Land Use and Socioeconomic Status and Trends in the Barataria-Terrebonne Estuarine System

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Publication #23
Barataria-Terrebonne National Estuary Program
1995

Citation:

McKenzie, L.S. III, M. W. Wascom, W. R. Keithly, R. E. Emmer, W. H. Hudnall, M. T. C. Johnson, F. Niami, and B. A. Touchet. 1995. *Land Use and Socioeconomic Status and Trends in the Barataria-Terrebonne Estuarine System.* BTNEP Publ. No. 23, Barataria-Terrebonne National Estuary Program, Thibodaux, Louisiana, 184 pp. plus Appendix.

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This project was partially funded by the United States Environmental Protection Agency and the Louisiana Department of Environmental Quality under Grant # CE-006660. The contents of this document do not necessarily represent the views of the United States Environmental Protection Agency nor the Louisiana Department of Environmental Quality nor do the contents of this document necessarily constitute the views or policy of the Barataria-Terrebonne National Estuary Program Management Conference. The information presented represents the scientific findings and interpretations of the authors and is intended to provide background information for Management Conference deliberations in drafting of official policy in the Comprehensive Conservation and Management Plan. The mention of trade names or commercial products does not in any way constitute an endorsement or recommendation for use.

This public document was published at a total cost of $. Three hundred copies of this public document were published in this first printing at a cost of $. The total cost of all printings of this document, including reprints, is $. This document was published by the Barataria-Terrebonne National Estuary Program, NSU Campus, P.O. Box 2663, Thibodaux, LA 70310, to provide the public with environmental information under the authority of La. R.S. 30:2011. This material was printed in

accordance with standards for printing by state agencies established pursuant to La. R.S. 43:31.

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PREFACE

In 1990, the U.S. Environmental Protection Agency (EPA) and the State of Louisiana agreed to work as partners to establish the Barataria-Terrebonne National Estuary Program (BTNEP). The overall mission of the BTNEP is to work with a wide variety of citizens and interest groups to develop a comprehensive, long-term management plan to preserve and protect the fragile environmental resources of both the Barataria and Terrebonne basins. This novel partnership is based on the premise that true change will take place only if the basins' stakeholders determine for themselves the problems and the solutions. The BTNEP is composed of representatives of not only federal, state, and local government, but also landowners, industry, fishermen, farmers, citizens groups, and academic institutions. The BTNEP is administered by the Louisiana Department of Environmental Quality and governed by a series of committees, each with varied representation and expertise. The committees are collectively referred to as the Management Conference. The final product of the five-year planning process is a Comprehensive Conservation and Management Plan (CCMP) which incorporates specific actions to enhance the quality of life in the Barataria and Terrebonne basins.

One of the many steps taken during the five-year planning process was the development of a series of four reports, which document the current status and the past trends of particular resources within the basins. Members of the report preparation teams were selected by the Management Conference based on their expertise in a particular subject, and with an eye toward ensuring that each subject was given accurate, fair, and balanced treatment. The entire Management Conference and a team of designated reviewers reviewed each draft report and provided comments to the preparation teams at day-long interactive review meetings. At that time the Management Conference also agreed upon needed modifications to each report.

The final step in the BTNEP planning process is the finalization of the CCMP. The information presented in this report will be instrumental in the development of all the management recommendations made in the final CCMP, which is scheduled for submission to EPA in the summer of 1996.

For information about this or other reports or the CCMP, please contact the BTNEP Office.

Steve Mathies
Program Director

ACKNOWLEDGMENTS

The project team wishes to acknowledge the support and guidance provided by the Barataria-Terrebonne Estuary Program on this effort. Particular appreciation is extended to the Local Government Committee for developing the land use and socioeconomic component and for fostering its inclusion in the Status and Trends effort and to Mr. Stephen C. Smith, the BTNEP project coordinator, for his constructive review and guidance.

EXECUTIVE SUMMARY

The Barataria-Terrebonne estuarine system encompasses an area of approximately 6,500 mi^2, covering all or part of sixteen Louisiana parishes. The crooked-neck, squash-shaped basin begins on the Mississippi River near Morganza in Pointe Coupee Parish. Continuing south, the system is constrained geographically by the levee systems of the Mississippi and Atchafalaya rivers. Terrain varies from broad riverine flood plains in the north to coastal marshes in the south. The entire area is interlaced with natural levees that offer slightly elevated terrain attractive to cultural development.

The expanse of land within the system has been impacted by cultural and natural forces and by the combined effects of those forces. Sediment deposition, which is needed to replenish the system, has been severely impacted by human attempts to control nature through channelization and flood control levees. Activities developed by modern society have modified natural systems and accelerated natural erosion processes. Humans have impacted land use from the times of the earliest hunting and gathering activities to contemporary hydrocarbon extraction and transmission. The net results of these phenomena are land use change and, in some areas, land loss.

The amount of land suitable for development is limited. Most (78%) of the system is classified as wetlands or water. The amount of undeveloped land continues to decrease because of agricultural and urban expansion.

The estuarine system is home to 602,258 people. The population of the parishes that are part of the basin, either completely or partially, is 1,568,553. Of Louisiana's total population (4,219,973), 14% live within the study area, and 37% live in system parishes.

Approximately 75% of the population reside in urban areas. The entire Houma-Thibodaux metropolitan statistical area and the west bank portions of the Baton Rouge and New Orleans metropolitan statistical areas lie within the estuarine system.

Residents have, on the average, relatively low incomes. In 1989 the per capita income within the system was $9,824 as compared to $11,503 in its parishes and $11,207 in Louisiana as a whole.

The number of people in the work force is growing. Jobs are shifting among sectors with growth in the services and finance/insurance/real estate sectors and decline in the mining and contract construction sectors. The financial influence of economic sectors also is shifting. Of the nine economic sectors for which employee payrolls are reported, manufacturing ranked first in 1975 and 1990; mining dropped from second in 1975 to eighth in 1990; agricultural services ranked last in 1975 and 1990.

Earnings are shifting by employment sector. Manufacturing and transportation/utilities were the only two sectors where constant dollar payroll per employee increased from 1975 to 1990. In 1990 payroll per employee expressed as a percentage of payroll per employee for 1975 amounted to 59% for agricultural services, 62% for finance/insurance/real estate, 69% for retail trade, and 72% for mining. These percentages indicate a substantial drop in earnings on a per-employee basis for these sectors.

Human activity and land use change stimulated by economic influences have modified habitat and will continue to contribute to wetland loss and coastal erosion.

The future estuarine system will have more people and less land. The amount of land is decreasing because of coastal erosion and wetland loss. Natural processes of subsidence and rising sea level contribute to wetland loss and coastal erosion. Humans also contribute to land loss by building levees which deprive coastal wetlands of alluvial sediment and fresh water; by building canals in coastal wetlands that accelerate saltwater intrusion and physically convert wetlands to water; by clearing forested wetlands for development; and by dredging and depositing fill adjacent to canals, which disrupts the hydrological flow in wetlands.

The most recent projections indicate the population within basin parishes is expected to increase from 1,558,031 in 1990 to 1,696,190 by the year 2010, an increase of 183,178 people. Demands on land, water, and other natural resources will accompany the population increase.

The increased population is expected to cause the amount of urban land to increase by as much as 32,972 acres. This increase will likely be at the expense of agricultural land, which will encroach further on forest land.

The increased population will create demand for more consumables and services. The demand for potable water will increase. The increased population will generate more landfill waste and waste water. The presence of more people has the potential to impact the identified priority problems in the following ways:

•hydrologic modification—increased urban development leading to accelerated runoff; increased demand for forced drainage and flood protection levees; increased extraction of water for residential, commercial and industrial uses

•reduction in sediment availability—increased demand for flood-control structures that inhibit lateral discharge and sediment replenishment

•habitat loss/modification—increased pressure to encroach into sensitive habitat, especially wetlands

•changes in living resources—more people boating, fishing, hunting, and recreating outdoors

•eutrophication, pathogen contamination and toxic substances—increased waste water and runoff; increased generation of landfill waste.

Contending with these problems will not be easy, but solutions can be found. The people of the system can control their future. Quality land use and a viable socioeconomic environment are predicated on the actions of individuals, organizations, and governments. The mechanisms necessary to achieve a desired outcome are available within the existing societal and institutional framework; however, they must be put to prudent use.

The following research shows how land use in the Barataria-Terrebonne estuarine system has changed over the years as varying populations developed different economic orientations. It also shows how the economy has shifted dependency from one natural resource to another and how the recent economy has been changing from natural resource–dependent sectors to sectors where human resources assume paramount importance.

INTRODUCTION

Overview

The Barataria-Terrebonne estuarine system (BTES) encompasses an area of approximately 6,500 mi^2. The crooked-neck, squash-shaped system begins near Morganza in Pointe Coupee Parish (figure 1). Continuing south, it is constrained geographically by the levee systems of the Mississippi and Atchafalaya rivers until the Mississippi River turns sharply to the east in St. James Parish. From the Assumption–St. James Parish area south, the basin widens considerably until reaching the Gulf of Mexico along the coastal sections of Terrebonne, Lafourche, Jefferson, and Plaquemines parishes.

The system is physiographically diverse. Terrain varies from broad riverine flood plains in the north to coastal marshes in the south. The area is interlaced with natural levees that offer slightly elevated terrain attractive to cultural development.

Development and human impact are evident from settlements and from communication, utility and transportation networks. Although much of the study area is sparsely populated, the entire Houma-Thibodaux metropolitan statistical area (MSA) and portions of the Baton Rouge and New Orleans metropolitan statistical areas lie within the system.

The expanse of land has been impacted by cultural and natural forces. Sediment deposition, which is needed to replenish the system, has been severely impacted by human attempts to control nature through channelization. Activities cultured by modern society have modified natural systems and accelerated natural erosion processes. The earliest hunting and gathering activities impacted land use as do contemporary hydrocarbon extraction and transmission. The net result of these phenomena is land use change and, in some areas, land loss.

The estuarine system covers all or part of 16 Louisiana parishes. Four parishes (Assumption, Lafourche, Terrebonne, and West Baton Rouge) are located totally within the system. The west bank portion of eight parishes (Ascension, Iberville, Jefferson, Orleans, Plaquemines, St. Charles, St. James, and St. John) bisected by the Mississippi River are in the system.

Much of Pointe Coupee Parish, including the populated area in and around New Roads and Livonia, is in the estuarine system. Only the Morgan City area of St. Mary Parish located east of the Atchafalaya guide levee is in the system. Small and sparsely populated portions of the extreme southern part of St. Martin Parish and the extreme eastern part of Iberia Parish are in the system.

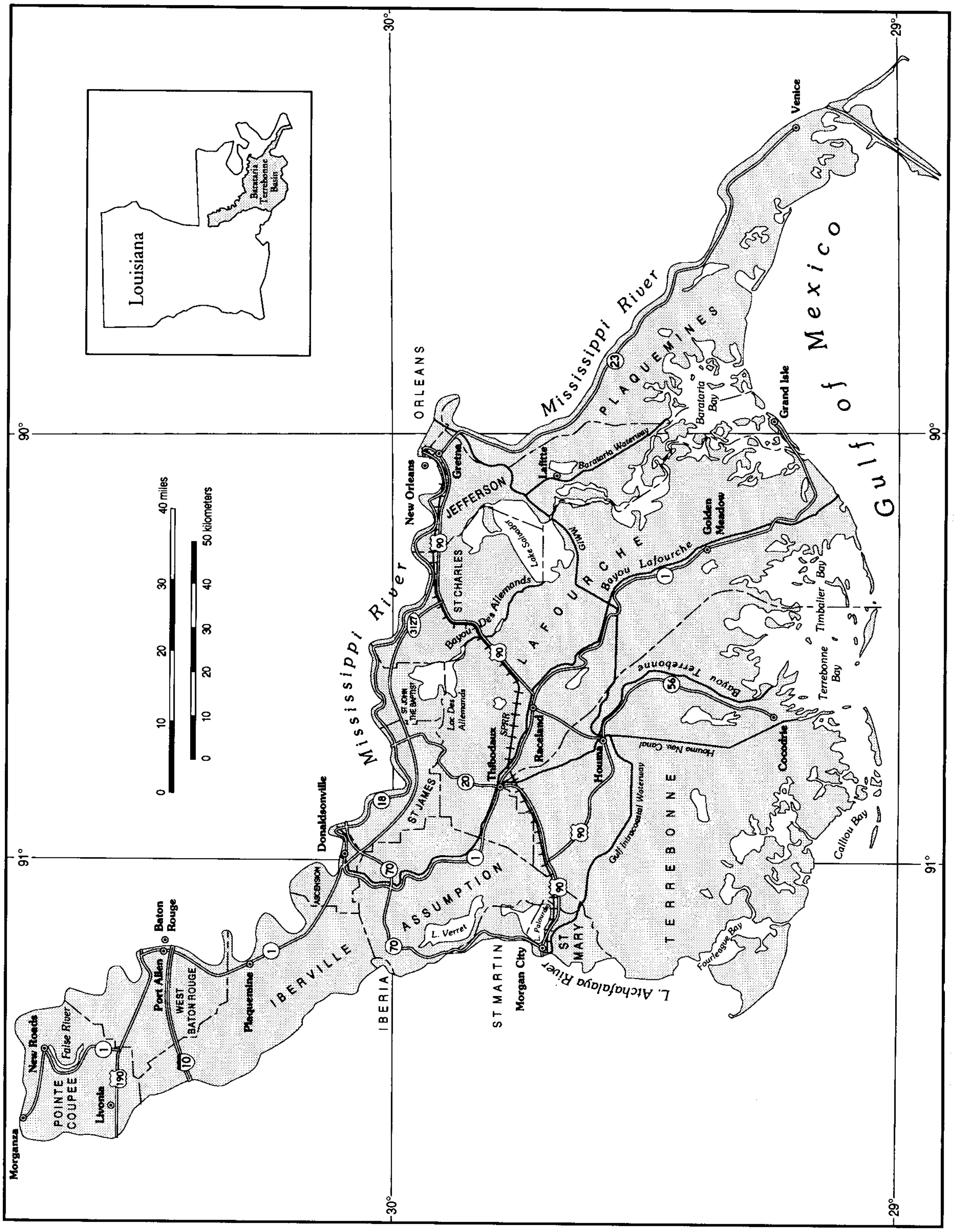


Figure 1. Map of the Barataria-Terrebonne estuarine system.

About one-in-seven Louisiana residents live in the Barataria-Terrebonne estuarine system. The system is home to 602,258 people (U.S. Bureau of the Census 1992a). The population of the parishes that are part of the basin, either partially or completely, is 1,568,553. Of Louisiana's total population (4,219,973), 14% live within the system, and 37% live in estuarine system parishes. Most people reside in urbanized parts of metropolitan areas.

Objectives

The status and trends of land use and socioeconomic characteristics of the Barataria-Terrebonne estuarine system constitute the subject of this report. The collective goals of the system status and trends series of four reports are to substantiate the problems affecting the estuary, to evaluate the cause of those problems, and to recommend management solutions. The status and trends reports provide the technical support and foundation for the characterization report. The characterization report is written for a nontechnical audience and will be distributed to the general public.

This report has been prepared to meet the following objectives: to characterize past socioeconomic and land use trends of the Barataria-Terrebonne estuarine system, to assess the current status of socioeconomics and land use, and to formulate future scenarios.

Presentation

Historical trends and current status presented in this document are based on existing data. These data have been analyzed to establish associations between socioeconomic activities and land use changes. Causal relationships were documented whenever possible.

Future scenarios have been formulated based on identified trends and likely future events. Management alternatives associated with control over likely future scenarios are presented. Throughout the effort, attention has been directed to the identification of relationships between socioeconomic and land use trends. The status and trends report of land use and socioeconomic characteristics within the Barataria-Terrebonne estuarine system documents present and historical scenarios as well as the direction and management of future scenarios.

Land use is categorized based on human activity on and civil ownership of the environment. Land cover (which is often used interchangeably with land use) refers to the natural or artificial components covering the earth's surface at a given location. While land cover is determined by physical surface characteristics, land use is reflective of human use of the land regardless of surface characteristics. Changes in land use are by definition primarily attributed to people. However, natural processes play a role in changing the suitability of land for human use.

The analyses of existing data have generated information on the present status of land use, cultural and natural factors that have impacted land use, land-user conflicts, and future land use scenarios.

Socioeconomic activity is culturally induced. A certain amount of the activity is associated with human exploitation of renewable and nonrenewable natural resources. Socioeconomic conditions and trends have been evaluated within the context of population (level of demand people are placing on the land) and industry (which natural resources and geographic advantages are being used in commerce and economic enterprises). Attention was given to identifying socioeconomic characteristics and the resulting impacts on indigenous cultures and on the land.

LAND USE STATUS AND TRENDS

Historical Land Use: 12,000 B.C.–1950

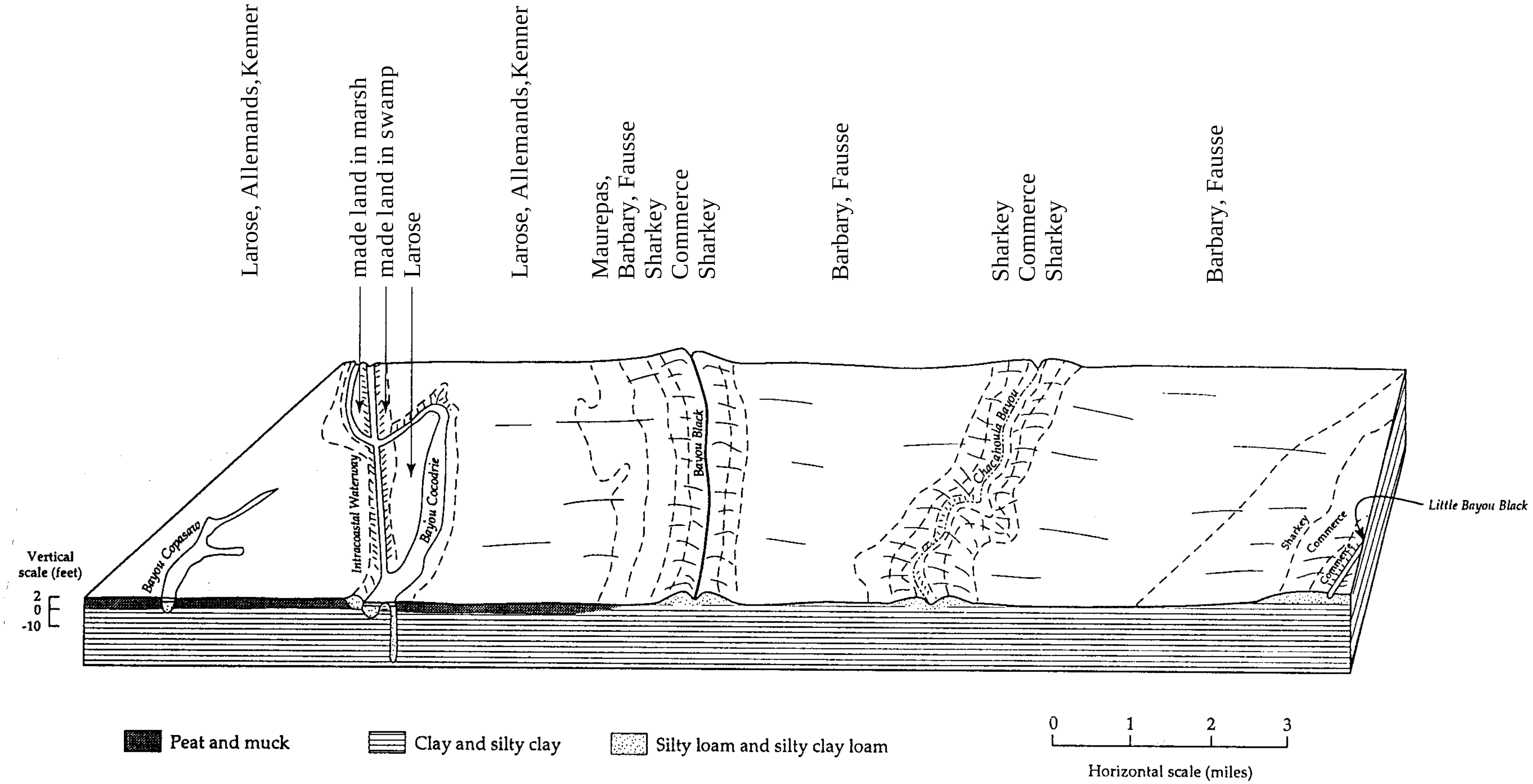
Landform and Surface Geology

Twenty-thousand years ago, when sea level was approximately 400 ft lower than today, the Louisiana shoreline was located far gulfward of its current position. From the period 17,000 to 4,000 years ago the Gulf of Mexico sea level rose to roughly its current height. The lower Mississippi River valley was an arm of the Gulf until alluvium filled the valley, and emergent deltas began to appear (Kolb and Van Lopik 1958). These Mississippi River deltas generally consisted of two major landforms: overbank or natural levee deposits consisting of loamy soil material, and the broad, interdistributary flats (swamps and marshes) consisting of clayey soil material.

The loamy deposits of the natural levees consisted of the Commerce or similar soils that have excellent potential for human habitation, agriculture, and animal husbandry (appendix A). The clayey deposits of the broad, interdistributary flats (swamps and marshes) composed of the Sharkey or similar soils are poorly drained and found on the lower parts of the natural levees and the back swamps in the interdistributary alluvial plains. Sharkey soil's potential for cropland and pastureland is good. If this clayey material does not dry and consolidate, however, the soil type is the Barbary series, which is nearly continuously flooded and consists of very poorly drained, semifluid, clayey soils on the low back swamps of the alluvial plain. These soils support swamp forests—primarily cypress, water tupelo, and red maple—and wildlife habitat.

The Louisiana Coast, especially the delta plain marsh, is a delicately balanced ecosystem. The soils of this system consist of mineral and organic material. The mineral soils consist of loamy Commerce soils and clayey Sharkey soils of the natural levees along distributary streams and back swamps, and the sandy Felicity soils and clayey Scatlake soils of the beaches or barrier islands and the salt sea rim (figure 2, appendix).

To survive subsidence along the bayous and wave action along the shore, these mineral soils require mineral nourishment. Without an active source of nourishment, these landforms will gradually give way to the sea. Nearly all of the Barataria and Terrebonne basins are sediment starved.



Source: Arville Touchet, 1995, adapted from Soil Survey Series No. 1 of Terrebonne Parish, 1956, U.S. Department of Agriculture and Louisiana Agricultural Experiment Station, Soil Conservation Service, Alexandria, Louisiana.

Figure 2. Diagram depicting the soil relationships in Terrebonne Parish from Minerva Plantation of Little Bayou Black southwest to Bayou Copasaw.
Source: Arville Touchet 1994.

The organic soils, which are the most fragile soils of the basin marsh, were developed by the accretion of plant material in a freshwater system as the deltas of the Mississippi River expanded into the Gulf. The subsiding soft mineral surface or mudflats between the distributary bayous was kept by the accretion of organic material preserved in an anaerobic condition in shallow water. Plants, such as maidencane and bulltongue, grew on top of the ever-subsiding older growth, thereby increasing the thickness of the organic layers. The thickness of this accretion of peat and muck depends on subsidence rate and time. It ranges from a few inches to >20 ft thick—the thicker the organic matter accretion, the more fragile the soil. The organic soils developed in this system are the Allemands and Kenner soil series (appendix).

Under natural conditions of delta deterioration when sediment is unavailable, brackish seawater may slowly encroach the Allemands and Kenner soil series land forms. A gradual change of vegetation occurs. The maidencane and bulltongue plants are slowly replaced by the marshhay cordgrass and Olney bulrush. The live plant-root mat that holds the organic soils intact is not destroyed.

When soil salinity surpasses 5 ppt. in salt content, the soils change from Allemands and Kenner soil series to Clovelly and Lafitte soil series (appendix). The Clovelly and Lafitte soil series landform, in turn, may be encroached by salt seawater. The brackish vegetation is slowly replaced by the more salt-tolerant smooth cordgrass and seashore salt grass. The live-root mat which holds the organic soils intact is not destroyed. When the salinity of the soil surpasses 8 ppt. in salt content, the soils change from Clovelly and Lafitte soil series to Bellpass and Timbalier soil series (appendix).

Whenever the sandy beaches and barrier islands' Felicity soil series and Scatlake soil series (salt sea rim) run out of mineral nourishment and are attacked and subsequently destroyed by storms, the Bellpass and Timbalier soil series are, in turn, attacked and destroyed by wave actions. The above action pushes the saline soils, Bellpass and Timbalier, farther inland, which in turn pushes the brackish soil, Clovelly and Lafitte, farther inland at the expense of the fresh Allemands and Kenner soil series.

When the marshlands have all disappeared, then the swamps and natural levees along old, inactive distributary streams will be subject directly to storms and wave actions. Whenever salt water intrudes a freshwater marsh system such as the Allemands and Kenner soil series areas, the freshwater vegetation is decimated. The root mat that holds the organic soil together is destroyed. The salt water disperses the organic matter and open water areas rapidly develop. Canals without saltwater locks that flow directly into the marsh interior are the principal cause of this very rapid, unnatural marsh loss.

If deltaic subsidence exceeds the rate of accumulation of mineral deposits, the land surface may somewhat maintain its elevation by the formation of organic plant remains. The peaty and mucky soils of these soft organic deposits are the Allemands and Kenner soil types of the freshwater marshlands, the Clovelly and Lafitte soils of the brackish marsh, and the Bellpass and Scatlake soils of the saltwater marshes (appendix).

Alluvial materials that are deposited in the longshore currents in the Gulf of Mexico off Louisiana become marine reworked material, lifted out of the shallow longshore currents by storm tides and deposited on top of the marsh along the coast. If the material is sandy, barrier islands consisting of Felicity soils are formed; if it is clayey, salt sea rims consisting of Scatlake soils are formed (appendix).

The first emergent delta within the system was the Maringouin delta, which formed in the area of the present-day communities of Livonia, Gross Tete, Maringouin, and Rosedale in Iberville Parish. The Maringouin delta is buried under more recent deposits. After the Maringouin delta matured, one of its major distributary channels extended and became the main river channel for the development of the Salé-Cypremort delta. This delta is also buried under more recent deposits (figure 3).

Just southwest of the present city of Plaquemine in Iberville Parish, the Salé-Cypremort channel crevassed to the southeast and became the main channel for the formation of the Cocodrie delta. Most of this delta has either been cut away or is buried by more recent deposits. A small part of this delta still exists in the Boutte area of St. Charles Parish.

After the Cocodrie delta was formed, the river shifted to the west side of the alluvial valley and formed the Teche delta (figure 3). Portions of the Teche delta still exist in the system, just east and south of Morgan City along Bayou L'Ours. When the Teche delta matured, the Mississippi shifted to the east side of the valley and produced a very large delta known as the St. Bernard delta. This delta is subsiding and rapidly disappearing. The Chandleur Islands are part of the St. Bernard delta. (figure 3).

A crevasse channel near the present-day town of Donaldsonville eventually captured the river and formed the Lafourche delta. This delta is entirely within the system. It is also rapidly subsiding, and its lands are disappearing at a rate that has increased from 18 mi^2/yr in 1978 to 22 mi^2/yr today (figure 3). Primary flow in the river shifted east forming the Plaquemine delta (figure 3). The present delta, the Balize delta, originated from a distributary channel out of the Plaquemine delta and is still forming (figure 3).

After the great Mississippi River Flood of 1927, Congress implemented the provisions of the Mississippi River and Tributaries Project (MR&T). The MR&T project was designed to prevent flooding along the Mississippi River. Construction of a control structure at Old River was authorized by Congress as part of the MR&T project in 1954. Without construction of the Old River Control Structure, it was estimated that the Mississippi would have again changed its course and that the Atchafalaya River would have become the new main channel of the Mississippi River between 1965 and 1975. While the structures have prevented this course change, the 70–30 flow distribution maintained between the rivers by the Old River structures has resulted in the formation of a new delta at the mouth of the Atchafalaya River (Wascom and Wallace 1994).

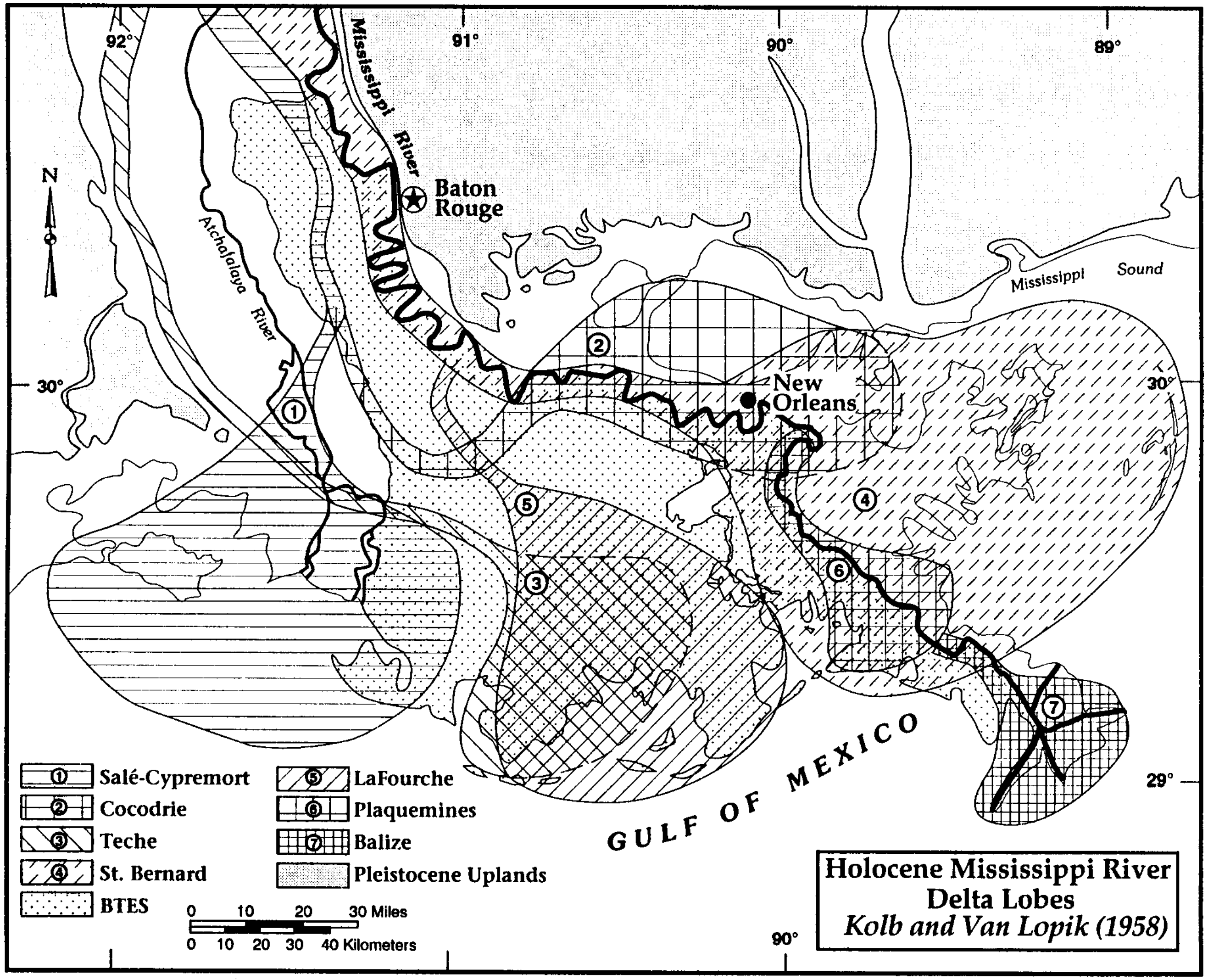


Figure 3. The deltaic lobes responsible for the creation of the deltaic plain. Source: Kolb and Van Lopik 1958.

First Occupation: Land and Human

These various deltas emerged and pushed out to sea, offering a new and dynamic resource with very rich soils. As soon as the vegetation and wildlife took hold of these new landmasses, it became attractive for humans because of the abundance of food, proximity to freshwater sources, and ready access to a transportation network.

A diversive vegetative cover developed on these new deltas and created transition zones ranging from bottomland hardwoods to swamp, marshes, lakes, and bays. Wildlife and plants were plentiful and diverse over very short distances. They ranged from deer, bear, turkey, rabbit, squirrel, raccoon, and opossum to muskrat, otter, turtle, and bullfrogs. The rivers, bayous, bays, wetlands, and ridges produced clams, oysters, catfish, drum, gar, and bowfin as well as roots and berries. The area is a natural component of the Mississippi River flyway for migratory birds, many of which spend winter in the area (Kniffen and Hilliard 1988).

Native Americans probably first inhabited portions of Louisiana 10,000–12,000 years ago (Kniffen et al. 1987). Kniffen and Hilliard (1988) described how these first inhabitants found Louisiana: “Sea level was lower, broad grasslands extended towards the Gulf of Mexico and to Lake Ponchartrain, and mammoths, ground sloths, and other mammals now extinct were abundant in Louisiana.”

The oldest Native American sites in Louisiana were associated with streams draining the terraces and on Avery Island. The early Indians likely lived in the flood plains and possibly along the shore of the Gulf. For example, shell middens (piles of discarded shells) are common in lower St. Mary Parish south of Morgan City. They indicate that coastal shellfish were a prominent element of the diet of Native Americans in that region. At the time that Europeans began to inhabit Louisiana (about 1700), Native Americans were still living in the flood plains, but the coastal population was less than it had been 500 or 1,000 years earlier (Kniffen et al. 1987).

The first Native Americans to occupy those new areas subsisted from hunting, fishing, and gathering. Their main protein sources were deer (supplemented by other upland wildlife), shellfish and fisheries, and waterfowl during the winter months. Starch sources included tuber-producing genera such as *Smilax* (greenbriar), *Scirpus* (bulrush), and *Sagittaria* (arrowhead). Because reliance for food was based on hunting, fishing, and gathering, very little agriculture was utilized.

