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The Mississippi River Delta Basin and Why We are Failing to Save its Wetlands

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The Mississippi River Delta Basin
and
Why We Are Failing to Save Its Wetlands

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Abstract

Every thousand years or so, when the Mississippi River's sediment load lengthened and blocked the River's route to the Gulf of Mexico, the mother stream changed course completely, finding a shorter route to the sea. Then, it built a new delta, thus spreading the gift of land creation along a wide coastline and creating the bayou region of Louisiana. However, this ancient, natural process was gradually halted by the arrival of man who settled across the River's natural floodplain (delta) and constructed levees and other structures to control the great Mississippi River. Since the 1930s, the Mississippi River Delta Basin and the coast of Louisiana have been literally losing ground. The decline of this environment is now affecting, and will continue to affect, our nation's economy, infrastructure, culture, and safety. Moreover, efforts to fix this problem are not working. My research and this thesis will address the issue of how plans without action have appeased Louisianans while the nation looses vital wetlands daily.

Keywords:

Introduction to the Mississippi River Delta Basin

The Mississippi River

Deltaic Plain Landforms

Deltaic Evolution and Process

Mississippi River Delta Lobes

The problem the Mississippi River Delta Basin and its people is facing

Why Louisiana and the nation ignore the problem

The plans that have failed to fix the problem

Why using the river to fix the problem has failed

Chapter 1

Introduction to the Mississippi River Delta Basin

Being a Plaquemines Parish resident and having grown up hunting and fishing in the wetlands of the Mississippi River Delta Basin (Southeast Plaquemines Parish), I can attest to the problem at hand. My father, known to east Plaquemines parish residents as "Sonny the marsh man," and I have hunted, trapped, and fished all our lives in these wetlands. We now see hundred acre lakes where once only small two acre duck ponds with shoreline blinds existed. These shorelines have continuously receded over the past 20 years. Thirty-foot-wide canals we fished are now 130 feet wide. Areas where we once trapped alligators are no longer habitat for the freshwater reptiles due to saltwater intrusion. Post hurricane Katrina, this area is no longer protected by the Breton Island chain and is now mostly open water extending into the Gulf of Mexico. These are just a few examples of my experience of the decline of Louisiana's wetlands that I have witnessed in my 41 years.

Historically, the Mississippi River has had a great effect on the land formation of coastal Louisiana. The entire coastal area is the result of sediment deposits following the latest rise in sea level about 5,000 years ago. Each Mississippi River Deltaic cycle was started by a gradual capture (take over) of the Mississippi River by a natural channel which created a shorter route to the Gulf of Mexico. The abandonment of the previous delta lobe resulted in the cutting off of the fresh water supply and sediment to the lobe.[1] As a result, an area would undergo compaction, subsidence, and erosion. The previous delta lobe would begin to retreat as the gulf advanced,

[1] C.R. Kolb and J. R. Van Lopik, "Geology of the Mississippi river deltaic plain , *S*outheastern Louisiana." U.S. Army Corps of Engineers Waterways Experiment Station: Vicksburg, Mississippi, 1958.

creating lakes, bays, and sounds. Meanwhile, a new delta lobe would start an advance toward the gulf. Over the past 5,000 years this delta-building process has caused the coastline of south Louisiana to advance toward the Gulf of Mexico, forming the present coastal plain.

The Mississippi River

The major drainage in the Central United States and one of the major rivers of the world, the Mississippi River, which extends from Cairo, Illinois to the Gulf of Mexico, some 700 miles, has created a distinct channel through its course in southeast Louisiana. Changes in its depocenter (site of active sedimentation deposits) during the last 2,000 years have created a series of different delta lobes and sediments.[2]

Progradation (building process causing shoreline migration into the basin) of the present and former Mississippi River courses and deltas helped mold the recent alluvial valley and deltaic plain of southeastern Louisiana. Each time the Mississippi River has built a major delta lobe seaward, that course has subsequently been abandoned in favor of a shorter, more direct route to the sea. These meander belt changes in the Alluvial Valley and accompanying shifts in centers of deposition have caused the variety and distribution of deltaic sediments along the coast of southeastern Louisiana. Marine transgression caused by compaction and subsidence of deltaic sediments begins after a delta lobe is abandoned. Nevertheless, the net result between the advancing deltas and the encroaching sea generally has been an overall increase in the size of the

[2]C.R. Kolb and J.R. Van Lopik, "Depositional Environmental of The Mississippi River Deltaic Plain-Southeastern Louisiana." Edited by M. L. Shirley and J. A. Ragsdale, 1966: 17-62.

recent coastal plain.[3] However, within the last few decades, coastal land loss has accelerated due to chemical and physical erosion as well as the restriction of sediment supply to these areas.

The term "delta" is derived from the Δ-shaped (triangle shaped) land form of the lower Nile Valley, originally described by Herodotus (Greek historian, "Father of History"). In current geological literature, however, the term describes any coastal accumulation of river-derived sediments located at, or immediately adjacent to, the source of the stream.[4] Because of the tectonically induced drainage systems of continental land masses, major deltas form on the trailing edge of the continents. Deltaic facies (characteristically deposited rock mass), therefore, generally account for a large percentage of the sedimentary rocks on passive continental margins.[5]

The Mississippi Deltaic Plain is one of the world's best examples. Rocks of deltaic and closely related facies account for the bulk of the Mesozoic (66 to 245 million years ago) and Cenozoic (65 million years ago to present time) stratigraphic column of the gulf coast basin. The present drainage basin of the Mississippi covers and drains 41% of the continental United States.

At present, the Mississippi River delivers about 500 million tons of sediment to the Gulf Coast each year. This load consists of approximately 20 percent fine and very fine sand, and 80 percent silt and clay. The fine grained load of the Mississippi has been instrumental in building a very shallow delta front which, in turn, greatly attenuates the incoming waves. As a consequence, the nearshore wave energy at the Mississippi Delta distributaries is much less than

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[3] Kolb and Van Lopik, 1966.

[4] L.D. Wright, *River Deltas:* In, Davis, R. A. Jr. (ed.), "Costal sedimentary environment", Springer Verlag , N.Y.,1978: 5-68.

[5] D.L. Inman and C.E. Nordstrom. "On the Tectonic and Morphologic Classification of Coasts." J. Geol., Vol. 79, 1971:1-21.

the offshore deep-water wave energy. This wave attenuation is a major factor contributing to the strongly fluvially-dominated sedimentation pattern of the modern Mississippi delta.[6]

The modern Mississippi Delta is classified as a fluvially dominated delta. A fluvially dominated delta's sediment dispersal depends on the density contrast of issuing and ambient water, the water depth in the basin, as well as the river hydrograph and grain size characteristics of the sediment load. As a result, the two presently active Mississippi Deltas, the modern (or Balize) and the Atchafalaya, developed vastly different morphologies. The resulting differences reflect largely the variance in water depth and density of the two receiving basins, the open Gulf of Mexico as opposed to the shallow, restricted Atchafalaya Bay.[7]

Deltaic Plain Landforms

The framework of the modern Mississippi Delta is a set of bird's-foot-like linear sand bodies built through the process of mouth bar progradation along the main river distributaries. These bar finger sands have a lenticular cross-section with typical thicknesses of approximately 75 meters and widths of approximately 10 kilometers.[8] These sand bodies coarsen upward, are commonly pierced by intrusions of underlying mud, and grade laterally into delta front and lower delta plain. An example of this growth rate is the distributary mouth bar at Southwest Pass which has prograded 11 kilometers since 1760.

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[6] L.D. Wright and J.M. Coleman. "Effluent Expansion and Interfacial Mixing in the presence of a Silt Wedge, Mississippi River Delta." J. Geophys. Res., Vol. 76, 1971: 8649-8661.
L.D. Wright and J.M. Coleman. "Variations in Morphology of Major River Deltas as Functions of Ocean Wave and River Discharges Regimes." Am. Assoc. Petroleum Geologists, Bull, Vol. 57, 1973: 370-398.

[7] C.C. Bates. "Rational Theory of Delta Formation." Am. Assoc. Petroleum Geologists, Bull, Vol. 37, 1953: 2119-2161.

[8] H.N. Fisk. "Bar Finger Sands of the Mississippi Delta." In, Peterson, J. A. and J.C. Osmond (Eds.) "Geometry of Sandstone Bodies.", Am. Assoc. Petroleum Geologists Symp. Vol. 1, 1961: 29-52.

