ways does commodification threaten this landscape?

The case study has been effectively used as a research method in geography to examine environmental interactions within landscapes (Young 1999; Head 2000). As stated previously, physical, social, land management, economic, and soil variables affect the geography of Texas coastal prairie restoration efforts. The research plan utilized a case study to explore and investigate factors determining the geography of coastal prairie ecological restoration, and to specifically identify which social processes influence landscape results and how they do so. This approach positions my study in the tradition of human-land interaction studies in geography. In the tradition of geographers like Jim Blaut (1953), I sought to understand the workings of a single small area, a restoration project, to see what it tells us of the larger issue of restoration geography in the upper coastal prairie.

Questions I used to guide my inquiry in the field were:

- What were the exact details of the restoration work?
- What is the restorationist's personal evaluation of the project?
- What additional information will clarify the particularities of this case?
- Is there evidence of commodification on this site?

In addressing these questions, it is important to be aware of restoration both as a process and as a product (Jordan 1990; Higgs 1991). I elected to focus on further defining coastal prairie restoration, giving attention to both the outcome and the process details. Commodification, or the objectification of the resultant restored parcel, was also a consideration. Also I investigated whether restoration of the site was concentrated more as the *process* of restoring or the *product* of restoration.

More basically, two statements of definition for 'geography' guided my environmental research. They are: "Geography is the study of the earth as the home of the people." (Tuan 1991, 99), and "The intellectual purpose of geography is the study of human activity in the physical environment." (Guelke 1989, 129).

Like geography, restoration ecology certainly involves an interaction between humans and the environment. For clarity, I specifically defined restoration before selecting my case study site. I built upon the previously stated SER definition, and adapted it to acknowledge the coastal prairie ecosystem. The definition of restoration for this research has three components: (1) active reestablishment of vegetation in the form of seeding is practiced, (2) the land manager manages the project as if it is not complete, and (3) the acreage can vary.

Because dominant grass species determine prairie type, I focused on the planting component of restoration activities during my selection of a site. The emphasis on revegetation became an important part of this definition in selection of the study site. Many people manage for reclamation or mitigation without attempting to re-plant and re-establish the seedbank. Because of my own scholarly interest in vegetation, I chose to make this both a criterion and focus. Additionally, since vegetation defines this ecosystem, a focus on botanical restoration was warranted.

Fieldwork was undertaken exploring and gaining an overview of native South Texas vegetation from August 1999 to September 2001. Mad Island Marsh Preserve (MIMP) was chosen as the case because of its restoration method, which included a revegetation component, and because of its location in the upper coastal prairie. To make the formal fieldwork inquiry, I requested and received permission from Mark Dumesnil, South Texas Senior Land Steward for The Nature Conservancy.

In addition to field visits and interviews, I relied upon topographic maps, spatial analysis utilizing GIS, and archival data reconnaissance. During my three site visits, I kept detailed field notes. These visits occurred in September and October 2001. The trips served to provide specific interviews with Mad Island employees and groundtruthing.

CHAPTER IV

THE CASE OF MAD ISLAND

The study site, Mad Island Marsh Preserve (MIMP) is located in Matagorda County, 80 miles southwest of Houston. Figure 3 depicts an annotated aerial photograph of The Nature Conservancy's Clive Runnels Family Mad Island Marsh Preserve.

Approaching Mad Island from the west, not only do you pass vast tracts of farmland: cattle, grass farms, and rice fields, but in autumn, you see occasional stands of pink-lavender flowering Gulf muhly (*Muhlenbergia capillaris*) grass. The land sprawls flat and outward; the air is thick. Nearing MIMP, the mosquitoes swarm. The name Mad Island is derived from a legend involving these buzzing insects. It is not a real island—there is no island. There were cows, though, in the early 1900s that were so bothered (or made mad) by mosquitoes that the bovines grouped together in the middle of Mad Island Lake in an effort to seek some respite from the annoyance of the biting creatures.

Clive Runnels Mad Island Marsh Preserve is a 7063-acre site operated since 1989 by The Nature Conservancy (TNC), a private, non-profit conservation organization. The Nature Conservancy has a decentralized power structure; a Board of Governors runs it. My contact was entirely with the local and regional Texas offices of The Nature

Figure 3

Clive Runnels Family Mad Island Marsh Preserve, Matagorda County, Texas

Aerial photograph showing Mad Island Marsh Preserve.
2.5 meter DOQQ courtesy of
Texas Natural Resources Information Service.