The abundance of food found along the natural levees and back swamps of the major streams and the use of the ready-made, maintenance-free system of waterways for transportation meant that native populations were strongly concentrated along the waterways (Kniffen and Hilliard 1988).

The natural levee ridges also offered the highest and best-drained ground for building homes and fields. Consequently, Native American settlement patterns were linear along the larger, active distributary streams, with settlement centers at confluences of streams because two or more waterways for travel were available there. To provide greater utilization of the available natural resources, the population was initially widely scattered.

As the landforms and soil provinces became more stable, populations began coalescing into larger groups. Centers of populations were positioned at points of maximum transitional area between adjacent ecological regions (e.g., areas of water-land interface) with an emphasis on the use of the available lacustrine environment and water corridors for transportation.

With the development of larger population centers about 2,000 years ago came a need for intensive agriculture in surrounding regions. During the period immediately before European colonies, Native Americans relied on maize (corn), beans, and squash, supplemented by hunting, fishing, and gathering. Kniffen and Hilliard (1988) describe the role that fire played in Louisiana Native American slash-and-burn agriculture:

> They girdled trees to make them die, lose their leaves, and let the sun get to the ground. Small brush was cut, piled, and burned, thus creating a clearing for planting and incidentally adding potash fertilizer from the ashes to the soil. Fires were set to produce better grazing and so encourage the presence of game. Fires were also set to clear the ground under nut trees so that the crop could be more easily gathered...Clearing the forest for agriculture and repeated burning created grassy openings, some of them now referred to as Indian old fields. The openings encouraged the greater growth of sunloving plants, or heliophytes. In heavily forested areas burning tended to destroy hardwood trees.

At the time the Europeans (initially the French) came to live in Louisiana (about 1700), there were perhaps 15,000 Native Americans living here. Three dominant linguistic families lived in Louisiana at that time: Muskhogeans, Tunican, and Caddoan. The three major tribal groups located in the vicinity of the Barataria-Terrebonne estuarine system were the Houmas (Muskhogean), near present-day Angola; the Bayougoula (Muskhogean), near the present community of Bayou Goula in Iberville Parish community; and the Chitamacha (Tunican), located at the mouth of Bayou Plaquemine, on the Mississippi River, and on Bayou Lafourche (named Lafourche de Chetimeches by the French) (Kniffen et al. 1987, Kniffen and Hilliard 1988). These tribes initially cooperated with and assisted the French explorers and settlers of French Louisiana; however, battles over living space and hunting grounds, the practice of Native Americans being sold into slavery by the French, the ravages wrought on Native Americans by diseases brought by Europeans, and wars and other intertribal conflicts eventually caused the relocation of these tribes. Nearly all of the Chitamacha villages on Bayou Plaquemine, Bayou Lafourche, and the Mississippi River vanished. Their ancestors now live on a small reservation near Charenton. The Bayougoulas were later assimilated into the Houmas. Eventually, the Houmas relocated to the coastal marshlands, where they remain today (Terrebonne, Lafourche, and Jefferson parishes). As Kniffen et al. (1987) noted:

> Harassed tribes such as the Houma found refuge literally at land's end, occupying the attenuated natural levees that extended toward the Gulf of Mexico. Places of concentration included Barataria, Bayou du Lac, Grand Caillou and Isle Jean Charles. The settlements in these places were the antecedents of the line villages of later French population.

Many present-day communities in the system are located on the site of former Native American villages, e.g., Houma, Grande Isle, Labadieville, Livonia, and Brusly.

As of 1990 there were 10,354 Native Americans in the region (U.S. Bureau of the Census 1992a). Aside from their descendants and the culture that they maintain, the Native Americans have left one very significant Louisiana imprint: place names, such as Chacahoula, Plaquemine(s), Cabahannocey, Chetimeches, Atchafalaya (River), Fordoche, (Lake) Cataouache, Choupique, and Bayou (Bayou Choctaw, Bayou Latenache, etc.) (Parkerson 1969, Kniffen and Hilliard 1988).

European Settlement Imprints

The first European explorers and settlers in south Louisiana learned much from the native Americans and their understanding of the landscape. New animals and plants, such as maize and persimmons ("plaquemines" from the Native American "piakimin") were incorporated into the European diet. Filé—dried and ground sassafras leaves—became a staple in what would become the unique Louisiana cuisine known around the world. The Europeans used the same Native American water highways and trails along levee ridges, and their towns grew on the sites of or near Native American villages located on the natural levees. Consequently, there was continuity of settlement patterns from the Native Americans to the Europeans.

Two French Canadians, Iberville and Bienville, were responsible for establishing the permanent settlement of the French colony of Louisiana. In 1718 Bienville chose a location on the lower Mississippi River for a new city, New Orleans. It had a relatively high natural levee and was the shortest distance from Lake Ponchartrain at the location of a Native American portage that ran from the River to Bayou St. John, and thence to the lake. It would shortly become the capital of the French colony (Davis 1960, Kniffen and Hilliard 1988). The early history of draining, levying, and establishing New Orleans and its vicinity was indicative of the process of future development in south Louisiana, especially in the system, because it foreshadows the manner in which the Europeans would convert swamp and marshland to human uses, including habitation and transportation.

Getting the site cleared and a town established proved to be no easy task, and the work progressed slowly because the natural levee at New Orleans is narrow and the back swamp was relatively close to the river. Finally, in 1720 an assistant engineer arrived from John Law's Company of the Indies, which held a proprietary grant from the French king to operate the Louisiana colony. Under the direction of engineer Adrien de Pauger, the town gradually began to take shape. Drainage ditches and canals were dug, and a low levee fronting the town was built (Davis 1971).

Initially, the Company of the Indies forced French criminals and persons of bad character to come to Louisiana to colonize. They were in Louisiana against their will and had no desire to build a colony. A subsequent attempt to attract wealthy Frenchmen to the colony also failed. Finally, in an attempt to attract families to settle the Louisiana colony from other nationalities, the Company of the Indies flooded sections of Germany, the Low Countries, and Switzerland with pamphlets and handbills describing the "wonderful land of Louisiana." The Company promised to pay the expenses of families who came and to give them "thirty arpents of land, horses and oxen for the cultivation of fields, pigs, sheep, and chickens, furniture and kitchen utensils, and food supplies for the first harvest." (Davis 1971)

From 1719 to 1721 roughly 250 German colonists recruited by the Company of the Indies were settled on the west bank of the Mississippi River about 30 miles north of New Orleans. They were later joined by Germans brought over by the French and settled in Arkansas who, after receiving little assistance, returned to New Orleans, demanding passage to return to Europe. The French authorities convinced them to settle at the German coast. After a hurricane in 1722 destroyed two of their settlements, some of the German colonists migrated to the east bank. This area, now comprising St. Charles and St. John parishes, became known by the French as Côte des Allemands, the "German Coast" (Le Conte 1967, Read 1963, Kondert 1985). Many German immigrants followed.

In 1722 the Company of the Indies went bankrupt, and the Louisiana colony was in a state of disarray because of disruption in shipments of goods and food from France. The hard-working residents of the German Coast came to the colony's rescue in order to take advantage of the opportunity to own their own farms and succeed in this new land. They became industrious farmers and within ten years were supplying their coveted surpluses of vegetables, herbs, butter, eggs, and poultry to New Orleans (Kondert 1985). The Germans are credited with saving the Louisiana colony by adjusting to their new landscape and converting what had been wilderness to productive farm land.

The Germans also left their imprint on place names such as Lac des Allemands and Bayou des Allemands and on names of communities such as Kraemer, Montz, Des Allemands, Hahnville, and Luling. The German surnames have often become gallacized. For example, "Zweig" (German for twig) became "La Branche," Trischl became Triche, Himmel became Hymel, Foltz became Folse, and Dubs became Toups, (Deiler 1909).

In the early 1760s, while Louisiana was still under French rule, exiled residents of the former French Acadia (present-day Nova Scotia), began arriving in Louisiana. These Acadians initially settled in the area of the Mississippi River just above the German Coast. From this Acadian Coast (the current parishes of Ascension and St. James), some settled on the broad natural levees of Bayou Lafourche and at the settlement of Pointe Coupeé. The Acadians cleared some of the clayey land between the natural levee and the swamps or marshes as pasture land for their cattle.

With European colonization, the concept of defined land ownership became important. The French brought a concept of land division that assured an equitable partitioning of land. A narrow but deep partitioning based on the arpent (192 ft) assured each landowner five to six arpents of frontage on the higher and drier lands most suitable for cultivation. These lots extended back 40 or more arpents onto the heavy clay soils of the poorly drained swamp. Linear communities developed on the "frontlands" bordering the rivers and bayous. This division is best illustrated by Bayou Lafourche, approximately 85 mi of continuous development from Donaldsonville to Golden Meadow.

When the Spaniards took control of Louisiana from the French in the 1760s, they generally confirmed French practices in granting land to new settlers. The French and Spanish required a grantee of land

> to clear his property back for a distance of two arpents, build and maintain levees and construct a road forty feet wide next to the levee. He then had to dig parallel drainage ditches the length of his property from levee to back swamp, and he had to build culverts over the ditches where they crossed the road.
>
> This system of running property lines at right angles to the river, from front lands to back swamp, worked out very well for those grants located on the outside, or convex side, of a meander, for here the lines kept getting farther and farther apart away from the river. The owner had an increasing width of land, with more to cultivate and more back swamp for timber. But what of the grantee who got his land on the inside, or concave side, of the meander? His property lines quickly converged so that his cultivated acreage was much reduced, and he might have too little or too much back swamp. Few people wished to have property on the inside of meanders. The Spanish authorities wanted the land continuously occupied so that someone would be responsible for building and maintaining levees and roads. To bring this about they granted twice as much frontage, or twelve arpents, on the points that occupied the inside of meanders. If this was not attractive enough, the land was sometimes granted outright to neighboring owners (Kniffen and Hilliard 1988, figure 4).

Trees were cleared for fields on the "frontland" and on the "backland," the area between the "frontland" and the swamp. Initially agriculture meant small farms growing produce needed by an expanding urban population. Eventually, specialization began with the first major crops of indigo and rice. Indigo remained an important commodity until 1794. In 1750 sugarcane arrived in Louisiana with Jesuits from Saint Domingue (Haiti), but it did not become the dominant crop until in 1794

> the indigo crop, the staple of extreme South Louisiana at the time, was blighted by damp weather and/or by a worm that devastated the crop. The planters faced ruin, and in desperation one of them, Etienne de Boré, decided to risk his fortune in the manufacture of sugar, although this crop had failed in all previous trials and Boré's father-in-law, Jean-Baptiste Destréhan, had suffered disastrous reverses in his attempt to manufacture sugar some time before. Boré is said to have purchased a supply of cane from two Spaniards, Méndez and Solís, who had been manufacturing rum at Terre-aux-Boeufs, and with the advice and expert help of a sugar maker named Antoine Morin from Santo Domingo, he succeeded in making sugar granulate (Center for Louisiana Studies 1980).

This development encouraged consolidation of smaller farms into plantations. It was not, however, until the British blockaded the port of New Orleans during the War of 1812, cutting off supplies of sugar from the Caribbean, that Louisiana sugar production increased dramatically (Lytle 1959).

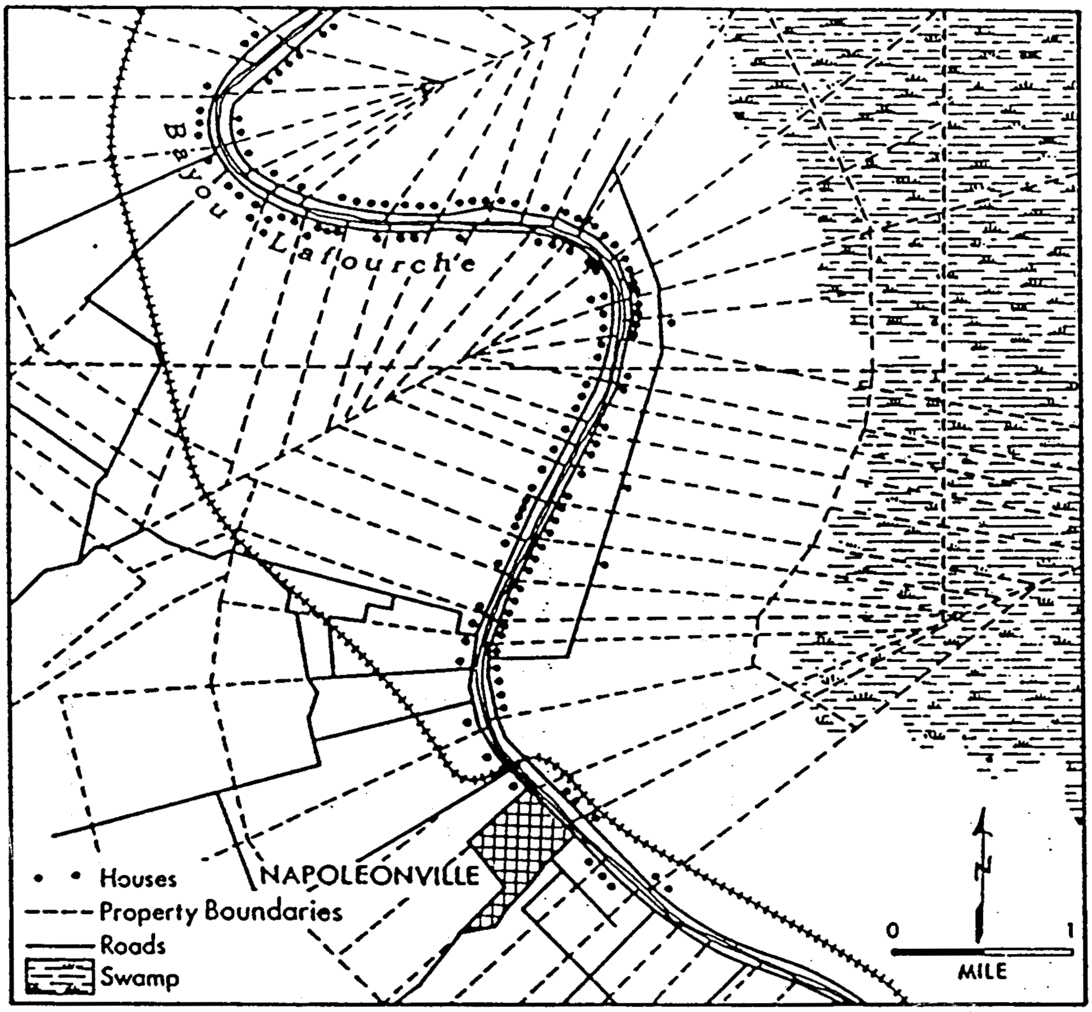


Figure 4. Land-holding settlement patterns.
Landholding boundaries (dashed lines) and houses (black dotes) indicate the manner in which settlers arranged their holdings. Note how landholdings taper from front to back on the inside and outside of bends in the bayou.
Source: Kniffen and Hilliard, 1988.

After establishing themselves as small farmers, some of the Acadians developed small plantations to grow sugarcane. In many cases, larger plantations grew after 1803 when Anglo-Americans poured into the Mississippi River and Bayou Lafourche regions and purchased several smaller parcels from Acadian "petit habitants" (small farmers) to form plantations. The Acadians then moved into the swamps and onto the narrower ridges further west and south.

A sugarcane plantation in Louisiana required a good drainage system, which all owners of sugarcane developed. Because most of the cane was grown on the natural levees along waterways, drainage was imperative for a good yield, and ditches were dug to drain into the swamp and/or into a drainage ditch at the "back" of the plantation. At present, there are numerous levee districts established in the system that now have grown to protect urban and suburban land uses.

Because sugar and other goods needed to be moved to market in New Orleans and the major streams of the Mississippi River delta plain ran north-south, a series of private east-west toll canals were created to enable the transport of crops and goods back and forth to market. For example, the Barataria and Lafourche Canal Company's canal (Company Canal) allowed for water transport between New Orleans and Thibodaux. A later canal extended navigation from Thibodaux to Morgan City. Two other examples were the Attakapas Canal and Harvey Canal (Becnel 1989). Segments of the Company Canal and Harvey Canal became part of the Gulf Intracoastal Waterway, completed in 1934. Over the years, many drainage canals and trainasses dug by trappers in the system widened through erosion to become navigation or drainage channels (Davis 1972).

Bayou Plaquemine served as an access highway to the Atchafalaya basin and the lands to the west of it (Comeaux 1972, Brasseaux 1987). A navigation lock was constructed at Bayou Plaquemine in 1909 and closed in 1961 when the alternate route of the Gulf Intracoastal Waterway was constructed.

Louisiana Purchase–1900

After Louisiana was acquired by the United States in 1803, a great population influx from other areas of the country continued throughout the nineteenth century. Over the years, as demand for farm land increased and available cleared levees became scarce, there developed a movement to open up the swamps and marshes to development. Most of these "swamp and overflowed lands" in Louisiana were owned by the U.S. government.

By virtue of the Swamp and Overflowed Lands Act in 1849 and 1850, the federal government conveyed 9.5 million acres of land to Louisiana. These lands were transferred on the condition that funds from the sale of this land be used to build the levees and drainage necessary for the state's economic development. In 1853 Louisiana created three major levee and drainage districts governed by a board of commissioners who hired engineers to determine the locality, extent, and dimensions of the levees and drains necessary to protect and reclaim swamp land for the state. The commissioners of each district formed the Louisiana Board of Swamp Land Examiners (Harrison 1961). Many of these district boards remain active.

Railroads were extended from New Orleans to the west, including a line to Brashear City (Morgan City) in 1857. This construction, coupled with the availability of cheap marsh land made available by the Swamp and Overflowed Lands Act, created a number of marsh reclamation and development schemes in coastal Louisiana for diking, draining, and reclaiming land for agriculture and pasturage. A leading supporter of these efforts was Edward Wisner. Through his Louisiana Meadows Company and affiliated companies, Wisner at one time owned 1,500,000 acres of coastal marsh, purchased at 12½ cents an acre. His and other such projects involved levying an area of marsh and draining the levied area with forced drainage (using pumps). While some of these "marsh developments" succeeded in staying dry and are evident in the system today, most failed, including Delta Farms, Clovelly Farms, and Avoca Island in the system (Davis 1972).

The failed Avoca Island reclamation project was located south of Morgan City. The work began in 1890, and by 1914 there were three major pumping stations with 42 miles of canal and a levee system that surrounded the entire island. All of this came to an end with the Mississippi River flood of 1927. The levees were broken in several places, inundating much of the island's interior. The entire venture went bankrupt in 1928. The Whitney Bank of New Orleans now owns Avoca Island.

Louisiana's coastal marshes and barrier islands were initially populated by various privateers and pirates in the 1700s and early 1800s. They found the unique configuration of the Louisiana coastline to be good for eluding capture. Three examples of human adaptation to the lower landscape of the system and susceptibility to the forces of nature in the nineteenth century were the shrimp-drying platform communities of Barataria Bay, the resort complex at Last Island, and the community of Cheniere Caminada.

In the 1800s, a series of more than 75 shrimp-drying platform villages such as Manilla Village, Bassa Bassa, and Fiji's Island were established in Barataria Bay by Filipinos and a variety of other immigrant groups. The great hurricane of 1893 destroyed these villages and their platforms. Manilla Village returned to business but closed for good in 1965 after being destroyed by Hurricane Betsy.

Last Island was a Louisiana barrier recreational resort in the 1840–1850s. Affluent vacationers would arrive by steamboat from Houma and New Orleans to stay at either the Ocean House or Capt. Muggah's Hotel. The resort days of Last Island ended with the hurricane of 1856, which wreaked havoc upon the Island and left 150 dead and the novel hotels destroyed. The legend of Last Island was immortalized in Lafcadio Hearn's novella *Chita*. No attempt was made to rebuild the resort, and Last Island became known as Isles Dernieres (Sothern 1990).

Cheniere Caminada was a barrier island adjacent to Grande Isle and originally known as the "Island of Chetimachas." The island had 1,470 inhabitants when the hurricane of 1893 destroyed the thriving community. The settlement was abandoned, and the surviving residents moved to higher ground in Leeville and Golden Meadow (Davis 1990).

1900–World War II

Because of the great demand for lumber from a burgeoning U.S. population in the late 1800s, and because timber supplies in the northern United States were nearly exhausted, lumber companies began buying up timber properties in the South. One of the most desired species was cypress, so the cypress swamps of the system were a major target of these companies. The cypress logging industry grew rapidly with the development of two logging technologies in the late 1880s: the "pull boat" and the "over head skidder" (Mancel 1972, Norgress 1935).

In Louisiana, the heyday of the cypress logging industry was 1890–1925 (Mancel 1972, Norgress 1935), although the industry continued a few years beyond 1925. Aside from decimating the first growth cypress of Louisiana, the cypress logging industry left numerous logging canals, some of which are today used by oil companies, sportsmen, and trappers and as drainage canals by local governments (Davis 1972).

After the great Mississippi River flood of 1927, Congress passed the Mississippi River and Tributaries Project, which required larger, more secure levees and a series of floodways. In Louisiana, levees along the Mississippi River were designed to better confine flood waters, and the Atchafalaya Floodway System and its attendant guide levees were established. Another result was that sediment replenishment from annual overflows in the Mississippi River would cease.

This levee building—along with improved drainage and pumpoff capabilities and the advent of tractor power in 1939—expanded sugarcane culture to the clayey Sharkey soil series landforms of the back swamps and to the mucky and peaty landforms of freshwater marshes and its fringe (appendix).

World War II–1950

Although a major oil field had been found in 1901 beneath the marsh at the Spindeltop field near Beaumont, Texas, the logistics of exploring the marshes in Louisiana at that time were too complicated for most companies. Oil and gas exploration and development continued in other areas of Louisiana, and the Standard Oil of New Jersey oil refinery at Baton Rouge was constructed in 1909 (Gramling and Brabant 1984).

In the late 1920s the Texas Company (Texaco) began to lease large areas of the coastal wetlands from the state of Louisiana and the Louisiana Land and Exploration Company. To explore these leases at an economical price per well, G. I. McBride of Texaco submitted plans in 1932 for a drilling barge that could be floated to the location and sunk so that it rested firmly on the bottom. After drilling, the barge could be raised, then quickly and economically moved to a new location. No platform would be necessary because everything needed would be on the barge or could be supplied by boat when necessary. A routine patent search was conducted, and it was discovered that Louis Giliasso had secured a patent on what later came to be known as a submersible drilling barge on August 21,1928. After designing the drill barge, Giliasso had attempted unsuccessfully to market his design to various companies (Gramling and Brabant 1984, Davis and Place 1983).

Texaco came to an agreement over patent rights with Giliasso and decided to risk building a rig that consisted of two barges fastened together. Just in case it did not prove feasible, the design allowed the two units to be easily converted into ordinary barges so that the investment would not be totally lost. A contract was signed, and the rig was built at Leesdale, Pennsylvania, and floated to Louisiana. A third barge carried a steam power plant that could be connected to the drill barges. On November 7, 1933, the "Giliasso" as the rig was named, spudded the State-Lake Pelto #10. The rig had been designed to drill 6,000 ft deep in water up to 15 ft deep. This rig proved an immediate success because on completion of drilling it was ready to be moved to a new location in one or two days. Once the new site was secured, drilling could commence again in several days on another site. Before the development of submersible drilling rigs, approximately 17 days were needed to set up a well and a similiar time to get the rig disassembled and transported to a new site. Almost immediately the news of this success spread, and the big oil and gas exploration rush into the Louisiana wetlands was underway (Gramling and Brabant 1984, Davis and Place 1983).

One of the major land use impacts from the development of oil and gas in Louisiana's coastal wetlands has been the extraordinary damage caused by the construction of oil and gas canals. While coastal Louisiana was very familiar with canals—e.g, trainasses of trappers, drainage canals, and navigation canals—the proliferation of oil and gas canals in coastal Louisiana wetlands since 1933 has been dramatic. More than the actual acreage excavated for these various types of canals is involved: when they erode they become significantly larger (Turner and Cahoon 1988). However, the advent of the Louisiana coastal use-permitting program in 1981 has significantly reduced the average length of oil and gas canals permitted since that time (figure 5). Nevertheless, it has been estimated as of 1990 that 6,953 mi (linear) of human-made canals crossed the Louisiana coastal plain and that 20 ft of spoil bank existed for every acre of the coastal plain (R. E. Turner 1995).

Sulphur mining in the system began in 1933 and has continued to be an important industry. To alleviate transportation problems associated with development of its Grande Ecaille mine, Freeport Sulphur created the town of Port Sulphur as a base. While sulphur mining in the system has heavily declined, sulphur from the new Main Pass complex will be barged to Port Sulphur for shipment (Davis and Detro 1992, *Times-Picayune* 1990).

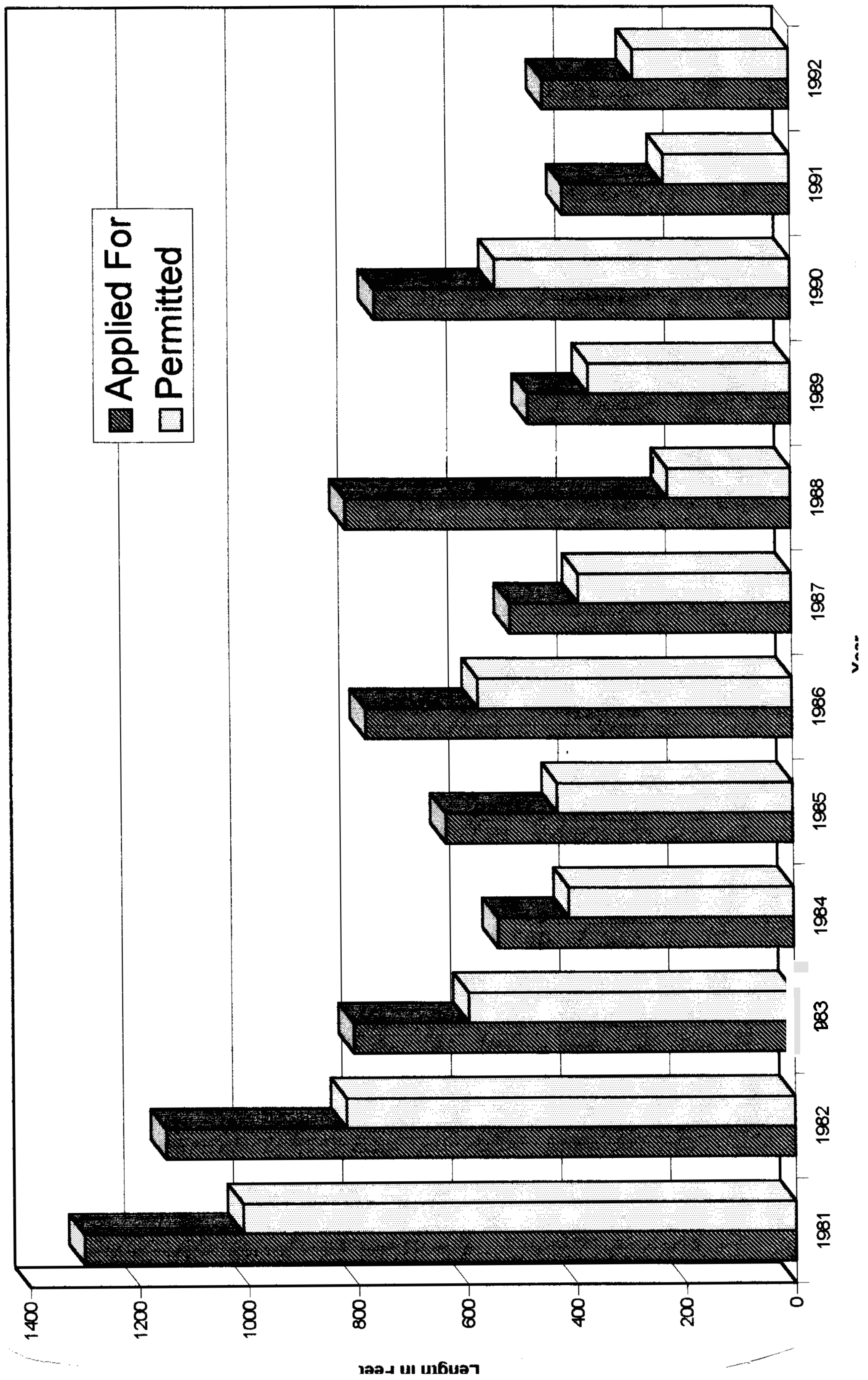


Figure 5. Oil and gas canal average lengths: 1981–1992.
Source: Morgan, 1994.

Current Imprints: 1950–Present

Overview of Current Land Use

Interpretations prepared by state and federal agencies characterize land use in the system and for the parishes wholly or partially within the system. The statistics vary because of differences in methods used to estimate land use, in classifications used to categorize land use, and in definitions of project area boundaries. These differences place limitations on making comparisons across sources.

The latest available land use assessment sets the size of the Barataria-Terrebonne estuarine system, including coastal bays and coastal waters of the territorial sea, at 4,158,939 acres or 6,498 mi² (Louisiana Department of Environmental Quality 1993a). Over three-quarters of the system's area is classified as either water or wetlands (table 1 and figure 6). Agriculture accounts for the largest proportion of nonwetland use in the basins, followed by forest land and then urban and built-up land (figure 7).

Table 1. Land use in Barataria and Terrebonne basins.

Classification	Acres	Percent of Total
Urban	111,818	2.69
Extractive	8,673	0.21
Agricultural	501,951	12.07
Forest land	287,314	6.91
Water	1,186,224	28.52
Wetland	2,054,786	49.41
Barren land	8,173	0.20
Total	4,158,939	100.00

Source: Louisiana Department of Environmental Quality 1993a.

The land, the coastal waters, and the wetlands support extensive renewable resources, but traditional human development is by necessity concentrated in a relatively small area. Because over three-quarters of the basin is classified as open water or wetlands, only about 22% of the area is considered conducive to traditional cultural development for urban and agriculture uses based on soil capability to support development. The area suitable for development conforms with the areas characterized by Commerce and Sharkey soils (Touchet 1994, table 2).

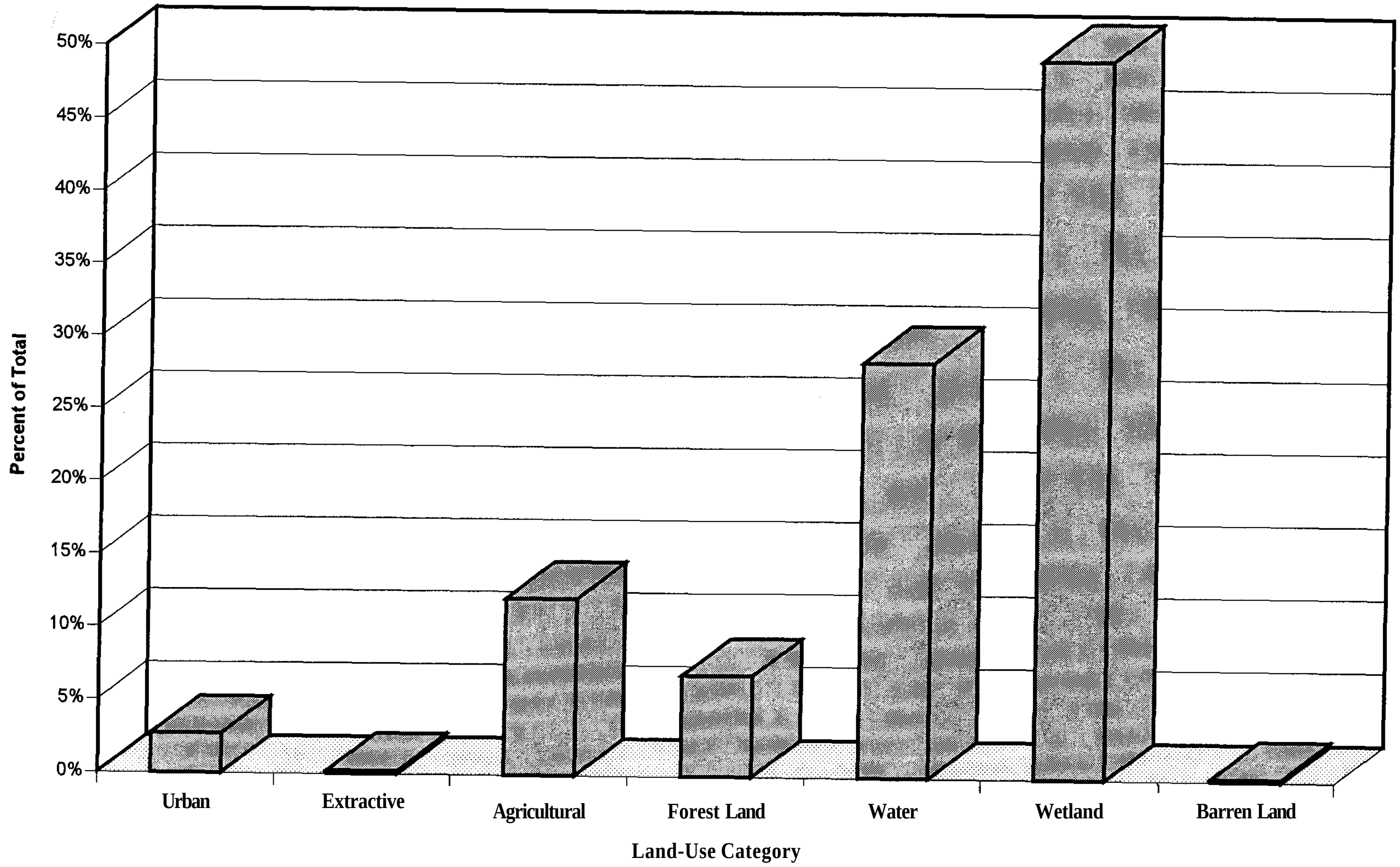


Figure *6*. Land use in the Barataria and Terrebonne basins.
Source: Louisiana Department of Environmental Quality 1993a.