The buoyant effluence and its turbulent mixing with ambient sea water create a dynamic that controls sedimentation at the river mouth and causes the coarsening upward delta front. Because most sedimentation occurs during river floods, river mouth dynamics are most directly tied to the distribution in deltaic sediments. The top of the silt wedge during a flood is pushed seaward from its pre-flood position to the crest of the distributary mouth bar. Consequently, intense turbulent mixing, reduction in current sediment carrying capacity, and rapid sediment fallout characterize the mouth bar crest. The South Pass bar increased 2.5 meters during the 1973 flooding.[9]

The movement and deposition of sediments in the Mississippi River Deltaic System also result from bay fills, crevasse splays, and submarine mass movement. Mud released by the Mississippi River distributaries fills the interdistributary bays. This is accomplished partly by currents and waves returning fine sediments landward from the main passes. The dominant bay fill, however, is caused by sediment influx across the distributary levels during flood stage and through crevasse splay distributary networks. Distill bay fill is uniformly fine grained and heavily pulverized due to modest sedimentation rate. During major storms or floods coarse sediments can be introduced across the bed of even large bays. Crevasse splays are responsible for most of the sedimentation occurring between river distributaries. Most surface land of the modern Mississippi River Delta is built by crevasse splays.[10]

A crevasse opens during a flood as the river water is excavating a channel across the levee in response to a local surface gradient advantage. This breaching is immediately followed by a rapid influx of sediment building fan shaped deposits (crevasse splay) into the bay.

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[9]L.D. Wright and J.M. Coleman. “Mississippi River Mouth Process, Effluent Dynamics and Morphologic Development.” J. Geol., Vol. 82, 1974: 751-778.

[10] J.M. Coleman and S.M. Gagliano. “Cyclic Sedimentation In The Mississippi River Deltaic Plain Gulf Coast Assoc.” Geol. Soc. Trans. Vol. 14, 1964: 67-80.

Following the formation of a major breach, the crevasse splay will continue to grow over a period of a few decades during which time it builds a coarsening upward sedimentary body into the bay muds.

Additionally, many gullies which appeared on the delta front were formed as a result of submarine mass movement. The setting for large-scale submarine sliding on the Mississippi Delta front is provided by the rapid accumulation of under-consolidated sediment.[11]

In order to understand the formation of the Mississippi Deltaic Plain, it is necessary to discuss deltaic features and landforms in greater detail. The Deltaic Plain has four primary environments: 1) distributary channels; 2) natural levee complexes; 3) interdistributary basins; and 4) barrier complexes.

Distributing Channels

Distributary channels are permanent channels that divert water away from the main course of a river often termed distributaries. There are several different types of distributary channels distinguished primarily by when the water is diverted, how much water is carried through the channel, and if the channel is filled with sediment. In deltas, streams often diverge from the parent channel. The point of diversion is initiated as a crevasse channel, but if it becomes enlarged to the point that flows become permanent, the result is known as a distributary channel. Distributary channels generally terminate in a large body of open water. They have many of the fluvial features of the main river stream including natural levees, crevasses, and

[11]F.P. Shepard. “Delta Front Valleys Bordering the Mississippi Distributaries.” Geol. Soc, America, Bull. Vol. 66 . 1955: 1489-1498.

splays. Distributaries (diversion channels) that continue to divert excess waters after high flow periods are considered active. They serve to move water away from the main course of the Mississippi River.

Abandoned distributaries are distributaries that are eventually abandoned because of reduction in flow resulting from upstream avulsion (changing of coarse) or crevassing producing an improved gradient advantage for the new course. Upon abandonment, the channel begins to fill with organic and inorganic sediments.[12]

River channels tend to flow in a curving pattern even if the slope is relatively steep. This is because water flow is turbulent and any bend or irregularity in the channel deflects the flow of water to the opposite bank. The force of the water striking the stream bank causes erosion and undercutting, which initiates a small bend in the river channel. In time, as the current continues to impinge on the outside of the channel, the bend grows larger and is accentuated and a small bend ultimately grows into a large meander bend (back and forth). On the side of the meander, velocity is at a minimum, causing some of the sediment load to be deposited. These deposits occur on the point of the meander bend and are called point bars. These two major processes, erosion on the outside of the meander and deposition on the inside, cause meander loops and forth) to migrate laterally. Point bars exist only along the present channels of the Mississippi River or its very large distributaries.

Another feature of the distributary channel system is referred to as an abandoned course. When the main flow path changes to a new position on a flood plain, the abandoned course fills with sediment. The abandoned course shows up as a scar or signature indicating the former

[12] L.M. Smith et al., Geomorphological Investigation of the Atchafaylaya Basin Area West, Delta,and Terrebonne Marsh. U. S. Army Corps of Engineers: Vicksburg District, Vicksburg. Submitted to the U.S. Army Corps of Engineers: N. O. District, New Orleans, Louisiana, 1986.

meander of the course. In addition, abandoned channels usually form during flood flows and may be produced by neck cutoffs of a single meander loop or by breaking through the natural levee or other sediment deposits. As the river moves laterally, it may completely abandon the old meander loop which remains as a crescent-shaped lake called an ox bow lake. However, the absence of true meanders in the lower deltaic plan of the Mississippi is attributed to the fact that the channel is fixed in very dense clays. These clays are very resistant to erosion and tend to retard lateral channel migration.[13]

Natural Levee Complexes

Alluvial rivers like the Mississippi River that flow on a floodplain develop a natural levee complex. A natural levee is a long, broad, low ridge or embankment of sand and coarse silt built by a river on its floodplain and along banks of its channel, especially in time of flood when water overflowing the normal banks is forced to deposit the coarsest part of its load. The resulting land formation parallels the river channel and consists of a wedge-shaped deposit that thins away from the channel. The highest elevation on the levee surface is adjacent to the parent channel at or near normal flood level. The surface slopes gently away from the channel and toward the surrounding environments. Natural levees in the Mississippi River Delta vary from less than 1.5 meters high along smaller channels to more than 7.6 meters high along larger channels of the river. These levees vary from several meters to several kilometers in width.[14]

[13] Smith , 1986.

[14]J.R. May. Geological Investigation of Mississippi Deltaic Plain U. S. Army Corps of Engineers, Waterways Experiment Station Vicksburg, Mississippi, 1984.

Additional formations of the natural levee complex are crevasse channels (streams formed from flooding and fracturing of the levee) and crevasse splays (non-uniform land forms resulting from sediment deposits of crevasse channels). A crevasse is a wide break or crack in the bank of a river, especially one in a natural levee or an artificial bank of the lower Mississippi River. Crevasses develop by breaching of natural levees during floods and usually only receive flow during high discharge periods. Crevasse channels are accompanied by development of broad natural levees. Crevasses often terminate distally (back side of levees) in accumulations of coarse-grained sediments known as crevasse splays. Splays are characterized by a fan or semi-elliptical shape and have numerous interconnecting smaller channels that radiate outward in all directions. The modern (Balize delta complex Plaquemines Parish) delta exhibits numerous splays along both the main course and distributaries.[15]

Interdistributary Basins

Natural levees and their associated channels generally occupy a relatively small portion of the lower Mississippi Deltaic Plain. The low-lying areas bordered by natural levees are called interdistributary basins and consist of large areas of marsh and swamp with numerous lakes and bays connected by tidal streams.[16]

Swamps are wetland areas that have woody vegetation with standing water for at least part of each year. Poorly drained areas that receive fresh water from overflow and that are situated far enough from the sea such that salt water intrusion rarely occurs, are classified as

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[15] Smith , 1986.

[16] American Geological Institute, Dictionary of Geological Terms Rev. Ed. Anchor Press New York, 1972.

inland swamps. These areas are bordered by natural levees with sediments typically composed of clays containing wood.

Back swamps occur in poorly drained, tree-covered low areas that are completely bounded by natural levee ridges. Back swamps are typically confined to flood plain areas and receive fine-grained sediment when natural levees are topped over during flooding.[17]

Marsh environments are extremely flat, treeless areas, with standing water, and dominated by grasses and sedges. Vegetative debris is added at the surface and normally keeps pace with subsidence so that a thick organic deposit eventually forms. It should be noted that peats are the most common form of marsh strata although inorganic sediments may be introduced by flooding and by unusually high tides. There are three types of marshes: fresh, brackish, and salt.[18]

Fresh water marsh in the western portions of the Mississippi River Delta is predominantly of the floating marsh or flotant type, consisting of a vegetation mat usually 10 to 35 centimeters thick, underlain by .9 to 4.6 meters of finely divided mulch or organic ooze. The brackish marsh is transitional in saline and physical characteristics between fresh and saline marshes. The saline to brackish marsh is firm and solid. The salt marsh is slightly higher in elevation than fresh and brackish marshes because of inorganic sediments introduced from main sources.[19]

Lacustrine deposits are associated with fresh water lakes. Lakes in interdistributary basins usually have muddy bottoms and shorelines. These lakes may go through cycles of filling when a distributary, or crevasse distributary, introduces sediment into the lake. Lacustrine delta

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[17] Smith,, 1986.

[18] Kolb, 1958.

[19] Smith, 1986.

deposits are the product of a fluvial system prograding into shallow, open water. These are generally coarser sediments than the lacustrine deposits because the channel mouth is closer.

The distributary channels associated with lacustrine delta deposition are lacustrine delta channels. These channels are formed by flow separation through the development of small elliptical lacustrine delta lobes.

Other formations of interdistributary basins are interdistributary bays. These are low areas between active distributary channels and are usually characterized by brackish water conditions. During flood conditions, overflow waters deposit sediments in interdistributary locations. Areas removed from the natural levees receive silty clays and clays deposited from suspension. These areas become marsh after they reach sea level.