Conservancy. In writing, Jim Bergan, Director of Science and Stewardship for the Texas chapter, offered me this perspective on TNC priorities: "The Nature Conservancy considers tallgrass coastal prairie to be an important conservation target within Texas." (pers. comm. January 2001).

Nearing the preserve, you see the enormous twin orbs of the South Texas Nuclear Project in the eastern horizon. From previous fieldwork experience in Texas, I already suspected that reduced fire, diminished source of seeds, and hazardous adjacent land use were issues responsible for ecological degradation in this area. The nuclear plant represents potentially damaging industry. But within minutes of the first visit, talking with Mark Dumesnil, it became apparent that agriculture was boldly important—the common factor behind most land use changes here.

Minor ecological notes on a field visit include feral hog control, blackbirds' flocking crowds' effects on rice farming. Exotic plant species that are on the preserve include tamarisk (*Tamarix ramosissima*), Chinese tallow (*Sapium sebiferum*), Bermuda grass (*Cynodon dactylon*), and from Asia, Macartney rose (*Rosa bracteata*). Native plants with aggressive, invasive tendencies are willow (*Baccharis* sp.), *Acacia* sp., and mesquite (*Prosopis glandulosa*).

Endangered species that historically were here, although are not found here now, include Attwater's prairie chicken and the whooping crane.

The 67-acre study site is the only piece of land at MIMP that has been restored in a fashion that fits my definition of focus—managers have made the attempt on this parcel to replant and to redistribute native vegetation through seeding. The goal for the project is to reestablish tallgrass coastal prairie "to a 70% cover of little bluestem-brown paspalum as the matrix community type." (Jim Bergan, pers. comm., 2001) MIMP is located on the coast of Matagorda Bay. The parcel is an upland, 67-acre tract on the northeastern section of MIMP. Land adjacent to the restored tract's north flank is a rice field. To the south and west lie grazed pastures, and to the east is Texas Parks and Wildlife Mad Island Wildlife Management Area. The 67-acre tract is over one mile from the headquarters building and the coast. Sounds of barges and boats from the Intracoastal Canal carry to the headquarters building. The area is within a mile of gulf marshes, but it historically supported upland (relative to the marshes) prairie. Aerial photographs taken previous to the 1960s show that mima mounds existed previous to the intensive rice farming in the restoration target area (Bergan, pers. comm., 2001).

The restoration project initially was set up as a participant in the Natural Resources Conservation Service (NRCS) Conservation Reserve Program. Under the Conservation Reserve Program (CRP), the government pays farmers to remove agricultural land from production by leaving it uncultivated for ten years. The agreements are to support erosion control and sequestration of carbon dioxide from the atmosphere. The temporary retirement of cropland from farming through conversion for 10 years to vegetative cover can facilitate carbon sequestration through the retention of biomass in the soil (Lal, et al. 1999, 36). The TNC tract will not be grazed until at least 2010. Thus one benefit to TNC in its restoration of the case parcel is that it receives financial incentives for participating in the CRP program.

Additionally the fee recipient must enter into consultation with NRCS, and follow their recommendations for improving the land. NRCS recommended that MIMP plant grasses and fertilize the planting. It was Jim Bergan's idea to make the seed source native prairie hay. This is the main part of the project that made the project a restoration. Had it been performed like many CRPs, with conversion to non-native grasses, I would never have been able to use this as a case.

The approach taken to restoration by Dumesnil and TNC does not appear to recognize the distinction between CRP (Conservation Reserve Program) and CPR (Coastal Prairie Restoration).

An overview of the preserve and restoration actions

Dumesnil used the terms of *creation*, *restoration*, and *enhancement* to describe the management work on the preserve. By enhancement he explained he meant a management act performed to improve the state of the land, like "burning native pasture." As I will explain later, Dumesnil specified restoration as being about improving conditions, along the lines of remodeling houses. The 67-acre land parcel was an abandoned rice field, which Jim Bergan engineered to be a restoration or *creation* through his choice of seed source, before restoration began in 1998.

Previous to seeding, Dumesnil had the 67 acres disced (surface tilled) three times to prepare the soil. Management did not apply any herbicides to existing vegetation on the tract. In March 1999, Dumesnil and a group of thirty volunteers utilized a hay-mulch blower to spread seed hay across the 67 acres. The source of the seed was a native prairie, never plowed before, and located 8 miles from the site. Bill Carr, TNC botanist, wrote that this source prairie is a "very intact remnant."(office memo 18 May 1998, Carr to Dumesnil). The proximity of the source seeds ensures that the seed used was local ecotype seed. Local ecotype seed is more effective because the organism is genetically more suited to the habitat it is planted in, if the genetic material originates nearby. For example, big bluestem seeds from the Austin area would be better adapted to grow in Central Texas than would be seeds of the same species from Kansas. The theory behind the push for local ecotype seed has been born out by results in prairie restorations across the nation (Manning 1995, 160). After spreading the hay, the restorationists went over the field with a light discing to ensure good seed-soil contact. Based on the NRCS recommendations and agreement, after the hayblowing, the management hired a pilot to fly over the field and apply fertilizer (Dumesnil, pers. comm., 2001). Expenses included fencing, seedbed preparation, native seed hay, and fertilizer (Dumesnil, pers. comm., 2001).