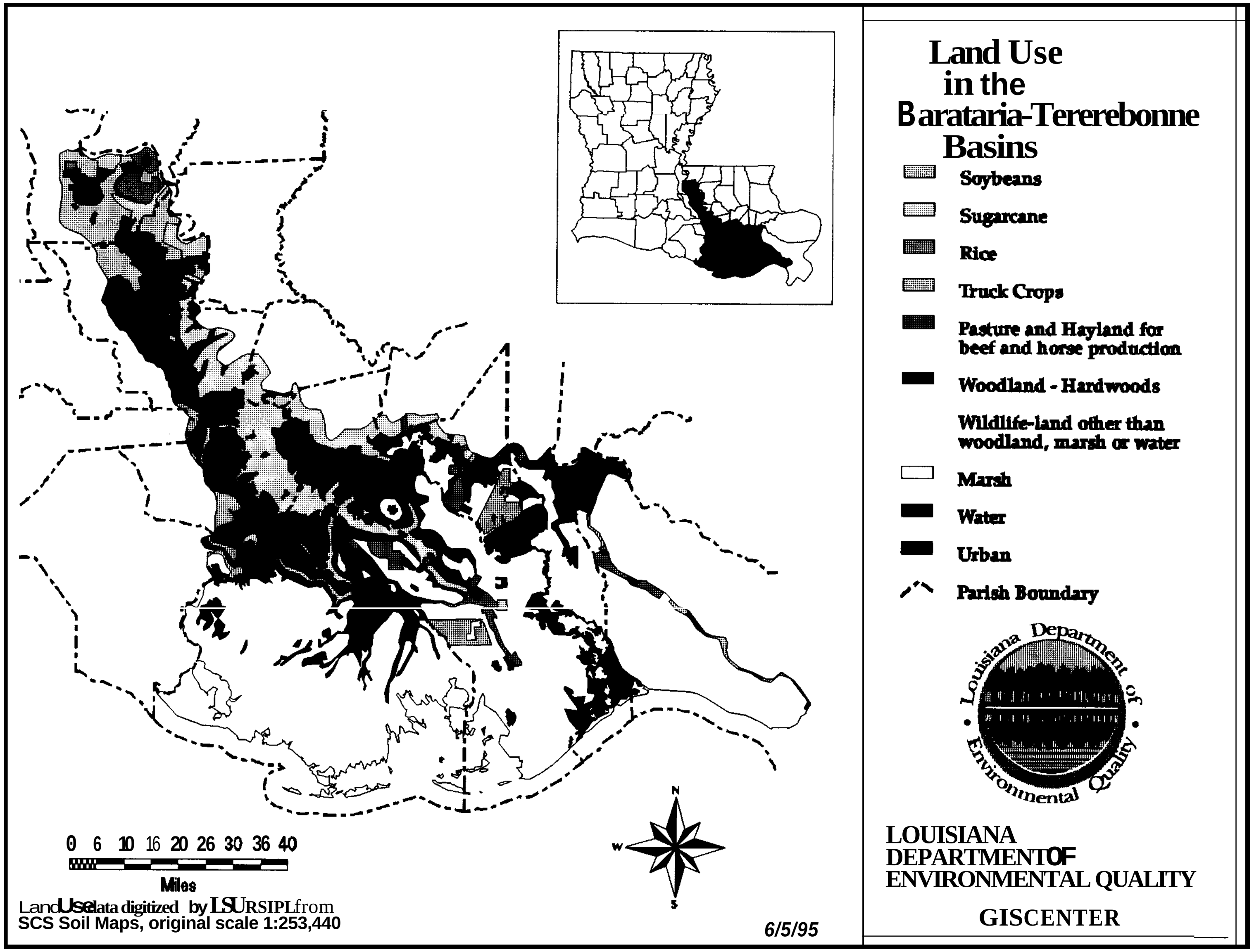


Figure 7. Land use map of the Barataria and Terrebonne basins.

Data from the National Resource Inventory for the years 1982, 1987, and 1992 indicate only slight changes in land use within the basins (table 3, U.S. Department of Agriculture 1995). These data show a continuing decrease in forest land and pasture land acreage and an increase in urban or developed land and open water.

Between 1982 and 1992 the amount of land in the system classified as urban increased by 14.4% (table 4). The increased urban land was developed from what had previously been either forest or cropland. From 1982 to 1992, 13,300 acres of forest land were converted to urban or developed use as were 9,600 acres of cropland. Water area increased by 2.3% from 1982 to 1992. By 1992, 13,300 acres of land that had been classified as minor/miscellaneous (includes marsh) in 1982 were converted to open water.

These data indicate two scenarios: one is development "pushing back" from the natural levees farther into back-swamp areas, and the other is wetland degradation and coastal "erosion" with more water area resulting. The "pushing back" phenomenon occurs where the initial cultural settlement along the natural levees encroaches on levee slopes that have been cleared for agriculture. The agricultural lands are subsequently "pushed back" further into the levee slopes and into the fringes of the back-swamp areas. The result is an increase in urban use, agricultural land use remains the same even though it has been shifted, and the amount of forest land decreases.

Natural processes including subsidence and sea-level rise contribute to the increased water area in the basins. Culturally induced hydrologic modification has in some areas accelerated the conversion of wetlands to open water. Oil and gas canal construction contributed to the increase in water area in the basin through the mid 1980s. Data from the Louisiana Department of Natural Resources indicate oil and gas activity alteration of vegetated wetlands decreased significantly from 1982 to 1986 (Morgan 1994).

The most comprehensive assessment of land use in the Barataria and Terrebonne basins and the state of Louisiana is based on high altitude, aerial photography taken in the winter of 1978–1979 and photointerpreted by the U.S. Geological Survey. The available published data are for complete parishes and provide a comprehensive assessment of how land in the basins was used by humans in 1978 (Louisiana State Planning Office n.d.). The changes likely to have occurred since the 1978 data are reflected in the U.S. Department of Agriculture data for the period for 1982–1992, which indicate only slight shifts in land use.

In 1978 wetlands accounted for 3,404,884 acres or 46.47% of the area contained within the political boundaries of the parishes wholly or partially within the Barataria and Terrebonne basins (table 5). Water covered 1,979,652 acres or 27.02% of the basin parishes. Agriculture was then ranked third in land use coverage at 1,123,054 acres or 15.33%, and forest land ranked fourth at 489,429 acres. Land classified as urban and built up land covered 304,397 acres or 4.15% of the total area.

On a parish-by-parish basis, the expanse of wetland coverage ranges from 63.35% of Lafourche Parish to 5.36% in West Baton Rouge Parish. Water coverage ranges from a low of 3.12% of Iberville Parish to 48.21% of Orleans Parish. Over half of the area of the coastal parishes and river parishes up to Ascension Parish in the basin are wetlands or water.

Table 2. Landforms, soil types, and land use acreage.

Acreage by Landforms and Soil Types–Acres*

1.	Loamy natural levees–Commerce and similar soils	512,500
2.	Clayey back swamp borders–Sharkey and similar soils	344,500
3.	Clayey and mucky swamplands–Fausse, Barbary, and similar soils	796,000
4.	Mucky and peaty marshland, fresh water marshes–Allemands, Kenner, and similar soils	526,000
5.	Mucky and peaty marshlands, brackish water marshes–Lafitte, Clovelly, and similar soils	410,000
6.	Mucky and peaty marshlands, salt water marshes–Bellpass, Timbalier, and similar soils	415,000
7.	Sandy barrier islands and clayey salt sea rims–Felicity, Scatlake, and similar soils	71,000
8.	Mucky and clayey drained marshlands–Rita, Harahan, Westwego, and similar soils	99,000
9.	Water bodies greater than 40 acres	527,000
	TOTAL	3,737,000

Land Use Acres–1950**

1.	Urban and built-up areas	70,000
2.	Water bodies greater than 40 acres	527,000
3.	Cropland	437,000
4.	Pasture	174,000
5.	Forest	1,030,000
6.	Marshland	1,499,000
	TOTAL	3,737,000

*Acres derived from Soil Conservation Publication.

**Conservation Need Inventory Data adjusted to Soil Survey acreages.

Table 3. Land cover/use, broad categories—Barataria and Terrebonne basins: 1982, 1987, and 1992.

	Acres (in thousands)		
Cover/Use Classification	1982	1987	1992
Cropland-cultivated	487	487	491
Cropland-noncultivated	1	0	0
Federal land-cover/use	17	31	38
Forest land	810	794	779
Minor land (other rural)	1326	1308	1305
Pastureland	152	147	143
Rangeland	9	9	8
Rural transportation	43	45	46
Urban	111	124	131
Water-census-streams	538	550	554
Water-small-stream	125	123	124
Totals	3618	3618	3618

	Percent of Total Area		
Cover/Use Classification	1982	1987	1992
Cropland-cultivated	13.45	13.45	13.57
Cropland-noncultivated	0.01	0.00	0.00
Federal land-cover/use	0.46	0.86	1.05
Forest land	22.39	21.94	21.53
Minor land (other rural)	36.66	36.15	36.08
Pastureland	4.21	4.07	3.94
Rangeland	0.25	0.23	0.22
Rural transportation	1.19	1.25	1.26
Urban	3.07	3.44	3.61
Water-census-streams	14.87	15.20	15.32
Water-small-stream	3.45	3.40	3.42
Totals	100.00	100.00	100.00

Source: U.S. Department of Agriculture 1995.

Table 4. Land use/coverage acreage conversion—Barataria and Terrebonne basins: 1982 to 1992 (Acres/1,000).

Broad Cover/Use, 1992	Broad Cover/Use, 1982: Cropland	Forest Land	Minor/Misc	Pasture & Range Land	Urban & Transportation	Water	Totals	Percent Change from '82 to '92
Cropland	463.5	14.0	0.5	12.0	0.0	0.9	490.9	0.80
Forest land	2.7	769.1	0.1	0.0	0.7	6.2	778.8	-3.84
Minor/Misc.	6.2	6.0	1328.7	2.3	0.0	0.0	1343.2	0.04
Pasture & Range Land	3.4	2.1	0.0	144.7	0.0	0.4	150.6	-6.69
Urban & Transportation	9.6	11.9	0.1	1.3	153.4	0.0	176.3	14.41
Water	1.6	6.8	13.3	1.1	0.0	655.1	677.9	2.31
Totals	487.0	809.9	1342.7	161.4	154.1	662.6	3617.7	

Percent of 1982 by Use in 1992:

Broad Cover/Use, 1992	Broad Cover/Use, 1982: Cropland	Forest Land	Minor/Misc	Pasture & Range Land	Urban & Transportation	Water
Cropland	95.17	1.73	0.04	7.43	0.00	0.14
Forest land	0.55	94.96	0.01	0.00	0.45	0.94
Minor/Misc.	1.27	0.74	98.96	1.43	0.00	0.00
Pasture & Range Land	0.70	0.26	0.00	89.65	0.00	0.06
Urban & Transportation	1.97	1.47	0.01	0.81	99.55	0.00
Water	0.33	0.84	0.99	0.68	0.00	98.87

Source: U.S. Department of Agriculture 1995.

Table 5. Land use of parishes wholly or partially within the Barataria and Terrebonne basins by 1978 U.S. Geological Survey level I land use classification.

The portion of parish area used that is classified as urban and built-up ranges from 21.1% in Orleans Parish to 1.63% in Terrebonne. Human habitation in Terrebonne Parish and in the other parishes in the basin is concentrated on the natural levees that parallel rivers and bayous. Traditional measures of population density based on total area of the political jurisdiction, such as persons per square mile by parish, do not accurately portray the limitations imposed by parishes that are predominantly water and wetlands.

The Louisiana Department of Wildlife and Fisheries (DWF) manages the largest tracts of land under public ownership or control in the system. In addition to two state parks, federal agencies control property used for a wildlife refuge, a historical park, and a naval air station. The largest blocks of federal and state lands in the system are presented in table 6.

Table 6. Federal and state land ownership and control in the Barataria-Terrebonne estuarine system.

Federal	
National Wildlife Refuge	
Atchafalaya National Wildlife Refuge (Iberville, a large portion)	15,220 acres
Barataria Unit–Jean Lafitte National Historical Park	12,200 acres
Belle Chasse Naval Air Station Joint Reserve Base	3,345 acres (includes acreage covered by comprehensive easements)
State	
State Parks	
Bayou Segnette State Park	580 acres
Grand Isle State Park	160 acres
DWF Wildlife Management Areas (WMA)	
Pointe-au-Chien WMA	29,000 acres
Salvador WMA	31,000 acres
Wisner WMA (leased from Wisner Foundation)	21,621 acres

Industrial, Agricultural, Urban, and Water

Louisiana's first petrochemical plant was the Chemical Products Division of (then) Esso Baton Rouge in 1941, which primarily produced synthetic rubber for use in World War II. The state's petrochemical boom really began in the 1960s when postwar consumer demand for new products and materials increased. Louisiana became a preferred site for commodity chemical production because the state had abundant natural resources, deep-water ports for shipping, and abundant land along the Mississippi River to site large operations (Louisiana Chemical Association 1994).

The enactment of Louisiana's industrial tax exemption program in 1965 created a building boom of chemical and refining plants along the Mississippi River corridor, and a historically rural state became industrialized almost overnight. Today over 60 facilities line the Mississippi River between Baton Rouge and New Orleans, and the state produces over 25% of all U.S. petrochemicals. The disposal of these industries' hazardous wastes and the reduction of their toxic emissions remain major problems (Louisiana Department of Environmental Quality 1995, Louisiana Chemical Association 1994, Louisiana Mid-Continent Oil & Gas Association 1994). The Baton Rouge area is a nonattainment area for ozone.

In 1947 Kerr-McGee Oil Company developed the first successful offshore rig out of sight of land off of the Louisiana coast. Thus began the modern offshore oil industry in the Gulf. Because of federal-state jurisdictional disputes, it was not until congressional passage of the Submerged Lands Act and Outer Continental Shelf Lands Act in 1952 that offshore development began in earnest.

If the 1940s can be characterized as the beginning of the offshore era of petroleum development, then the 1950s should be considered the beginning of the offshore industry's marine technological revolution. In this period, boat builders installed diesel rather than gasoline engines, and designed steel rather than wooden-hulled support craft for boats working offshore. Shipyards located along waterways began fabricating vessels capable of operating offshore. In 1976, 105 Louisiana shipyards were working to meet the needs of the offshore operators. The oil and gas marine service industry has been responsible for establishing Louisiana as a world leader in building thousands of supply boats, towing-supply vessels, and large utility craft operating around the world. A trend has developed whereby boats double as tug-supply, crewboat-research, and supply-support. In 1975 nearly 300 work boats were reported operating in the Gulf of Mexico. A 1981 survey of the marine transportation fleet recorded 589 support vessels stationed in the Gulf of Mexico (Davis and Place 1983).

The increase in oil and gas development in coastal and offshore Louisiana has caused a proliferation of pipelines and pipeline canals from a state perspective. Because of this increase, pipelines now commonly share rights-of-way in Louisiana's coastal zone.

In 1981 LOOP, the nation's only deep-water oil port, was constructed 19 miles south of Fourchon in Lafourche Parish. It currently handles 12% of the nation’s daily oil imports. The technology that has been developed for very deep offshore oil and gas platforms along with the presence of LOOP will ensure that the coastal Louisiana oil support industry will continue to be viable.

The recently completed Main Pass Block 299 Freeport Sulphur mine east of the Mississippi River insures the presence of a sulphur production industry in the system at Port Sulphur. The mine has reserves estimated at 67 million tons and a life expectancy of more than thirty years (*Times-Picayune* 1990).

Agricultural land use in the system has been and continues to be controlled by three factors: (1) government policies (especially federal farm policies), (2) economics and technology, and (3) quantity of land suitable for agricultural development and habitation. Each of these factors has a cause and effect.

The government policies that affect land use in an agricultural environment are the federal farm bills enacted every five years (the 1995 farm bill is currently being drafted) that dictate what farmers can or cannot produce. Their effects can most easily be seen by comparing the trends for the state and then comparing the state to the system. The major crop grown in the system is sugarcane, which requires a well-drained to moderately drained soil. These soils occur on the natural levees of the major water bodies in the system and are easily accessible and generally the most productive. When federal farm policies restrict the number of acres to be grown, these productive soils are used and less desirable soils remain idle. The state cropland trends for 1950 through 1992 are presented in figure 8. During the mid-1950s and early 1960s, farm policy dictated a specific number of acres could be planted with cotton, rice, and sugarcane. Sugarcane is the major crop grown in the system (and represents the trend for the state), and the number of acres harvested has remained about the same (figure 8). However, during the 1950s farmers began to seek alternative crops and additional land on which to produce crops because expenses were increasing and the federal price restriction on sugar began to have an economic impact.

During the late 1950s and 1960s, production costs were relatively low but increasing. Figure 9 shows that the amount of cropland harvested remained constant through the 1960s. More powerful tractors were being built. For example, John Deere introduced its new line of tractors (4010) in the 1960s. Also, the K-G blade was introduced by James E. Kissner and Edward L. Green (of Pointe Coupee Parish) near this time. The combination of these two technologies made it possible to clear large tracts of woodland, construct surface drains for many of the heavier textured soils (Sharkey clay) of the swamps, and open new lands to production.

Land normally too wet to farm was drained by constructing surface drainage that allowed pasture land to be brought into production. This change is reflected statewide in figure 10, which shows the decreased acres of pasture statewide. The system trend is similar to that of the state (figure 9). The K-G blade impacted the entire state, and woodlands were cleared throughout the state (figure 11). The impact was not as significant in the system because of the limited area that could be cleared; there was a steady rate of woodland clearing from 1954 through 1978 (figure 11).

Because there were federal acre-restrictions on growing sugarcane, an alternative crop was sought. Increasing world population required more high-protein food materials and

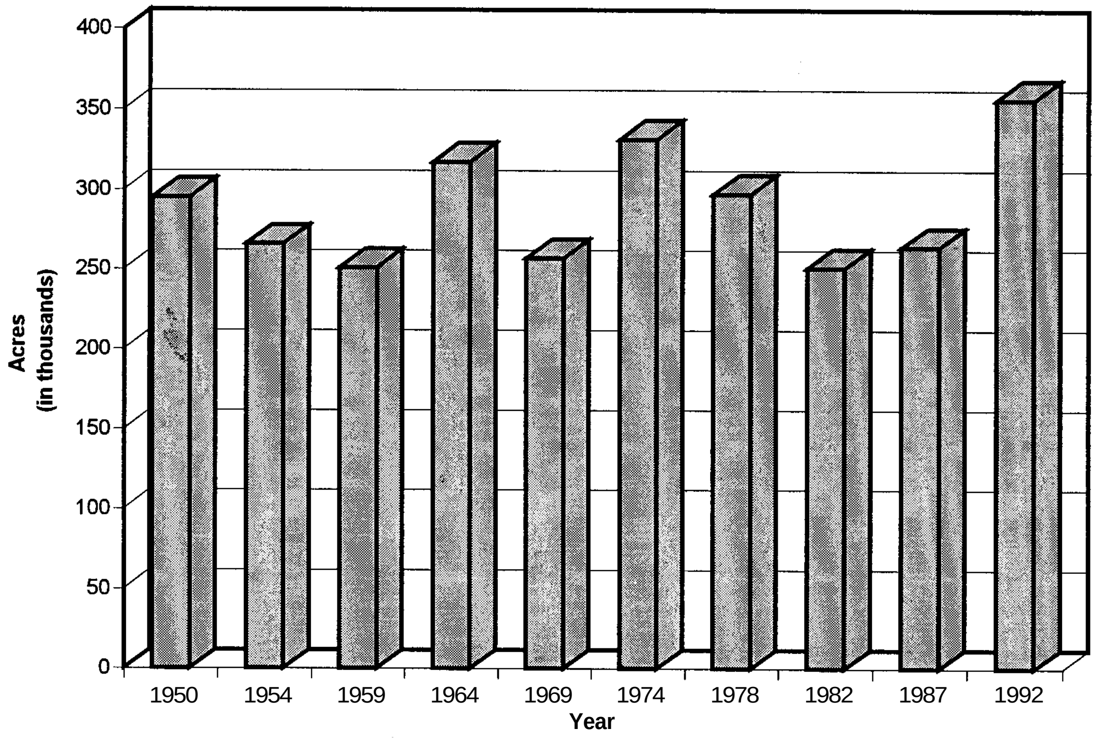


Figure **8.** Sugarcane harvested in Louisiana: 1950–1992.

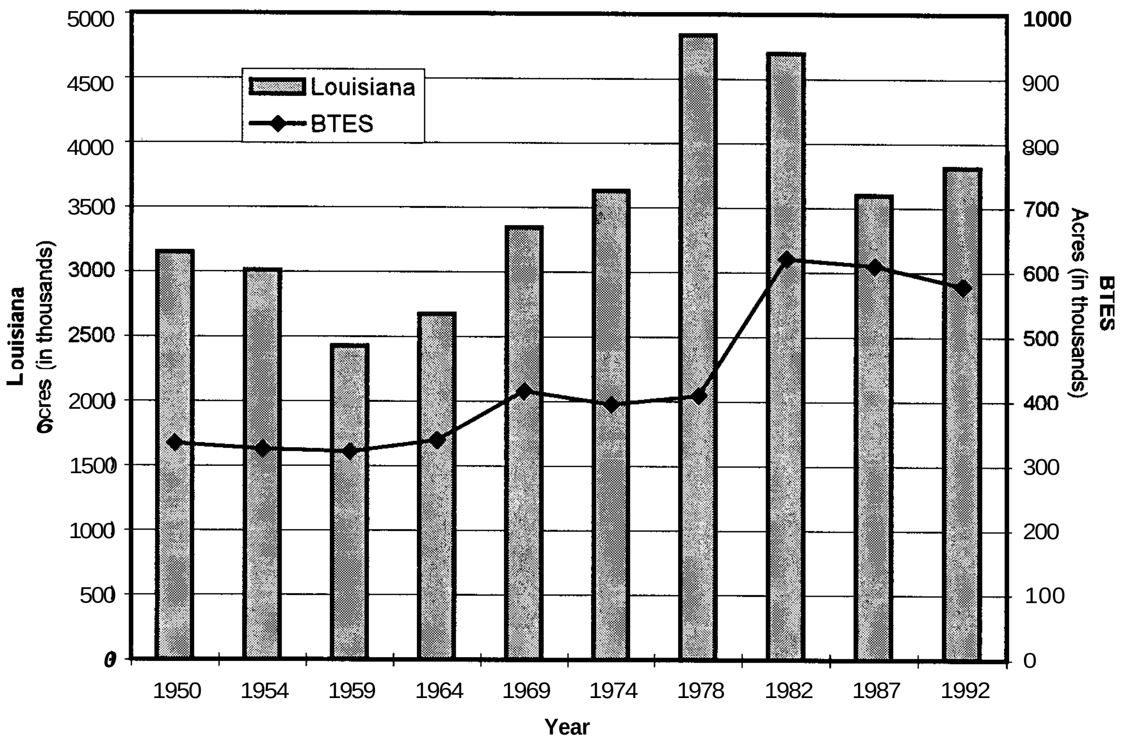


Figure 9. Number of acres of cropland harvested: 1950–1992.

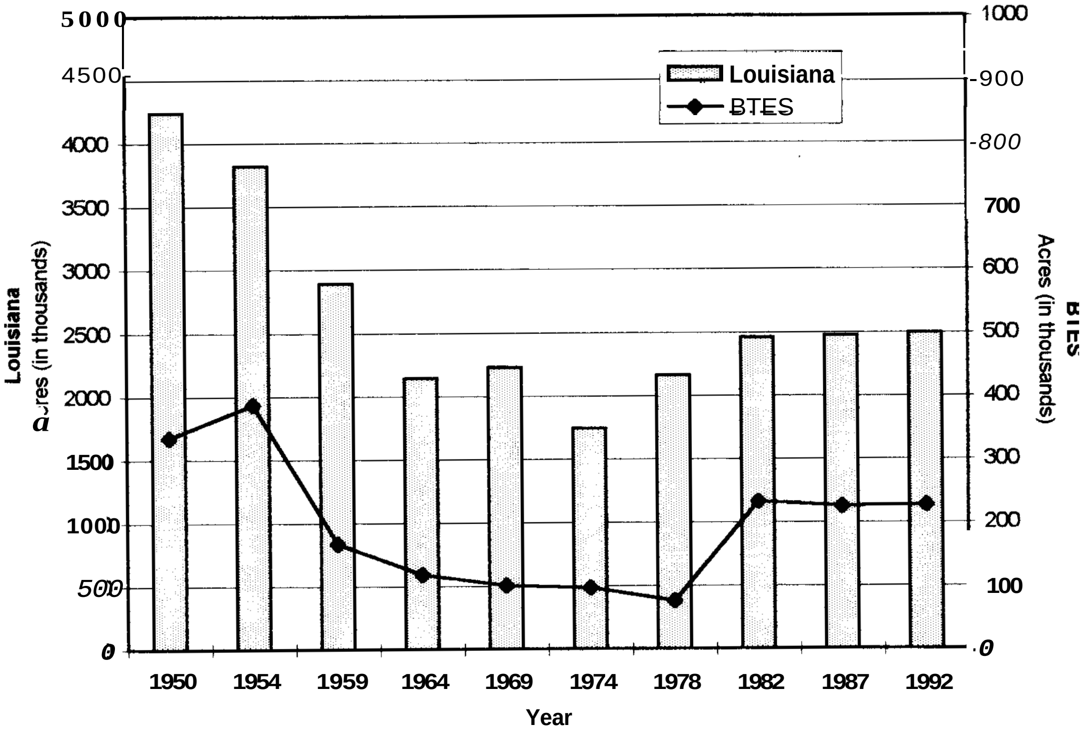


Figure 10. Number of acres in pasture: 1950–1992.

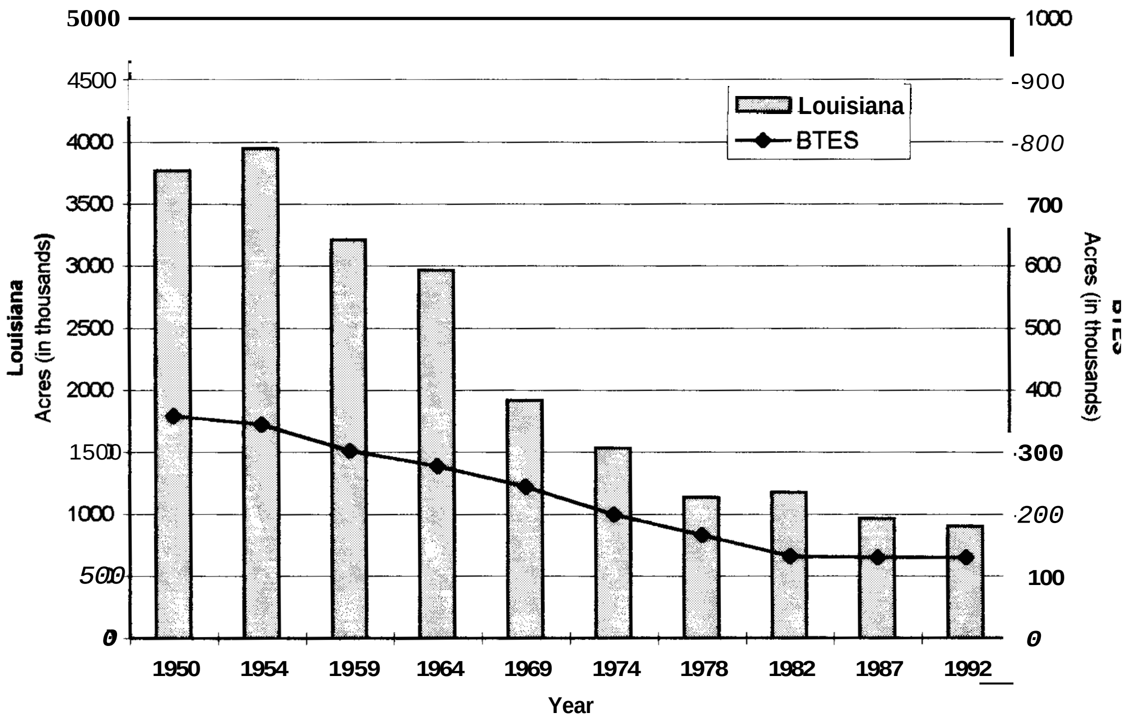


Figure 11. Number of acres in woodland: 1950–1992.

created the demand for more meat animals as well as a protein supplement. Soybeans seemed to fit this need.

Soybean varieties were developed that required a short growing period, meaning that the heavier textured soils that stayed wet well into the growing season could be used economically for soybean production. Figure 12 shows that between 1964 and 1969 soybean production in Louisiana more than tripled and then doubled from 1974 to 1978. Production in the system followed the trend for the state. The upper portion of the system was one of the major areas that was cleared and planted for soybeans.

Eventually technology was introduced into South America, and Brazil and Argentina cleared vast areas of tropical forest for planting soybeans. This increased production flooded the world market and the United States could not compete. The nation's soybean acreage decreased almost overnight.

Diseases also began to decrease yields, and it became less economically feasible to grow soybeans in the United States. Figure 13 shows that within the system, soybean production has followed the state trend. Much of the land previously used for soybeans has been left idle or returned to pasture although the trends do not reflect this change in land use.

The environment became a major issue beginning in the 1970s. Global warming, protection of endangered species, nonpoint source pollution, and wetlands regulation became major national issues. Wildlife interests became alarmed when pesticides being sprayed on sugarcane fields were blamed for fish kills. Concern about the destruction of wildlife habitat, water quality, and wetlands caused the passage of Section 404 of the Clean Water Act in 1972 and the Swampbuster Act was part of the 1985 farm bill. In 1990 Congress added the Wetland Reserve Program. Federal provisions discourage agricultural development in wetlands. This legislation has had a major impact on soybean production in Louisiana. When programs are combined with prices, the acreage of soybeans continues to drop.

There have always been some restrictions on sugarcane production: acre and/or price controls. During wet autumns, the harvesting of sugarcane becomes difficult on heavy textured soil. Ratoon crop yields are lower and diseases are more severe on these clayey soils than on the better drained soils. Therefore, sugarcane production has remained essentially constant in the state (figure 9). The increased sugarcane production shown for 1992 represents the increased planting of seed cane in the Red River Valley from Bunkie to Alexandria, which has offset the decline in sugarcane acreage of the system (figure 13).

Land suitability may be defined as qualities of soil on which humans are willing to live. Within the system, the land that may be most frequently chosen on which to live consists of those soils that are protected from flooding and have physical characteristics that provide for a sturdy foundation for structures. In the system, the soils most suited are the prime farmland soils. These soils have the fewest restrictions for building and occur on the natural levees of the major tributaries, which have always been desirable habitation sites.

One way to evaluate the status and trends of urban development is to evaluate the trends for farm size. In general the farm size for most states has continued to increase.

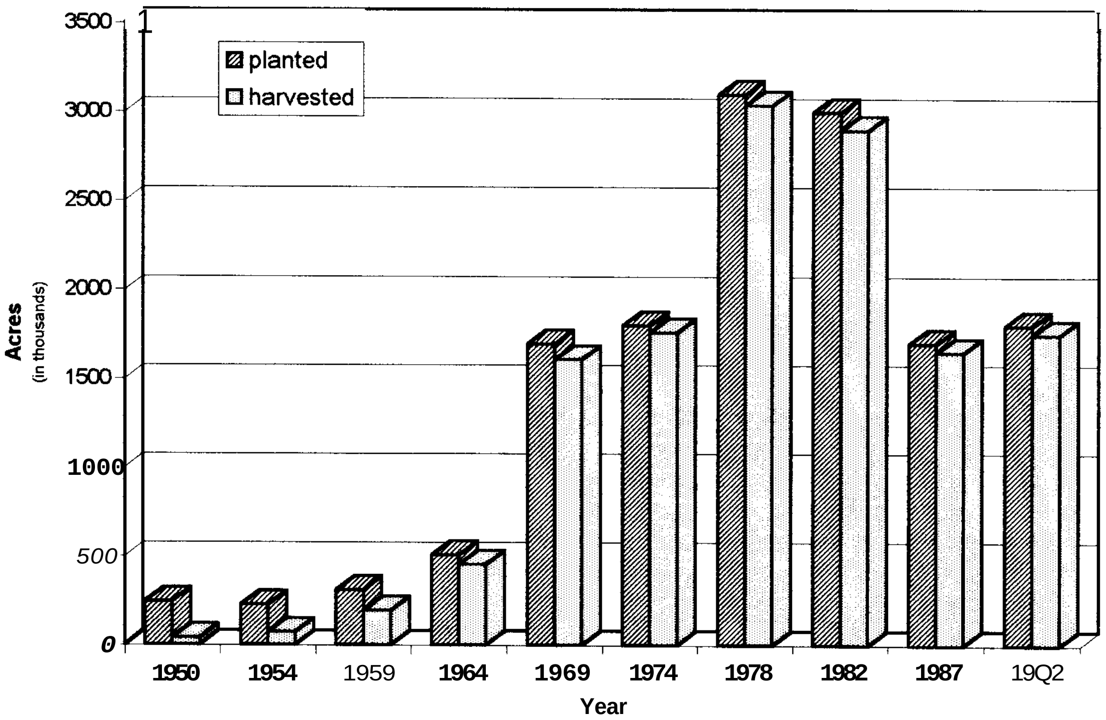


Figure 12. Number of acres of soybeans planted and harvested in Louisiana: 1950–1992.