Barrier Complexes

The fourth type of landform of the deltaic process is barrier complexes. Barrier complexes consist of beach ridges, barrier islands, and abandoned beaches. Barrier complexes are partly emergent bar-like ridges of sand or coarser sediment lying off a shore and usually subparallel to the shore. [20] A barrier is usually cut by one or more tidal inlets, forming a barrier chain.

During the active building process (progradation) of a delta lobe, fluvially transported sands are deposited in the immediate vicinity of the distributary mouth, where current velocities are reduced. These sands are redistributed along the delta margin and, depending on quantities

[20]W. A. Price. "Beaches and Islands In the Encyclopedia of Geomorphology." edited by R. W. Fairbridge, Book Corp, New York, Vol 3, 1968: 51-53.

of sand available and the wave/current activity, they may become apparent as delta marginal beaches or beach ridge complexes.[21]

As a delta lobe is abandoned and submergence of the deltaic surface is initiated as a result of subsidence, sand originally deposited as beaches, spits (sandy extension of a beach), and beach ridge complexes tends to remain as a series of barrier beaches or barrier islands separated from the high retreating delta shoreline by a shallow sound or estuary. Examples of barrier islands of the Mississippi deltaic system from west to east are Isles Dernieres, Timbalier Islands, Caminais – Moreau Coast, Grand Isle, Breton Island, and the Chandeleur Island.

An abandoned beach of the barrier complex also known as a "fossil" beach may be recognized by its orientation to former coastlines, discontinuity of distributary channels, and shell hash on the surface and subsurface.[22]

Deltaic Evolution and Process

To understand deltaic environments and their cultural resource potential, one must first understand deltaic evolution and formation processes of deltaic landforms. Deltas develop in a predictable fashion and go through three stages in the normal delta cycle: subaqueous (submerged) growth, rapid subaerial (surface) growth, and deterioration. Each of these stages is characterized by an assemblage of natural environments, processes, and landforms.

Deltas are formed when a stream enters a body of standing or low-energy water. The consequent loss of energy results in deposition of much of the sediment load at or near the point of entry and growth of the delta initiates through subaqueous deposition. During this subaqueous

[21]R.P. Savage. Notes on the Formation of Beach Ridges Beach Erosion Board Bulletin 13, 1959: 31-35.

[22] Smith, 1986.

stage, natural environments are limited in variety, salinity is high, and biological productivity is low.

As deposition continues, the delta begins a stage of rapid subaerial growth. The number and variety of natural environments greatly increases and each is characterized by specific depositional regimes. Near river channel sedimentation is rapid during periods of over bank flow and natural levees develop immediately adjacent to the channels. The levees continue to build vertically until reaching a height approximating normal flood level. The resulting topographic feature is typically a long, broad, low ridge or embankment, of sand and coarse silt paralleling the river channel. During floods, water escapes the channel through a variety of means. Some water may overtop the levee and flow in relatively unconcentrated form into adjacent environments. More typically, the natural levees are breached by short, relatively small, crevasse channels that provide excess waters; a course into lower areas outside the levees. Contained waters are highly charged with sediments and broad natural levees typically form along the crevasse. Crevasse channels usually terminate in marsh or swamp environments and fanlike accumulations of relatively coarse sediment called splays may develop at the termination.

As subaerial sedimentation continues, the delta builds upward and seaward. The channel progressively lengthens and the gradient decreases and eventually some or all of the water gains access to the ocean through more efficient channels. This loss may occur in several ways. An ephemeral (temporary) crevasse channel may become enlarged and deepened to form a permanent distributary channel that carries a significant portion of the total flow of the trunk stream. Active or previously occupied distributaries may eventually capture most or all of the flow, becoming the trunk stream. Alternatively, upstream avulsion (cutting off) may occur, shifting the entire channel and forming a new distributary channel. During this stage, sedimentation in interdistributary areas is mainly accomplished through settling out of suspended sediments and organic materials in low-energy marsh, swamp, and lake environments. Because inorganic sedimentation is slow, organic debris in marsh environments typically composes most of the materials deposited.

Eventually, the trunk stream feeding the delta lobe is abandoned in favor of a shorter, more efficient course. This results in the deterioration phase of the delta cycle. This phase is marked by subsidence, which results in progressively decreasing subaerial surfaces, increased salinity, and, initially, greatly increased biological productivity. Marine transgression and wave action result in the erosion of headlands and development of barrier complexes near the distal portions of the delta lobe.

Mississippi River Delta Lobes

The Mississippi River has delivered sediment to the Gulf of Mexico since at least Cretaceous times (65-135 million years ago). Since then, the depocenter (area of thickest sediment deposits) has shifted many times. Much of the sediment in the Gulf Coast syncline (downward curve of coast) is partly derived from the ancestral Mississippi River. As the river deposited sediment to the Gulf it built up a thick sequence of sediments that prograded (active sediment deposition causing landform migration) the coastal plain in a seaward direction, forming the Mississippi River Delta.

The early Mississippi Delta prograded and constructed lobes on the western flanks of the present Mississippi Deltaic Plain. These lobes were generally widespread and thin, averaging 10-15 meters in thickness. As the lobes prograded, the river's gradient was reduced and the channel shifted to more favorable positions, resulting in an eastward shift of the depocenter through time. Avulsion has occurred a number of times on the Mississippi River Delta, resulting in the deposition of multiple delta complexes, each reflecting a different position of the lower Mississippi River. Five such complexes have been identified.[23] From oldest to youngest, these are the Maringouin, Teche, St. Bernard, Lafourche, and Plaquemines-Modern complexes. These delta complexes have all been deposited in the last 12,000 years during the time when humans inhabited the New World.

The Plaquemines-Modern delta complex is divided into two delta complexes. The older one is the Plaquemines-Modern delta complex and the more recent is the Balize delta complex also termed the modern Birdsfoot Delta.

The erratic flow of the modern Mississippi has produced a delta complex different from the previous deltas of the Mississippi River. The elongated, confined birdsfoot shape of the modern delta is the result of a radical expansion in vertical thickness due to deposition in increasingly deeper water. Whereas the average thickness for all known previous Mississippi delta deposits is approximately 10-15 meters, the modern delta is 100-120 meters thick. The difference in water depth has resulted in construction of a delta having a much smaller subaerial extent. The modern Birdsfoot Delta is confined to a relatively small area of 1,900 km^2 where other deltas average 6,200 km^2.[24]

If the Atchafalaya River (currently an active distributary of the Mississippi River) were allowed full flow today, instead of the 30% flow allowed, which is controlled by man made locks

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[23] D.E. Frazier. "Recent deltaic deposits of the Mississippi River: their development and chronology." Trans. Gulf Coast Assoc. Geol. Soc., Vol. 17, 1967:287-315.

[24] J.M. Coleman. Deltas: Processes of Deposition and Models for Explanation. International Human Resources Development Corp., Boston, 1982.

up river, it eventually would become the New Mississippi River outlet. This would once again change the outlet to the west to start its eastward migration over the next several thousand years.

Upon abandonment of a distributary due to loss of gradient advantage, a shift in the site of active delta sedimentation (depocenter) occurs, a new lobe is constructed, and the inactive delta lobe is soon attacked by subsidence and the sea (marine transgression) as sedimentation ceases. The oldest delta complexes have undergone inundation and modification since active sedimentation ceased and, as a result, no remnants of the Miringouin and Teche complexes exist subaerially (above water) in southeast Louisiana. Each delta lobe proceeds through a life cycle and successive lobes have been modified to varying degrees depending on their age.

The deltas of southeast Louisiana and the aforementioned environmental features and land formations associated with the delta building process can arguably be considered the greatest resource of Louisiana. Throughout history this process has allowed the coast of Louisiana and its delta basins to be vibrant estuaries and safety zones (buffers) between man and Mother Nature (storms and tidal surge). However, human intervention in the natural evolution of the delta process has begun to result in dire consequences for Louisianans. For example, Louisiana estuaries are being lost at an alarming rate resulting in a declining fishing industry, loss of culture (fishing as a way of life), and loss of city population (New Orleans, as the result of hurricane displacement and private property damage). One of the gifts of the Mississippi River to Louisiana has always been rich sediment that has helped sustain Louisiana and its people for ages. As Louisianans approach the future the delta building process must not be taken for granted but used to fix the problems facing the Louisiana coastal basins.