The preserve manager's view of land management duties is that they are to observe and "fine-tune the landscape to the vision in your mind which you are trying to achieve." (Dumesnil, pers. comm., 2001). The goal for the restoration project as identified by TNC is presettlement tallgrass coastal prairie. During one interview segment, Dumesnil suggested that restoration is "putting things back together." This statement suggests that TNC is repairing past damage or "breaks" perpetrated on the land. With the practice of prescribed burning the managers are re-establishing ecological processes that historically maintained the grassland. By keeping cattle off the land until 2010, they are giving the seeds a chance to germinate and establish stable communities. The parcel is burned in the management cycle of the preserve.

Restoration as management for the whole preserve of Mad Island

Land stewards at Mad Island manage 4000 of 7000 acres as native prairie through a structured burn program. This works out to burning about 1200 acres per year, based on the fact that the rotation cycles cover 3-4 years between burns for a tract. Prescribed burns maintain grasslands by discouraging woody species' growth and by causing a flush in the regrowth of grass species and forbs. Dumesnil stated that TNC fire plans have to distinguish if they are for maintenance or for ecological restoration. He classifies this distinction based on whether he conducts a cool season burn or a warm season burn (Dumesnil, pers. comm., 2001). Summer burns are considered restoration burns; at this season fires generally reach a higher heat index.

MIMP management leases parts of the preserve out to grazing. In this way, they use cattle as a management tool. Dumesnil believes the cattle are also a restoration tool. Dumesnil suggested that TNC oversees grazing practice to ensure that it does not degrade the land. There are only semantic and philosophical differences between restoration and management tools. An example of good grazing practice is that the managers regulate it strictly. Specifically they restrict cattle's re-entry back onto MIMP if the cattle have been grazing in pastures outside the preserve that have a lot of exotic, introduced species for forage. By doing so, they control the accidental introduction of exotic, weedy species onto the preserve.

At present land managers are not satisfied with the species composition of the parcel. The restoration has not been as successful as they desired. Dumesnil is disappointed with the large amount of the non-native Bermuda grass present in the field. He wishes he had herbicided the introduced "tame" grass out, previous to spreading the hay bales. Bermuda grass remains a dominant species in the restored parcel at present, which indicates poor results thus far. However, TNC management did not treat the extant Bermuda grass with herbicide previous to spreading the native prairie hay because it was not in the list of NRCS recommendations.

Concrete social processes

My review of the restoration activities practiced at MIMP called my attention to the importance of understanding the social processes affecting restoration efforts. The next section breaks down the social processes affecting the restoration effort into concrete components and into abstract ones. What follows is how social processes figure into restoration's landscape form.