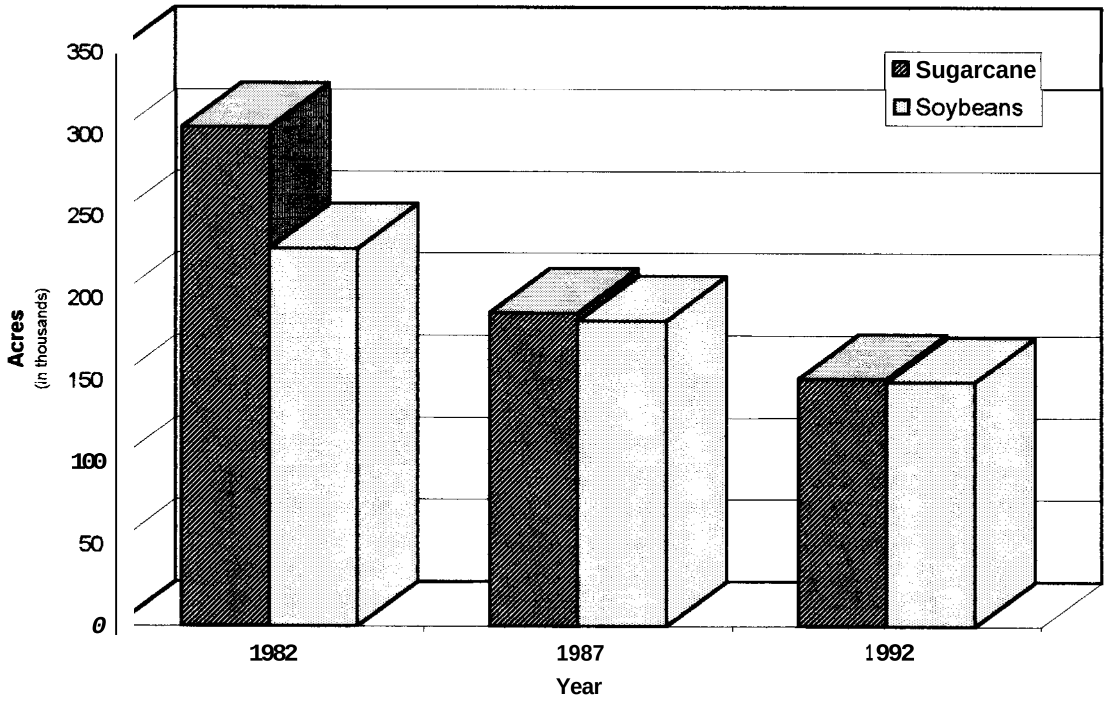


Figure 13. Number of acres of sugarcane and soybeans harvested in the region: 1982–1992.

Louisiana fits the norm. Figure 14 shows the average farm size for Louisiana and the system. Note that the farm size increased in the 1950s through the late 1970s for the state and the study area. This growth resulted from the introduction of larger equipment—especially the K-G blade—and from a decrease in people farming, and it was accomplished by the clearing of woodlands on farms in existence. However, the average farm size in the system is consistently 50–100 acres larger than the state's average size farm (figure 14). The maximum size of the farm peaked in 1974 in the system. The K-G blade was introduced in the system first, and consequently, the system was one of the first areas in which soybeans were grown.

Even though the average size of Louisiana farms, as defined by the U.S. Department of Agriculture, is still increasing, the average farm size in the system has decreased since 1982. In some parishes, such as Pointe Coupee and St. Mary, farm sizes are increasing; but in parishes that have major abandoned Mississippi River distributaries and are considered population corridors, farm sizes have decreased (i.e., comparing 1982 to 1992: Lafourche, 513 to 322 acres; St. Charles, 600 to 438 acres; Ascension, 204 to 195 acres; and West Baton Rouge, 462 to 429 acres).

This trend is likely to persist as these parishes experience continued urban growth and become the major population corridors for the system. Urban growth is the major cause for the decrease in farm size. These parishes have the highest percentage of natural levee soils, which are the best soils on which to build houses, roads, and businesses. Figure 15 presents the trend of urban growth quantified in acres. Note the tremendous increase in acres devoted to urban development from 1982 through 1992. Probably one major factor contributing to this development was the oil embargo in the late 1970s, which brought a tremendous influx of people into the system due to increased oil and gas activity in Louisiana. The oil bust of 1980 decreased the pressure for urbanization in the Barataria-Terrebonne estuarine system. The data do not reflect vacant homes or lots, just what has been changed to urban land. However, many of the people who came to the system during the late 1970s enjoyed the lifestyle and stayed in the area even after they lost their oil-related jobs. New jobs have been created in the area, and this trend is likely to continue. Farm size will decline in most parishes, and urban growth will continue. This observation raises serious questions regarding waste management, quality of life, and lifestyle in the study area.

Land use statistics of the system demonstrate that major land use categories are rural agriculture and wetlands. But human settlement statistics show a different picture. After World War II, a rural population consolidated into more urban settings as petrochemical plants and refineries were built along the Mississippi River; oil and gas industries hired workers and boat crews; and shipyards such as Bollinger, Avondale, and North American, were built. Offshore fabrication facilities were constructed from Morgan City to Lafourche Parish, and people abandoned isolated communities for the amenities of urban life. One-third of the system population can be found in Lafourche and Terrebonne parishes, either in the Thibodaux-Houma-Raceland triangle or in linear concentrations along the bayous.

Development in the Baton Rouge-to-New Orleans industrial corridor has changed from agriculture to industry on the natural levees. Petrochemical companies purchased

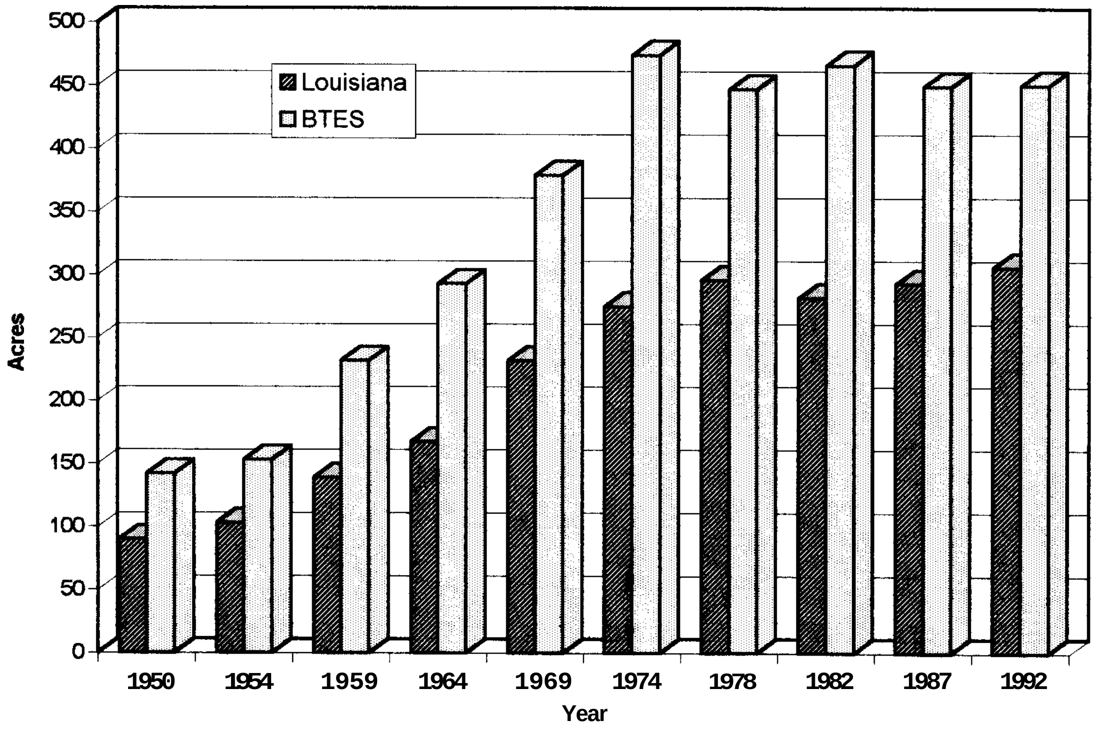


Figure 14. Average farm size: 1950–1992.

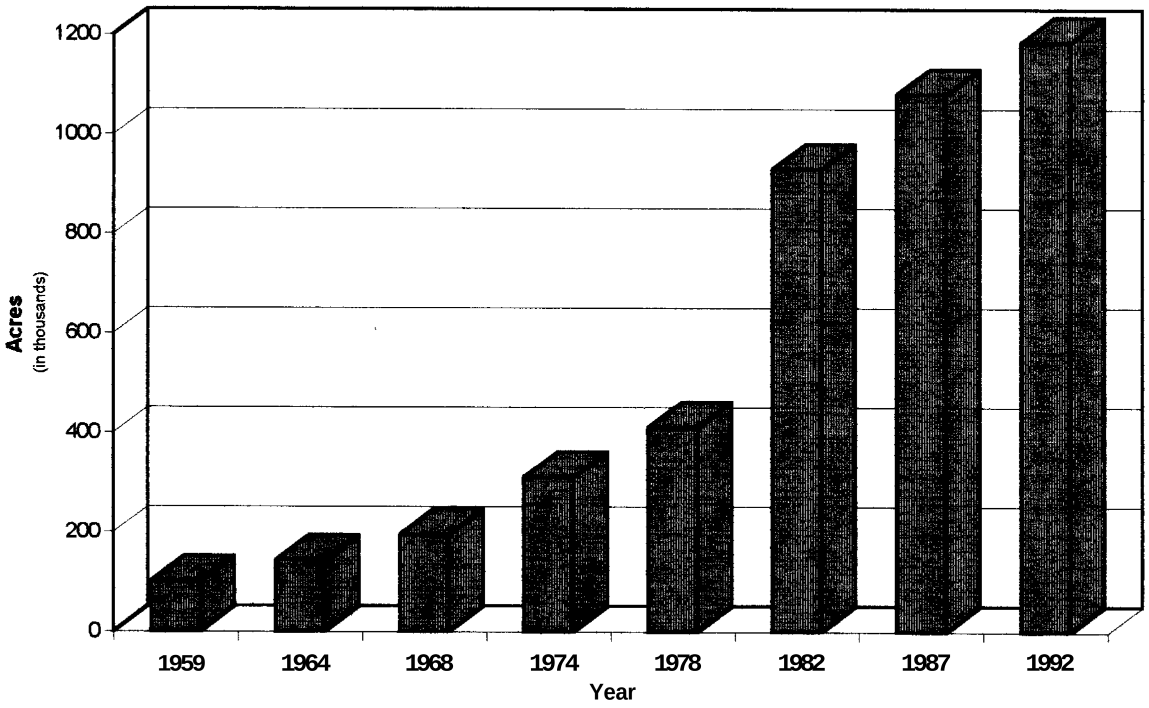


Figure 15. Number of acres in the Barataria-Terrebonne estuarine system devoted to urbanization: 1959–1992.

whole plantations and built facilities near the river. These plants are concentrated in the Baton Rouge-to-White Castle region and the St. Charles and Jefferson parish banks of the river. Farther south, support bases for offshore oil and gas production line the larger bayous such as Lafourche and Boeuf. Heliports allow for moving crews offshore efficiently, while supply bases at Fourchon, Morgan City, and Houma Navigation Canal transport the heavy equipment needed. Finally, boat yards and fabrication companies have changed fields and swamps to forests of cranes and buildings.

Future Imprints

Based on projections from 1990 census data, the population will increase for those parishes within the system from 1995 to 2000 and from 1995 to 2010 (Irwin 1994, table 7). In the short term (five years), there will be more people living in the system, and in the long term (beyond five years), there will be substantially more people living in the system. Consequently, human impact on land, water, and other resources of the system, and conflicts over human use of these resources, will increase dramatically.

Projections of future economic and population trends and discussion of federal and state legislation and institutions impacting the system are discussed in the following chapters. What is presented here is a discussion (1) on future land use trends and tools available to regional entities and local governments to affect these trends and (2) on how these trends might impact the seven priority problems. For ease of discussion, this section groups the priority problems into four broad categories: modification of hydrology; lack of sediment; habitat loss and changes in living resources; and water quality. Under these four categories, short- and long-term trends are reviewed.

The human habitat loss of such rich cultural areas as the historic communities of Isle Au Jean Charles and Marmande Ridge will have profound short- and long-term impacts on the culture and identity of people living in the system (*Times-Picayune* 1992 and 1991.)

Future Land Use Trends

Regional subsidence and local erosion are ever-present contributors to wetland loss. Through the 1993 Louisiana Coastal Restoration Plan and the 1990–1995 Coastal Wetlands Conservation and Restoration Plan (CWPPRA Plan), Louisiana is attempting to reduce the impacts of these problems and achieve no net loss of coastal wetlands. The trend of migration from rural to urban areas will continue (Larson et al. 1980), with restrictions on wetland development in swamp, marsh, and low-elevation areas due to the Section 404 permitting program administered by the U.S. Army Corps of Engineers (U.S. Department of the Interior 1994) and with restrictions added to the National Flood

Table 7. Population trends and projections by parish: 1970–2010.

Parish			Population[1]	Population Projections[2]		
	1970	1980	1990	1995	2000	2010
Ascension	37,086	50,068	58,214	64,180	64,410	74,440
Assumption	19,654	22,084	22,753	24,100	29,970	27,150
Iberville	30,746	32,159	31,049	31,390	32,050	24,100
Jefferson	337,568	454,592	448,306	465,560	478,190	513,980
Lafourche	68,941	82,483	85,860	92,610	96,090	104,810
Orleans	593,471	557,927	496,938	481,820	87,770	514,740
Plaquemines	25,225	26,049	25,575	26,850	27,630	29,820
Point Coupee	22,002	24,045	22,540	22,210	22,500	23,670
St Charles	29,550	37,259	42,437	46,290	48,390	53,200
St James	19,733	21,495	20,879	21,160	21,650	23,140
St John	23,813	31,924	39,996	43,360	43,380	49,950
St Martin	32,453	40,214	43,978	46,270	47,810	51,710
St Mary	60,752	64,253	58,086	57,440	57,950	60,780
Terrebonne	76,049	94,393	96,982	102,060	105,140	113,280
W. Baton Rouge	16,864	19,086	19,419	19,700	20,120	21,420
BTES Total	1,393,907	1,558,031	1,513,012	1,545,000	1,583,050	1,686,190

[1]Source: U.S. Bureau of the Census 1972a, 1982a, and 1992a.
[2]Source: Irwin 1994.

Insurance Program by Title V of the Riegle Community Development and Regulatory Improvement Act of 1994 (U.S. Congress 1994).

In addition, there will be an increasing trend of less habitation, development, and agricultural use in the swamp, marsh, and low-elevation areas, and an increasing shift of habitation and development to natural levee ridges. The projected system populations that increase on the natural levees will increase population density, intensify competing demands for land usage, increase solid waste and sewage output, increase demand for localized public services, and increase demand on drinking water supplies (Louisiana Department of Transportation and Development 1984, South Central Regional Planning Commission 1980).

Industrial development along natural levee ridges may be impacted by the new concept of "environmental justice" (Louisiana Department of Environmental Quality

1994). Fishing, trapping, and recreational camps will remain outside the natural levees. The use of marsh management plans by coastal landowners is expected to increase (U.S. Department of the Interior 1989, Cahoon and Groat 1990, Morgan 1994).

As oil and gas exploration and development efforts in Louisiana's coastal and territorial waters continue to decline, deepwater drilling technology will ensure continuing exploration, development, and production on the OCS offshore Louisiana (*Advocate* 1995). The Louisiana petrochemical and refining industries are expected to be in an expansion mode for the next few years (*Sunday Advocate* 1995). Seafood processing plants and offshore oil-and-gas support industries will continue to locate on the natural levee ridges.

A full suite of federal and state regulatory programs affects these land use shifts. Tools are available to units of local government in the system (i.e., parishes and municipalities) and regional entities, that will have to deal directly with the burden of these shifts in land use. These tools will be the constitutional (Article VI, Sec. 16, 1974 La. Constitution) and legislatively granted powers for managing competing land uses in local government areas: planning for use growth on a parish, municipal, or regional level; and implementing these plans by zones for various uses, e.g., residential, commercial, industrial, rural (La. R.S. 33:106, et seq; R.S. 33:131, et seq; R.S. 33: 140, et seq; R.S. 33:1236, et seq; and R.S. 33:4721 et seq).

Many parishes and municipalities have planning departments, directors, and/or commissions (Emmer et al. 1992b, Moore 1994; table 8). Most of the system parishes (and numerous other Louisiana parishes) wrote master plans for development in the late 1960s and early 1970s that were federally funded pursuant to Section 701 of the federal Housing Act of 1954. These plans and the data and methodology on which they were based, however, are obsolete (Emmer et al. 1992b, Moore 1994).

The majority of the system parishes are located in geographic areas served by four of the state's regional planning commissions: the South Central Regional Planning Commission, encompassing the mid-to-lower estuarine system; the Capital Regional Planning Commission, covering the northern system parishes; the Regional Planning Commission, including Jefferson, Plaquemines, Orleans parishes; and the Acadiana Regional Planning Commission, encompassing St. Mary Parish. The regional planning commissions are required to prepare, periodically, regional development plans recommending policies to the parishes and municipalities for development of the region.

The regional commissions have no zoning authority (Emmer et al. 1992b). Most of the system parishes have parish zoning ordinances and subdivision regulations. Likewise, a majority of estuarine system municipalities have zoning ordinances and subdivision regulations (Emmer 1992b, Moore 1994; table 8).

Table **8.** Status of planning in select parishes and municipalities in the study area.

Parish/Municipality	Planning Commission 191311976	1990	Planning Agency	Initial 701 Plan	CDBG Plan Ycar	Comprehensive Plan	Economic Plan	Zoning Rcgs	Subdivision Rcgs	Sanitary Code	Flood/Envir Ordinance	Planning Staff
Ascension	x	x		1966							Flood	
Donaldsonville				1966					x		Flood	
Iberia	x	x		1972			x		x	x	Flood	
Jefferson'		Advisory Bd	I	1965	1975,77-79	x	x	x	x	x	Flood,CZM Envir	x
Gretna				1958							Flood	
Harahan	x			1957	1978-80						Flood	
Jean Lafitte				1962	1978			Draft1975	x		Flood	
Westwego	x			1967					x		Flood	
Lafourche	x	x	I	1959		x	x		x	x	FloodCZM. Envir	x
Golden Meadow'		x		1961		x		x	x		Flood	
Lockport											Flood	
Thibodaux	x	x		1957							Flood	
Orleans	x	x	I	1965	1976 80	x	x	x	x	x	FIood,CZM	x
New Orleans	See Orleans Pansh			1960				x	x		Flood	
Plaquemines				1970				x			Flood	
Grand **isle**	x			1961			x	x		x	Flood	x
St Charles'	x	x	I	1964				x	x		Flood	x
St James'			Par Pres	1973					x		Flood, CZM	
St John1	x	x	I	1961				x	x	x	Flood	
St Mary'	x		I	1960					x		Flood	x
Morgan City		x	Insp Dept	1957	1918 79			x	x	x	Flood	
Terrebonne[1]	x	x	I	1963		x		x	x	x	Flood	x
Houma	See Terrebonne Parish			1963							Flood	
West Baton Rouge[1]	x	x		1962		x			x	x	Flood,Envir.	
Brusly		x		1962							Flood	
Port Allen	x	x		1962							Flood	

X = **Thc element exists** m the municipality.
Flood = **Thc** municipality is part of the **Rcgular** Flood Insurance Program.
ND = **Thc** municipality **has** 701 plan, but **the sfate** could not **be** determined
CZM = Parish ha, **a n** approved Local **Coastal** Program.

'**Responded to request** for information *or* wcrc visited and provided information

DPW, B & P = Department **of** Public Works, Buildings, and Pcrrniu
CDBG = Community Dcvclopmcnt Block Grant.
I = Independent Agency
√Z, s & P = with Zoning, Safety, and Permits

Source: Adapted from Emmer et al. 1992b.

Impacts on Priority Problems

Hydrology Modification. Because of federal laws and institutions (see next section) that restrain development on wetlands and limit population shifts to the natural levees, demand could increase for construction of flood protection levees at the back edge of the natural levees where they currently do not exist. Freshwater diversion projects under the federal and Louisiana coastal restoration plans also could increase the demand for protective levees. Any increase in the flow of Mississippi River water into Bayou Lafourche would require extensive dredging of the bayou— otherwise flooding problems along its route will increase. There also will be a need for new streets and roads, and their construction might alter hydrology in certain areas.

The continued use of marsh management plans (given the sanction of the Louisiana Coastal Restoration Plan) could continue to disrupt historic public access to waterways and canals and lead to conflict (Davis 1993). The 5,000-acre mariculture permit program managed by the Louisiana Department of Wildlife and Fisheries (La. R.S. 56:579.1 et seq.) will have significant impacts on the system.

Lack of Sediment. Federal and state plans for freshwater diversion projects will increase available sediment; however, the benefits of this increased sediment will be balanced against the global sea-level rise. Moreover, the question will arise concerning who will own newly filled land. Louisiana's Constitution, Civil Code, and public trust principles could lead to much litigation over this issue. The recent state–the Louisiana Land and Exploration Company disagreement over ownership of land to be reclaimed through CWPPRA on Isles Dernieres indicates that this question could generally be difficult to resolve (Hribernick and Wascom 1982, Wilkins and Wascom 1992, Louisiana State Law Institute 1992).

Habitat Loss. Aside from the beneficial effects of federal and state projects introducing new sediment, there is the question of land loss and land subsidence on future agriculture. The incentives for wetland maintenance and restoration on agricultural lands (established by the federal Food Security Act of 1985 and the Food, Agricultural, Conservation, and Trade Act of 1990) will provide assistance to those who must cease production on their agricultural lands and help maintain current wetland acreage on agricultural lands. Through the Wetland Reserve Program, available wetland acreage could actually be increased by allowing owners of agricultural property to retain ownership of the land subject to a permanent wetland protection easement and by paying up to the fair market-value for property devalued by the easement (Payne 1993).

With respect to fisheries resources, the short-term impacts of the CWPPRA Plan and the state Coastal Restoration Plan would be on the change in salinity levels in the lower part of the system’s fresh water, particularly in oyster grounds and shrimp and finfish nursery areas. Lower salinities in current oyster grounds will displace oystermen from their current areas of operation.

In the long term, it is anticipated that the CWPPRA and the state Coastal Restoration Plan will rebuild lost nursery habitat and decrease the loss of new habitat. The increase in nursery habitat in the lower estuarine system should benefit all system fisheries.

The CWPPRA and state Coastal Wetlands Plan will help to retard land loss on the system's barrier islands. The federal Coastal Barrier Resources Act will prevent government-subsidized new development on these system islands, with the exception of the only developed barrier island, Grand Isle.

Water Quality. In the short and long term, drinking water supplies—drawn for the most part from the Mississippi River—should be plentiful (Louisiana Department of Transportation and Development 1984, South Central Regional Planning Commission 1980). The extension of a freshwater line from lower Jefferson Parish to Grand Isle should take care of the latter's short- and long-term water needs.

In the short and long term, the effects of human use of the land will have significant impacts on the quality of surface drinking water supplies, and the water quality of the system water bodies, swamps, and marshes will be a significant concern (Louisiana Department of Environmental Quality 1994).

As noted above, the water quality impacts of CWPPRA and the state Coastal Restoration Plan freshwater diversion on salinity levels cause concern, as does the quality of water diverted from the Mississippi River. Should the Mississippi's flow into Bayou Lafourche be increased, the same water quality concerns would arise.

In the short and long term, population increases and additional agricultural development on natural levees will increase the nonpoint-source pollution runoff into the estuarine system water bodies. Increased production of solid waste will increase the possibility of leachate runoff from landfills and increased sewage output. The state's integrated regional solid waste management plan, with its emphasis on regional landfills with selected pickup sites, should adequately handle the system's increased solid waste in the short and long term and reduce the leachate runoff problem (Louisiana Department of Environmental Quality 1993b).

Increased flow into publicly owned treatment facilities could be adequately planned for and handled in the short and long term provided the local wastewater district can get necessary treatment improvements funded through the Municipal Facilities Revolving Loan Fund (Louisiana Department of Environmental Quality 1994). Untreated sewage from residences and camps will continue to pose problems in the short and long term.

Control of nonpoint-source pollution from municipal and agricultural runoff is being encouraged through the nonpoint-source education of the Louisiana Department of Environmental Quality (LDEQ) pursuant to Section 319 of the Clean Water Act (Louisiana Department of Environmental Quality 1993b). The Coastal Nonpoint Source Pollution Program will require mandatory nonpoint control measures on uses inside or outside the legislatively defined Louisiana Coastal Zone that affect coastal water quality.

It will have long-term beneficial impacts on the estuarine system water quality if it is implemented and continues to exist.

Conclusion

As noted at the outset, the tools available to the system's people for anticipating and adjusting to the increased land use demands on the natural levees are in place: the regional planning commissions, the parish/municipality planning departments and/or commissions, the Louisiana Coastal Resource Program, the four local coastal management programs, the Barataria-Terrebonne National Estuary Program (BTNEP) Comprehensive Conservation Management Plan. However, they must be used. And the development of regional/local-based management of increasing and conflicting land uses can be accomplished in the short and long term by the judicious use of legislatively granted zoning powers by the parishes and municipalities.

Zoning is not uniformly popular. But if used as a tool to implement regionally or locally based and supported plans for the future of an area, it can be an effective method of resolving these use-conflicts at a local level rather than having them resolved at the state or federal level.

There is a need for cooperation between the regional/parish/municipality planning bodies to accomplish a future development plan for the citizens of the system. The Comprehensive Conservation Management Plan for the system and the establishment of the Barataria-Terrebonne Foundation (Barataria National Estuary Program 1995) will assist these entities and the current and future residents to visualize and to achieve their hopes for the system's future.

SOCIOECONOMIC STATUS AND TRENDS

Introduction

Socioeconomic status and trends of relevance to the Barataria-Terrebonne estuarine system are explored in this chapter of the report. In the first section, socioeconomic characteristics of the relevant population are examined. Because there exists a strong tie between the population in the system and its resources, renewable and nonrenewable, analysis of the resource base and its impact on society is given in the second section. Then the role of agriculture in the system is examined. The transportation system, the availability or unavailability of which has historically demonstrated significant impact on the economic and social development of communities, is next given attention. Tourism is briefly examined in the fifth section because there exists interest in tourism as a means of diversifying and expanding the employment base. The chapter concludes with an analysis of socioeconomic events exemplifying specified priority problems. The status and trends associated with various social, economic, and other factors of relevance also are explored.

Socioeconomic Characteristics

Empowered by law, the U.S. Bureau of the Census has been establishing population counts by state every ten years since 1790 (Smith and Hitt 1952). Through time, this census has become much more than a simple population count. Specifically, a great deal of information also is now collected to permit social scientists to depict accurately the social and economic characteristics and changes of a given population within a geographical region of the country and over time.

The census information provides the basis for much of the discussion regarding socioeconomic characteristics within the estuarine system region. Published data associated with the various censuses are generally limited to the parish level. Hence, most of the analysis associated with socioeconomic status and trends is provided at the parish level, even though portions of several parishes lie outside the Barataria-Terrebonne boundaries.[1]

[1]Unpublished Census data for 1990 was available by which to analyze characteristics of the population living within the basin boundaries. Where applicable, analysis of this data was included throughout the report.

While 16 parishes are either totally or partially contained within the basin boundaries[2], two parishes—Iberia and St. Martin—have been excluded from the analysis of socioeconomic status and trends due to the fact that only a small proportion of their populations resides within the basin boundaries[3]. A related problem associated with the analysis of socioeconomic status and trends relates to the treatment of Orleans Parish. Orleans is the largest parish in the estuarine system region when measured in terms of population, accounting for about a third of the total population among the 16 parishes included in the region. According to unpublished census data, approximately 11% of the population of Orleans Parish resided within the basin boundaries in 1990. Because of its large absolute population outside of the basin boundaries, and different characteristics of its population (such as degree of urbanization), inclusion of Orleans Parish in the calculation of total or average figures for the region may significantly skew any findings. However, a significant share of the population of Orleans Parish (and absolute number of persons) resides within the basin boundaries. Hence, exclusion of Orleans Parish may result in the loss of valuable information that would be of particular interest to regional planning authorities, etc. As a compromise, information on Orleans Parish is generally presented in relevant tables. Averages and totals for the region, however, are often presented (1) excluding Orleans Parish and (2) including Orleans Parish. Discussion, with many exceptions, follows a similar format.

Population

Historical Patterns of Population Growth. In association with Louisiana Purchase of 1803, the first Decennial Census of Louisiana was conducted in 1810. It was not until 1830, however, that population counts for all 13 parishes included in the current analysis (14 when Orleans Parish is included) became available. At that time, the population count for the 13-parish estuarine system region was 71,000 (table 9), while another 50,000 persons resided in Orleans Parish. The state population in 1830 equaled 216,000 .

When examined in twenty-year increments, population growth in the region was positive during all periods of analysis with the exception of the 1910–1930 period wherein population declined by approximately 8% (table 9). In Orleans Parish, by comparison, population expanded by about 35% during the 1910–1930 period, while the state's population expanded by more than a quarter. When examined on a parish basis, particularly pronounced declines in population were evident in Ascension (23,837 in

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[2]These parishes include Ascension, Assumption, Iberia, Iberville, Jefferson, Lafourche, Orleans, Plaquemines, Point Coupee, St. Charles, St. James, St. John, St. Martin, St. Mary, Terrebonne, and West Baton Rouge.

[3]In 1990 an estimated 135 residents of Iberia Parish resided within the BTES boundaries, or about 0.2% of the total population of the parish (68,297). For St. Martin, the proportion was approximately 2.5% based on a total population of 43,978.

Table 9. Population in the BTES region and state: 1830–1990.

	BTES Region[a]		Orleans Parish		Louisiana		Population in BTES Region as % of State
Year	#	Rate[b]	#	Rate	#	Rate	
1830	71,095	-----	49,826	-----	215,739	-----	33.0
1850	138,703	95.1	119,460	139.7	517,762	140.0	26.8
1870	146,483	5.6	191,418	60.2	726,915	40.4	20.2
1890	214,386	46.4	242,039	26.4	1,118,588	53.9	19.2
1910	296,995	38.5	339,075	40.1	1,656,388	48.1	17.9
1930	272,593	-8.2	458,762	35.3	2,101,593	26.9	13.0
1950	383,059	40.5	570,445	24.3	2,683,516	27.7	14.3
1970	768,844	100.7	593,471	4.0	3,644,637	35.8	21.1
1990	971,826	26.4	496,938	16.3	4,219,973	15.8	23.0

[a]Includes thirteen parishes noted earlier in the chapter.
[b]Rate refers to the percentage change between two successive time periods.

Source: Calhoun 1992.

1910 compared to 18,438 in 1930), Assumption (24,128 to 15,996), Iberville (30,954 to 24,638), Plaquemines (12,524 to 9,607), St. James (23,009 to 15,338), St. Mary (39,368 to 29,397), and West Baton Rouge (12,636 to 9,716). Most, if not all, of these parishes had major logging (cypress) operations in the early 1900s, providing a major source of employment in the local communities. By the 1920s, logging operations had been curtailed greatly due to overharvesting of first growth cypress, and employment opportunities in this sector fell accordingly. As employment opportunities declined during the 1910–1930 period, workers and their families probably left the region.

In 1830 population in the region accounted for one-third of the state's total (when Orleans Parish is included, the proportion rises to 56%). When evaluated in twenty-year intervals, the proportion declined continuously before bottoming out at 13% in 1930 (table 9). Large population growth in the region relative to the state since 1930, however, led to a reversal of the downward trend. By 1970 the 13-parish region accounted for 21% of the state's population (37% when Orleans Parish is included), and in 1990 the proportion had advanced to 23% (if Orleans Parish is included, the proportion equaled 35% or about two percentage points below that reported in 1970, reflecting the sharp decline in the population of Orleans Parish).

Modern Trends in Population Growth. The analysis below of modern trends in population growth focuses on the 1950–1990 period, a period in which the region's population rapidly expanded and oil-and gas-related activities played a prominent role. As indicated in table 10, population in the 13-parish region (i.e., excluding Orleans Parish) advanced from 383,000 in 1950 to 972,000 in 1990, or by more than 150%[4]. The state population, by comparison, advanced from 2.68 million to 4.29 million, or by about 60%. The largest population growth in the region during the 1950–1990 interval occurred in Jefferson Parish, where population quadrupled from 104,000 to 448,000 (table 10). The next largest growth rates in the region occurred in two Mississippi River parishes proximate to Jefferson Parish: St. Charles Parish, where population grew from 13,000 to 42,000, and St. John the Baptist Parish, where population grew from 15,000 to 40,000. Population in another Mississippi River parish, Ascension, grew from 22,000 to 58,000, a growth rate comparable to that of St. John the Baptist.

Terrebonne and Lafourche parishes, with the largest populations in the region excluding Jefferson Parish, also exhibited population growth rates of over 100%, although their growth rates were substantially smaller than those of the Mississippi River parishes identified above. With 1950–1990 population increases of 43,000 to 99,000 in Terrebonne and 42,000 to 86,000 in Lafourche, these two coastal parishes grew more rapidly than the percentage growth rate for the state, i.e., 57%.

It is tempting but not completely accurate to attribute the large relative population increase in the 13-parish region, i.e., excluding Orleans, during the 1950–1990 period

[4]When Orleans is included, the percentage increase for the BTES region fell to approximately 55%, reflecting the decline in population in Orleans Parish between 1950 and 1990.

Table 10. Population in the BTES region by parish and state: 1950–1990.