Chapter 2

The problem the Mississippi River Delta Basin and its people is facing

Over the last 1,200 years, sediment deposits have occurred primarily at the mouth of the Mississippi River's Plaquemines-Balize delta. This area is defined as the Mississippi River Delta Basin and is located on the edge of the continental shelf of the Gulf of Mexico in Plaquemines Parish, Louisiana. It is noted for its "bird's foot" configuration which is characteristic of alluvial sediments deposited into deep water. This type of alluvial configuration requires large volumes of sediment to create land area. Currently, large volumes of sediment are being lost to the deep waters (up to 1,000 feet) of the continental slope or ocean floor, creating an environment not conducive to land building. As a result, land is being created in the Mississippi River Delta Basin at a slower rate than it is eroding away.[25]

Since the 1930s, the Mississippi River Delta Basin and the coast of Louisiana have been literally losing ground. Much of the Mississippi River Delta Basin has experienced coastal land loss. For example, dating back to the 1990s land loss estimates for the basin averaged between 819 and 1,337 acres/year. Since 1932, the basin has lost approximately 70 percent of its total land area. The total land area lost in this basin over the last 60 years has been approximately 113,300 acres. At current loss rates, up to 26,740 acres of wetlands will be lost during the next 20 years and 53,600 acres over 50 years.[26] Noticeable land loss began in the 1930s; the same time the lower Mississippi River was conquered by levees and oil exploration began in earnest

[25] D.E. Frazier, "Recent deltaic deposits of the Mississippi River: their development and chronology." Trans. Gulf Coast Assoc. Geol. Soc., Vol. 17, 1967:287-315.

[26] J.B. Dunbar et al., "Land Loss Rates, Report 3, Louisiana *Coastal Plain.*" U.S. Army Corp of Engineers Waterways Experiment Station, Vicksburg, Mississippi, 1992: Technical Report GL-90-2.

throughout the region. It was the dawn of the Louisiana gold rush, the infrastructure of which still produces or processes a staggering 18 percent of the annual U.S. oil supplies and 24 percent of U.S. natural gas. Big oil companies such as Texaco, Amoco, and Exxon launched extensive canal dredging that continued for a half century. They literally devoured the land creating ten thousand miles of canals spreading across the Louisiana coast.[27] The levees stopped the distribution of river sediments required for land building in the delta and the canals caused salt water intrusion which resulted in the death of fresh water wetland marshes.

The reason for the problem

The Mississippi River Delta Basin is losing its wetlands due to a variety of factors including: compaction causing a subsidence (sinking) rate of 5 feet per century; loss of sediment; possible fault zones; tidal and boat wake erosion; sea level rise; hurricanes; and other human activities such as maintenance of navigation channels, construction of canals for mineral exploration, and the removal of non-renewable mineral resources (oil and gas). This land loss in the delta basin is now being recognized as a human safety issue. For example, the Mississippi River Delta Basin (South Plaquemines Parish) in 1932 was comprised of approximately 521,000 acres, of which 83 percent is now open water. The remaining 101,100 acres consist of freshwater to brackish marshes that are very valuable as fish and wildlife habitat. Most importantly, these wetlands are a buffer for hurricanes, providing our first line of defense.[28] On August 29, 2005, Hurricane Katrina ravaged the wetlands east of the Mississippi River. Before the storm, general opinion was that this area might lose 60 square miles of wetlands by 2050. In

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[27] Mike Tidwell, *Bayou Farewell* (New York: Vintage Books a Division of Random House, Inc., 2003), 35-36.

[28] Dunbar , Report GL-90-2.

eight hours, Hurricane Katrina destroyed 80 square miles. After Hurricane Rita (September 24, 2005), the coastal wetlands of Louisiana had lost a total of 217 miles of vegetated marsh to open water from the two hurricanes.[29]

Even prior to hurricanes Katrina and Rita, loss of wetlands in Louisiana was recognized as a national problem. However, nothing has been done to effectively stem this tragedy. The decline of this environment is now affecting and will further affect, the United States economy, infrastructure, and culture. In addition, such decline poses a threat to the safety of the United States population. It is not easy to understand or admit, but Louisianans, the oil and gas industry, and the United States Government are responsible for the acceleration of the natural process of subsidence and compaction in the wetlands. Furthermore, the impact of storms such as hurricanes Katrina and Rita, as seen in the summer of 2005, were far more devastating in great part due to the decline of wetlands. It is now devastatingly clear that the Mississippi River Basin wetlands are the first lines of storm defense for the New Orleans Metropolitan area.

Coastal Louisiana has been extensively altered by human activity. Each of the primary causes of wetland loss has both a natural and human-induced component. Subsidence, for example, occurs naturally in the wetlands built by the Mississippi River as a consequence of geological down warping (bending of the earths crust) and compaction of sediment columns with a high component of water, gas, and organic materials. However, subsidence also may be significantly affected by local drainage efforts that reduce the water content of the upper few feet

[29] Mark Schleifstein, "Laying The Groundwork," *Times Picayune*, 6 March 2007, A12.

of the soil profile, by placement of levees and other structures that load the surface, or by removal of minerals (oil and gas) from near surface deposits.[30]

Additionally, sediment deprivation in a wetland environment can be a natural consequence of the switching and change in dominance of the various distributaries of the Mississippi River, but it also is affected by development of continuous river levee systems that prevent over bank flooding and crevasse development, or promote loss of sediment into deep waters overlying the continental slope.

Finally, hydrologic alterations to wetlands can occur as a natural consequence of the breakup of barrier island systems at the mouths of estuaries, abandonment of distributary channels, or development of tidal drainage networks. However, the viability of coastal wetlands is also affected by thousands of miles of dredged channels and associated levees that alter hydrology, sedimentation, and salinity of water.[31] For example, when oil companies dredge canals, the dredged materials are placed along banks of the dredged canal. These small levees known as spoil banks keep fresh sediment and nutrients placed during high tide from settling in the wetland marshes. The remaining vegetation eventually sinks into the water that has a high salinity level as a result of salt water intrusion from the dredged canal. This results in the death of the root systems of marsh grasses, causing the break up of remaining marsh land.

Since the Mississippi River is no longer free to alter its course and leave its banks to take over vast coastal areas, many of the areas suffer from lack of the abundant fresh water and sediment found in the river. As a result, the effects of human and natural forces which promote

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[30] R.W. Harrison and W. M. Kollmorgen, "Drainage reclamation in the coastal marshlands of the Mississippi River delta." *Louisiana Historical Quarterly*, Vol. 30 No. 2, 1947: 654-709.

[31] L.D. McGinnis et al., "Velocity Depression and Degasification subsidence in Louisiana Wetlands." *In Gulf Coast Section Society of Economic Paleontologists and Mineralogists, 12th Annual Research Conference*, Houston, TX, (December 1991): 128-133.

wetland deterioration are compounded. In this respect, the relationship between the Mississippi River and the problems facing the coastal wetlands is not limited to the river's delta basin, but rather extends across the entire Louisiana coast. The lack of growth in the Mississippi River Delta, on a large scale, is a coast-wide problem. This source of ample fresh water and sediment, which shaped the Louisiana coast as we know it, is no longer producing a net gain in coastal wetlands, placing the entire Louisiana coast at risk.

The Mississippi River discharges the headwater flows and suspended sediments from approximately 41 percent of the continental United States. This discharge of water and suspended sediments ultimately reach the Mississippi River Delta Basin. Approximately 85 million tons of sediments across coastal Louisiana were deposited each year until the river was shackled by levees in the 1930s.[32] Today, despite the constant arrival of these suspended sediments, much of the sediment remains unconsolidated (loose). Therefore, these sediments are highly susceptible to compaction, reducing the life span of emergent wetlands. Additionally, due to jetties built in the late 1800s at the mouth of the river (The Mississippi River Delta Basin, Port Eads) to prevent sandbars from forming and blocking the shipping industry, large amounts of sediments are lost as they do not settle and continue with the river flowing into the Gulf of Mexico, falling into the bottomless pit of the continental shelf.[33]

It is obvious that some of the aforementioned causal factors can not be controlled; however, Louisianans, industry, and government, have failed to manage the human activities that

[32] Tidwell, 117.

[33] Ari Kelman, *A River and Its City: The Nature of Landscape in New Orleans*. Berkley, CA: University Press, 2006, 131-132.

could be, and are, major causal factors in the deterioration and retreat of this basin. This failure is due to the following of four factors:[34]

1. Louisiana's government and people have been slow in committing their full energy to the effort.

2. Economic interests have used political power to block coast-saving projects that threatened their bottom line.

3. Federal administrations have never given more than lip service to the cause.

4. Bureaucratic, multiyear federal approval processes all but guarantee a project is outdated before it can be implemented.

The wetlands of coastal Louisiana and its delta basins support renewable resources that are of local, state, national, and international significance. Approximately one-third of the nation's fishery landings, which add an estimated $680 million to the state's economy annually, are dependent on these wetlands. Additionally, these areas add another $338 million annually to the state's economy by supporting the sporting and tourism industries.[35] However, unlike any other state in the union, even prior to hurricanes Katrina and Rita, Louisiana lost over 25 square miles annually of the resource base supporting such industries as a result of natural and human induced hydrological, geological, and ecological processes. The public use value of this loss was estimated (pre Hurricane Katrina) to exceed a total of $37 billion by 2050. Moreover, the losses associated with culture and heritage is immeasurable. Nearly one million acres of these

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[34] Bob Marshall and Mark Schleifstein, "Losing Ground," *Times Picayune*, 5 March 2007, A1and A4.