Agriculture

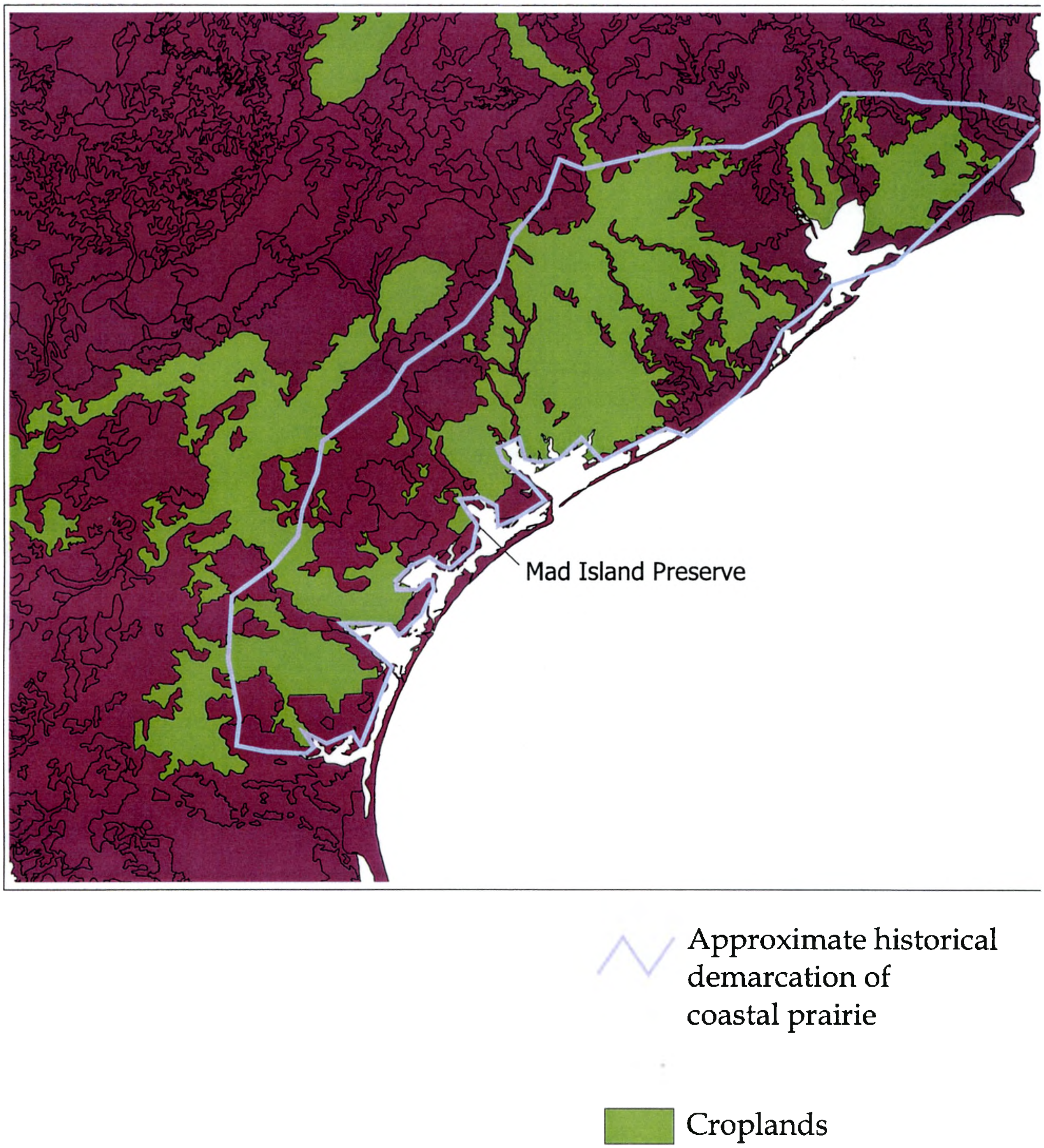
Cattle arrived with European settlement to North America. Grazing cattle as a livelihood is part of the history of land use in much of Texas. This area is no exception. As indicated earlier, TNC leases grazing rights to the MIMP property. The effects of the bovines are evident in all areas I witnessed (except for the 67-acre parcel, wetlands, and rice fields), with cattle excrement, trodden ground, and grass grazed almost to the roots.

It is useful to note here that caution has been urged with cattle grazing because some rare prairie species are sensitive to unrestrained or poor grazing practices (Leach, Henderson, and Givnish, 1999). If cattle find and graze plants that cannot recover quickly enough, the sensitive plant species can be decimated.

TNC also leases some of MIMP for rice farming. Rice farming constructs levees to trap and control water as the rice plants need to be submerged at times in the growing cycles. Rice farming is also important to the history of the study site. The land was previously farmed as a rice monoculture, and Bermuda grass spread from nearby fields as a weed. Rice cultivation also meant that topographic features such as mima mounds were destroyed. The MIMP restoration project, however, did not focus on restoring the topographic features.

Agriculture, so prevalent, affects restoration in terms of competition for land. Agriculture is akin to sprawl in its occupation of large amounts of land, and by extension agriculture is linked to patchiness of restoration projects across the ecosystem type. Figure 4 depicts croplands across the coastal prairie ecosystem during the mid-1970s. The predominance of croplands across the area is obvious. The agriculture sprawl indicates a competition for land use. The industrial, chemically-dependent norms for farming suggest possible effects on other land types adjacent to farmed tracts, yielding the inevitable reality of pesticide and fertilizer runoff, combined with escaped agricultural

Croplands 1972-1976 within Texas coastal prairies



Data source: The Vegetation Types of Texas. 1984. Texas Parks and Wildlife Department. Austin, Texas.

weeds such as Bermuda grass and Johnson grass. It is enough to imperil an ecosystem, and it has—the Texas-Louisiana coastal prairie.