Location	1950	1960	1970	1980	1990
Ascension	22,387	27,927	37,086	50,068	58,214
Assumption	17,278	17,991	19,654	22,084	22,753
Iberville	26,750	29,939	30,946	32,159	31,049
Jefferson	103,873	208,769	338,229	454,592	448,306
Lafourche	42,209	55,381	68,941	82,483	85,860
Plaquemines	14,239	22,545	25,225	26,049	25,575
Pointe Coupee	21,841	22,488	22,002	24,045	22,540
St. Charles	13,363	21,219	29,550	37,259	42,437
St. James	15,334	18,369	19,733	21,495	20,879
St. John	14,861	18,439	23,813	31,924	39,996
St. Mary	35,848	48,833	60,752	64,253	58,086
Terrebonne	43,328	60,771	76,049	94,393	96,982
W. Baton Rouge	11,738	14,796	16,864	19,086	19,149
Total BTES[a] (excluding Orleans)	383,049 -----	567,467 (48.1)	768,844 (35.5)	959,890 (24.8)	971,826 (1.2)[b]
Orleans	570,445	627,525	593,471	557,927	496,938
Total BTES (including Orleans)	953,494 -----	1,194,992 (25.3)	1,362,315 (14.0)	1,517,817 (11.4)	1,468,652 (-3.2)
Louisiana	2,683,516	3,257,022	3,644,637	4,206,312	4,219,973

[a]Includes the thirteen parishes identified in table
[b]Numbers in parentheses represent the percentage rate of change between successive twenty-year periods.

Source: Calhoun 1992.

primarily to expansion of oil- and gas-related activities in the region. As Renner (1980) noted, "(t)he precise association is hazy at best between population growth and long-term development on the one hand, and the petroleum industry on the other." Renner further states that "(u)nless more sophisticated growth simulation models are created to account more fully for the causal role of oil-and-gas development, one is left with the impression that while petroleum provided the initial impetus for growth in the Deltaic Plain region (which includes most of the region), this growth has assumed a character of its own." In other words, expansion of oil- and gas-related activities was the catalyst for the initial rapid rate of population growth in the region during the 1950–1990 period. Growth in this sector, in turn, provided the necessary infrastructure and capital for expansion of other business sectors. Expansion in these other business sectors translated into increased employment opportunities in the region and continued population growth. Finally, it should be noted that a portion of the observed growth in the 13-parish region likely reflects migration from Orleans Parish to the surrounding parishes, particularly Jefferson. As the infrastructure improved, people were able to move out of the city of New Orleans but commute there for work and other activities.

While the 1950-1990 period can be characterized as one of significant population increase in the region, consideration of each decade within this 40-year period suggests considerable differential growth rates when evaluated on a shorter time frame. Two features are most apparent. First, the rate of population increase in the region appears to have diminished during each decade since the 1950s, when examined on a percentage basis (table 10).[5] Second, the population growth in almost one-half of the estuarine system parishes during the 1980s—Iberville, Jefferson, Plaquemines, Pointe Coupee, St. James, and St. Mary—was negative.

The diminishing rate of population growth partly reflects an increasing base in the calculation of percentages (see Gramling and Brabant 1984 for details). Evaluation of the raw population data indicates that during the 1950–1990 period the population consistently increased by approximately 200,000 per decade with the exception of the 1980–1990 interval wherein it advanced by only 12,000 thousand. The relatively small increase in population in the 1980s coupled with the decrease within about one-half of the estuarine system parishes, including Jefferson Parish, most likely reflects the decline in oil- and gas-related activities in the early-to-mid-1980s and the loss of jobs associated with the decline.

Rural to Urban Population Shift. In 1950 about 42% of the population in the 13-parish region resided in urban areas compared to 55% statewide (table 11).[6] By 1960 the urban

[5]Between 1950 and 1960, the population in the 13-parish region advanced by 48%. This figure fell to 35.5% between 1960 and 1970, 25% between 1970 and 1980, and 1.2% between 1980 and 1990.

[6]Adding Orleans Parish, the proportion of the region’s population residing in urban areas in 1950 increased to more than 75%. This figure reflects the large population base of Orleans parish and the parish residents’ degree of urbanization (100%).

Table 11. Percent urban population in the BTES region by parish and state: 1950–1990.

Location	1950	1960	1970	1980	1990
Ascension	18.5	33.4	32.0	30.3	25.7
Assumption	0	0	0	14.3	13.6
Iberville	21.5	25.7	33.3	32.4	23.1
Jefferson	88.8	94.1	95.8	98.5	98.5
Lafourche	25.0	41.5	38.8	48.8	51.9
Plaquemines	0	34.5	28.3	58.3	82.6
Pointe Coupee	12.9	17.6	17.9	16.3	23.5
St. Charles	25.2	22.1	27.2	59.2	89.1
St. James	0	17.8	32.8	51.8	35.4
St. John	30.0	47.9	51.8	82.2	97.3
St. Mary	51.7	59.4	65.2	73.0	64.7
Terrebonne	37.7	52.1	52.6	70.8	76.1
West Baton Rouge	26.4	39.2	38.9	35.1	34.6
Total BTES Region[a] (excluding Orleans)	42.1	58.4	64.6	74.6	76.1
Orleans	100.0	100.0	99.7	99.9	99.9
Total BTES Region (including Orleans)	76.7	80.2	79.9	83.9	84.2
Louisiana	54.8	63.3	66.1	68.6	68.1
United States		70.0	73.6	73.7	75.2

[a]Includes the thirteen parishes identified in table

Sources: Maruggi 1992 and U.S. Bureau of the Census 1952a.

share in the region approached 60%, at which time the urban share in the region was only about 5 percentage points lower than that reported for the state.

Since 1980 the share of the population residing in an urban setting has exceeded that reported for the state. In 1990 the urban population within the region equaled 76%, compared to 68% for the state. The net effect has been that the region's urban population, excluding Orleans, grew from about 160,000 in 1950 to 740,000 in 1990, or by about 350%. The state's urban population during the same period expanded from about 1.5 million to 2.9 million, or slightly less than 100%.

Geographically, the greatest impact on urban growth in the region occurred in Jefferson Parish, primarily because of the sheer magnitude of this population, and secondarily because of the growth in its urban share. From 1950 to 1990, the urban population in Jefferson grew from 92,000 to 442,000. During this 40-year period, the urban population of Jefferson Parish consistently represented from 57% to 60% of the 13-parish region's urban population, which highlights the impact of Jefferson Parish on the region's level of urbanization. This impact is evident when Jefferson is excluded from region's totals. Evaluated on this basis, only 57% of the region's other inhabitants resided in urban areas in 1990, or about 20% less than when Jefferson Parish is included.

The largely rural parishes in the region were inland and primarily on the eastern side of the basin: Assumption (86% rural in 1990), Iberville (77%), Pointe Coupee (76%), Ascension (74%), West Baton Rouge (65%), and St. James (65%). In contrast, the highly urban parishes were located along the Mississippi River: St. John the Baptist (97% urban), St. Charles (89%), and Plaquemines (83%).The moderately urban parishes were on the coast: Terrebonne (76%), St. Mary (65%), and Lafourche (52%).

According to Gramling and Brabant (1984), two migration trends have been occurring with the U.S. population over the past century. First, a rural to urban migration has been evident since the Civil War. Second, following World War II and lasting through much of the 1970s, many of the more affluent middle class migrated from the central cities to the suburbs. Gramling and Brabant (1984) further stated that "(t)hese trends provide the background upon which more local population changes must be displayed."

Larson et al. (1980) suggested three primary reasons for increased urbanization in many of the estuarine system parishes under consideration. First, there was an exodus from New Orleans to the surrounding suburbs, such as those in Jefferson Parish, after World War II. The decline in Orleans Parish population since 1960 is given in table 10. Second, the shift from 1960 to 1970 reflected a movement from the farm or small fishing towns to small towns or cities on the urban fringe. Finally, rural-based industrial complexes, directly related to hydrocarbon exploration and development, were located in small, secondary service centers. Development of these industries resulted in out-migration from rural farm and swamp settlements. Larson et al. (1980) observed that there now exist "a number of secondary population centers that are relatively distant from primary service centers that serve their own market areas, as in the case of New Iberia and Thibodaux. These centers are significant because they serve as agglomeration points for public services and job opportunities."

Population Density, Land Habitability, and Land Loss. Population density can be defined as the ratio of population to a given land area. When defined as such, population density can be used as an economic indicator. If density is too low, for example, an insufficient labor force may exist for industrial development or expansion. As density increases, however, additional pressure is placed on a region's resources. While the relationship between population density and economic well-being is far from complete, all social sciences agree that there is no more fundamental relationship than between human and land (Jones and Rice 1972). Of particular importance in the analysis of population density in the region is the interplay of population size, urbanization, availability of habitable land, and land loss in the basin.

Population density. From 1950 to 1990 the population density in the 13-parish region (i.e., excluding Orleans Parish) increased from 52 to 142 inhabitants per square mile of land area (table 12).[7] While this increased population density primarily reflects an increasing population, land loss has also been a small contributing factor (table 13).[8]

Since 1960 the region's population density has exceeded that reported for the state, and the differential has increased through time. By 1990 there were 1.5 times more residents per square mile in the region (142 per square mile of land area) than in the state (97 per square mile of land area), and there were twice as many region inhabitants per square mile as in the United States (70 per square mile). This increasing differential in population densities reflects the higher population growth rate in the region (see table 10), most particularly in Jefferson Parish, as well as the land loss in the region (see table 13), which is high in relation to comparable statistics for the state.

Jefferson Parish, where almost 1,500 persons per square mile resided in 1990, is the most highly and densely populated parish in the 13-parish region. In contrast, only about 80 persons per square mile resided in the estuarine system parishes when Jefferson Parish is excluded from the analysis. This latter figure reflects the relatively rural character of the basin population that resides outside of Jefferson Parish as well as the vast marshlands.

While the more densely populated parishes in the region are located on the eastern side of the basin along the lower Mississippi River, the more sparsely populated parishes are located, for the most part, on the western side of the region along the Atchafalaya Basin Protection Levee. Low population densities are also characteristic of the region's coastal parishes; Plaquemines, for example, has exhibited the lowest density of just 30 residents per square mile of land area.

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[7]When Orleans Parish is included, population density equaled 126 per square mile in 1950 compared to 209 per square mile in 1990. The higher density exhibited when Orleans Parish is included reflects the large population base of Orleans Parish and the relatively small amount of land area.

[8]To some extent, the change in land area reflects an artifact of increased sophistication with measuring land area (see Footnote b of table 13).

Table 12. Population per square mile of land[a] in the BTES region by parish and state: 1950–1990.

Location	1950	1960	1970	1980	1990
Ascension	74.6	93.1	123.2	169.1	199.4
Assumption	48.4	50.4	55.2	64.6	67.1
Iberville	42.6	47.7	49.0	50.5	50.2
Jefferson	254.0	510.4	914.8	1310.1	1465.1
Lafourche	36.5	47.9	60.4	72.3	79.1
Plaquemines	14.5	22.9	24.5	35.2	30.3
Pointe Coupee	38.7	39.9	39.1	42.5	40.5
St. Charles	44.0	69.8	100.5	130.3	149.4
St. James	61.6	73.8	78.0	86.7	84.9
St. John	66.0	82.0	104.9	149.9	182.6
St. Mary	59.3	80.7	97.4	104.8	94.8
Terrebonne	31.1	43.7	55.6	69.1	77.3
West Baton Rouge	58.4	74.0	83.1	98.4	101.7
Total BTES Region[b] (excluding Orleans)	52.0 -----	77.0 (48.1)	104.5 (35.7)	131.8 (26.1)	141.9 (7.7)[c]
Orleans	2866.6	3153.4	3012.5	2801.6	2745.5
Total BTES Region (including Orleans)	125.9 -----	157.8 (25.3)	180.4 (14.3)	202.8 (12.4)	208.9 (3.0)
Louisiana	59.4	72.2	81.0	94.5	96.9

[a]The definition of land excludes open bodies of water which can be considerable in many of the BTES parishes.
[b]Includes thirteen parishes indicated in table.
[c]Numbers in parentheses represent the percentage rate of change between successive time periods.

Source: Maruggi 1994.

Table 13. Land area[a] in the BTES region by parish and state (mi^2): 1950–1990.

Location	1950	1960	1970	1980	1990[b]
Ascension	300	300	301	296	292
Assumption	357	357	356	342	339
Iberville	628	628	627	637	619
Jefferson	409	409	369	347	306
Lafourche	1,157	1,157	1,141	1,141	1,085
Plaquemines	984	984	1,030	1,035	845
Pointe Coupee	564	564	563	566	557
St. Charles	304	304	294	286	284
St. James	249	249	253	248	246
St. John	225	225	227	213	219
St. Mary	605	605	624	613	613
Terrebonne	1,391	1,391	1,368	1,367	1,255
W. Baton Rouge	201	200	203	194	191
Total BTES Region[c] (excluding Orleans)	7,374 -----	7,373 (0.0)	7,356 (-0.2)	7,285 (-1.0)	6,850 (-6.0)[d]
Orleans	199	199	197	199	181
Total BTES Region (including Orleans)	7,573 -----	7,572 (0.0)	7,553 (-0.2)	7,484 (-1.0)	7,031 (-6.0)
Louisiana	45,162	45,106	44,930	44,521	43,566

[a]Excludes open bodies of water.
[b]Some of the decline between 1980 and 1990 likely reflects changes in techniques used to calculate land area. Specifically, with the introduction of digitizing technology, lakes under 40 acres were no longer classified as land area as of 1990. Also, the U.S. Geological Survey used high water markings in determining land area in 1990 as opposed to low water markings used in previous censuses.
[c]Includes thirteen parishes indicated in table
[d]Numbers in parentheses represent the percentage rate of change between successive time periods.

Sources: Calhoun 1992 and Maruggi 1994.

Land habitability. According to Jones and Rice (1972), "[m]any of the problems attributed to excessive population are actually caused by uneven distribution."[9] An uneven distribution of a population can occur when the availability of habitable land is limited. A great portion of the basin in the region is occupied by water and marshlands. Much of it is probably uninhabitable for humans. In fact, many of the parishes in the region have a high water/marshlands to total area ratio and also have a high proportion of inhabitants residing in urban areas. These factors are important when examining population densities of the estuarine system parishes because the limited availability of habitable land and high urbanization could result in uneven distribution of the region's population and associated socioeconomic problems.

An examination of a 1968 study revealed that, in a majority of the parishes in the region, there was a high ratio of water/marshlands to total area (Louisiana Department of Public Works 1968). In Plaquemines Parish, for example, 36% of the total area has been characterized as water, while another 55% has been characterized as marshlands, much of it likely uninhabitable. Other parishes in the region with high water/marshland to total area include the following: Jefferson (36% water, 41% marshland), Lafourche (19% water, 45% marshland), St. Charles (32% water, 29% marshland), St. John the Baptist (44% water, 4% marshland), St. Mary (19% water, 38% marshland), and Terrebonne (28% water, 54% marshland). Today, a certain amount of the area in the basin that was characterized in the 1968 study as marshland is now likely to be characterized as open waters.

Problems associated with uneven population distributions may be operating in the region. Specifically, the lower the proportion of land suitable for habitation relative to total area, the more concentrated the population will be, and the more likely the population will be unevenly distributed. Because many of the above cited estuarine system parishes are likely to have limited availability of habitable land given the high water/marshland to total area ratios, it is likely the basin population is unevenly distributed. This inference is supported by the fact that, in general, a large majority of the parishes exhibiting high water/marshlands to total area ratios also exhibited high urbanization patterns. For example, more than 60% of the population in Plaquemines resided in three towns: Belle Chasse, Buras-Triumph, and Port Sulphur. Similarly, almost one-third of the population of Terrebonne resided in Houma.

Land loss. Land mass in Louisiana and the estuarine system region is not constant. Increasing amounts of land loss have been reported in the basin as well as the state, according to censuses data from 1950 to 1990 (table 13).

Over the 40-year period from 1950 to 1990, the land mass in the 13-parish region declined from an estimated 7,374 to 6,850 mi², representing a total reduction of 7%. This loss of 524 mi² represented one-third of the 1,596 mi² of land lost statewide over this 40-year period. Two-thirds of the land loss in the region occurred in three coastal parishes:

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[9]For example, the impacts of nonpoint pollution may be exacerbated if sources are concentrated in a small area. In such instances, they may collectively impact the environment before being assimilated therein.

Plaquemines (139 mi²), Terrebonne (136 mi²), and Lafourche (72 mi²). An additional 10% loss occurred in Jefferson Parish (103 mi²).

Land loss rates in the region and state have grown increasingly higher over the 40-year period from 1950 to 1990. For 30 years, the rates of land loss in the basin and state were less than 1% per decade. Between 1980 and 1990, however, the rate of land loss in the basin increased to 6%, three times higher than the 2% rate of loss reported for the state.[10] The land lost during this one decade, 1980-1990, accounted for the majority of the 40-year land losses in the basin and the state. For the estuarine system region, the loss of 436 mi² from 1980 to 1990 represented about 80% of the total land lost in the Barataria-Terrebonne estuarine system since 1950. In comparison, the 1980–1990 loss of 955 mi² statewide represented almost 60% of the total land lost in Louisiana since 1950.

Current Area Statistics. In 1990 the 13-parish region accounted for almost 16% of the 43,566 mi² in Louisiana and 23% of the state's 4.29 million population.[11] Of the 6,850 mi² of land in the region, almost one-half (47%) is located in the three easternmost coastal parishes in the estuarine system region: Terrebonne (1,255 mi²), Lafourche (1,085 mi²), and Plaquemines (845 mi²).

The westernmost coastal parish, St. Mary (613 mi²), and the western parishes along the Atchafalaya Basin Protection Levee—Assumption (339 mi²), Iberville (619 mi²), and Pointe Coupee (558 mi²)—accounted for 31% of the region's total land.

Located on the eastern side of the basin along the Mississippi River are several of the smallest parishes in the region. The three smallest parishes—West Baton Rouge (191 mi²), St. John the Baptist (219 mi²), and St. James (246 mi²)—accounted for only 10% of the total land area. Three other Mississippi River parishes—St. Charles (284 mi²), Ascension (292 mi²), and Jefferson (306 mi²)—represented about 13%.

Current Population Counts. Several geographical population patterns related to population size and density are observable in the Barataria-Terrebonne estuarine system (table 14). Located along the Mississippi River on the eastern side of the basin, Jefferson Parish is the region's most populated and most densely inhabited parish. In 1990 almost one-half of the region's population resided in Jefferson Parish, and 99% of this parish's inhabitants lived in an urban setting.[12] In comparison, only 57% of the 523,520 inhabitants in the other 12 parishes lived in urban settings.

Next in population size are the coastal parishes, which were also the region's largest in terms of land mass. Although their population densities were low, Terrebonne and

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[10]Some of the reported increased land loss may reflect changes in the method used to calculate land area (see Footnote b in table 13).

[11]When Orleans Parish is included in the analysis, the comparable population figure changes to 35%. Land area, however, remains essentially the same due to the small size of Orleans Parish.

[12]When Orleans is included, the population of Jefferson Parish as a percentage of the totals falls to 30.5%.

Table 14. Population and land area in the BTES region by parish and state: 1990.

BTES Parishes	Population #	Population %[b]	Land Area Sq. Miles	Land Area %[c]
Ascension	58,214	6.0	292	4.3
Assumption	22,753	2.3	339	4.9
Iberville	31,049	3.2	619	9.0
Jefferson	448,306	46.1	306	4.5
Lafourche	85,860	8.8	1085	15.8
Plaquemines	25,575	2.6	845	12.3
Pointe Coupee	22,540	2.3	557	8.1
St. Charles	42,437	4.4	284	4.1
St. James	20,879	2.1	246	3.6
St. John	39,996	4.1	219	3.2
St. Mary	58,086	6.0	613	8.9
Terrebonne	96,982	10.0	1255	18.3
West Baton Rouge	19,419	2.0	191	2.8
BTES region[a] (excluding Orleans)	971,826	100	6,852	100
Orleans	496,938	-----	181	-----
BTES region (including Orleans)	1,468,652	-----	7,030	-----
Louisiana	4,219,973	-----	43,566	-----

[a]Includes the thirteen parishes identified in table.
[b]Reflects percentage of population in the thirteen parish BTES region (i.e., including Orleans).
[c]Reflects the percentage of land area in the thirteen parish BTES region (i.e., excluding Orleans).

Sources: Calhoun 1992 and Maruggi 1994.

Lafourche parishes had the highest populations (96,982 and 85,860, respectively) in the region outside of Jefferson Parish. In several of the coastal parishes, the majority of the population resided in urban areas.

The inland parishes on the western side of the region along the Atchafalaya Basin Protection Levee were of average size in terms of land mass but were sparsely populated in terms of magnitude and density. These were the more rural parishes.

The eastern basin parishes along the Mississippi River north of Jefferson Parish were more densely populated than the western parishes and, for the most part, the coastal parishes. However, several of these Mississippi River parishes were some of the region's smallest in terms of land mass.

Two coastal parishes, St. Mary on the western side of the basin and Plaquemines on the eastern side, tended to set atypical patterns. For example, the population density of St. Mary Parish more closely resembled the high densities in the eastern parishes along the Mississippi River; in contrast, the population density of Plaquemines Parish, the lowest in the region, more closely resembled the inland western parishes.

According to 1990 census data, Jefferson Parish, with a population of 448,306 residents, accounted for almost one-half of the 971,826 population in the region (table 14). The majority of the population in Jefferson Parish lives on the East Bank, with Metairie (population 149,000) and Kenner (population 72,000) accounting for about one-half of the total. Occupying only 306 mi², or 4.5% of the total land area in the region (6,852 mi²), this lower Mississippi River parish had the region's highest population density, 1,466 per square mile. In comparison, the adjacent metropolitan parish of Orleans, with a 1990 population of 496,938, had twice the population density (2,752) and only one-sixth the land (181 mi²) of Jefferson.

Due west of Jefferson Parish and in the heart of the basin are the two largest parishes in the region, Terrebonne Parish (1,255 mi²) and Lafourche Parish (1,085 mi²). Together, Terrebonne and Lafourche represented 18.8% of the region's total population and 34.1% of the region's total land area. However, with low population densities of 77 and 79 per square mile, Terrebonne and Lafourche ranked tenth and ninth, respectively (table 12).

Low population densities prevailed in the three noncoastal parishes along the Atchafalaya Basin Protection Levee west/northwest of Terrebonne Parish: Point Coupee (40 per square mile), Iberville (50 per square mile), and Assumption (67 per square mile). With three of the region's four smallest populations, these inland western parishes accounted for only 7.8% of the region's total population: Pointe Coupee (22,540), Assumption (22,753), and Iberville (31,049). Yet, in terms of land mass, these parishes represented 22.0% of the total land in the region: Iberville (619 mi²), Pointe Coupee (557 mi²), and Assumption (339 mi²).

In contrast, the parish of St. Mary, which lies directly northwest of Terrebonne Parish, had the highest 1990 population density of the region's western and coastal parishes. This coastal parish, which lies predominantly west of the Atchafalaya Basin Protection Levee, ranked sixth population density (95 per square mile) and fifth in population size (58,086) and land area (613 mi²).

However, the region's least inhabited parish was Plaquemines Parish, with a population density of only 30 per square mile and a total population of 25,575 in 1990.

This easternmost coastal parish was the region's third largest in terms of land area (845 mi²), representing 12.3% of the region's total.

Excluding Jefferson Parish, the highest 1990 population densities per square mile in the basin were in four of the five Mississippi River parishes located on the eastern side of the region north of Jefferson Parish: Ascension Parish (200 per square mile), St. John the Baptist (188 per square mile), St. Charles (150 per square mile), West Baton Rouge (102 per square mile), and St. James (85 per square mile). Outside this five-parish area and Jefferson Parish, the only parish with a population that was as highly concentrated was St. Mary with a population density of 95 per square mile. Although the region's highest population concentrations were located in this five-parish Mississippi River area, only 18.6% of the region's total population and 18.0% of the region's total land area were in these five parishes. In fact, these parishes are also the region's five smallest land areas: West Baton Rouge (192 mi²), St. John (219 mi²), St. James (246 mi²), St. Charles (284 mi²), and Ascension (292 mi²). This five-parish area included the region's two smallest populations, West Baton Rouge (19,149 mi²) and St. James (20,879 mi²), as well as the fourth largest population, Ascension (58,214 mi²), and the sixth and seventh largest populations, St. Charles (42,437 mi²) and St. John (39,996 mi²).

Current Population Statistics within the Basin Boundaries. As noted earlier, published census data are generally not provided at a level of detail beyond the parish level. Hence, all discussion regarding population statistics to this point has been limited to the parish level, even though portions of several parishes extend beyond the basin boundaries. Associated with the 1990 census, unpublished data became available that permitted the estimation of various socioeconomic data within the basin boundaries. Analysis related to population is presented in this section.

As table 15 indicates, the estimated population within the basin boundaries equaled approximately 600,000 in 1990 (including Orleans Parish). Jefferson Parish represented almost one-third of the total (31.2%), followed by Terrebonne Parish (16.1%), Lafourche Parish (14.3%), and Orleans Parish (9.4%). Combined, these four parishes accounted for an estimated 71% of the 600,000 persons residing within the basin boundaries in 1990.

With a few exceptions, the proportion of parish population residing in an urban setting reflected that of the parish population within the basin boundaries (table 16). These exceptions included Ascension Parish, St. John Parish, and St. Mary Parish. With respect to Ascension Parish, only about one quarter of the total parish population resided in an urban setting. However, an estimated 70% of the parish population living within the basin boundaries resided in an urban setting. With respect to St. John Parish, more than 95% of the total population of the parish resided in an urban setting, yet less than three-quarters of the parish population living within the basin boundaries resided in an urban setting. Finally, about 65% of the population of St. Mary Parish lived in an urban setting compared to more than 80% of the parish's population that resided within the basin boundaries. Overall, about 74% of the basin's 600,000 inhabitants in 1990 resided in an urban setting (including Orleans). When Orleans is excluded from the analysis, the share fell to 71% or approximately five percentage points below the region’s 76% average.

Table 15. Estimated population within the BTES region by parish: 1990.

Parish	Parish Population	Population within Basin	% of Parish Population within Basin	% of Basin Population (Including Orleans)
Ascension	58,214	11,265	19.4	1.9
Assumption	22,753	22,753	100.0	3.8
Iberville	31,049	26,319	84.8	4.4
Jefferson	448,306	187,597	41.9	31.2
Lafourche	85,860	85,860	100.0	14.3
Plaquemines	25,575	23,211	90.8	3.9
Pointe Coupee	22,540	19,630	87.1	3.3
St. Charles	42,437	20,677	48.7	3.4
St. James	20,879	9,167	43.9	1.5
St. John	39,996	3,710	9.3	0.6
St. Mary	58,086	17,700	30.5	2.9
Terrebonne	96,982	96,982	100.0	16.1
W. Baton Rouge	19,419	19,419	100.0	3.2
Total BTES[a]	971,826	544,290	56.0	-----
Orleans	496,938	56,707	11.4	9.4
Total BTES[b]	1,468,764	600,997	40.9	100.0

[a]Total based on thirteen parishes identified earlier in table, excludes Olreans Parish
[b]The 1990 BTES populations of Iberia and St. Martin parishes were estimated at 135 and 1,086, respectively. Total includes Orleans Parish.

Source: U.S. Bureau of the Census 1992b.

Table 16. Estimated urban population within the BTES region by parish: 1990.

Parish	% Urban Population of Parish	% Urban Population Within Basin[a]
Ascension	25.7	70.6
Assumption	13.6	13.6
Iberville	23.1	27.3
Jefferson	98.5	96.4
Lafourche	51.9	51.9
Plaquemines	82.6	91.1
Pointe Coupee	23.5	27.0
St. Charles	89.1	82.9
St. James	35.4	37.8
St. John	97.3	72.3
St. Mary	64.7	82.1
Terrebonne	76.1	76.1
West Baton Rouge	34.6	34.6
Total BTES[a] (excluding Orleans)	76.1	71.2
Orleans	99.9	100.0
Total BTES (including Orleans)	82.4	73.9

[a]Reflects that proportion of population within the basin boundaries that resided in an urban setting.

Source: U.S. Bureau of the Census 1992b.

Approximately 72% of the total land area among the 13 parishes was estimated to lie within the basin boundaries in 1990, falling to approximately 70% when Orleans Parish is included (table 17). Less than one-half the land area of four parishes (excluding Orleans)—Ascension, Pointe Coupee, St. John, and St. Mary—was within the basin boundaries, while all of the land area of another four parishes—Assumption, Lafourche, Terrebonne, and West Baton Rouge—was contained within the basin boundaries. With a total estimated land area of 4,934 mi^2 in 1990, the basin accounted for about 11% of the state's total land area of 43,566 mi^2 (see table 13).

Overall, the average population density within the basin boundaries in 1990 (110 persons per square mile excluding Orleans) was only about 77% of the total population density among the 13 parishes included in the analysis (142 persons per square mile) and only 58% when Orleans is included (122 persons per square mile of land area compared to 209). The most notable differences in population densities were evident in Jefferson Parish (a population density of 1,465 persons per square mile of land area at the parish level compared to 732 within the basin boundaries), Plaquemines Parish (30 persons per square mile at parish level compared to 53 within basin), St. Charles (149 at parish level versus 95 within basin boundaries), St. John (183 at parish level versus 57 within basin), and St. Mary (95 persons per square mile of land area at the parish level versus 403 within the basin).

Income Characteristics

Per Capita Income. To facilitate analysis of the changes in the per capita income, the statistics below have been adjusted to real dollars by dividing the per capita incomes for 1989, 1979, 1969, and 1960 dollars by the 1990 Consumer Price Index (i.e., 1990 = 100). The result is real per capita income expressed in 1990 dollars.

Income trends, 1960 to 1989. In 1960 the real per capita income for the 13-parish region (i.e., excluding Orleans Parish) averaged $5,900 compared to the state average of $6,500 when adjusted to 1990 dollars (table 18). Expressed in 1960 dollars, the per capita incomes for the region and state were $1,300 and $1,500, respectively. Either way, the per capita income for the region was lower than that of the state in 1960. By 1989, however, the inverse was the case. Whereas the ratio of the region's real per capita income to state's real per capita income in 1960 was 0.91:1, the ratio in 1989 was 1.05:1, suggesting a strong relative gain during the 30-year period. The real per capita income more than doubled between 1960 and 1989 in all but three parishes: St. Mary ($5,600 to $9,200), Jefferson ($7,800 to $13,500), and Plaquemines ($5,800 to $10,000); its growth averaged just less than 100% among the combined 13 parishes. The percentage increase in real per capita income at the state level during the 1960–1989 period, by comparison, was less than 75%.

The trend in which the gain in per capita income was greater in the region than in the state peaked in 1979 with a ratio of 1.09:1. The average real per capita income in the

Table 17. Land area and population density within BTES region by parish: 1990.

			Persons Per Square Mile	
	Land Area Within Basin (mi^2)	% of Parish Land Area	Parish	Within Basin
Ascension	51.8	17.8	199	217
Assumption	338.7	100.0	67	67
Iberville	567.5	91.7	50	46
Jefferson	256.3	83.8	1,465	732
Lafourche	1,084.8	100.0	79	79
Plaquemines	438.4	51.9	30	53
Pointe Coupee	270.0	48.4	41	73
St. Charles	217.0	76.5	149	95
St. James	137.0	55.7	85	67
St. John	64.8	29.6	183	57
St. Mary	43.9	7.2	95	403
Terrebonne	1,255.1	100.0	77	77
W. Baton Rouge	191.2	100.0	102	102
Total BTES[a] (excluding Orleans)	4,916.5	71.8	142	110
Orleans	17.4	9.6	2,745	3,254
Total BTES (including Orleans)	4,933.9	70.2	209	122

[a]Includes the thirteen parishes identified in table.
Source: U.S. Bureau of the Census 1992b.

Table18. Per capita income in the BTES region: 1960–1989 (adjusted to 1990 dollars).

Location	1960	1969	1979	1989
Ascension	4,507	7,491	11,434	11,045
Assumption	3,758	5,754	9,314	8,511
Iberville	4,753	6,388	9,872	9,957
Jefferson	7,841	10,843	13,870	13,535
Lafourche	4,793	7,740	11,697	9,747
Plaquemines	5,771	8,359	10,564	10,011
Pointe Coupee	4,317	5,456	9,429	9,177
St. Charles	5,097	8,231	12,569	12,541
St. James	3,458	6,292	10,319	9,440
St. John	4,330	6,701	11,481	11,016
St. Mary	5,551	7,779	12,232	9,249
Terrebonne	4,921	7,765	12,204	10,016
West Baton Rouge	4,868	6,705	10,782	10,806
Average BTES[a] (excluding Orleans)	5,919	9,205	12,572	11,729
Orleans	-----	9,690	11,645	11,983
Average BTES (including Orleans)	-----	9,416	12,231	11,816
Louisiana	6,493	8,345	11,586	11,207

[a]Includes the thirteen parishes indicated in table.

Sources: U.S. Bureau of the Census 1962, 1972a, 1982a, and 1992a.

estuarine system region and the state declined from 1979 to 1989. The rate of decline was twice as great in the region (6.7%) as in the state (3.3%), and the decline was even more significant (10.7%) when Jefferson Parish is excluded from the calculations. The decline in real per capita income in the region, relative to the state during the 1980s, reflects the impact of the decline in the oil-and-gas sector in the early-to-mid 1980s, which had a particularly pronounced impact in the state's coastal region.

Almost every estuarine system parish experienced no growth or decline in real per capita income from 1979 to 1989, particularly in the basin parishes outside of Jefferson. Within the region, the largest decreases occurred in the coastal parishes: St. Mary ($12,200 to $9,200), Terrebonne ($12,200 to $10,000), and Lafourche ($11,700 to $9,700). The economies of these three coastal parishes depend highly on Outer Continental Shelf (OCS) oil- and gas-related activities, which dominate total state production. With the downturn in oil- and gas- related activities in the early-to-mid 1980s, the concomitant loss in income in these three parishes was particularly pronounced. St. James Parish ($10,300 to $9,400) and Assumption Parish ($9,300 to $8,500) also had sizeable decreases. Real per capita income growth for the decade was essentially stagnant in the remaining parishes.