[35] W. Keithly, Louisiana Seafood Industry Study. New Orleans, Louisiana: Louisiana Seafood Promotions and Marketing Board, 1991.

nationally important wetlands have been lost in the last 60 years, over one-tenth in the Mississippi River Delta Basin alone.[36]

Why Louisiana and the nation ignore the problem

Historically, Louisianans have ignored the fact that while the rapid emergence of wetlands can naturally occur over large areas in the delta, these areas deteriorate in an equally rapid manner due to human interference. One of the most ironic reasons Louisianans have remained silent about the Mississippi River Delta Basin and the coast in many cases is due to the estuary itself. Even wounded, it's still amazingly productive. People are still making a living in the oil field. Fishermen are still catching plenty of fish, crabs, shrimp, and oysters. Duck hunters are still killing plenty of ducks. As a result, many Louisianans feel they have been hearing the dire, but accurate, prediction that the coast is at the point of collapse while they are still making a good living in the remaining wetlands.[37] As a result, they decide to go on without making waves, even though they themselves see the land turning to water day by day. As Mike Tidwell, Bayou Farewell author, pointed out, "it's sometimes hard to get ten shrimpers to agree on what day of the week it is, much less get them together and get them politically organized, especially when they're still catching shrimp."[38]

Louisianans have known since the 1930s that the wetlands of the Mississippi River delta and the coast have been turning to open water. They also know why. Decisions made many

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[36] Dunbar , Report GL-90-2.

[37] Tidwell, 139.

[38] Tidwell, 140.

years ago to tame the river with levees to stop flooding, dikes at its mouth to stop the river from silting and filling, and endless canals dredged for oil and gas exploration were to blame. Scientists have pointed out that levees and dikes produced a gradual march to the gulf, estimating that the coast and its basins could survive for another 1000 years. However, the discovery of gas and oil and the resulting thousands of miles of dredged canals accelerated this process by 50 years.[39] These oil and gas pipe line canals dredged by big industry advance the Gulf of Mexico into salt sensitive freshwater wetlands. Louisianans accept this practice as a necessary evil to sustain the state's economy.[40]

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[39] Marshall and Schleifstein, A-4.

[40] Tidwell, 304.

Chapter 3

The plans that have failed to fix the problem

Coastal Wetlands Planning, Protection and Restoration Act

After approximately 60 years of rapid wetland loss, a Federal government law to fight the erosion of the Mississippi River Basin and the coast of Louisiana marked the beginning of a concentrated effort to combat coastal erosion. Louisianans saw this as the way to have it all: Flood control, shipping, fishing and the oil industry, along with a plan to correct and stop erosion and repair the coastal basins of the Mississippi River.[41] It was known as The Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), also known as the Breaux Act, named after Louisiana Senator John Breaux. In November 1990, The United States Congress passed, and President George Bush Sr. signed, CWPPRA into Public Law.[42]

CWPPRA identified two major approaches to saving Louisiana's wetlands: (1) using various tools and methods to fight coastal erosion immediately by developing and implementing priority projects to retard the loss of wetlands in the existing delta and (2) new long-term efforts to build large-scale projects and to otherwise restore and build new wetland areas (the actual diversion of the Mississippi River).

In 1990 CWPPRA set forth objectives to be met in 20 years. At this point, it is safe to say the plan did not solve the problems of coastal and wetland erosion. The original CWPPRA

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[41] "The Restoration Plan."

[42] West Group. Federal Environmental Laws, 2002. Coastal Wetlands Planning, Protection and Restoration Act 1990 {CWPPRA 302-307}, (16 U.S.C.A. 3951-3956), (1990 Acts. Pub. L 101-646, Title III).

plan took approximately three years in the planning phase alone. To date, planning by the CWPPRA formed task force continues, led by the United States Army Corp of Engineers. It continues as a living document subject to modification with the finding of new facts through monitoring, issue resolution, and the conclusions derived from lengthy feasibility studies.

The plan took almost a decade to begin implementation. During this period at least 60 (short term) priority projects were identified, with a fully funded planning cost of $123 million. However, during the delayed implementation period, the cost of materials, equipment, and legal/professional fees multiplied by ten. The original projects included sediment diversions, sediment dredging, sediment capture projects, enhancement and protection of existing wetlands, restoration of barrier islands, fresh water diversion, outfall management, hydrological restoration, hydrological management of impoundments, marsh management, erosion control, and herbivore control. Prior to hurricanes Katrina and Rita it was projected the recommended projects would create or prevent loss of more than 74,000 acres of wetlands in the Mississippi River Delta Basin over the 20 year period.[43] The 20 year goals of these basin projects will not be realized, however, due to delay in implementation, bureaucracy, and human subversion.

In addition, CWPPRA funded and demanded a coastal wetland plan to protect and restore Louisiana's coastal environments. The CWPPRA concentrated its efforts in priority projects for restoration in the nine hydrological basins of the coast of Louisiana. These basins are identified as the Mississippi River Delta, Breton Sound, Pontchartrain, Barataria, Terrebonne, Atchafalaya, Techce/Vermilion, Mermentau, and the Calcasieu/Sabine.[44] The federal government in

[43] "The Restoration Plan."

[44] Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority, Coast 2050: Toward a Sustainable Coastal Louisiana. Baton Rouge, La.: Louisiana Department of Natural Resources, 1998.

partnership with the Louisiana allocated approximately $250 million dollars between 1990 and 1997 through the CWPPRA. However, the allocation of funds was spread over the entire coast of Louisiana (all nine basins) in a trickling manner that caused projects not to be cost effective by the time they were initiated. Therefore, most projects were further stalled or deauthorized. As the 1990s began, coastal advocates believed CWPPRA was a turning point. In light of the mentioned progress, or lack thereof, it soon became apparent that belief was an illusion.[45]

Coast 2050

When the CWPRA seemed to be literally loosing ground in 1998, the CWPPRA funded a plan to initiate a program assuring all the best priority projects of CWPPRA would be built in the most efficient and timely manner possible. Named the "Coast 2050" plan, it was intended to implement all CWPPRA projects from a single plan with a clear strategic vision (the big picture). This plan was developed dividing the coast into four planning regions based on CWPPRA hydrological basins. The regions were described as: Region 1, known as the Pontchartrain; Region 2, known as Breton, Barataria, and Mississippi River; Region 3, known as Terreborne, Atchafalaya, and Teche/Vermilion; and Region 4, known as Calcasieu/Sabine and Mermentau. The Coast 2050 plan was designed based on the following mission statement:

> *"In partnership with the public, develop by December 22, 1998, a technically sound strategic plan to sustain coastal resources and provide an integrated multiple use approach to ecosystem management" (Coast 2050, 1998).*[46]

[45] Marshall and Schleifstein, A-4.

[46] Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority.

The crisis of Louisiana's land loss and decline of the ecosystem, however, made it apparent that much larger projects to restore the Coast and its basins' natural ecosystem structures and processes, working in conjunction with the CWPPRA projects, were required to deal with the problem; hence, the development of, "Coast 2050 Toward a Sustainable Coastal Louisiana."

Louisiana Coastal Area

Six years later, after little was done in 2004, Coast 2050 evolved into the Louisiana Coastal Area (LCA) study, which was developed to form a broader scale effort for the restoration of Louisiana's coastal area ecosystem.[47] The LCA plan focuses on the Mississippi River deltaic plain and the Chenier Plain (Southwest Louisiana). For planning purposes, the same study areas identified by CWPPRA and Coast 2050 was divided into four Subprovinces in the LCA plan, with the Deltaic Plain comprised of Subprovinces 1, 2, and 3, and the Chenier Plain comprising Subprovince 4 . Subprovince 1 is comprised of the Pontchartrain, Breton Sound, and East Mississippi River basins; Subprovince 2 is comprised of the Barataria and West Mississippi River basins; Subprovince 3 is comprised of the Terreborne, Atchafalya, and Teche/Vermilion basins; and Subprovince 4 is comprised of the Calcasieu/Sabine and Mermentau basins.[48]

Each of these plans is basically the same plan with a different name. The fact is they were plans that appeased Louisianans every half decade or so when little progress was made. As

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[47] Marshall and Schleifstein, A-5.

[48] Louisiana Department of Natural Resources. U.S. Army Corps of Engineers, New Orleans District. Louisiana Coastal Area (LCA) Ecosystem Restoration Study. LCA Study- Main Report, vol. 1. Baton Rouge, La., 2004.

a matter of fact, the only plan that was federally funded was the CWPPRA plan. Both the Coast 2050 plan and the LCA are state drafted plans on paper with additional funding expected from the federal government, but never received. These plans required $14 billion dollars over 30 years to repair the basins of the Mississippi river and the Louisiana coast. The current Bush administration would only approve between $1.2 billion and $1.9 billion. The reduction in the amount approved stemmed from unprecedented budget deficits spurred by a wave of tax cuts and the invasion of Iraq.[49] To date, Louisiana has still not received funding for the later plans.[50]

Coastal Protection and Restoration Authority

In December 2005, following the devastation of hurricanes Katrina and Rita the State of Louisiana established yet another plan. This plan is a comprehensive coastal restoration and hurricane protection plan developed by the new Coastal Protection and Restoration Authority (CPRA). The CPRA was established by the Louisiana Legislature, through Act 8 of the First Extraordinary Session of the 2005 Legislature.[51] Utilizing input from a wide variety of stakeholders the CPRA developed a comprehensive master plan seeking sustainable coastal protection integrating the two goals of hurricane protection and coastal restoration. In April 2007, the plan known as the Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast ("Master Plan") was

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[49] Marshall and Schleifstein, A-7.