Hunting

MIMP is neighbored on both its east and west sides by hunting lands. The legal hunted prey are alligators and waterfowl. Hunting would seem to partner with restoration in that both hunters and restorationists want quality habitat. However, hunting is species-specific and restoration should be species-holistic to truly accomplish its objectives. If the MIMP were restoring fauna, the hunting might affect the efforts. However, since the project is focused so specifically on grasses, hunting adjacent to the 67-acre tract is a secondary factor. The amount of fauna and processes by which they impact the plant life, however, are questions for future research that measures species abundance patterns around the preserve and effects on the restoration of coastal prairie.

Human population

Population of the coast of Texas increases yearly (Gunter and Oelschlager 1997, 55). Despite continued population growth, the population density of Matagorda County is quite low with an average of 21 people per square mile (U.S. Census, 2000). Direct observation corroborates this spatially diffuse arrangement of humans. The low population density suggests that large land holdings managing or harboring habitat are not challenged by density of humans on land. The low population density, I suspect, is related to the presence of the nuclear power facility and the large amount of land it occupies. The only community members mentioned in the interviews were grazing and farming lease tenants. Lack of awareness about restoration is possible; in fact lack of awareness of restoration is common in many places. If the public is unconcerned with restoration, the project receives input only from the managers. We know that restoration is a value-laden process, and by extension, if the restoration is wholly privately undertaken and ecology is not public—which it is not—then we know that the values taken into the project are not public. Ecological restoration can be a vehicle through which people participate as equals in a connection to the earth. This scenario is a possibility in which the politics of restoration are democratized. The inherently democratic nature of restoration challenges corporate-sponsored restoration projects which Light and Higgs (1996) see as incarnations of commodification. The same authors also state that the democratic potential of restoration is a "potential for local human-nature relationships." (1996, 236). If community is not involved in a project, and local knowledge is not incorporated into the ecological restoration work, then these local human-nature relationships are left flopping like dead limbs.

Fire

Burning is a social process because it presently is a process which humans manipulate in land management. Historically, wildfire was one of the main forces that shaped the coastal prairie (Smeins et al. 1992). In contemporary times, to run a fire, it must be planned, prescribed, and managed if it is to occur. Fire keeps the amount of woody species in check (Johnston 1963; Archer 1989; Leach and Givnish 1996). Fire is important to healthy grasslands because it boosts the growth of grasses and forbs. Fire suppression is responsible for loss of diversity in prairie species, especially diversity of nitrogen-fixing plants (Leach and Givnish 1996). The substance of Dumesnil's comments on fire consisted of his enthusiasm for burns and a description of their burn cycles.

Industry

The South Texas Project, a nuclear plant that generates approximately 8.5 billion kilowatt hours of electricity annually, sits on 12,200 acres in Matagorda County's total 1,158,000 acres. The nuclear plant is within 10 miles of the MIMP, but it has no significant notable effect on MIMP other than the huge amount of acreage it occupies and its vulnerability. During an interview, one Mad Island employee noted concern about being at the TNC site, within the 10-mile radius of the power plant. In times of national crisis, such as at present, following the attacks that occurred on 11 September 2001 on the east coast of the United States, the nuclear project renders Matagorda County, particularly the area within the 10-mile radius, a target for possible destructive attacks.

More abstract social processes

Commodification and Private property

The frontier mentality of Texas, rooted in taming wild land, is probably the most characteristic aspect of the state. The image of a lone, independent landowner shapes much of Texas' mystique and reality. By almost fetishizing the ownership of land, the land is commodified into highly valued private property. Since Locke put forth notions of private land ownership in Britain (Laslett 1988), sovereignty of man over land has been explicit in the United States as well.

To what extent do we turn land management actions, such as restoration, into objects for show, sale, or tour? Signs of corporate sponsorship are omnipresent on TNC sites. It is a common practice of TNC to accept major corporations such as Shell, Dow Chemical, and Exxon as sponsors. Light and Higgs state that restorations sponsored by corporations exemplify "how ecosystems become commodified to serve the interests of global capital, and thus the extension of global capital's paradigmatic relationship with nature—as a commodified object to serve the process of consumption." (1996, 231). At MIMP, the gazebo is named the Shell (Company) Pavilion. In addition, the widespread corporate sponsorship suggests that absolution (from evils perpetrated on the land) is for sale to the person or entity that can support the financial cost. This relates to William Jordan's articulation of restoration as a gift exchange (2000, 25). I mean to suggest that the value of the land can be underestimated. In one sense the government money received for the CRP commodifies the site.