Current income. In 1989 the real per capita income for the 13-parish region averaged $11,700 compared to the state average of $11,200 when adjusted to 1990 dollars[13] (table 18). Within the region, real per capita incomes varied from a low of $8,500 in Assumption Parish to a high of $13,500 in Jefferson Parish.

Although the region's average exceeded the state average in 1989, most parishes had real per capita incomes several hundred dollars or more below the state average. Only two parishes surpassed the state average: Jefferson ($13,500) and St. Charles ($12,500).[14] Both of these parishes are predominantly urban. Excluding Jefferson Parish, the real per capita income for the other basin parishes in 1989 was $10,200 or 10% less than the state average.

Low per capita incomes were characteristic of the region excluding Jefferson Parish. Three parishes along the Mississippi River had the region's next highest real per capita incomes, albeit 5% below the state average: Ascension ($11,000), St. John the Baptist ($11,000), and West Baton Rouge ($10,800). St. John the Baptist is overwhelmingly urban while Ascension and West Baton Rouge are primarily rural parishes adjacent to East Baton Rouge, a highly urbanized parish.

Seven parishes had real 1989 per capita incomes that were 10% below the state average. Three of these parishes had real per capita incomes of $10,000: Terrebonne, Plaquemines, and Iberville. Lafourche Parish had a real per capita income in 1989 of $9,700. The real per capita incomes in the remaining four parishes were at least 15%

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[13]When Orleans Parish is included in the analysis, real per capita income in the region fell approximately one-half thousand dollars to $11.2 thousand.

[14]The per capita income in Orleans Parish also exceeded the state average.

lower than the state average in 1989: Assumption ($8,500), Pointe Coupee ($9,200), St. Mary ($9,200), and St. James ($9,400).

Per capita income within the basin. As noted earlier, the estimated population within the basin boundaries equaled approximately 600,000 in 1990, when the section of Orleans within the designated boundaries is included in the total (see table 15). The 1989 per capita income among these basin inhabitants (adjusted to 1990 dollars) averaged $10,354 (and fell approximately $250 to $10,109 when the 57,000 residents of Orleans Parish within the basin boundaries were excluded). These numbers are significantly below comparable averages when all parish residents are included in the analysis (table 19). As indicated, the overall average per capita income of inhabitants within the basin boundaries was approximately 13% below the average per capita income given at the parish level ($10,354 compared to $11,816 when Orleans Parish is included). Furthermore, the average 1989 per capita income within the basin ($10,354 in 1990 dollars) was approximately eight percentage points below the average state per capita income of $11,207 (see table 18).

In Ascension, Jefferson, and St. John parishes, 1989 per capita income of the basin inhabitants was less than 80% of the parish average (table 19). Because of the large proportion of basin inhabitants represented by Jefferson Parish (31%), the relatively low per capita income of these residents ($10,642) as compared to the parish average ($13,535) tends to bring down the overall basin average by a considerable amount. Only St. Mary Parish exhibited an average per capita income within the basin ($10,258) in excess of 110% of the overall parish average ($9,249).

Poverty Status. Excluding Jefferson Parish, more than one-fourth of the families residing in the 13-parish region had incomes below the poverty level in 1959. Over one-half of the families had incomes below the poverty level in two parishes, Pointe Coupee (57.7%) and Assumption (53.4%), and from 40% to 50% of the families were below the poverty level in four other parishes: Ascension (41.4%), Iberville (48.8%), St. James (41.7%), and West Baton Rouge (40.1%). Excluding Jefferson Parish, there were only five parishes with less than one-third of the family incomes below the poverty level in 1959: St. Charles (27.0%), Plaquemines (27.2%), Terrebonne (27.8%), Lafourche (31.1%), and St. Mary (31.6%). About 15% of the families in Jefferson Parish reported income levels below the poverty level in 1959.

Over time, the percentage of families below the poverty level declined significantly in all of the parishes. Whereas in 1959 only Jefferson Parish achieved a family poverty ratio below 25%, by 1979 none of the parishes had 25% or more of the families in poverty status. The highest percentage of families below the official poverty level in 1979 was 23.1% in Pointe Coupee Parish, and the lowest was 7.8% in Jefferson Parish. The percentage of families living in poverty in 1979 exceeded 15% in only three other

Table 19. Estimated 1989 per capita income of population within BTES by parish (adjusted to 1990 dollars).

	Per Capita Income		
Location	Parish	Basin	Basin Income as % of Parish Income
Ascension	11,045	8,009	72.5
Assumption	8,511	8,511	100.0
Iberville	9,957	9,562	96.0
Jefferson	13,535	10,642	78.6
Lafourche	9,747	9,747	100.0
Plaquemines	10,011	10,196	101.9
Pointe Coupee	9,177	9,738	106.1
St. Charles	12,541	11,357	90.6
St. James	9,440	8,574	90.8
St. John	11,016	8,080	73.4
St. Mary	9,249	10,258	110.9
Terrebonne	10,016	10,016	100.0
W. Baton Rouge	10,806	10,806	100.0
Total BTES[a] (excluding Orleans)	11,729	10,109	86.2
Orleans	11,983	12,705	106.0
Total BTES[a] (including Orleans)	11,816	10,354	87.6

[a]Includes the thirteen parishes indicated in table.

Source: U.S. Bureau of the Census 1992b.

parishes: Assumption (17.7%), Iberville (18.7%), and West Baton Rouge (15.6%). It was below 11%, however, only in Jefferson Parish.

From 1979 to 1989 the percentage of families below the poverty level had increased in every parish and exceeded 20% in five parishes: Assumption (22.6%), Iberville (23.3%), Pointe Coupee (25.6%), St. Mary (22.4%), and Terrebonne (20.2%). The percentage of families below the poverty level between 1979 and 1989 increased by more than 50% in four parishes: Lafourche (11.0% to 19.0%), Plaquemines (12.2% to 18.7%), St. Mary (12.6% to 22.4%), and Terrebonne (11.4% to 20.2%).[15] The economies of each of these four parishes are highly tied to oil-and-gas production, including that in the Outer Continental Shelf (OCS). The sharp decline in real per capita income in each of these parishes has been previously identified (see table 18).

Labor Force.

Size of labor force. In 1990 about three-fifths (61.7%) of adults at least 16 years of age worked in the civilian labor force in the 13-parish region (i.e., excluding Orleans) as well as in the state (59.3%) according to census data. Two-thirds (65.8%) of the population 16 years and older in Jefferson Parish participated in the labor force, the maximum percentage among estuarine system parishes. At the low end of the spectrum, slightly more than half of all adults (53.2%) in Iberville and in Pointe Coupee belonged to the civilian labor force.

Excluding Jefferson Parish, 58.0% of the adults sixteen years and over that resided in the other parishes were in the labor force in 1990. In addition to Iberville and Pointe Coupee, those parishes which reported percentages of 58 or less were Assumption (54.5%), Lafourche (55.8%), Terrebonne (56.4%), St. James (56.7%), St. Mary (57.4%), and Plaquemines (58.3%). Four Mississippi River parishes in addition to Jefferson Parish had labor force percentages greater than the state average: St. Charles (63.7%), St. John the Baptist (63.4%), West Baton Rouge (62.6%), and Ascension (61.7%).[16]

Unemployment. Twenty percent of the state's unemployed civilian labor force, or 35,000 people, resided in the region (i.e., excluding Orleans Parish) in 1990. The unemployment rate for the civilian labor force in 1990 was 1.6% lower in the region

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[15]Within the BTES boundaries, percent ages of persons below the official poverty level in 1989 by parish were as follows: Ascension, 30.7%; Assumption, 24.8%; Iberville, 24.3%; Jefferson, 16.3%; Lafourche, 19.9%; Plaquemines, 17.7%; Pointe Coupee, 24.0%; St. Charles, 16.1%; St. James, 24.5; St. John, 30.1%; St. Mary, 21.2%; Terrebonne, 20.5%; West Baton Rouge, 17.1% and Orleans, 22.7%.

[16]Within the BTES boundaries, the percentages of adults at least sixteen years of age within the civilian labor force in 1990 by parish were as follows: Ascension, 53.5%; Assumption, 54.5%; Iberville, 56.8%; Jefferson, 63.5%; Lafourche, 55.8%; Plaquemines, 56.9%; Pointe Coupee, 54.2%, St. Charles, 59.6%; St. James, 56.7%; St. John, 46.0%; St. Mary, 58.9%; Terrebonne, 56.2%; West Baton Rouge, 62.6%; and Orleans, 56.1%.

(8.0%) than in the state (9.6%). The lowest civilian unemployment rate in the region was reported in Jefferson Parish (6.9%) and the highest in Pointe Coupee Parish (11.7%). Adjacent Orleans Parish had a civilian unemployment rate of 12.7% in 1990.

Excluding Jefferson Parish, the civilian unemployment rate in the other parishes in 1990 was 9.1%, only one-half percentage point less than that of the state. Next to Jefferson Parish, St. Charles had the second lowest civilian unemployment rate (7.3%). Civilian unemployment rates of about 8% percent for 1990 were reported in Lafourche (8.1%), Ascension (8.1%), and Terrebonne (8.2%), and an 8.6% unemployment rate occurred in St. John the Baptist.

Civilian unemployment rates higher than the state's unemployment rate occurred in St. Mary (11.1%), Iberville (10.8%), Assumption (10.8%), and Plaquemines (10.5%) as well as Pointe Coupee (10.5%). In St. Charles and West Baton Rouge parishes, the civilian unemployment rate in 1990 was 9.5%.

In 1950 the region's civilian unemployment rate was 5.2% compared to the statewide rate of 4.6%. While the region's unemployment rate was less than one percent greater than the state's rate in 1950, the region did not experience as great an increase in unemployment as statewide over the 40-year period. From 1950 to 1990 the region's civilian unemployment rate increased from 5.2% to 8.0%, while the state's rate more than doubled from 4.6% to 9.6%.

Within the region, the civilian unemployment problems in the parishes outside of Jefferson Parish were much like the state's, as reflected in the doubling in unemployment rates from 5.3% to 9.1% over the 40-year period. In 1950 the lowest civilian unemployment rates in the region occurred in West Baton Rouge (2.7%), Jefferson (4.1%), and St. Charles (4.3%). The region's highest civilian unemployment rates occurred in Ascension (7.0%), St. Mary (6.6%), and Pointe Coupee (6.3%).

During the 40-year period, the lowest civilian unemployment rates for the region and the state occurred in 1970. At that time, the rates for the region and the state were 4.5% and 5.4%, respectively. Within the region, the lowest civilian unemployment rates for 1970 were reported in Terrebonne (3.3%), Jefferson (3.7%), and Plaquemines (3.9%). The highest civilian unemployment rates in the region in 1970 occurred in Iberville (9.5%), Pointe Coupee (9.4%), and West Baton Rouge (8.0%).

By 1980 the civilian unemployment rate had advanced only marginally to 4.7% for the region and 6.0% statewide. By 1990, however, the region's civilian unemployment rate had increased substantially to an average of 8.0% largely because of the decline in hydrocarbon activities. Furthermore, use of decennial data obscures the fact that many of the parishes achieved high double-digit unemployment rates in the mid-1980s concomitant with the precipitous downturn in oil- and gas- related activities.

Government workers. Local, state, and federal government workers represented a smaller percentage of those employed in 1990 in the 13-parish region (13.9%) than in the state overall (17.9%). Within the region, the highest percentage of government workers was reported in Iberville (21.0%), Pointe Coupee (19.7%), West Baton Rouge (18.8%), Plaquemines (17.8%), and St. James (16.8%). The lowest percentage of government workers, 12.3%, occurred in St. Mary and St. John the Baptist. Jefferson Parish reported 13.1% compared to 20.5% in adjacent Orleans Parish. Excluding Jefferson, the percentage of local, state, and federal government workers in the other basin parishes (excluding Orleans) was 14.8% in 1990.

Demographic Characteristics

Race.

Current racial distributions. Populations in the region, in Louisiana, and in the United States differ distinctly in racial distribution (table 20). Across the United States, this distribution in 1990 was 80.3% white, 12.1% black, and 7.8% other races. Compared to the nation, Louisiana has a proportionately smaller white population of 67.3%, a proportionately larger black population of 30.8%, and a proportionately smaller "other" race population of 1.9%.

In the study area (i.e., excluding Orleans), racial distribution appears as a mixture of national and state patterns. Overall, the region contains a proportionately large white population of 74.5%, a sizeable black population of 22.3%, and an other-race population of 3.2%. The white population proportion closely resembles the national average; the black population proportion is smaller than the state average but larger than the national average; and the proportion of other races is smaller than the national average and somewhat larger than the state average. On closer examination, this blend of national and state patterns is the result of the confounding effect of a complex set of dichotomous patterns within the region. Inclusion of the dominant black population pattern in Orleans Parish substantially changes the racial configuration of the Orleans-estuarine system area.[17]

The dominant pattern is set by the magnitude of the white population in the region (table 20). The system parishes with the largest predominantly white populations in 1990 were Lafourche (84.3%), Jefferson (78.3%), Terrebonne (77.4%), Ascension (76.4%), St. Charles (74.6%), and Plaquemines (72.4%). There were also several parishes with proportionately large black populations: St. James (49.6%), Iberville (46.3%), Pointe Coupee (41.1%), St. John the Baptist (36.1%), and West Baton Rouge (36.0%). Nonetheless, the dominant white pattern in the region obscures this dichotomous pattern. Thus, while several parishes had sizeable black populations of between one-third and one-half, the black population for the region represented only 22.3% of the area's total

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[17]When Orleans Parish is included, the black population percentage advanced from 23.3% to 35.7% while that of the white population declined from 74.5% to 61.1% (see table 20).

Table 20. Racial distribution of population in the BTES region by parish: 1990.

Location	% Black	% White	% Other
Ascension	22.8	76.4	0.8
Assumption	32.3	67.1	0.6
Iberville	46.3	53.2	0.5
Jefferson	17.6	78.3	4.1
Lafourche	12.5	84.3	3.2
Plaquemines	23.2	72.4	4.4
Pointe Coupee	41.1	58.5	0.4
St. Charles	24.2	74.6	1.2
St. James	49.6	50.2	0.2
St. John	36.1	62.6	1.3
St. Mary	31.6	64.9	3.5
Terrebonne	16.5	77.4	6.1
West Baton Rouge	36.0	63.5	0.5
Total BTES Region (excluding Orleans)[a]	22.3	74.5	3.2
Orleans	61.9	34.9	3.2
Total BTES (including Orleans)	35.7	61.1	3.2
Louisiana	30.8	67.3	1.9
United States	12.1	80.3	7.6

[a]Includes the thirteen parishes identified in table.

Source: U.S. Bureau of the Census 1992a.

population and only 16.7% of the state's total black population. In contrast, 25.5% of the state's total white population resided in the estuarine system region.

Another relevant pattern is influenced by the magnitude of the black population in the region when combined with the black population in adjacent, metropolitan Orleans Parish. Unlike the racial distribution patterns of the state or country or other estuarine system parishes, Orleans Parish has a racial population distribution that is the inverse of the state pattern. In 1990 the black population in Orleans represented 61.9% of the parish's total population and 23.7% of the state's total black population. In addition to the large black population in Orleans Parish, proportionately large black populations as high as 49.6% exist in other parishes, as noted above. When the black population of the estuarine system parishes and Orleans Parish are considered together, a significantly large black pattern is recognizable, representing 35.7% of the area's total population and 40.3% of the state's total black population.

Racial distributions: 1950 to 1990. While Louisiana's population has grown from 2.7 million in 1950 to 4.2 million in 1990, there has been little change in the 2:1 ratio of the white and nonwhite populations in Louisiana. Growing much faster than the state, the population in the region grew 2.5 times from 383,049 in 1950 to 972,096 in 1990, and the ratio of white and nonwhite populations in the region changed from 2.3:1 to 3:1.

Overall, the statewide white populations of 1950 and 1990 represented similar proportions of the state population: 66.9% and 67.3%, respectively. However, in the estuarine system, the white population grew from 69.3% to 74.5% between 1950 and 1990. The difference in the statewide and estuarine system white population proportions was greatest in 1970, at which time these white populations peaked at 69.8% and 78.2%, respectively, before turning downward: 265,491 (1950); 420,097 (1960); 600,860 (1970); 747,143 (1980); and 723,791 (1990).

While there was only a two-percent decline in the black population proportion from 32.9% in 1950 to 30.8% in 1990, the estuarine system black population proportion declined eight percent—from 30.0% to 22.3%—between 1950 and 1990. The difference in the statewide and the estuarine system black population proportions was greatest in 1980 when these black populations reached the bottom of their downward trends at 29.4% and 18.3%, respectively, before turning upward: 114,923 (1950); 144,399 (1960); 162,261 (1970); 193,889 (1980); and 216,357 (1990).

Statewide, other-race populations have grown considerably from 4,405 in 1950 to 81,554 in 1990. Compared to 1950 when other races comprised less than 0.1% of the state's population, other races in 1990 represented 1.9% of the state's population, 39.2% of which resided in the region. Even greater has been the rate of growth of other-race populations in the region from 0.7% to 3.3% between 1950 and 1990: 2,635 (1950); 2,971 (1960); 4,862 (1970); 18,858 (1980); and 31,948 (1990).

Two important other-race groups that have impacted the region are the Native Americans and the Asians and Pacific Islanders. Over half of the state's Native American population and one-third of the state's Asian and Pacific Islander populations lived in the region in 1990. Numbering 3,587 in 1960, the state's Native Americans have grown considerably each decade: 5,294 (1970); 12,065 (1980); and 18,541 (1990). Likewise, the region has experienced an increasing growth of Native Americans: 2,524 (1960); 2,265 (1970); 6,422 (1980); and 10,354 (1990).

Even greater has been the rate of growth among the Asians and Pacific Islanders. Statewide growth among Asians and Pacific Islanders has been: 2,004 (1960); 3,712 (1970); 23,779 (1980); and 41,099 (1990). Correspondingly, the growth for these populations in the region has been: 366 (1960); 818 (1970); 7,273 (1980); and 13,547 (1990).

Current racial distribution within the basin. As identified in table 21, approximately 28% of the basin's 600,000 residents in 1990 (i.e., including Orleans Parish) were black, while 68% were white. In Ascension, St. James, and St. John parishes, the black population represented in excess of 50% of the total population within the basin boundaries. In contrast, the black population represented less than 20% of the total population within the basin boundaries in Lafourche, Plaquemines, and Terrebonne, which are coastal parishes.

Hispanic Origin, French Ancestry, Nativity, and Related Characteristics.

Hispanic origin. In 1990 only 2.2% (93,000) of Louisiana's inhabitants reported being of Hispanic origin compared to 9% nationally. A sizeable proportion, over one-third, of the state's Hispanic population lived in the 13-parish region (35,270) in 1990, and most of this Hispanic population resided in Jefferson Parish (26,611). Less than two percent of the population in the other basin parishes was of Hispanic origin.

French ancestry. In 1990 an estimated one million (almost 13%) of Louisiana's inhabitants reported being of Acadian, French (except Basque), or French Canadian ancestry. One of the last strongholds of this distinctive French heritage is in the Barataria-Terrebonne region. Over one-third of the state's Acadian, French (except Basque), and French Canadian populations resided in the region in 1990.

An estimated 368,000 inhabitants, about two-thirds of the population in the region, were of French ancestry in 1990: 14% Acadian, 20% French (except Basque), and 32% French Canadian. In comparison, the state's percentages were smaller: 5% Acadian, 7% French, and 1% French Canadian. Overall, one-third of the region's French peoples lived in Jefferson Parish and almost two-thirds lived in other parishes.

Within the region, these three French populations are unevenly distributed among the parishes. One-half (51%) of the region's French population (except Basque) resided in Jefferson Parish; however, most of the region's Acadians (82%) and French Canadians (72%) did not live in Jefferson Parish. Almost one-half of the region's Acadians and one-third of the region's French Canadians resided in Lafourche and Terrebonne parishes.

Table 21. Estimated racial distribution of population within the BTES region by parish: 1990.

	% Black		% White		% Other	
Location	Parish	Basin	Parish	Basin	Parish	Basin
Ascension	22.8	55.8	76.4	43.5	0.8	0.8
Assumption	32.3	32.4	67.1	67.4	0.6	0.2
Iberville	46.3	44.7	53.2	55.1	0.5	0.3
Jefferson	17.6	29.2	78.3	66.1	4.1	4.8
Lafourche	12.5	12.3	84.3	84.6	3.2	3.0
Plaquemines	23.2	19.5	72.4	76.1	4.4	4.4
Pointe Coupee	41.1	38.1	58.5	61.6	0.4	0.3
St. Charles	24.2	25.6	74.6	73.5	1.2	1.0
St. James	49.6	62.1	50.2	37.9	0.2	0.0
St. John	36.1	87.1	62.6	12.9	1.3	0.0
St. Mary	31.6	23.2	64.9	70.2	3.5	6.7
Terrebonne	16.5	16.4	77.4	77.7	6.1	5.9
W. Baton Rouge	36.0	36.0	63.5	63.8	0.5	0.2
Total BTES[a] (excluding Orleans)	22.3	26.4	74.5	70.0	3.2	3.6
Orleans	61.9	48.7	34.9	47.1	3.2	4.2
Total BTES (including Orleans)	35.7	28.5	61.1	67.8	3.2	3.7

[a]Includes the thirteen parishes identified in table.

Note: Some minor discrepancies exist between published data and unpublished data. For example, parish and basin numbers should be identical for Terrebonne Parish but differ slightly.

Source: U.S. Bureau of the Census 1992a.

Nativity. A distinctive characteristic of the population in the region as well as the state is the relatively low proportion of residents born out of state. Eighty-five percent of the 1990 inhabitants of the region were born in Louisiana compared to 81% of the state's population. Elsewhere in the United States, only 68% lived in the state in which they were born.

Jefferson Parish had a higher percentage of its population born out of state (20%) than any other parish in 1990. In the other basin parishes excluding Jefferson, the percentage was 10%. Coastal and western parishes in the region had a higher in-state population, and the Mississippi River parishes had a somewhat larger out-of-state population. The percentage of Louisiana-born residents in the region ranged from 81% in Plaquemines Parish to 98% in St. James Parish.

Foreign-births. Compared to the nation (8.0%), the foreign-born populations in Louisiana (2.1%) and the region (3.8%) were small. In 1990 the foreign-born populations in the region, the state, and the nation were: 32,196, 87,407, and 19.8 million, respectively. By far the largest foreign-born population in the region resided in Jefferson Parish (26,335). Over two-thirds of the foreign-born inhabitants that resided in Jefferson in 1990 entered the parish between 1970 and 1990. St. Mary Parish and Terrebonne Parish had relatively large foreign-born populations although proportionately these populations were small: 2% and 1%, respectively. In St. Mary 81% of the 1,164 foreign-born inhabitants entered between 1970 and 1990, and in Terrebonne 75% of the 910 foreign-born inhabitants entered between 1970 and 1990.

Foreign languages. About 12% of the estuarine system population spoke a foreign language at home in the region in 1990 compared to 10% of the Louisiana population and 14% of the national population (table 22). Nationally, the predominant foreign language spoken at home is Spanish; however, French is the predominant foreign language spoken at home in Louisiana and the region.

Compared to the nation's French-speaking populations, the size of Louisiana's French-speaking population is significant. While less than two percent of the nation's inhabitants lived in Louisiana in 1990, almost 14% or 262,000 of the nation's French-speaking people resided in the state.

About one-fourth of the state's French-speaking residents lived in the region in 1990. The distribution of the region's 68,000 French-speaking people is different from the distribution of the region's total population. Whereas the total estuarine system population was nearly equally divided between Jefferson Parish and the other basin parishes, only 18% (11,861) of the region's French-speaking population lived in Jefferson Parish. The other 82% (55,665) of the region's French-speaking people lived in the other basin parishes. Although the French-speaking population of Jefferson Parish was sizeable, it represented less than 3% the total population in Jefferson compared to the other basin parishes where 12% of the population was French-speaking.

Table 22. Percentage of population five years and older speaking languages other than English at home: 1990.

Language Spoken at Home	United States		Louisiana		BTES Region[a]	
	# (millions)	%	#	%	#	%
English Only	198.60	86.2	3,494,359	89.9	783,169	87.6
French	1.93	0.8	261,678	6.7	67,526	7.6
Spanish	17.35	7.5	72,173	1.9	26,477	3.0
German	1.55	0.7	8,588	0.2	1,635	0.2
Other	11.02	4.8	49,555	1.3	15,419	1.7

[a]Excludes Orleans Parish.

Source: U.S. Bureau of the Census 1992a.

The largest French-speaking populations in the region in 1990 were in the coastal parishes of Lafourche (20,123) and Terrebonne (14,527). One-half of the region's French-speaking population over four years of age lived in these two parishes. In Lafourche Parish 26% of the population was French-speaking and in Terrebonne Parish the percentage was 16%.

Another parish with a relatively large French-speaking population of 23% was Assumption; however, this population was small in size, 2,487, and represented only 7% of the region's total French-speaking population. Other sizeable French-speaking populations resided outside of the region in St. Martin (15,285) and Iberia (11,286) as well as Orleans Parish (7,550). In these parishes, French-speaking peoples represented 38%, 18%, and 1.6% of the parish populations, respectively.

Less than ten percent of the populations in the other basin parishes were French-speaking: Pointe Coupee (10%), St. James (9%), and St. Mary (7%), Iberville (5%), Ascension (5%), West Baton Rouge (5%), St. Charles (4%), and St. John (3%).

Compared to the state's French-speaking population, its Spanish-speaking population was one-fourth as large. Over one-third of the state's Spanish-speaking people lived in the region in 1990. Unlike the French-speaking population, the majority (80%) of the region's 26,000 Spanish-speaking peoples resided in Jefferson Parish (21,265).

***Other Demographic Characteristics*.**

Age distribution. For the most part, the median age of the estuarine system population—30.9 in 1990—resembled the median age in the state (31.0) and was two years younger than the median age for the nation, 32.9.

There was less than a four-year difference among the system parishes in the median age of the youngest population (28.8 in St. John the Baptist Parish) and the oldest population (32.2 in Jefferson Parish). Excluding Jefferson Parish, the median age for the other parishes overall was 29.7, or about one year younger than the state average.

When the median ages in the region and state are examined by sex, the median age of females was generally about two to two and one-half years older than the median age of males.

Families. Of the 1.1 million families residing in Louisiana in 1990, 23% or 257,093 lived in the region (i.e., excluding Orleans). The number of families in the region has almost tripled since 1950 (88,240) compared to the number statewide, which was short of doubling (648,410).

The largest growth occurred in Jefferson Parish where 46% (119,065) of the region's families resided in 1990 compared to 29% (25,960). In the basin parishes excluding Jefferson Parish, the number of families doubled from 62 ,000 to 138,000 in 1950 and 1990, respectively. The coastal parishes of Terrebonne and Lafourche experienced rather large growths in families from 1950 to 1990: 9,785 to 25,518 and 9,480 to 23,240, respectively.

Educational Characteristics

Educational Attainment. Educational characteristics of the populations in the region, in Louisiana, and in the United States differ distinctly. Overall, the educational attainment of the population in Louisiana is less than the average of that in the United States.

At the high-school level, only 68.3% of the Louisiana population 25 years of age and older were graduates in 1990 compared to the national average of 75.2%. Similarly, at the college level, only 16.1% of the Louisiana population 25 years of age and older had earned a baccalaureate or higher degree in 1990 compared to the national average of 20.3%.

As a region, the system's population excluding Jefferson Parish has lower levels of educational attainment than the state. In contrast, the population of Jefferson Parish, in which nearly half of the system's population resides, has attained a high-school educational level that matches the national average and a college educational level positioned between the state and national averages. The adjacent metropolitan population of Orleans Parish, which is about 10% larger than Jefferson, has a high-school educational level that is comparable to the state average and a college educational level that exceeds the national average.

High-School Graduates. The problem of undereducation in the region is evident in the second and third largest parishes, Terrebonne and Lafourche, which lie in the heart of the basin. In Terrebonne Parish, less than 60% of the population 25 years and older were high-school graduates in 1990, and only 56% of the residents of Lafourche Parish graduated from high school (table 23). In Assumption Parish, only one-half (50.4%) of the adult population 25 years and older had completed high school.

Table 23. Percentage of persons 25 years and older who graduated from high school: 1990.

Below State Average			Above State Average		
Parish	#	%	Parish	#	%
Assumption	6,629	50.4	Jefferson	215,082	76.0
Lafourche	27,945	56.2	St. Charles	18,827	74.0
Plaquemines	8,635	58.0	St. John	16,283	71.5
St. Mary	19,500	58.1	Ascension	22,917	68.5
Pointe Coupee	8,010	58.6	West Baton Rouge	7,639	66.0
Iberville	10,948	59.0			
Terrebonne	33,159	59.6			
St. James	7,344	61.1			

Source: U.S. Bureau of the Census 1992a.

Within the region, the lowest high-school completion rates occurred in the coastal and western parishes. Except for Plaquemines Parish, the highest high-school completion rates occurred in the parishes on the eastern side of the basin that the Mississippi River intersects. Of these parishes, the highest high-school completion rates were in Jefferson (76.0%), St. Charles (74.0%), and St. John the Baptist (71.5%). In adjacent Orleans Parish, the high-school completion rate was 68.1%, which was comparable to the state average.

When Jefferson Parish is excluded from the region, there is a higher undereducated population than the remainder of the state. Only 61.7% of the 1990 population 25 years and older in the parishes of the region, excluding Jefferson Parish, had completed their high-school education compared to the 68.3% statewide and 75.2% nationally. Even when the 76.0% high- school education rate for Jefferson Parish is included as part of the region, the percentage completing their high-school education remained below the state and national averages. Almost one-third (31.4%) of the entire region's adult population over 25 years did not complete high school.

Furthermore, the relative outcome of this analysis is not affected when persons older than 34 years are excluded. Regardless of the maximum age used to measure the high-school completion rate, the region continued to exhibit a greater undereducation problem than the rest of the state. Of the population 25 to 34 years of age, excluding Jefferson Parish, 72.8% completed high school compared to 78.9% statewide for 1990. Comparative statistics for Jefferson and Orleans parishes and the remainder of the state were 85.0%, 78.6%, and 70.2%, respectively.

Illiteracy. Illiteracy also is a problem for the region. One measure of low educational attainment, or "illiteracy," is the proportion of the adult population that has less than a fifth-grade education. By this definition, the statewide illiteracy rate for the state in 1990 was 4.5%.

Excluding Jefferson Parish, the region had an illiterate population proportionately larger than the state. In 1990 this rate was 6.3% for the region excluding Jefferson compared to illiteracy rates of 2.3%, 3.5%, and 4.7% for Jefferson Parish, Orleans Parish, and the remainder of the state, respectively (table 24).

High-School Dropouts. Another problem of undereducation is reflected in the population 16 to 19 years of age that was neither enrolled in nor graduated from high school. Overall, the "dropout" rate in the 13- parish region was higher than the dropout rates of 12.5% statewide and 13.1% in adjacent Orleans Parish.

In the analysis of dropout rates, however, there is a different relationship among the region’s parishes than occurred for high-school completion rates (table 25). Only one parish in the region, St. Charles (6.9%), had a significantly lower dropout rate than the state, while three other parishes had rates marginally lower than that of the state: Ascension (11.0%), Pointe Coupee (11.3%), and Iberville (12.3%).

Nine parishes including Jefferson Parish had higher dropout rates than the state average. The worst dropout rates in the region occurred in Assumption Parish (19.6%) and West Baton Rouge Parish (18.3%). In contrast, dropout rates in adjacent Orleans Parish (13.1%) and in the remainder of the state (12.1%) were also lower than the dropout rate in the region for 1990.

Given that the educational attainment levels of the adult population 25 five years and older in Jefferson Parish are above the state level and comparable to the national average,

Table 24. Percentage of persons 25 years and older with less than fifth-grade education: 1990.

Above State Average			Below State Average		
Parish	#	%	Parish	#	%
Assumption	1,321	10.0	Jefferson	6,530	2.3
Pointe Coupee	1,151	8.4	St. Charles	674	2.6
Lafourche	4,115	8.3	St. John	817	3.6
St. Mary	2,506	7.5	Ascension	1,237	3.7
Plaquemines	1,079	7.2			
Terrebonne	3,919	7.0			
Iberville	1,113	6.0			
St. James	692	5.8			
West Baton	609	5.3			

Source: U.S. Bureau of the Census 1992a.

Table 25. Percentage of persons 16 to 19 years neither enrolled in high school nor graduated from high school: 1990.

Below State Average			Above State Average		
Parish	#	%	Parish	#	%
Assumption	281	19.6	St. Charles	154	6.9
West Baton Rouge	217	18.3	Ascension	425	11.0
St. Mary	587	15.8	Pointe Coupee	141	11.3
Terrebonne	889	15.2	Iberville	238	12.3
Plaquemines	234	15.2			
Lafourche	816	14.5			
St. James	176	14.3			
St. John	300	13.4			
Jefferson	3,280	12.9			

Source: U.S. Bureau of the Census 1992a.

it could be expected that the "dropout" rate for the teenage population 16–19 years of age in Jefferson would be lower than the state average of 12.5%. Although Jefferson's school enrollment levels for this age cohort are comparable to the statewide enrollment levels, the "dropout" rate for Jefferson Parish (12.9%) in 1990 was one-half percent higher than statewide. This explains the nearly one-half percent difference in the "dropout" rate of 13.5% for the region when Jefferson Parish is included versus 13.9% for the region when Jefferson is excluded.

College Education. Despite the location of Nicholls State University in Thibodaux, 10% of the 1990 adult population over 25 in Terrebonne (9.4%) and Lafourche (10.0%) had a baccalaureate degree. This low college-education rate was one-half the national average and representative of the heart of the basin (table 26). Assumption Parish, which had the region's lowest high-school completion rate, also had the region's lowest baccalaureate completion rate (6.7%).