[50] Bob Marshall, "Last Chance," *Times Picayune*, 4 March 2007, A-19.

[51] "Public Hearings on the Draft Master Plan" 2007. http://www.louisianaspeaks.org (Accessed 21 February 2007).

completed.[52] The Master Plan builds on and utilizes past plans and existing programs such as CWPPRA, Coast 2050, and the LCA with additional hurricane and flood protection elements. However, the plan has no dedicated funding source. Additionally, the funding streams that do exist as well as those promised by the federal government are received piecemeal. As a result, long-term implementation of the plan cannot be realized.[53]

Coastal Impact Assistance Program

Following hurricanes Katrina and Rita, under the Coastal Impact Assistance Program (CIAP) approved by Congress, an estimated $540 million was expected to be available starting in Spring 2007 in order for coastal parishes to jumpstart programs to stabilize their shorelines. This program, as part of the Energy Bill, is financed by revenue paid from extraction of minerals (oil and gas) from the outer continental shelf in the Gulf of Mexico.[54] Although this sounds promising, there is a $58 billion backlog of necessary requested projects to save the coast of Louisiana.[55] The CIAP was authorized by the Energy Bill, Section 384 of the Energy Policy 2005, to assist coastal producing states and their political subdivisions (parishes in our case) in mitigating the impact of outer continental shelf oil and gas production. Louisiana is one of seven coastal states selected to receive funds under this appropriation. This results in $540 million dollars over a four-year period. The break down provides the state with 65 percent and the 14

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[52]"Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast." 2007. http://www.louisianacoastalplanning.org . (Accessed 12 June 2007).

[53]Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast." 2007. http://www.louisianacoastalplanning.org . (Accessed 12 June 2007).

[54] Bill Walsh, "Vitter announces coastal plan," *Times Picayune*, 31 March 2005, A2.

[55] Bill Walsh, " La. coast plans face review today," *Times Picayune*, 18 July 2006, A7.

coastal parishes with 35 percent. This results in Plaquemines Parish getting about $14-18 million dollars (over 4 years). Standing alone, this is not enough for even one major project. Each parish is responsible for deciding how the money received is used on coastal and wetland restoration projects as well as which priority projects are petitioned to the state for support with funding from the state's percentage of the CIAP.[56]

For Plaquemines Parish and the Mississippi River Delta Basin, the $540 million is too little, too late. This money pales in comparison to the impact of Hurricane Katrina, which accelerated coastal erosion by 50 years. Congress failed to approve emergency funds requested to address the devastation caused to the Louisiana wetlands by hurricanes Katrina and Rita. Congress did not approve these requests in part after pointing out that Louisiana lacked a master plan explaining how requested funding would be utilized in repairing the wetlands and the coast. Additionally, members of congress would not support the funding for the coastal effort as a result of the billions of dollars recently approved to repair the damages and house the population of New Orleans and other cities of the state following the two storms. Furthermore, the Parish was expected to receive the first 25% of its CIAP funds in Spring 2007 and, to date, is still waiting.[57]

On September 20, 2006, a Plaquemines Parish Coastal Zone Management Advisory Committee (CZM) meeting revealed that the first draft of the CIAP will be about $4 million dollars and the average diversion project costs approximately $20 million dollars. The plan of the Parish is to identify short-term and long-term projects to begin the process. It plans to use its own CIAP funds on inexpensive projects which have a big impact and petition the Louisiana

[56] Plaquemines Parish Coastal Advisory Committee Meeting, 20 September 2006.

[57] Plaquemines Parish Coastal Advisory Committee Meeting.

Department of Natural Resources (DNR) to fund the larger projects using a portion of the state's CIAP funds as matching grant funds. There is no guarantee that this will happen since Plaquemines Parish will be competing against 13 other parishes as Louisiana shares crucially needed funding with six other states.[58]

Surely, funding for such priority projects is always welcomed as long as the loss of wetlands exists. Plaquemines Parish has observed net gains of land and wetland vegetation as a result of fresh water diversion projects at Caernarvon (East Plaquemines Parish) and Naomi (West Plaquemines Parish). However these gains are local and limited to the areas of the projects. These two projects were authorized by the Flood Control Act of 1965 and funded by the Water Resources Development act of 1974. The Corp of Engineers did not complete the projects until 1991 and 1992, almost 30 years after being authorized.[59] As with all of the projects discussed herein, the implementation and funding of the plans appear to be negatively impacting their effectiveness.

State of Louisiana

Furthermore, the federal government is not alone in making hollow promises. Alongside the federal CWPPRA law, the State of Louisiana also passed laws to protect and manage coastal wetlands. Louisiana Act 6 was supposed to provide a long-term state economic revenue source (the state congress approved to fund) for coastal restoration that may vary from $5 million to $25

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[58] Plaquemines Parish Coastal Advisory Committee Meeting.

[59] "Caenarvon Freshwater Diversion Project." 1998. *http://www.mvn.usace.army.mil/prj/caernarvon* (Accessed 21 April 2007).

million per year (Louisiana Revised Statues 49:213 and 49:214).[60] Additionally, a referendum was passed to protect this funding source through an amendment to the Louisiana constitution. This amendment passed by a margin of three to one, demonstrating overwhelming statewide public support. This was thought by many to be a commitment by the State of Louisiana to address the problem at hand. This state law was designed to assure funding would be available for state projects and necessary matching funds for federal initiatives to address loss of the coastal wetlands. However, other than CWPPRA, demonstration projects (small test projects) there were no federal initiatives to match. Moreover, the amount of state funding secured by statute (without federal fund enhancement) would basically only fund approximately one or two projects statewide. At this rate, state project funding could not keep up with, or make a difference in, realized wetland gains at current loss rates. In many cases, the state funds were not allocated due to stalled federal projects for which state funds were meant to be provided as matching funds.[61]

Additionally, Louisiana has an image problem with the rest of the nation. Louisiana is seen as being historically corrupt and downright backward. As a result, the United States Legislature and their constituencies do not trust the state with the money of the nation. Therefore, when Louisiana asks for money, the initial response is to be suspect, and requests are usually denied.[62] Outright political corruption or the perception of it is woven deeply into the fabric of Louisiana's history, a tradition well established even before Governors Huey Long and Edwin Edwards names became synonymous with the worst type of Louisiana backroom power

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[60]West's Louisiana Statues Annotated, 2003. Louisiana Coastal Wetlands Conservation, Restoration, and Management, vol. 27A Title 49, (LSA-R.S. 49:231), (LSA-R.S. 49-214).

[61] "Purpose of the Plan." 1993. http://www.lacoast.gov. (Accessed 5 March 2007).

[62] Marshall and Schleifstein, A-7.

abuse and malfeasance.[63] In 1929, Governor Huey Long was impeached by the Louisiana House on nineteen counts of wrongdoing. Although Governor Long was considered by Louisianans as a governor who did great things for the state, this impeachment was still perceived negatively by the rest of the nation. In the late 1980s and throughout the 1990s, Governor Edwin Edwards was indicted and brought to trial three times for various acts of political corruption involving fraud and extortion.[64] Edwards was finally convicted on a variety of charges in 2001.

Indeed, throughout Louisiana's history corruption has existed. In the 1700s, French colonial governors were regularly sentenced to the Bastille in Paris for financial scandals in the far-off subtropical territory (Louisiana). In the 1740s, The Marquis de Vaudreuil set the standard for granting open monopolies to traders in return for premiums paid to his personal account and blatantly seizing military material for his own enrichment. In 1812, so called "democratic" elections were largely mockeries, rigged so wealthy politicians and planters could have their way through open fraud, intimidation, stuffed ballots, and casting ballots for dead people. Even during the civil war when Union Major General Ben Butler, also known as "Spoons Butler" (because he pilfered the silver spoons and dinnerware of St. Charles Avenue hotels for his own wealth) occupied New Orleans, he too fell to the atmosphere of fraud and abuse, closing down gambling houses and reopening them only after a fee was paid to him and his brother.[65]

Furthermore, not practicing what you preach seems to be Louisiana's legacy. In 1994, at the same time the state's congressional delegation begged for money to protect the coast, its members joined the anti-regulation movement that republicans brought to Washington when they

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[63] Tidwell, 78.

[64] Tidwell, 80.

[65] Tidwell, 80.

took control of Congress. This movement supported efforts to soften regulations protecting the wetlands in favor of industry (oil and gas) and compensation to land owners facing wetland restrictions. This inflated the potential cost of restoration projects.[66] With this going on in the crucial years of getting things done to save the coast of Louisiana, who in their right mind would take Louisiana seriously?