The 67-acre tract is not a tourist attraction. In fact, it is largely a forgotten area, except to the few who have an interest in the botany there. The restoration project is not being advertised or promoted as a stop on sightseeing itinerary. MIMP hosts school groups, birding groups, and elder hostels. But other than the corporate branding visible on all built pieces of the preserve, MIMP is not being marketed as a commodified destination for tourists, except implicitly. One aspect that MIMP shares with other preserves that are more explicitly commodified, such as Australia's Penguin Reserve on Summerland Island, is that its "management strategy is predicated... on the desirability of human absence" (Head 2000, 52). The preserve as a *natural* place requires few humans and no inhabitants, in keeping with the dominant view of "wilderness." The preserve's existence as a TNC site positions it as a privately-owned property.

Sense of place

Every area is rich with essence. Richard Manning states, "A place possesses a certain set of circumstances, weather, soil, and community, that lead to a certain manifestation of life in a place." (1995, 259). The attachment to place is not immediately evident at Mad Island to an outside observer. But in my field visits, I missed witnessing the community component—the only people I saw were the three TNC employees, two of whom appear to be attached to the place. As a young boy, one employee had helped work cattle with Clive Runnels on the MIMP, previous to its TNC status. (Clive Runnels donated the land to the Conservancy in 1989.)

Thirty volunteers helped spread hay during the actual restoration workday. Figure 5 depicts several volunteers running the haymulch blower on the Saturday that the restoration hay-spreading took place. Dumesnil had an active group of volunteers at that time. The scholar William Jordan believes that community participation is one of the richest acts of restoration, and in communal works of restoration, he identifies the previously discussed democratic potential (2000). The Mad Island project shows potential for community acts of restoration by the participation of volunteers. As for who these

Figure 5 Volunteers operating the hay-mulch blower

Photograph courtesy of Mark Dumesnil

volunteers were or the specific character of their involvement, Dumesnil did not have particular details.

Process/ product

If a restoration is oriented to *process*, it is concerned with ongoing management and recognizes that human involvement in restoration is not complete until the processes that maintains the ecosystem type in nature work on their own. An orientation to *product* instead, targets one outcome for restoration and focuses on that, effectively turning the project into an object and effectively transforms ecosystem links to commodification. In one way, it seems that the restoration project on the MIMP tract is operating under a *process* rather than a *product* mindset.

Dumesnil, however, is not satisfied with restoration successes at this point. The ecosystemic processes around the parcel are not occurring naturally as they were when wildfires swept the land in the 1400s. By managing the land for these goals, the managers must perpetuate the processes. Several indicators suggest they are managing for project success instead of process reestablishment: inconsistent attention paid to the parcel, exotic species flourishing, no other restoration foci attempted such as mima mounds, soil microorganisms, fauna.

Dumesnil believes that restoration is about ongoing maintenance for this parcel. One irony is that Dumesnil uses the mental criteria associated with *product* goals to judge a restoration *process*. He notes that "....restoration work doesn't always turn out as you planned." There seems to be little attention being paid to the land in terms of change of species composition. He is concerned with outcome. The short-term outcome may be the only way he can find to evaluate his success with the restoration project. In this case, these factors are not considered because (1) CRPs focus on vegetative coverage rather than on ecosystems, and (2) the restorationist Dumesnil does the same. He does not ponder the philosophy of restoration; rather he equates his thoughts on restoration to analogies having to do with fixing up old houses. Asking my permission to use an analogy, Dumesnil says, "To me a restoration is when there's something structurally wrong with the house. It needs to be re-levelled and the windowsills need to be redone. There's a need to address the structural problems, so the house can function as a house." (Dumesnil, pers. comm., 2001). When it is done, it is done. However since the earth's systems are dynamic creations rather than static displays, the place will not stop and stay as it has been left. Whatever systems are in process will cause change. One outcome includes possible reversion to the pre-restoration state, since in the larger human ecological complex, this pre-restoration state is not an accident, but is the result of socio-economic structures.

In terms of process, managerial concern in the project's authenticity would be more apparent if *vegetation monitoring* were regularly employed to measure species change and results over time (like at Houston Coastal Center) and if species diversity indices were calculated. *Ecological sampling* could be a definite sign of investment in the restoration process rather than just completing the project. True commitment to process might look deeper at *replicating other factors of prairie* such as animal species, topography (mima mounds), and soil microorganisms.

Thinking about the above-mentioned social components, the fact that all the factors exist show that this restoration project has *some* process-oriented foci. To use fire and mowing/grazing as part of permanent management indicates an emphasis on process and a recognition that the restoration is ongoing, and managed as such. The economic activities hunting, farming, and grazing, indicate an acceptance of human interaction within the process with which the ecosystem must co-exist.