Table 26. Percentage of persons 25 years and older with bachelor's degrees: 1990.

Less Than BTES Average Excluding Jefferson < 9.7%			Greater Than BTES Average Excluding Jefferson > 9.7%		
Parish	#	%	Parish	#	%
Assumption	881	6.7	Jefferson	53,205	18.8
Plaquemines	1,117	7.5	St. Charles	3,765	14.8
St. James	974	8.1	St. John	2,596	11.4
St. Mary	2,786	8.3	Lafourche	4,972	10.0
Iberville	1,651	8.9	West Baton Rouge	1,146	9.9
Ascension	3,111	9.3			
Terrebonne	5,230	9.4			
Pointe Coupee	1,326	9.7			

Source: U.S. Bureau of the Census 1992a.

Except for Jefferson Parish, none of the parishes in the region had a college-educated population proportionately comparable to the state average. In 1990 only 9.7% of the adult population over 25 years in the region (excluding Jefferson) had completed four years of college compared to the state average of 16.1% and the national average of

20.3%. Jefferson Parish had the highest baccalaureate completion rate of 18.8%, followed by St. Charles Parish and St. Mary Parish with rates of 14.8% and 11.4%, respectively.

Educational Attainment Patterns, 1950 and 1990. Undereducation has been a problem for the region for the past four decades although the high-school completion rate has increased across the state and across the region (table 27). During that period, several population relationship shifts occurred between the region and the state as well as between the region and Jefferson Parish. The proportion of the population over 24 years that completed high school increased across the state as well as the region. In addition, the proportion of the statewide population 25 years and older that resided in the region declined from 26.6% of 1.2 million to 23.2% of 2.5 million. In contrast, the proportion of the region's population over 24 that resided in Jefferson Parish increased from 29.0% of 188,890 to 48.2% of 402,918. The net result was that by 1990 the gap between high-school completion rates statewide and regionwide decreased to less than six percent.

Table 27. Percentage of persons 25 years and older graduated from high school: 1950 and 1990.

Location	1950 %	1990 %	Location	1950 %	1990 %
BTES (excluding Jefferson)	13.5	61.7	Orleans	28.6	68.1
Jefferson	27.6	76.0	Other Parishes	25.9	68.2
Total BTES[a]	17.6	68.6	Statewide	25.4	68.3

[a]Defined as the thirteen parishes referenced earlier in chapter (i.e., excludes Orleans).

Sources: U.S. Bureau of the Census 1952a and 1992a.

Baccalaureate completion rates increased from 1950 to 1990 across the state as well as in the region (table 28). In 1950 only 3.5% of the Louisiana population and 3.3% of the region's population had completed a baccalaureate education compared to 1990 rates of 16.1% and 14.1%, respectively. Of the 6,140 college-educated population in the region, 45.2% resided in Jefferson Parish compared to 64.3% of the 82,760 college-educated region population in 1990.

Table 28. Percentage of persons 25 years and older with bachelor's or higher degrees: 1950 and 1990.

Location	1950 %	1990 %	Location	1950 %	1990 %
BTES (excluding Jefferson)	2.5	9.7	Orleans	6.1	22.4
Jefferson	5.1	18.8	Other Parishes	2.3	15.7
Total BTES[a]	3.3	14.1	Statewide	3.5	16.1

[a]Defined as the thirteen parishes referenced earlier in chapter (i.e., excludes Orleans).

Sources: U.S. Bureau of the Census 1952a and 1992a.

Education Attainment within BTES, 1990. When examined at the parish level, the percentage of population 25 years and over with high-school degrees in 1990 is often lower than that reported for the total population (25 years and over) of the respective parish (table 29). In Jefferson, for example, 76% of the total population in the parish 25 years or over had achieved a high-school degree compared to 68.4% of that portion of the population residing within the basin boundaries. The difference was even more apparent in St. John where 71.5% of the total parish population 25 years and over had attained a high-school degree in 1990 compared to only 51.8% of the parish's population within the basin boundaries. The percentage of parish residents within the basin boundaries with a high-school degree exceeded the overall parish average in only two of the fourteen parishes (including Orleans): Point Coupee and Orleans. Because Assumption Parish, Lafourche Parish, Terrebonne Parish, and West Baton Rouge Parish are all contained within the basin boundaries, high-school attainment levels within the basin are identical to those at the parish level.

The percentages of parish populations 25 years and over with a bachelor's degree within the basin boundaries are presented in table 30. With some exceptions, these findings follow those associated with a high-school degree (table 29). The most noticeable exceptions include St. James Parish and St. Mary Parish, where the percentage of population with a college degree within the basin boundaries exceeds the overall parish averages.

Table 29. Percentage of population 25 years and older with high school degrees in the BTES by parish: 1990.

Location	Parish Population (%)	Basin Population (%)
Ascension	68.5	60.0
Assumption	50.4	50.4
Iberville	59.0	58.5
Jefferson	76.0	68.4
Lafourche	56.2	56.2
Plaquemines	58.0	57.8
Pointe Coupee	58.6	60.6
St. Charles	74.0	69.9
St. James	61.1	58.2
St. John	71.5	51.8
St. Mary	58.1	57.9
Terrebonne	59.6	59.6
W. Baton Rouge	66.0	66.0
Orleans	68.1	74.5

Source: U.S. Bureau of the Census 1992c.

Table 30. Percentage of population 25 years and older with bachelor's degrees in the BTES by parish: 1990.

Location	Parish Population (%)	Basin Population (%)
Ascension	9.3	9.1
Assumption	6.7	6.7
Iberville	8.9	8.7
Jefferson	18.8	11.2
Lafourche	10.0	10.0
Plaquemines	7.5	7.3
Pointe Coupee	9.7	10.2
St. Charles	14.8	11.6
St. James	8.1	10.0
St. John	11.4	7.6
St. Mary	8.3	11.1
Terrebonne	9.4	9.4
W. Baton Rouge	9.9	9.9
Orleans	22.4	23.7

Source: U.S. Bureau of the Census 1992c.

Housing Characteristics

Detailed housing characteristics have been collected by the U.S. Bureau of the Census since 1940. To facilitate this analysis, select housing statistics were aggregated to produce consistent comparable data sets for the time period 1940–1990. Total units by occupancy status were aggregated into three major categories: occupied, seasonal (including migratory and held for occasional use), and other vacant units. Occupied units were further delineated as owner occupied or renter occupied. Water source data were aggregated to the three major categories of public or private system, individual well, and other. Sewage disposal also was aggregated to three consistent categories: public sewerage, septic tank or cesspool, and other sewage disposal. Additionally, parish-level water source and sewage disposal data were unavailable until the 1970 census.

Total Housing Units. Overall, the region and the state as a whole experienced increases in the total number of housing units for each 10-year period between 1940 and 1990. Between 1940 and 1980 the region was growing significantly faster than the state as a whole, with average ten- year growth rates of 44% and 26%, respectively. This rise was primarily due to the rapid growth of Jefferson Parish.

While the magnitude of growth in total housing units did vary somewhat for individual region parishes between 1940 and 1990, the magnitude of the growth rates for Jefferson Parish were significantly higher than the growth rates for the remainder of the region. Between 1940 and 1950, Jefferson experienced a 127% increase in the number of total housing units compared to a 26% increase for the state and a 36% increase for the region as a whole. While this growth rate slowed after 1950, the rate of increase in housing units for Jefferson Parish continued to be significantly faster than that in the remainder of the parishes throughout 1970.

During the 1970–1980 time period, all of the region's parishes experienced significant increases in housing growth rates, with St. Charles and St. John the Baptist joining Jefferson Parish with rates over 50%. The region experienced a 50% increase whereas the state's housing growth rate increased 35% during this decade.

While each parish in the region experienced significant growth during the 1970–1980 time period, certain parishes differed in the time frame for their maximum percentage growth in total housing units. The metropolitan parish of Jefferson and the adjacent metropolitan parish of Orleans experienced their greatest percentage increases between 1940 and 1950. Plaquemines, St. Charles, and St. Mary experienced their greatest percentage increase one decade later, between 1950 and 1960.

Between 1980 and 1990 the percentage increase in total housing units for the state (11%), the region (13%), and each individual region parish slowed dramatically from the growth spurts of the 1970s. The fastest growing parishes in the region during the 1980s were St. Charles (39%), St. John the Baptist (36%), and Ascension (27%). Growth rates in these parishes well outpaced those of the state and the region. The slowest growing parishes were St. Mary (2%), Iberville (3%), and St. James (7%). Plaquemines Parish experienced a slight decrease in total housing units during this 10-year period.

Occupancy. From 1940 to 1990 the percentage of total occupied housing units in the state averaged 92% with a high of 95% in 1940 and a low of 89% in 1990. The percentage of total housing units in the region that were occupied during this time period has remained within 2% of the occupancy rate for the state, although state occupancy rate was slightly higher between 1940 and 1960 while the region's rate was slightly higher from 1970 to 1990.

Owner occupancy rates in the region have shown a steady increase from 44% in 1940 to 70% in 1990. While owner occupancy rates for the region were on average 5% higher than state rates, the state followed a similar pattern of increase in percentage of owner occupancy from 37% in 1940 to 66% in 1990.

The number of persons per occupied housing unit has shown a slight but steady decrease from 1960 to 1990 for both the state and the region as a whole (table 31). By 1990 the higher rate of decline in unit occupancy in the region almost converged with the slower rate of decline statewide.

Table 31. Persons per occupied housing unit: 1940–1990.

Location	1940	1950	1960	1970	1980	1990
BTES Region	4.2	3.4	4.0	3.7	3.1	2.8
Louisiana	4.0	3.2	3.5	3.4	2.9	2.7

Sources: U.S. Bureau of the Census 1943, 1953, 1961a, 1972b, 1983, and 1993.

Water Source. Since the 1970 census, the region has reported 94%–96% of housing units receiving water supplied by a public or private water system. These data average 9% higher than the state usage of public or private systems, which ranged from 82% in 1970 to 89% in 1990. The difference is reflective of a higher percentage of individual-well usage for the state than for the region. The overall trend for both the state and the region is toward private and public system water sources.

While the water-source usage rates for the majority of individual region parishes followed the regional trend of at least 95% of units utilizing public or private systems by 1990, two parishes were significantly below this norm: Ascension at 53% and Pointe Coupee at 88%. Both of these parishes had higher utilization of individual wells (table 32).

Sewage Disposal. From 1970 to 1990 the trend in sewage disposal has been moving toward the use of public sewerage systems for the state and the region. The percent usage of public systems for the region (69% in 1970 and 76 % in 1990) is only slightly higher than the statewide usage (68% in 1970 and 73% in 1990), with the state having a slightly higher rate of septic tank or cesspool usage.

Sewage disposal methods showed greater variation among individual region parishes. By 1990 Assumption Parish had the lowest percent utilization (12%) of public sewerage

Table 32. Source of water and sewage disposal: 1990.

Location	Source of Water			Sewage Disposal		
	Public System or Private Company	Individual Well	Other Source	Public Sewer	Septic Tank or Cesspool	Other
Ascension	52.8%	47.1%	0.1%	40.9%	56.4%	2.7%
Assumption	98.4%	1.1%	0.5%	11.6%	84.7%	3.7%
Iberville	94.2%	5.6%	0.2%	47.0%	50.4%	2.5%
Jefferson	99.9%	0.0%	0.1%	97.3%	2.5%	0.2%
Lafourche	99.7%	0.0%	0.3%	31.9%	64.4%	3.7%
Plaquemines	97.7%	0.4%	1.9%	81.2%	17.8%	1.0%
Pointe Coupee	87.5%	12.0%	0.5%	37.5%	59.9%	2.6%
St. Charles	99.5%	0.2%	0.3%	92.1%	6.9%	1.1%
St. James	99.2%	0.4%	0.3%	40.0%	57.7%	2.3%
St. John	97.7%	1.7%	0.6%	81.0%	18.1%	0.9%
St. Mary	96.5%	2.4%	1.1%	83.6%	15.1%	1.3%
Terrebonne	99.9%	0.1%	0.1%	60.5%	37.1%	2.4%
W. Baton Rouge	97.8%	2.0%	0.2%	56.0%	42.5%	1.5%
Total BTES	96.3%	3.4%	0.3%	76.4%	22.3%	1.3%
Louisiana	89.0%	10.7%	0.3%	72.6%	25.8%	1.6%
Orleans	99.4%	0.5%	0.1%	98.3%	0.8%	0.8%

Source: U.S. Bureau of the Census 1993.

system with 84% of the parish using septic tanks or cesspools. Ascension, Iberville, Lafourche, and Pointe Coupee parishes all had less than 50% utilization of public systems and over 50% utilization of septic tanks or cesspools (table 32).

Business Establishment Characteristics

Business establishment characteristics in the region[18] were analyzed using various issues of "County Business Patterns." The data included in each report are limited to types of employment covered by the Federal Insurance Contribution Act. Hence, certain employee groups and types of establishments are excluded (e.g., self-employed persons, agricultural production workers, and most government employees). In terms of definitions, an establishment is defined as a simple physical location at which business is conducted or where services or industrial operations are performed. Annual payroll includes all forms of compensation (e.g., salaries, wages, commissions, bonuses, etc.). While certain differential changes have occurred through time with respect to the data reported in this publication, the change was at a level of detail that would only minimally impact the analysis presented below.

Employment. Based on "County Business Patterns," employment in the 13-parish region advanced from 115,000 workers in 1965 to almost 315,000 workers in 1990 (table 33). Essentially all of the employment growth, however, occurred before 1980. Hence, the 1980–1990 period can be characterized as one of stagnant job creation. This trend was also exhibited in the overall population (see table 33). Between 1970 and 1980, by comparison, employment expanded by almost 40%. Population in the region advanced by 25% during the same period. The differential between job growth and population growth during the 1970s can be attributed to an increasing proportion of region residents aged 16 and over entering the work force (census data).

The employment data in table 33 capture several relevant features. First, three sectors —manufacturing (16.1%), retail trade (23.8%), and services[19] (25.5%)— dominated the 1990 employment in the region, representing more than two-thirds of the total. These figures are compatible with those reported for the state: manufacturing (13.9%), retail trade (22.7%), and services (30.0%).

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[18]All information concerning business establishment characteristics excludes Orleans Parish with the exception of the last section, wherein Orleans Parish is treated separately.

[19]Services include a wide range of activities: hotels and other lodging places, personal services (e.g., laundry services and beauty shops), business service (e.g., advertising, credit reporting, and collection), auto repairs and services, other repair services, health services (e.g., offices and clinics of medical doctors), etc.

Table 33 Employment by business sector in the thirteen-parish region[a] for various years, 1965–1990.

Employees/Establishments	Year					
	1965	1970	1975	1980	1985	1990
Total # of Employees (1,000's)[b]	114.9	159.3	221.2	313.0	313.0	314.4
Percent of Employees in:						
Agricultural Services	-----	-----	< 1.0	< 1.0	< 1.0	< 1.0
Mining	14.9	12.2	9.9	6.2	4.6	3.6
Contract Construction	13.8	11.5	10.3	11.2	8.4	6.7
Manufacturing	23.8	23.3	20.9	18.9	15.8	16.1
Transportation/Utilities	9.1	9.2	10.0	12.3	11.1	10.1
Wholesale Trade	6.3	6.3	7.8	8.6	8.9	8.2
Retail Trade	19.1	19.5	18.9	20.6	22.0	23.8
Finance/Insurance/Real Estate	2.7	2.8	3.8	4.2	5.7	5.7
Services	9.0	12.5	14.3	16.9	21.2	25.5
Unclassified	-----	-----	1.1	1.0	1.1	< 1.0

Table 33 Continued Employees/Establishments	1965	1970	1975	1980	1985	1990
Total # of Establishments	8,772	10,079	14,646	17,619	22,396	21,247
Percent of Establishments In:						
Agricultural Services	3.3	2.3	2.4	< 1.0	< 1.0	1.0
Mining	3.8	3.4	2.6	2.1	2.0	1.7
Contract Construction	10.2	9.9	*	9.8	8.4	7.4
Manufacturing	5.7	5.7	4.8	4.5	4.0	4.3
Transportation	9.4	9.3	8.2	8.2	6.9	6.4
Wholesale Trade	7.9	8.5	9.6	10.0	9.5	9.5
Retail Trade	31.8	30.2	26.9	25.7	25.5	25.5
Finance/Insurance/Real Estate	5.9	6.4	6.4	9.0	7.9	8.5
Services	20.2	22.4	*	21.6	27.9	32.1
Unclassified	2.1	1.9	*	8.6	7.9	3.1

[a]Note: All information in table excludes Orleans Parish.
[b]In some isolated instances, employment in a given sector could not be presented for specific parishes due to confidentiality of data. A range was presented in these instances beginning with the 1975 data. The midpoint of this range was used in estimating employment by sector in these cases.

Source: U.S. Bureau of the Census 1967, 1971a, 1977a, 1982b, 1987a, and 1992d.

A second relevant feature reflected in the data concerns the substantial decline in the percentage of workers employed in the mining sector. In 1965 almost 15% of total employment in the region was mining based. By 1990 the share had fallen to less than four percent. The state's share of employment in the mining sector, which equaled 6.6% in 1965, fell to 4.4% in 1990. The other sector in the region experiencing a large reduction in the percentage of workers employed is that of contract construction. A decline in the manufacturing share of employment, while apparent in the data, was more moderate than in either mining or contract construction.

Growth areas in the region, in terms of percentage of employees, were the finance/insurance/real estate sector (historically a relatively minor sector) and the services sector. Percentage of the total region workers employed in the service sector more than doubled between 1965 and 1990, and the percentage of them employed in the finance/insurance/real estate sector more than doubled. Growth in retail trade, measured in terms of percentage of total employees, also expanded but to a lesser degree.

Jefferson Parish, because of its large population base, tended to dominate employment in many of the previously mentioned sectors. There were notable exceptions, however. With almost 175,000 employees in 1990, Jefferson accounted for 55% of the private work force. Less than 15% of the mining jobs, however, were based there. Terrebonne Parish accounted for 34% of employment in the mining sector despite representing only 9.5% of total private employment in the region. Similarly, while Plaquemines Parish represented less than four percent of total employment in the region, its share of the region's mining employment approached 15%. Finally, St. Mary Parish accounted for 13% of the total region employment in mining while accounting for only 6.3% of the region's total employment (see table 34 for business sector employment by parish).

With respect to manufacturing, Jefferson Parish accounted for 36% of the total employment in the sector in 1990 (compared to the 55% overall region employment). Ascension Parish, while accounting for only 5.2% of the total 1990 region employment, accounted for 10.5% of the total manufacturing employment. Other parishes revealing high relative employment in the manufacturing sector included: Iberville (9.0% in manufacturing compared to only 3.0% of the region employment base), St. Charles (8.7% versus 4.3%), St. James (5.2% versus 1.7%), and St. John the Baptist (4.8% versus 2.6%). Terrebonne Parish, while providing a base for 9.5% of the total employment in the region in 1990, accounted for only 5.7% of the total manufacturing jobs.

With a few notable exceptions, relative employment in the retail trade and service sectors, by parish, reflected that parish's contribution to total employment in the region. Specifically, Jefferson Parish relative employment data in the retail trade sector (61.9%) and services sector (65.8%) were well above the parish's overall employment share in the region, not unexpected results given its degree of urbanization. To compensate for the differential reported in Jefferson Parish, most other parishes in the region had relative employment in these two sectors slightly below their overall employment contribution to the region.

Table 34. Employment by business sector in the region, by parish: 1990.

Location	Agricultural Services	Mining	Contract Construction	Manufacturing	Transportation and Other Public Utilities	Wholesale Trade	Retail Trade	Fiance, Insurance, and Real Estate	Services	Unclassified
	Business Sector									
	No. of Employees									
Ascension	60	175	2,115	5,317	1,195	602	3.579	652	2,869	22
Assumption	-----	10	411	411	138	240	596	133	397	10
Iberville	20	156	532	4,535	710	251	1.483	277	1,394	21
Jefferson	573	1,665	9.787	18,302	13,750	16,489	46,209	12,343	54,055	405
Lafourche	89	285	773	1,764	4,028	889	3,880	942	3,114	87
Plaquemines	50	1,618	1,515	2.224	1,677	787	1,565	361	2,005	22
Pointe Coupee	7	44	64	152	108	166	788	179	653	6
Sl. Charles	22	60	753	4.408	1,948	1,191	1,763	215	31 10	10
St James	10	60	175	2,625	506	235	677	267	681	10
Sl. John	60	60	323	2,449	579	569	1,861	469	1,885	10
St Mary	51	1.500	1,614	4,120	3,583	1,263	3,490	690	3,510	30
Terrebonnc	127	3,917	1,714	2,879	2,553	2,720	8,054	1,333	6.462	71
W. Uaton Rouge	103	1,819	1.419	1,419	914	399	768	88	10	766

In some isolated instances, employment in a given sector could not be presented for specific parishes due to confidentiality of data. A range was presented in these instances. The midpoint of this range was uxd in estimating of

Number and Size of Establishments. As with employment, the number of business establishments in the region increased significantly during the 1965–1990 interval (table 33). The number of employees per establishment ranged from a low of 13.1 in 1965 to a high of 17.8 in 1980 and equaled 14.8 in 1990. More than one-half of the total number of business establishments in the region have traditionally been engaged in either retail trade (25.5% in 1990) or services (32.1% in 1990).

Among major business sectors, manufacturing has traditionally employed the highest number of workers per establishment (55 in 1965 and 1990). Employment per establishment data in the wholesale trade sector (12.7 in 1990), retail sector (13.8 in 1990), and finance/insurance/real estate sector (10.0 in 1990) were, by comparison, considerably lower.

Annual Payroll. The 1990 annual payroll (before taxes and deductions for social security, etc.) in the region's private sector was estimated to equal approximately $6.6 billion in 1990, an increase of 23% (in real terms) over that reported in 1975 (table 35). The manufacturing and service sectors accounted for just under 50% of the total annual payroll in 1990 compared to less than 40% in 1975. The annual payroll in the service sector more than doubled between 1975 and 1990 due to an increase in number of employees. The real annual payroll per employee in the sector fell almost 10% during the period of analysis.

In general, the annual payroll per employee in the manufacturing sector is relatively high vis-a-vis other sectors. In contrast, the annual payroll per employee in the services sector is relatively low. Relative employment in the manufacturing sector declined sharply during the period of analysis (16.1% in 1990 compared to 23.8% in 1965), while relative employment in the services sector advanced sharply (25.5% in 1990 compared to 9.0% in 1965). Similarly, annual payroll per employee in the retail trade sector is relatively low although this sector has accounted for much of the employment growth since 1965. It should be noted, however, that the relatively low payroll per employee in the retail trade sector in 1990 may to some extent reflect the part-time nature of that employment sector.

Business Establishment Characteristics Specific to Orleans Parish. As noted earlier, the large population base of Orleans Parish, largely outside the basin boundaries, could potentially distort relevant findings. This risk may be particularly strong in the context of business establishment characteristics. However, the Orleans Parish area likely serves as an important employment source for many of the region's residents who commute to that parish for work. Hence, a brief discussion related to business establishment characteristics specific to Orleans Parish is presented below.

Table 35. Annual payroll and payroll per employee in the region by business sector: 1975 and 1990.

Sector	1975[a]		1990	
	Annual Payroll ($ Mill.)	Per Employee ($)	Annual Payroll ($ Mill.)	Per Employee ($)
Agricultural Services[b]	20.9	22,915	14.0	13,477
Mining[c]	698.8	32,373	258.2	23,335
Contract Construction[d]	558.5	24,565	482.2	22,942
Manufacturing	1,416.5	30,624	1,592.9	31,478
Transportation/Utilities[e]	568.0	25,663	830.9	26,220
Wholesale Trade	482.5	27,930	653.8	25,341
Retail Trade	667.5	15,949	821.3	10,993
Financial/Insurance/Real Estate	291.7	34,801	389.9	21,723
Services	638.1	20,101	1,510.4	18,397
Unclassified[f]	11.4	5,871	10.6	16,003
Total[g]	5,352.9	-----	6,564	-----

[a]Converted to 1990 dollars based on the 1990 Consumer Price Index.
[b]Excludes Ascension Parish, St. James Parish, and St. John the Baptist Parish in 1990 due to confidentiality of data. Ascension Parish, Assumption Parish, Iberville Parish, Plaquemines Parish, Pointe Coupee Parish, St. Charles Parish, and St. John the Baptist Parish were excluded in 1975 due to confidentiality of data.
[c]Excludes Ascension Parish, Assumption Parish, St. Charles Parish, St. James Parish, St. John the Baptist Parish, and West Baton Rouge Parish in 1990. Assumption Parish and St. James Parish were excluded in 1975.
[d]St. James Parish was excluded in 1990.
[e]Assumption Parish was excluded in 1975.
[f]Several Parishes were excluded in both 1990 and 1975.
[g]Totals for 1975 and 1990 are slightly underestimated due to exclusion of certain parishes in the calculation of annual payrolls by sector. When annual payroll was excluded for a given parish, the number of employees was also excluded for purposes of calculating per employee figures.

Sources: U.S. Bureau of the Census 1977a and 1992c.

Based on “County Business Patterns,” employment in Orleans Parish equaled 204,000 workers in 1990. This represents about a 15% reduction from the 237,000 workers reported in 1980 and a five percent reduction from the 214,000 reported in 1965.

Forty-three percent of the 204,000 Orleans Parish workers in 1990 were employed in the services sector while another 20% were employed in the retail trade sector. Other important business sectors included transportation and other public utilities (10%), finance/insurance/real estate (8%), manufacturing (7.8%), wholesale trade (4.5%), mining (3.3%), and contract construction (3.0%).

In many sectors, these percentages differ significantly from those reported in 1965. For example, manufacturing accounted for 32.3% of the total 214,000 jobs in Orleans Parish in 1965. Jobs in the services sector, by comparison, accounted for only 20.3% of the total employment base in 1965 compared to 43% in 1990. Other significant business sectors in terms of employment in 1965 included retail trade (17.6%), transportation and other public utilities (14.5%), wholesale trade (10.2%), and contract construction (7.9%). The mining sector accounted for less than three percent of employment.

The 1990 annual payroll (before taxes and deductions for social security, etc.) in Orleans Parish private sector was estimated to equal $4.36 billion, or approximately $21,400 per employee. While accounting for 43% of total employment in Orleans Parish (private sector) in 1990, the services sector represented only 38.6% of the total payroll ($19,200 per employee). The retail trade sector represented another 10.4% of the total annual payroll ($11,100 per employee). Though the transportation and public utilities sector accounted for only about 10% of employment in Orleans Parish in 1990, it accounted for about 14% of the total annual payroll due to a relatively high average compensation per employee ($28,700). This compensation figure was comparable to that reported in manufacturing ($28,200), which accounted for 10.3% of the annual payroll.

Resources

Renewable Resources

The Louisiana Coastal Zone is a fertile habitat for fish and wildlife as well as a base for major commercial shellfish and finfish industries. It also attracts many outdoor enthusiasts in pursuit of recreational activities.

The density of population on the coastal zone, along with major manufacturing and extractive industries, transportation networks, etc., negatively impact the environment through crowding, noise, air, and water pollution.

Fishing and wildlife-associated activities on the Louisiana Coastal Zone have traditionally provided many families with jobs, sources of income, and pleasure, and have contributed to their culture. Additionally, these activities generate in excess of $2 billion annually.

The area’s diverse resources have a significant impact on its economic and social structure. They must be carefully managed and effectively planned to ensure their continued use in recreational and commercial activities. What follows are detailed descriptions of these activities intended to be helpful in management and planning of the resources.

Commercial Fisheries of the System. Louisiana is the second largest producer of seafood in the United States and is a leader in the production of shrimp, blue crabs, oyster, crawfish, tuna, red snapper, wild catfish, black drum, sea trout, and mullet. During the 1989–1992 period, it contributed an average of 1.13 billion pounds of commercial landings worth $276 million, annually (LDWF Socioeconomic Section). The 13 parishes (including the east bank of Plaquemines Parish) were responsible for 54% of the total poundage (610,535 pounds), valued at $193.6 million or 70% of the total value, annually, during the same time period. The parishes of Plaquemines, Terrebonne, St. Mary, and Lafourche were responsible for most of the valuable tonnage (tables 36 and 37).

The importance of the region to Louisiana’s economy cannot be overemphasized. This system is responsible for the development and production of commercial and recreational fishery species harvested in the state's coastal areas. Review of Louisiana's commercial landing statistics and their associated values (published by National Marine Fisheries Service) for the year 1992 indicates that about 95% of the total landings (shellfish and finfish) were estuarine-dependent species that composed 64% of the total value. Of these landing figures 79% were for the finfish, comprising 17% of the total value, and 15.6% for the shellfish, comprising 64% of the total value. Yet certain recreational species—such as red drum, which are completely estuarine dependent—are not included in the analyzed figures. They also estimated that the basin accounts for “26% of the state's freshwater resident recreational licenses sold and 55% of the state's saltwater recreational licenses."

Major factors affecting the decline of fisheries production within the basin have been analyzed and reported by several studies. Perret and Melancon (1991) demonstrated a pattern of change in the overall production by illustrating the top 20 commercial finfish species harvested in Louisiana.

The following information demonstrates the impact of the system’s commercial landings and their values over a 14-year period. This information comprehends activities pertaining to the commercial harvest of finfish and shellfish species. Although some species such as tuna and red snapper are not estuarine dependent, they are included in the total landing statistics within the area. Thus, recorded statistics do not necessarily reflect the point of harvest, but only where the catch was landed.

Five parishes dominated over the others: Plaquemines, Terrebonne, St. Mary, Jefferson, and Lafourche. In the first five-year breakdown, these five parishes compensated for a deficit in four of five parishes that contributed little or nothing at all.

Table 36. Total and value of commercial landings by BTES parishes: 1979–1992.

Parish	Five Year Avg. 1979–1983	Five Year Avg. 1984–1988	Four Year Avg. 1989–1992	Five Year Avg. 1979–1983	Five Year Avg. 1984–1988	Four Year Avg. 1989–1992
	Thousand Pounds			Thousand Dollars		
Ascension	24	338	436	8	156	210
Assumption	2,905	6,334	4,780	1,292	2,738	2,519
Iberville	1,346	1,116	3,044	419	417	1,483
Jefferson	17,802	25,494	20,392	25,539	30,774	24,151
Lafourche	15,812	23,526	23,804	20,763	32,758	30,009
Plaquemines*	284,498	324,199	282,132	35,459	61,073	60,009
Pointe Coupee	0	0	68	0	0	37
St. Charles	1,086	1,363	2,316	424	534	853
St. James	0	109	525	0	43	219
St. John	0	0	412	0	0	213
St. Mary	175,957	64,379	114,848	12,690	11,475	15,286
Terrebonne	252,943	328,570	157,776	49,110	66,813	57,808
W Baton Rouge	0	0	2	0	0	2
BTES Total	752,373	775,368	610,535	145,704	206,782	193,682
State Total	1,554,511	1,715,534	1,132,578	218,184	296,962	276,187
%BTES of Total	48.4	45.2	53.9	66.8	69.6	70.1

*Compiled from a National Marine Fishery Service Database by the Louisiana Department of Wildlife and Fisheries, Marine Fishery and Socioeconomic Sections.

Note: The figures reflect neither the magnitude of unreported landings nor the origin of the harvest. Recorded landings and their corresponding values are for the west bank as well as the east bank.

Table 37. Total and value of commercial landings by BTES parishes: 1979–1992 (species).

Species	Five Year Avg. 1979–1983	Five Year Avg. 1984–1988	Four Year Avg. 1989–1992	Five Year Avg. 1979–1983	Five Year Avg. 1984–1988	Four Year Avg. 1989–1992
		Thousand Pounds			Thousand Dollars	
Finfish						
BTES Total	659,861	637,916	483,307	31,272	9,484	12,042
State Total	1,482,480	1,527,952	957,921	65,351	11,350	15,011
% BTES of Total	46.2	41.7	50.5	47.9	83.6	80.2
Shellfish						
BTES Total	92,513	137,452	127,228	114,432	159,360	144,606
State Total	126,031	187,582	174,657	152,833	211,457	196,715
% BTES of Total	73.4	73.3	72.8	74.9	75.4	73.5
Shrimp						
BTES Total	70,419	89,378	78,394	98,785	123,008	105,418
State Total	89,828	118,120	103,234	129,359	163,718	142,534
% BTES of Total	78.4	75.7	75.9	76.4	75.1	74.0
Oyster						
BTES Total	7,238	11,412	7,329	10,989	4,640	5,269
State Total	9,920	13,247	9,052	14,593	5,568	6,586
% BTES of Total	73.0	86.1	81.0	75.3	83.3	80.0
Crab						
BTES Total	12,284	30,124	31,188	3,442	10,234	12,568
State Total	18,657	39,503	43,993	5,271	13,771	18,749
% BTES of Total	65.8	76.3	70.9	65.3	74.3	67.0
Other Shellfish						
BTES Total	2,572	6,538	10,317	1,216	21,478	21,351
State Total	7,626	16,712	18,378	3,610	28,400	28,846
% BTES of total	33.7	39.1	56.1	33.7	75.6	74.0

Note: Compiled from the Louisiana Department of Wildlife and Fisheries Licensing Database by the Socioeconomic Section.
The figures reflect neither the magnitude of unreported landings nor the origin of the harvest.
Recorded landings and their corresponding values are for the west bank as well as the east bank of Plaquemines Parish.

The system averaged 48.4% of the state's total 1.6 billion pounds of fishery between 1979 and 1983. In 1985 and 1986 St. Mary fell from third place among the top five system parishes to fifth place in landings, and Plaquemines Parish was replaced by Terrebonne Parish as the leader in 1988. These five parishes fared slightly less well in the averages between 1984 and 1988, with 45% of the state's total 1.7 billion pounds. Between 1989 and 1992 Louisiana's total pounds of commercial landings declined to 1.1 billion pounds, but the system's total increased to 610 million pounds, 54% of the total.