The Bureaucracy

Meanwhile, CWPPRA proved to be a mixed blessing. While it provided a small amount of desperately needed funding, it created new bureaucracies that slowed progress and it focused on financing small projects that did not make an impact on the big problem. As mentioned, CWPPRA provided the first national mandate for action, addressing the loss of Louisiana wetlands as a national problem. Additionally, the Act was intended to initiate the process of reinvesting in restoration a tiny fraction of the billions of dollars that these wetlands provide in renewable (fisheries industry) and non-renewable (oil and gas industry) resources. Most importantly, the Act directed a Task Force consisting of representatives of five federal agencies and the State of Louisiana to develop a comprehensive approach to restore and prevent the loss of coastal wetlands in Louisiana. Section 303 (a) (1) of the CWPPRA directed the Secretary of the Army to convene the Task Force consisting of the following members: the Secretary of the Army (chair agency, Army Corps of Engineers, New Orleans District), the Administrator of the Environmental Protection Agency, the Governor of the State of Louisiana, the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce.

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[66] Marshall and Schleifstein, A-4.

The restoration plan was supposed to be a product of coordination and cooperation not only among the aforementioned members, but also among numerous local government agencies, the academic community, private environmental and business groups, and many motivated individuals with good ideas. However, this group turned into a large bureaucratic tangle. Although the task force included stakeholder members, no one could agree on anything. The approval process of every project included the review and approval of required environmental impact studies, authorized priority projects, and a review of cost effectiveness as opposed to net gains. For example, a requirement of the task force was to reach a consensus on each project. Although this was realized to be a necessity to succeed obstructionism continued.[67]

During the program's first eight years, dozens of projects were approved, only to be abandoned after stakeholders realized it would affect their bottom line. Like the old saying, sometimes you have to break eggs to make an omelet. In this case nobody wanted their eggs broken. For example, an approved project in the Mississippi River Delta Basin known as the Pass a Loutre Crevasse was approved in 1997. It was to be a sediment diversion that would restore 1043 acres of wetlands in the basin. However, in 1998 the project was deauthorized when it was learned that oil companies had pipelines and utilities in the affected area and it would be too costly for them to move them or work around the diversion project.[68]

Another example of obstructionism in the Mississippi River Delta Basin is the mishandling of civil law suits brought against the State of Louisiana and the U.S. Government by oyster farmers in the path of proven effective fresh water diversion projects. In these instances, $1.3 billion in Plaquemines Parish and $661 million in St. Bernard Parish was awarded by State

[67] Marshall and Schleifstein, A-5.

[68] Marshall and Schleifstein, A-5.

judges (state elected officials) to oyster farmers as compensation for the loss of state acquired oyster leases. These leases were rendered useless after the State began to flood marshes with fresh water from the Mississippi River. These cases have continued for approximately a decade in various appellate courts and were recently overturned by the United States Supreme Court. State officials realized a victory for the oyster farmers would have derailed coastal conservation efforts. Although the state has made concessions to many oyster farmers by issuing new leases in suitable oyster farming habitat, many of the farmers, approximately 130 in Plaquemines Parish alone, continue to seek compensation for water bottoms leased to them, but owned by the state.[69] Accordingly, it is evident some ineffectiveness of the plan has resulted from subversion of the goals of wetland growth and preservation, in favor of financial benefit to certain individuals and certain industries.

[69] Matt Scalla, "Oyster farmers petition top court," *Times Picayune,* 17 March 2005, A2.

Chapter 4

Why using the river to fix the problem has failed

Priority Projects

To date, there have been numerous specific priority projects set forth by the CWPPRA task force as part of a long-term strategy to restore and retard the retreat of the Mississippi River Delta Basin. These plans continue as part of the Coast 2050 plan now instituted by the LCA effort and included in the CPRA Master Plan. It is obvious that each plan recognizes the unique opportunity present in the basin, which is the tremendous volume of sediment transported by the Mississippi River and its tributary systems and the introduction of fresh water which is necessary to control salinity levels crucial to emergent growth of wetland vegetation. Each plan uses sediments and natural materials available to restore or build vegetated wetlands in areas that once were wetland acreage. These priority projects attempt to achieve this common objective by placing sediment materials through sediment diversion, pumping, placing, dredging, and the introduction of fresh water through river water diversion (fresh water).

The history of the projects and plans discussed herein are excellent examples of innovative and common sense thinking. The trend of all projects and plans is to use the river and its resources to maintain and restore our wetlands (coast). The true problem is the time it is taking to implement the plans and the fact that the real funds to get the job done are not being provided. Every proposed solution is picked apart for years, studied, and tested prior to implementation. By the time the project is implemented, we cannot afford it or the allocated funds are no longer realistic. Louisianans realize the Task Force (lead by the U.S. Army Corps of Engineers) and parishes are held accountable and liable for their actions and every dollar spent; however, we are losing wetland acreage at a rate faster than we can build them using these prolonged processes. Bureaucratic impediments continue to exist. In particular, current funding promised by the Water Resources Development Act of 2004 has been continually delayed for years. Wherever congress and federal funding are involved a convoluted process exists. Restoration projects proposed by a local sponsor must undergo a series of studies known as environmental impact studies (EIS) and feasibility studies that take 3-5 years. Then, in a separate process, the Corps must seek money in its annual budget to conduct the studies. Once completed, the studies pass through three more levels of review and approval by the Chief of the Corps, the Secretary of Army for Public Works, and the White House's Office of Management and Budget and Council for Environmental Quality. Following their recommendations, the project goes back to Congress for approval. Congress must then put the proposed project in the water resources bill, which must be approved (not guaranteed). If the project is approved, it will be another 6-10 years before construction begins.[70] These bureaucratic practices must stop.

All experts agree that the solution to the problem is sediment placement. However, flawed implementation of projects designed to do so have marked Louisiana's history. For example, the following are 10 CWPPRA priority projects that were approved in the Mississippi River Delta Basin:[71]

1. Beneficial use of Hopper Dredged Material (demonstration): Type of project: demonstration marsh creation, Approval 7/1997, deauthorized 10/2000, as a result of the hopper dredge's inability to spray sediment over the bank of the river, south of the Head of Passes. Cost: $58,310, study and design only.

[70] Marshall and Schliefstein, A-7.

[71] "Priority Projects." 1993. http://www.lacoast.gov/projects. (Accessed 7 June 2007).

2. Benney's Bay Diversion: Type of project: sediment diversion, involves two phases of water/sediment diversion through construction of an initial channel into Benny's Bay followed by monitoring and subsequent enlargement of the channel. Estimated gains: 5,706 acres, over 20 years. Approval of phase I 1/2001, design complete 10/2004, construction started 8/2006. Cost: $1.08 million continued funding through CWPPRA as part of the LCA effort.

3. Channel Armor Gap Crevasse: Type of project: sediment diversion, involves deepening a shallow gap in the stone armor along the river bank (levee) and enlarging the gap to Mary Bowers Pond. Estimated gains: 936 acres, over 20 years. Approval 1993, design complete 10/1996, project completed 12/1997. Cost: $1.01 million.

4. Delta Wide Crevasses: Type of project: sediment diversions, involves maintaining presently existing crevasse splays and construction of new crevasse splays in the Pass a Loutre Wildlife management Area and the Delta National Wildlife Refuge. Estimated gains 2,386 acres over 20 years. Approval 1997, design complete 12/1998, construction start 6/1999, construction completion 12/2014. Cost: $6.8 million, continued through LCA effort.

5. Dust pan maintenance dredging operations for creation in the Mississippi River Delta (demonstration): Type of project: demonstration marsh creation, involves the use of a dustpan hydraulic dredge to deposit dredged sediments into open shallow waters near Head of Passes, restoring approximately 40 acres of deteriorated marsh in 8 days. Approval 1997, design complete 10/1998, demonstration 6/2002. Cost: $2 million, demonstration proved effective, method used by LCA effort to extend barrier shoreline.

6. Mississippi River Trap: Type of project: sediment trapping and marsh creation, involves digging a pit 4miles x 1500ft x 65ft in the river to trap sediment between Venice and Head of Passes. The sediment will then be mined with hydraulic dredges and pumped into designated areas on the East and West banks of the river. Estimated gains 1,190 acres over 20 years. Approval phase I 8/2002, design complete 7/2006, construction start 7/2007, project complete 1/2008. Cost: $2.3 for river trap, continued funding by LCA effort.

7. Pass a Loutre Crevasse: Type of project: sediment diversion, involves the cutting of a crevasse near the mouth of Pass a Loutre to create new emergent marsh. Monitoring plan approval 4/1997, deauthorized 7/1998, due to 2 pipelines and 2 power poles in the area of the crevasse, increasing relocation costs by $2.15 million. Cost: $119,835, planning stage and design.

8. Periodic Introduction of Sediment and Nutrients at Selected Diversion Sites (demonstration): Type of project: demonstration of introducing sediments in selected water diversions, involves the use of a hydraulic pipeline dredge to provide increased sediment through a diversion structure or siphon. Approval 2000, design complete 9/2005, construction start 4/2006. Cost: $1.8 million used as sediment diversion demonstration for all LCA subprovinces.