CHAPTER V

RESULTS: ANALYZING INTERCONNECTIONS

A familiarity with biogeography and extinction ecology is necessary to fully comprehend what it is that coastal prairie restoration attempts—a healing of the land, a realization of conservation. Many social processes are in place within this ecosystem. The question is not whether they will be removed but what the cumulative effect of all the interconnectedness of the activities is.

Rice farming has been identified as a social factor figuring in the story of Mad Island restoration work. The nearly ubiquitous rice production units are factors in restoration's form throughout the rest of the upper coastal prairie. They cause it to exhibit vast and intense spatial diffusion. The rice farms overwhelm the prairie remnants; it follows that restoration efforts face effects of location near rice farming too. The bleak future of the nearly extinct Attwater's prairie chicken demonstrates one by-product of rice monoculture and intense urban development. The prairie chicken's demise is caused by habitat loss and habitat fragmentation.

Another complication of restoration activities on parcels when rice farming has been practiced, is that gilgai and mima mounds—the natural topography of the coastal prairie—is disrupted and quite difficult to put back. In clay soils, gilgai will return (Smeins 2001), but mima mounds will not. These soil level variations are connected to diversity of species within a small area. Lehman reported that Attwater's prairie chickens thrived where the soil topography was responsible for vegetation diversity (1941). This suggests that mima mounds are associated not only with vegetation diversity but also with faunal diversity. In ecosystems, all the pieces fit together. To extend the point of the difficulty of a fully authentic restoration would be to stray too far from the subject.

The case study described the physical and human factors that affect coastal prairie restoration. The two subsequent research questions have been discussed in the context of the analysis. In summary, **how do social processes influence the physical forms and results of coastal prairie restoration?** The social processes in the Mad Island restoration site act together to create a project that is one-sided. The site revolves around a one-time effort to establish native grass seeds; other maintenance is currently not seriously pursued. Most other aspects of the restoration are ignored. The site itself is not taken seriously as a project. The work being done there does not reach the full potential of ecological restoration. The current result of the combination of all social processes operating there is an area dominated by Bermuda grass.

In what specific ways does commodification threaten this landscape? Specific commodification of the site seems to be less of a threat to the landscape than does habitat fragmentation. Factors including the demise of natural wildfires, and agricultural and industrial sprawl, align together to reveal the present situation of an ecosystem which is threatened. The same threats pose difficulty to restoration of the ecosystem.

The focused examination of a single project brings up truths about ideas behind restoration ecology. The case study highlights the fact that the language of environmental discourse can be imprecise, conflicting, and have multiple, biased definitions (Hull and Robertson 2000, 97). Dumesnil's use of the terms *creation*, *enhancement* and *restoration* to differentiate management acts did not hold up well when I asked him to explain the differences. A single, solid meaning for each term was not revealed. The potential of the restoration project may not be fully developed. I believe they may just be applying labels to management acts, and merely going through the motions. Second, restoration ecology and other sciences that value nature, such as conservation, are normative (describing standards for us). Values are inherently part of these discussions, there is not one unique objective goal for the restoration of MIMP to achieve (Hull and Robertson 2000, 99), until a land manager articulates a goal. Third I am certain that effective restorations depend on *defining* which "nature" you are restoring. "The selection of which nature to use as a benchmark is further intertwined with social values" (Hull and Robertson 2000, 101). Deep thought and clarity of intention are of paramount importance with many projects in life, including ecological restoration. What time period and state of ecological succession the land manager holds as her goal for the land needs definition and clarity about what parameters held that state in place. These intentions were not thoroughly probed and are not being examined at present at MIMP.

Mad Island's project represents upper coastal prairie restoration well because it is in its formative years. It is also representative because deeper semantic and philosophical meanings behind the land actions are not being probed. MIMP management seized an opportunity to transform a simple CRP agreement into an ecological restoration project. The innovative labeling swap, made possible by utilizing the native prairie hay as a source of seeds, demonstrates how in the implementation of immediate action, action can happen but not follow theory and potential in a pure way. The MIMP restoration has focused on outcome and not probed the fuller opportunities of democratization, a more public ecology, and increased sense of place, which allegiance to the deeper theory of ecological restoration provides.

Members of the local community, and people with a strong sense of place need to have more involvement in restoration actions. The multiple perspectives provided can be a valuable contribution (Robertson et al. 2000). The Mad Island managers are not local. Nor do they exhibit a strong sense of place. People without a strong attachment to the place may not enact the follow-through needed for restoration.