9. West Bay Diversion: Type of project: sediment diversion, involves diversion of Mississippi river water and sediments into West Bay 4.7 miles above Head of Passes. Estimated gains 9,831 acres over 20 years. Approval 1991, design complete 5/2002, construction complete 11/2003. Cost: $22.3 million, completed through Coast 2050 plan.

10. Spanish Pass Diversion: Type of project: sediment diversion, involves diverting river water and sediments through a diversion channel from Grand Pass just south of the jump near Venice. Estimated gains 433 acres over 20 years. Approval 2004, design complete 10/2005, construction start 5/2006, construction complete 2/2007. Cost: $1.14 million, continued through the LCA effort.

Implementation to completion of the projects articulated above took from 3-17 years. This is unacceptable. More studies are not the solution. What is needed is to put shovels in the ground to construct real projects in the near term that will make a difference in saving the wetlands.

Conclusion

Proposals to use the energy bill to enhance CWPPRA are good. This may help, but to fix this problem Louisiana must change. The resources of Louisiana's politicians and legal system should be used to influence the use of additional Smart Growth tools (innovative planning techniques and policies) in order to speed up the implementation to solutions that are obvious. This is a crisis, where Environmental Impact Studies are hindering progress; Louisianans should demand a blanket finding of no significant impact (Fonsi) when it comes to restoration projects.

This will allow for faster implementation without unnecessary studies that take years to complete and agree upon. Common sense tells us that Louisiana must be decisive; to wait for studies will impact more negatively than anything people can do attempting a solution. With a Fonsi an EIS will not be required. Where land is being lost there is no land environment left to affect. For example, the EIS is required on land and water environments, the land existed there previously; restoring it will not have a negative impact. Where property owners are using litigation and holding out for settlements before allowing access to project areas, we should exercise tools such as Eminent Domain or approach landowners with Transferable Development Right (TDR) proposals to gain rights of way. Accordingly, with a TDR land-owners can be compensated for the use of their land by giving them development rights on properties in proposed areas not designated for a particular use. Additionally, we should apply Parish Impact Fees (fees attached to the sale of private property to pay for future infrastructure) to immediately fund parish-generated projects in line with the Corp of Engineers plans. With the money generated from parish-wide Impact Fees the parish could match grants as well as fund private projects. In addition these funds could be used to encourage private developers to restore and manage acreage for private industry and pleasure in the basin.

Finally, all of the parish and otherwise private projects should hire contractors to complete the projects utilizing Financial Performance Guarantees (guarantees in contracts to meet certain goals or forfeit partial payment). These Smart Growth tools will safeguard the parish monies and projects allowing minimum bureaucracy. These restoration projects could use the same ideas in CWPPRA, however, implement them without delay (studies and approvals) by private contractors in addition to the Army Corp of Engineers. While these measures might be viewed as “creative,” there are no significant negatives to trying at this point; acreage is being lost faster than it can be restored. An uncertainty surely exists; nothing ventured is the loss of Louisiana's wetland resources and nothing is gained.

To Louisianans it appears that the problem of coastal erosion facing Louisiana and the nation has been ignored. Even now, it appears that no one outside of Louisiana is paying attention. For example, the Florida Everglades are getting almost $8 billion in federal and state money for restoration. The City of Boston received $14 billion to build an underground highway, the notorious "Big Dig." For almost the exact same price, coastal Louisiana the birds, the beauty, the seafood, the culture, the source of energy, the buffer against hurricanes could be saved. [72] Meanwhile, the State of Louisiana has only been promised up to $1.9 billion over 10 years. With this funding, Louisiana plans to build 5 large projects at a cost of $1.2 billion and 10 smaller projects at a cost of $700 million. However, these projects must be approved by Congress and the Corps, and must compete nationally with other environmental restoration projects. Again, as history has shown, the problem appears to be ignored in favor of funding other state and national issues.

It does not appear that the nation recognizes the urgency facing Louisiana. The nation has failed to make a significant investment in something that is very important. If the federal government provided the amount of money it spends on one month of the Iraq war or if the state government provided the amount of money it agreed to spend on remodeling the Superdome prior to Hurricane Katrina on the Louisiana wetlands ($140 million), maybe it could be said that the problem is being taken seriously.

Hurricane Katrina highlighted this problem. A wetland buffer would have made a difference in New Orleans. The devastation in New Orleans caused by Hurricane Katrina caused

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[72] Tidwell, 135.

Congress to authorize spending in the tens of billions of dollars on disaster relief and billions more on repairing the city. Looking at the problem from this perspective, one can only think, “Pay me now or pay me later.” What Louisiana and the nation must realize either do what’s necessary to save the wetlands, or spend billions of dollars leading a retreat away from coastal Louisiana. It’s one or the other.[73]

Louisianans must stop being appeased by the plans and hollow state and federal government promises of funding. The bottom line is when Louisianans show concern over the problem at hand a new plan is produced by the state government and associated federal entities. Following, a news paper article articulates the plan and how Louisiana’s politicians will seek funding. At this point Louisianans feel the problem is under control. They then go back to what they were doing, not paying attention to the outcome.

As pointed out in this research there are real solutions to the problem. They are many, the plans, the funding, the implementation, the awareness of bureaucracy, and suggested smart growth solutions. These efforts can and will work if Louisianans get behind them and not wait for someone else to take care of the problem or make decisions. Louisianans must take over their future. This must become the biggest issue for Louisiana. The true solution is educating Louisianans, even those not concerned at this time because they are still making a living. The message must be that this problem is not being fixed and will not be until Louisianans do it themselves. An excellent example of this is the environmental decline of Lake Pontchartrain in the 1980s and 1990s. The government and industry did not fix the problem facing this basin, and it was thought to be a loss. However, a non-profit organization of Louisianans, known as, The Lake Pontchartrain Basin Foundation, doggedly educated the citizens of the problem and solutions to the problem. This put pressure on government (politicians) and industry to

[73]Tidwell, 141.

implement plans without delay, resulting in the reversal of an environmental disaster that many Louisianans thought could not be fixed.

As a southeast Louisianan, I can personally attest to the problems in our wetlands and the outcome that southeast Louisiana is facing if Louisiana does not take charge of its own destiny. For the last 40 years I have been a study of southeast Louisiana's culture, industry, and environment. In many cases Louisianans have accepted the decline of the wetlands as the price of progress. The same waters and wetlands that are so vital to Louisiana's culture are also vital to the nation's energy and transportation infrastructure. It is also crucial to the prosperity of the people and communities of the entire state of Louisiana. Somehow, this environment affects all Louisianans. However, I am a witness that progress is slowly leaving the southeast Louisiana wetlands. Additionally, progress is leaving Louisiana with a mess.

The retreat has begun. After 70 years of prosperous inshore oil and gas production the reserves are drying up. All across what is left of the marshes are abandoned wells and tank batteries. This equipment is rusting and falling apart causing additional environmental and safety hazards for Louisianans. The large oil and gas companies are leaving Louisiana wetlands behind in favor of the new frontier of offshore reserves. Big oil and gas are selling inland wells to smaller companies that will squeeze the last few drops from the dwindling reserves. Ultimately, these companies will also leave. With this, southeast Louisianans will also have to retreat, unless they decide to make a stand, and fix the problem themselves.

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Glossary

Avulsion: When a channel breaches its levee and takes another coarse cutting off or tearing away from the mother stream.

Crevasse Channels: Streams formed by a fracture in the natural levee caused by over bank flooding.

Crevasse splay: When a channel temporarily floods over its banks depositing a non-uniform shape of sediments.

Deltaic facies: The characteristics of rock and soil mass that reflect its depositional environment distinguishing it from deposit in adjacent environments.

Depocenter: The site of thickest active sediment deposits; maximum deposition.

Distally: The backside or behind the levee.

Distributaries: Permanent channels that divert water away from the main course of a river.

Down warping: The slight flexing or bending downward of the earth's crust on a broad regional scale.

Fonsi: A finding of no significant impact when relating to environmental impact studies.

Marine transgression: The advance of the sea over land areas.

Meander: The back and forth channeling of a river main stream; often referred to as snaking.

Progradation: The accumulation of deposits in which beds are deposited basin ward causing the shoreline to migrate into the basin.

Subaqueous: When delta building deposits occur (submerged) beneath the water line.

Subaerial: When delta building deposits occur above the water line.

Subsidence: The process of the sinking of the earth's surface.

Transfer development rights (TDR): Permits owners of land in development restricted areas to sever the development rights from a piece of property and sell those or obtain rights in other specified areas.

Vita

Lon J. Boudreaux Jr. was born in Marrero Louisiana and was raised hunting, fishing and trapping in the marshes of Plaquemines Parish, Louisiana. He received his B.S. from Our Lady of Holy Cross College and is currently a master's level student in the Urban Studies program at the University of New Orleans. Mr. Boudreaux is also a full time law-enforcement professional in the City of New Orleans.