There is no set practice in place for accountability. MIMP's restoration is not officially monitored except for random and occasional visual assessments by TNC botanist Bill Carr; the restoration is used as a commodity and thought of as an outcome by TNC. The lack of monitoring evidences that the process of the restoration act is not honored.

The case study of Mad Island informs the upper coastal prairie region by providing the specifics of a single restoration project. Table 3 diagrams how the basic facts of MIMP restoration (which are typical of the area) demonstrate social processes and also demonstrate the success of restoration as I defined it.

Table 3 Summary of Mad Island ecological restoration

Mad Island restoration fundamentals	How it typifies restoration in coastal prairie
recent start date- 1998	ecological restoration is still in formation.
restored an old rice field	Agriculture is common in the rich soils of the coastal prairie. However it is largely practiced chemically, and not sustainably.
exotic Bermuda grass is dominant species	Bermuda grass is an escaped agricultural weed, originally planted for forage. Because it is non-native and has no natural competitors, it flourishes. Its dominance reduces diversity. The geography of restoration characteristically involves herbicides to remove exotic grasses from the beginning of a project.

The social processes affecting Mad Island restoration geography account similarly for the structure of the geography of other restorations. The issues of private property, little accountability on follow-through, and non-holistic restorations that are still ever vulnerable to fragmentation and genetic bottlenecks are issues that typify coastal prairie restoration work in Texas. On private lands, the details of projects are lacking. On public lands, available funds do not currently support a longer-term commitment to process.

CHAPTER VI

CONCLUSION

The story is the umbilical chord between past, present, and future.

TERRY TEMPEST WILLIAMS

There is not just one simple answer to the question of what ecological restoration is. We need to hear more stories. The story has ultimate importance. The story of local people with commitment to a place needs to be incorporated into conservation and restoration actions (Robertson et al. 2000).

This thesis research has contributed additionally through its unorthodox style, the melding of philosophical, abstract writing with concrete, focused ecological discussion. It may serve as a model for future studies that seek to pursue integrated, holistic ways of thinking and writing. The most ideal goal would be achieved if this thesis were to bring awareness to the endangered tallgrass coastal prairie and more awareness to restoration work in the ecosystem.

To preserve biological diversity, seed banks, are there ways we have yet to consider by which we could manage human actions to maximize the persistence of genetic diversity in native habitats? Restoration may appear to hold fuel to this glimmer of a bright possibility. We've thought of ways, some ways, but how many people actually care, or know or do....?

Because of confusion in language, in some ways, my research and Dumesnil's management practice were misaligned. Given a background component of this thesis (that language constructs much of our world, and is so nebulous and vague), then my and Dumesnil's differences of interpretation make the results of this research an even more compelling case demonstrating the need for a more public ecology and standards (that are explicit rather than implicit—because not everybody "gets" the implicit) within ecological restoration.

In my analysis of the case, some recommendations for restoration processes surfaced. They are particularly in response to the project at Mad Island, but are equally applicable to any human involvement in the restoration process.

- Think about the ideas behind restoration ecology work.
- Think through what you are doing.
- Define goals and objectives—a strategic plan. (An increased clarity and willingness to admit and deal with reality honestly is needed in restoration work in the case example.)
- Define what referent state of nature is to be restored through the process.
- Realize that if the landscape processes of disturbance such as fires, that historically were responsible for the state of nature one is trying to achieve—if these processes are not in place any longer, to restore will necessitate

management that perpetuates these processes, thereby keeping the focus of restoration in process.

- We need a more public ecology, with precise meanings behind these fluid terms. Consistency among managers and stewards of land will assist a higher grade of effort by all concerned with restoration work. * (Although the question of who would determine these meanings could be controversial.)
- Involve local people with attachment to the place to participate in restoration work. A project will be maintained only if there is local interest.

The work will never end as long as the large scale landscape processes do not act in and of themselves. Restoration faces challenges from the complicated interweavings of social processes on the land. These interconnections can be further elucidated if multiple perspectives and environmental narratives, emphasizing local knowledge, are integrated into restoration ecology and data gathering.

Future research should investigate other parts of the ecology in restoration plans, such as faunal-floral interactions, topography, and soil to discover if the restorations are succeeding in other aspects than in vegetation. Future research should compile all coastal prairie restoration sites and analyze their approximation of ecological referent goals using ecological sampling and statistical means. Future research should study environmental narratives in the regions in which groups are setting restoration goals to legitimize multiple perspectives and the contribution that local knowledge can make to restoration ecology.

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This thesis was typed by Michelle Pulich.