This study brings to light additional interesting details of the system's impact on Louisiana fisheries. For example, over 50% of the state's total landing revenue is supported by the system's parishes. Between 1979 and 1983 the region contributed 63% of the state's total landing revenue or $146 million. Between 1984 and 1988 the state gained $297 million in landing revenue, of which the region constituted 70%. Moreover, between 1989 and 1992 the region maintained an average contribution of 70% in a market of total pounds less proportions at $276 million loss over the last five years. These figures do not reflect unreported landings. Recent developments in Louisiana's commercial fisheries make it almost impossible to predict the future outcome. However, in the absence of alternatives, if commercial fisheries—specifically, in coastal communities—are reduced by environmental pressures, legal or otherwise, the negative economic impact may be overwhelming.

Table 38 shows the number of commercial licenses issued during the 1990–1994 period within system parishes. During the last decade, Louisiana in general—and system parishes in particular—has experienced a consistent decline in the number of commercial license sales. However, the system consistently maintained its approximate 55% of the total sales. In 1994 the sale of commercial licenses in the region consisted of 39,357 of the total 72,425 of licenses issued in Louisiana. Major contributors to this total sale were the parishes of Terrebonne, Jefferson, Lafourche, and Plaquemines.

Many factors may have contributed to the decline in the number of commercial licenses issued in Louisiana, including stabilization of oil and gas prices and increased petroleum exploration activities. These opportunities would attract many part-time commercial trappers and fishermen, thus leaving the fishing industry to primary full-time commercial enthusiasts. Also, an increase in regulations pertaining to environmental and conservation concerns, as well as increased cost of such activities, may have contributed to this decline.

Commercial harvest of finfish. Between 1979 and 1983 the 13 parishes of the system averaged 46% of the state's total finfish landings. Again, between 1984 and 1988 they played a significant role in finfish harvest, averaging 42%. Between 1989 and 1992 their percentage of total state landings increased to 51%. These percentages represent the overall pounds harvested; information on the values of landings proves even more interesting. Between 1979 and 1983 system parishes landed 48% of the state's $81 million yield, accounting for over $38 million. The following five years, 1984 through 1988, they averaged 56% of the state's $86 million in finfish landings. Between 1989 and 1992 the value of the system's total finfish landings was $48 million, that is, 61% of the

Table 38. Number of commercial licenses issued by license year for BTES parishes, Louisiana: 1990–1994.

Parish	1990	1991	1992	1993	1994
Ascension	87	439	401	389	319
Assumption	1044	837	875	772	721
Iberville	471	369	398	366	427
Jefferson	12,173	10,669	10,497	9,134	8,468
Lafourche	8,716	8,611	8,215	7,583	7,242
Plaquemines*	7,793	7,244	7,019	6,455	6,169
Pointe Coupee	184	156	163	177	173
St. Charles	1,818	1,678	1,504	1,456	1,431
St. James	629	570	474	408	410
St. John	829	757	725	675	653
St. Mary	4,362	3,878	3,684	3,339	3,060
Terrebonne	13,533	12,373	12,086	11,412	10,183
W. Baton Rouge	143	142	134	126	101
BTES Total	52,082	47,723	46,175	42,292	39,357
State Total	95,174	87,165	83,169	77,178	72,425
%BTES of Total	54.7	54.8	55.5	54.8	54.3

*Compiled by the Louisiana Department of Wildlife and Fisheries, Socioeconomic Section. Data is inclusive of the multiple licenses issued to individuals. Inclusive of the east bank.

state's total for those years. The parishes of Terrebonne, Plaquemines (inclusive of the East Bank), and St. Mary continuously led the region in volume and values.

Commercial harvest of shellfish. Between 1979 and 1983, twelve of the system parishes collectively averaged 73% of the state's total pounds of shellfish landings. This average was maintained between 1984 and 1988 and recurred between 1989 and 1992. The value of the system's shellfish landings is further evidence of their importance. In the first five-year average, the 13 parishes accumulated 75% of the state's total of $153 million. This success continued in the following five years with 75% of the $211 million state's total. Although the state's total shellfish landings decreased slightly between 1989 and 1992, the system parishes were able to sustain 74% of the state's total. Among the leaders contributing to both total poundage and value were the parishes of Terrebonne, Plaquemines (including the East Bank), Jefferson, and Lafourche.

Commercial harvest of penaeid shrimp. The system is crucial to Louisiana's shrimp industry. Data suggests that thirteen system parishes were the primary participants in shrimp landings. Yet they accumulate over 75% of the state's total shrimp landings. Between 1979 and 1983 Jefferson, Lafourche, Plaquemines, St. Mary, and Terrebonne parishes recorded 78% of the total 89 million pounds of catch. Between 1984 and 1988 they landed 76% of the total shrimp. The same ratio was maintained during the 1989–1992 period. Without the impact of these parishes, the state would experience a drastic decline in overall shrimp landing revenues. The value of the landings between 1979 and 1983 was 76% of the $129 million, between 1984 and 1988 it was 75% of the $164 million, and then it fell to 74% of the $143 million during the 1989–1992 period.

Commercial harvest of oyster. Oyster landings were accounted for by only 10 system parishes. Consistently throughout the 14-year study, Jefferson, Lafourche, Plaquemines, and Terrebonne parishes landed oyster, whereas the remaining parishes constituted oyster landings only during some years of study. Between 1979 and 1983 the ratio of total landings was 73% of the total harvest. In the period between 1984 and 1988 landings were improved further for the entire area such that the system's percentage of the total harvest was significantly high at 86%. The state's reported oyster landings were on average between 1989 and 1992 just over 9 million pounds, of which the system landed 81%. The monetary value of the landed oyster in the parishes constituted 82% of the total state's harvest of $26 million in 1992.

There is a significant bedding industry on the west side of the Mississippi River within the system, and many of the landings within the estuary often reflect moving oysters from the east side on public grounds to the west side onto private leases. This industry further indicates the commercial importance of the system (Melancon 1995).

By 1992 there were a total of 8,093 oyster leaseholders in Louisiana, accounting for 356,711 acres of oyster beds. The majority of the leases were within system parishes, totaling 251,880 acres of oyster beds or 71% of the total area. In the system, the majority of the leases were in Plaquemines Parish (including the East Bank), affecting a total of 153,000 acres, followed by Terrebonne, Jefferson, and Lafourche parishes accounting for 55,000, 23,000 and 18,000 acres, respectively.

Commercial harvest of crab. Out of the 11 system parishes reporting crab landings (including blue and stone crab), the parishes with the largest impacts are St. Mary, Lafourche, Jefferson, and Terrebonne. During the first five-year averages, the four system parishes mentioned above contributed 95% of the total system's crab landings: i.e., they landed 11,632,349 of the total 12,283,553 pounds of crabs harvested in the area. As a whole, the system's parishes during the 1979–1983 period landed 66% of the state's total. Between 1984 and 1988 the four parishes landed 28,016,870 pounds of crabs, accounting for 93% of the total within the system. The average total poundage for the region was 76% during the same time period. However, an overall increase of landings and participation by all parishes within the system has been observed since 1990.

The value of landed crabs in the system has been 65% of the state's $5 million total during the 1979–1983 time period. From 1984 to 1988 the average increased to 74% of the total $14 million. Between 1989 and 1992 this value increased to $13 million but constituted a drop in average to 67% of the state's $19 million total.

Sports Fishing. A 1991 survey of recreational fishermen in Louisiana, conducted by the U.S. Fish and Wildlife Service, provided valuable information on the overall participation of anglers and their direct and indirect contributions to the economy of the state. In 1993 the Louisiana Department of Wildlife and Fisheries conducted a comparative analysis of the recreational fisheries activities in Louisiana, as opposed to its neighboring states. The results suggested that 899,000 adults, ages 16 years and older, actively support and participate in the fisheries of the state. What follows is a brief descriptive analysis of fisheries in Louisiana in general and in the system.

For the 1992–1993 fiscal year, adult individuals between 16 and 60 years of age were issued a total of 866,787 fishing licenses for recreational purposes (table 39). Of these, 90% were issued to state residents. A little over 36% of the total recreational fishing licenses were issued within the system, or 313,953. The parishes of Jefferson, Lafourche, Terrebonne, and St. Mary were the major contributors to this total sale, collectively proving responsible for 73% of it. However, over 50% of the residential saltwater licenses, as well as 65% of the nonresidential saltwater trips, 44% of the nonresident two-day combination license, and 31% of the basic recreational licenses were issued within the system parishes. According to the 1991 federal survey, recreational fishing activities generated in excess of $686 million in Louisiana. Using the percentage of participation by area as a proxy to estimate the total economic impact results in $124.9 million revenue generated within the system.

Wildlife of the System. Exploitation of the region's wildlife resources was among the earliest economic activities ventured by early settlers of Louisiana. At the turn of the century, there were several thousand individuals benefiting from hunting, trapping, and similar activities in the Barataria basin. Fur traders traveled to this area for the valuable hides of alligator, mink, raccoon, and other plentiful fur-bearing animals (Davis 1991).

Parallel to commercial wildlife activities of traders of the past and recent entrepreneurs, hunting for recreational purposes has been favored by Louisiana residents. Today, 332,000 individuals, 10.5% of the population 16 years of age and older, are in possession of a hunting license in Louisiana. They spend an excess of $434 million annually (U.S. Department of the Interior 1993). This expenditure is of major interest to state and local governments and to businesses that supply outdoor sportsmen. Louisiana recreational hunters were only second to Texas in numbers and in the total value of their expenditures (Louisiana Department of Wildlife and Fisheries 1993).

Commercial harvest of furbearers. Nutria, a rodent native to Argentina, was introduced into the wetlands of Louisiana in 1938. Trappers by 1950 were able to harvest as many as 80,000 annually. In less than 20 years, the total harvest of nutria increased to 500,000 pelts annually (Davis 1991). Today, more than 40% of the total wild fur harvested in the United States comes from Louisiana's wetlands. In addition to nutria, other furbearers

Table 39. Sport license sales* for BTES parishes: 1992–1993 fiscal year.

Parish	Fishing Total	Hunting Total
Ascension	8,595	14,959
Assumption	3,705	6,247
Iberville	4,087	5,747
Jefferson	24,945	109,111
Lafourche	14,307	52,302
Plaquemines	2,034	18,148
Pointe Coupee	6,400	7,245
St. Charles	4,133	10,429
St. James	2,108	3,152
St. John	3,284	7,812
St. Mary	8,354	20,196
Terrebonne	12,661	48,932
West Baton Rouge	6,576	9,673
Total BTES Region	101,189	313,953
Louisiana	557,134	866,787
% BTES of State	18.2%	36.2%

Compiled from unpublished data collected by the Louisiana Department of Wildlife and Fisheries, Socioeconomic and Development Section.
* Does not include lifetime licenses.

such as muskrat, mink, raccoon, otter, bobcat, beaver, coyote, and opossum are of economic importance to the area (Louisiana Sea Grant 1993). The recent decline in the harvest of nutria stems from a general decline in demand for furs and, consequently, in their prices.

Commercial harvest of alligators. Harvest of alligators in Louisiana, wild and farm raised, is widely practiced and is an important source of revenue in the wetland areas. The coastal population of wild alligators exceeds 600,000 and approximately 26,500 wild alligators are harvested each year. Additionally, each year thousands of farm-raised alligators are harvested for their meat and hides. Wild and farm-raised alligators produce an annual value in excess of $20 million. The 1994 harvest of farm-raised alligators produced 122,800 skins and 540,000 pounds of meat valued at $9.6 million. Louisiana exported to France 48% of its alligator skins. Additionally, Italy, Japan, and Singapore import 17%, 13%, and 10%, respectively (tables 40 and 41).

Table 40. Reported commercial harvest of wild alligators by parish: 1989–1992 average.

Parishes	Tags Issued	Tags Used	Avg. Size(ft.)	Avg. $ Price/30.5	Total Value $
Ascension	129	124	7.05	41.00	35,842
Assumption	270	250	7.45	41.00	76,362
Iberville	497	459	6.83	41.00	128,534
Jefferson	487	482	7.48	41.00	147,820
Lafourche	2,469	2,456	7.35	41.00	740,116
Plaquemines	997	986	7.37	41.00	297,940
Pointe Coupee	105	86	7.89	41.00	27,820
St. Charles	1,119	1,114	7.14	41.00	326,112
St. James	225	244	7.02	41.00	70,228
St. John	552	544	7.57	41.00	168,841
St. Mary	1,561	1,547	7.39	41.00	468,726
Terrebonne	4,423	4,377	7.71	41.00	1,383,613
W. Baton Rouge	51	43	7.27	41.00	12,817
BTES Total	12,885	12,712	7.35	41.00	3,884,771
State Total	25,363	24,573	7.30	41.00	7,315,892
% BTES of Total	50.8	51.7	53.1		

Compiled from a National Marine Fishery Service Database by the Louisiana Department of Wildlife and Fisheries, Marine Fisheries, and the Socioeconomic Section.

Recreational Wildlife Activities. The duck population in Louisiana approaches 4 million annually. Also, approximately 700,000 geese are attracted to Louisiana wetlands each winter. The total number of waterfowl hunters reached 74,000 recently. Their activities contributed to the creation of 840 jobs and generated $2.2 million in state sales taxes and $331,000 in state income taxes (Louisiana Office of the Governor 1995).

Table 41. Alligator farm harvest in Louisiana: 1980–1992.

Alligator Harvesting	Four Year Avg. 1980-1983	Five Year Avg. 1982-1988	Four Year Avg. 1989-1992
Licensed farms	10	25	116
No. farms which sold skins	3	19	81
No. of skins sold	528	10,322	100,564
Avg. length (cm)	136	132	123
Avge. value of skins/30.5c	$14	$25	$21
Total value of skins	$33,348	$1,327,839	$7,656,392
Amount of meat (deboned)	1,187	19,498	205,642
Value of meat (deboned)	$9,145	$202,095	$1,983,605

Compiled from a National Fishery Service Database by Louisiana Deptartment of Wildlife and Fisheries, Marine Fishery and the Socioeconomic Section. Neither the data for the year 1979 nor information by parish was available at the time this study was being conducted.

Deer-hunting activities in Louisiana are responsible for the creation of 4,240 jobs and generate $6.2 million and $1.4 million in state sales taxes and income taxes, respectively. There are approximately 187,000 deer hunters registered in Louisiana engaged in 3.3 million days of hunting activities, annually (Louisiana Office of the Governor 1995).

For the 1992–1993 fiscal year, Louisiana issued well over 550,000 sports hunting licenses, out of which 100,000 were issued within the system. The most popular licenses sold were resident hunting, resident big game, resident waterfowl, and resident bow hunting licenses. During this time period, only one sports trapper license was issued in the state.

The system's participation in the sale of the mentioned licenses was 18.5%, 16.7%, 23.9%, and 16.7% respectively. Of the fifty nonresident muzzle loader licenses issued, only one was sold within system parishes. Overall, Jefferson, Lafourche, Terrebonne, Ascension, and West Baton Rouge parishes issued most of the licenses for the area, accounting for 18.2% of the state's total.

Based on the 1991 National Survey of Recreational Activities, the recreational hunters were responsible for $433.8 million of total expenditures in Louisiana, of which $157 million was spent within the system, if the percentage of the area's participation was used as a proxy for estimation (U.S. Department of the Interior l993). The same survey indicated that a total of 1.06 million individuals have participated in primary nonconsumptive activities in Louisiana, composed of 67% of the participating residential population. This group contributed a total of $221.8 million to the economy of the state indirect expenditures, consisting of $60.7 million trip-related and $161.1 million equipment and other expenditures.

Boating activities within the system. By April 27, 1994, over 306,000 boats were registered in Louisiana, 81,524 within system parishes (26.6% of the total). Within the system, pleasure boats constituted the majority (68,243 or 83.7% of the total), followed by commercial boats (10,036 or 12.3% of the total), passenger boats (244 or 0.3% of the total). Among the thirteen system parishes, Jefferson, Terrebonne, Lafourche, and St. Mary each registered more boats than any other parish.

Nonrenewable Resources

Oil and Gas. The production of oil and gas has been a major industry in Louisiana for more than half a century. Direct benefits to the state from this extraction industry include severance taxes and lease royalties. Indirect benefits include employment and income generated from these extraction activities, primary and secondary in nature. Also, allied sectors, such as the refining and chemical industries, have located in Louisiana and have become major contributors to the state's economy as a result of the oil and gas extraction activities.

Brief history. The history of Louisiana's oil and gas industry is treated in detail by Davis and Place (1983). Provided herein is a summary of the relevant historical activities discussed by those authors.

The first producing oil well in south Louisiana was drilled in 1901 by W. Scott Heywood. Exploration in this region was temporarily abandoned three years later, however, when the search moved to northwestern Louisiana in Caddo Lake. The Caddo Lake field was highly productive; as Davis and Place reported," [i]t was 30 years before southern Louisiana petroleum production exceeded that of the Caddo Lake region."

Initial exploration and development in the coastal plain "[w]as hampered by the logistics and economics of working in the coastal wetlands." Renewed interests in the coastal wetlands was shown in the 1920s, however, with advances in geological exploration. After World War II, the number of exploratory wells drilled in south Louisiana began to advance rapidly.

According to Davis and Place, "[d]rilling in Louisiana's wetlands served as a training ground for successful drilling in the Outer Continental Shelf (OCS). Many facilities had already been established to serve onshore oil and gas fields accessible only by boat and barge in the canalized coastal wetlands. Operations on a sea of mud are not too different from those used on a sea of water." In 1947 Kerr-McGee brought in the first oil well out of sight of land (about 45 miles south of Morgan City), marking the birth of the offshore oil and gas industry (Louisiana Mid-Continent Oil & Gas Association 1991). Davis and Place comment, "[f]rom a rather quiet beginning, the search for hydrocarbons on the OCS grew rapidly, far exceeding early expectations." And, it might be added, development in the OCS completed the cycle of movement of the oil and gas industry from north Louisiana to south Louisiana to offshore Louisiana. Furthermore, most development in recent years has been moving further and further offshore.

Oil and gas production. Statistics pertaining to the oil and gas extraction industry and related activities are generally presented on the basis of three regions (following the classification originally proposed by the old Louisiana Oil and Gas Commission): (a) north Louisiana, (b) south Louisiana, and (c) offshore (state waters) with the Intercoastal Canal representing the boundary between north and south Louisiana.

Production, as noted, also occurs in federal (OCS) waters. While the state receives no direct royalties or severance taxes from production in federal waters, indirect benefits through employment and income are substantial.

Oil production. Louisiana currently ranks fourth in the nation in the production of crude oil when production from the OCS is excluded and third when the OCS is included (Louisiana Mid-Continent Oil & Gas Association 1994). As discussed below, however, production of crude oil has fallen sharply during the past three decades (particularly non-OCS), and further declines may jeopardize Louisiana's relative standing.

In 1960–1964, Louisiana's crude oil production (excluding condensates) averaged 333 million barrels annually, and 415 million barrels annually when production from federal waters is included (table 42). South Louisiana accounted for about 60% of the 415 million barrel total followed by federal offshore (20%), state offshore (11%), and north Louisiana (10%).

Crude oil production (excluding production in federal waters) averaged 106 million barrels annually between 1990 and 1993, a decline of about 70% from the 1960–64 period. Because of significantly higher production in Louisiana federal offshore waters, however, total production of crude oil (i.e., state and federal waters) between 1990 and 1993—340 million barrels annually—was only about 18% below that produced between 1960 and 1964.

Two trends are discernible from this information. First, production of crude oil (excluding Louisiana federal offshore) has fallen sharply during the past three decades in all regions of the state (i.e., north, south, and state offshore). Second, federal offshore production currently dominates total production. Coastal parishes of the state are the primary beneficiaries of the crude oil production in federal waters. Some of the benefits, derived from a study commissioned by Mid-Continent Oil & Gas Association, can be found in the 32nd edition of *Louisiana Oil and Gas Facts*.

Total crude oil production in Louisiana (excluding federal offshore) equaled 116 million barrels in 1990 (Louisiana Mid-Continent Oil & Gas Association 1991). Parishes in the study region (excluding Iberia, St. Martin, and Orleans parishes) accounted for 51% of this production (59 million barrels). Plaquemines Parish accounted for 46% of the the region production followed by Lafourche Parish (21%) and Terrebonne Parish (9%). Combined, the production from these three parishes accounted for more than three-quarters of the total crude oil production in the region in 1990. Other region parishes with significant 1990 shares included St. Mary (6%), Jefferson (5%), and Iberville (5%).

Table 42. State and Louisiana federal offshore crude oil production: 1960–1993.

Period	------------------- 1,000 barrels --------------------			
	North Louisiana	South Louisiana	Louisiana Offshore	Federal Offshore
1960–1964	43,393	246,445	43,595	81,361
1965–1969	48,742	332,760	54,242	209,487
1970–1974	39,558	321,767	56,993	336,167
1975–1979	32,593	170,687	31,404	267,671
1980–1984	30,130	101,301	23,895	255,224
1985–1989	25,303	92,055	23,127	269,017
1990–1994	20,500	64,973	20,771	233,474*

Sources: Center for Energy Studies 1991 and Louisiana Mid-Continent Oil & Gas Association 1991 and 1994.

Natural gas. Excluding OCS production, Louisiana is the third leading producer of natural gas (Louisiana Mid-Continent Oil & Gas Association 1991). When OCS production is included, Louisiana's relative position moves up to number two.

Natural gas production in Louisiana averaged 2,636 billion cubic feet (BCF) annually in 1960–1964 when production from federal waters is excluded, and 3,082 BCF when production from federal waters is included (table 43). In the 1960–1964 period, south Louisiana contributed 65% of the total natural gas production (including OCS) followed by north Louisiana (18%), federal offshore (15%), and offshore state (3%).

Natural gas production for the 1990–1993 period averaged 4,906 BCF annually. Seventy percent of this total was derived from federal offshore waters. South Louisiana contributed an additional 22% of the total.

As was the case with crude oil, two trends are apparent from the information contained in table 43. First, production is declining. Excluding production from federal waters, Louisiana's natural gas production fell from a peak of 4,460 BCF annually between 1970 and 1974 to 1,612 BCF between 1990 and 1993, a decline of more than 60%. The decline was approximately 30% when production from federal waters is included. The second trend relates to the increasing share contributed by the federal offshore production. Between 1960 and 1964, this share averaged 15%. During the 1990–1993 period it advanced to about 70%.

Table 43. State and federal offshore natural gas production: 1960–1993.

Period	------------------- Billion Ft.^{3} -------------------				Total
	North Louisiana	South Louisiana	Louisiana Offshore	Federal Offshore	
1960–1964	555	1,990	91	446	3,082
1965–1969	471	3,088	342	1,186	5,087
1970–1974	367	3,579	514	2,839	7,299
1975–1979	301	2,240	459	3,758	6,758
1980–1984	332	1,450	332	3,735	5,849
1985–1989	314	1,088	203	3,066	4,671
1990–1993[a]	369	1,092	151	3,445[b]	5,507

[a]Includes some casinghead gas.
[b]Federal offshore average excludes 1993.

Sources: Center for Energy Studies 1991 and Louisiana Mid-Continent Oil & Gas Association 1991 and 1994.

Production of natural gas and casinghead gas in Louisiana (excluding federal waters) equaled 1,675 BCF in 1990. Production among system parishes equaled 519 BCF, or 31% of the total. Terrebonne Parish accounted for 28% of the total production among system parishes followed by St. Mary Parish (26%), Plaquemines Parish (17%), Lafourche Parish (9%), and Pointe Coupee Parish (9%).

Estimated proved final reserves of oil and gas. As indicated above, Louisiana's oil and gas production has been declining for several years. This decline can be attributed to several factors, of which a principal factor is that Louisiana is a mature province (Louisiana Mid-Continent Oil & Gas Association 1991). This can be established from estimates of proved final reserves. In the 1965–1969 period, for example, total Louisiana estimated proved final reserves averaged 5,481 million cubic feet (MMBLS) (including federal OCS). By the 1985–1989 period proved estimated final reserves had declined 55% to 2,438 MMBLS (Center for Energy Studies 1991). During the 1965–1969 period Louisiana's estimated proved final reserves equaled 18% of the U.S. total of 30,904. By 1985–1989 Louisiana's share had fallen to 9% of the U.S. total (27,177 MMBLS). Over

90% of the estimated proved final reserves in the state are situated in south Louisiana (including OCS).

Prices. Another factor which influences production is fluctuating price. According to Seydlitz and Laska (1994), Louisiana oil prices can be evaluated on the basis of four distinct periods: (1) low, stable real prices between 1956 and 1973, (2) rapidly increasing prices between 1974 and 1981, (3) rapidly decreasing real prices between 1982 and 1985, and (4) low, stable real prices between 1986 and 1990. In 1956 Louisiana's crude oil prices (including OCS) equaled $2.93 per barrel ($14.09 when adjusted to 1990 dollars) at the wellhead[20]. In 1973 the price, expressed in 1990 dollars, equaled $11.76 per barrel. In 1974, in association with the development of the foreign oil cartel, the Louisiana crude oil price at the wellhead advanced to an average of $17.28 (1990 dollars), peaked at more than $50 per barrel in 1981, and equaled almost $44 per barrel (1990 dollars) in 1982. After 1982 the price fell rapidly and equaled $19.39 per barrel in 1989 (expressed in 1990 dollars).

In general, the Louisiana natural gas price mirrored that of crude oil. In 1956 the Louisiana natural gas wellhead price equaled about $0.55 per thousand cubic feet (MCF) (1990 dollars) and in 1972 $0.64 per MCF. After 1972 the price advanced sharply, peaking (in 1990 dollars) at $3.52 per MCF in 1982. By 1989 the average wellhead price had fallen to $1.92 per MCF, a decline of 45% from the peak price. The 1993 price, adjusted for inflation, was very close to that reported in 1989.

Other Minerals. The second major mineral resource in coastal Louisiana is sulfur. Sulfur is used primarily in the production of sulfuric acid, which is then used in the manufacture of fertilizer (Jones and Rice 1972). A history of Louisiana's sulfur industry is given by Davis and Detro (1993).

Related Industries. The development of a large mineral extraction industry in Louisiana generated the development of allied industries wishing to locate in close proximity to the natural resource base. The two primary industries to do so were the refining industry and the chemical industry. These industries are briefly discussed below.

The refining industry. Standard Oil Company, Louisiana's first refinery, was completed in Baton Rouge in 1909 (Center for Energy Studies 1991). From this beginning, the number of operable petroleum refineries advanced to 36 by 1980. The number fell to 26 by the following year. Since the mid-1980s, the number has remained relatively constant at about 20.

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[20]All price information is derived from Center for Energy Studies, Louisiana State University (1991).

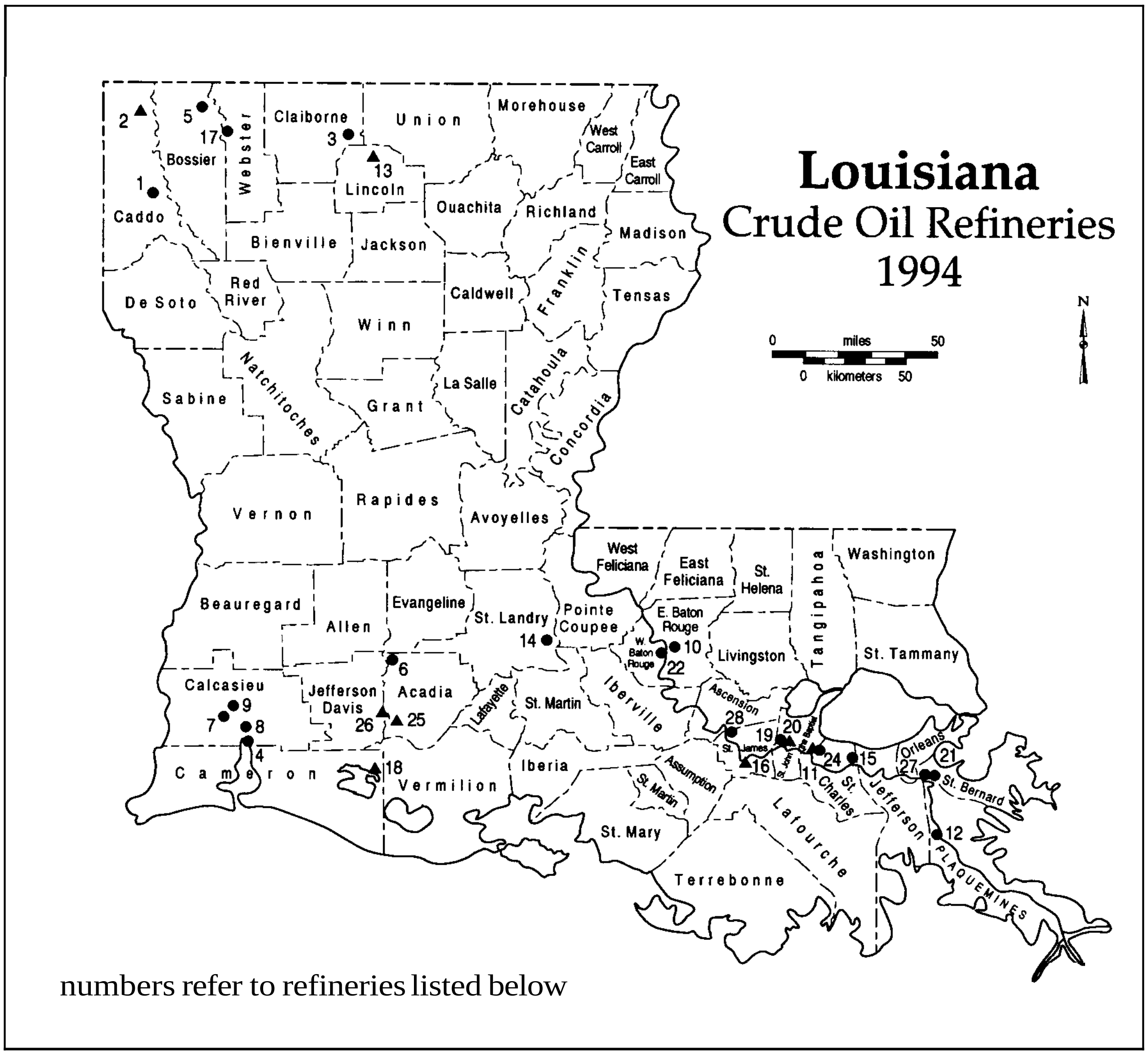
The location of each of the operating and nonoperating refineries (as of 1994) is presented in figure 16. As indicated, they tend to be situated in three regions of the state: (1) southwest Louisiana (primarily Calcasieu Parish), (2) the northwest region, and (3) along the Mississippi River corridor. Operating refineries within the region include: Placid Refining Company in Port Allen, Star Enterprise in Convent, Marathon Oil Company in Garyville, Shell Oil Company in Norco, St. Rose Refining Company in St. Rose, and B.P. Oil Company in Belle Chasse.

The relationship between Louisiana oil production and refinery capacity is presented in figure 17. Since the early 1970s, as indicated, capacity has exceeded state oil production. Furthermore, the margin has increased substantially over the past two decades in relation to the sharp decline in the state's production of oil. The refineries have increasingly turned to foreign sources of oil to achieve desired production rates (figure 18). Currently, only about 21% of the crude oil used by Louisiana's refineries comes from the state (Troy 1994). Since 1985 employment in the refining industry in the state has averaged from 10,000 to 12,000 workers annually.

The chemical industry. The chemical industry is the largest source of earnings in Louisiana's manufacturing sector (Scott 1993). With shipments of $20.2 billion in 1990, Louisiana ranked third to only Texas ($46.6 billion) and New Jersey ($23.5 billion). Industrial organic chemicals account for approximately 50% of the total value of shipments by the Louisiana chemical industry followed by plastic materials and synthetics (20%), agricultural chemicals (13%), and industrial inorganic chemicals (11%).

As the state's largest employer in the manufacturing industry, the chemical industry was providing more than 30,000 wage and salaried jobs in October 1992. According to Scott, "over 92% of Louisiana's chemical workers are employed (1) in the corridor of parishes between and including Baton Rouge and New Orleans, and (2) in Calcasieu Parish," a claim highlighting the relevance of the chemical industry to the region. The 1992 number of chemical plants in selected region parishes was: Ascension (18 plants), Iberville (11 plants), Jefferson (19 plants), Plaquemines (6 plants), St. Charles (7 plants), St. James (6 plants), St. John (6 plants), and West Baton Rouge (6 plants). Employment by the chemical industry in these parishes was almost 16 thousand for the second quarter 1992.

Socioeconomic Impacts. It is safe to say that the development of the extractive and allied industries in the region have greatly influenced its social and economic characteristics, probably more so than any other single factor. For example, while not empirically verifiable, there is little doubt that the large population growth in the region vis-à-vis the rest of the state since the 1950s can be linked directly to the development of the oil and



● Operating Refineries

1 Atlas Processing Co.-Div. Pennzoil/ Shreveport
3 Arcadia Refining & Marketing Co. L.P./Lisbon
4 Calcasieu Refining Co./Lake Charles
5 Calumet Lubricants Co., L.P. /Princeton
6 Canal Refining Co./Church Point
7 Gold Line Refining, Ltd./Lake Charles
8 CITGO Petroleum Corp./Lake Charles
9 Conoco Inc./Lake Charles
10 Exxon Corp., U.S.A./Baton Rouge
12 B.P. Oil Co./Belle Chase
14 Phibro Energy U.S.A./Krotz Springs
15 St. Rose Refining Co./St. Rose
17 Kerr-McGee Refining Corp./Cotton Valley
19 Marathon Oil Co./ Garyville
21 Murphy Oil U.S.A., Inc./Meraux
22 Placid Refining Co./Port Allen
24 Shell Oil Co./ Norco
27 Mobil Oil Corp./Chalmette
28 Star Enterprise/Convent

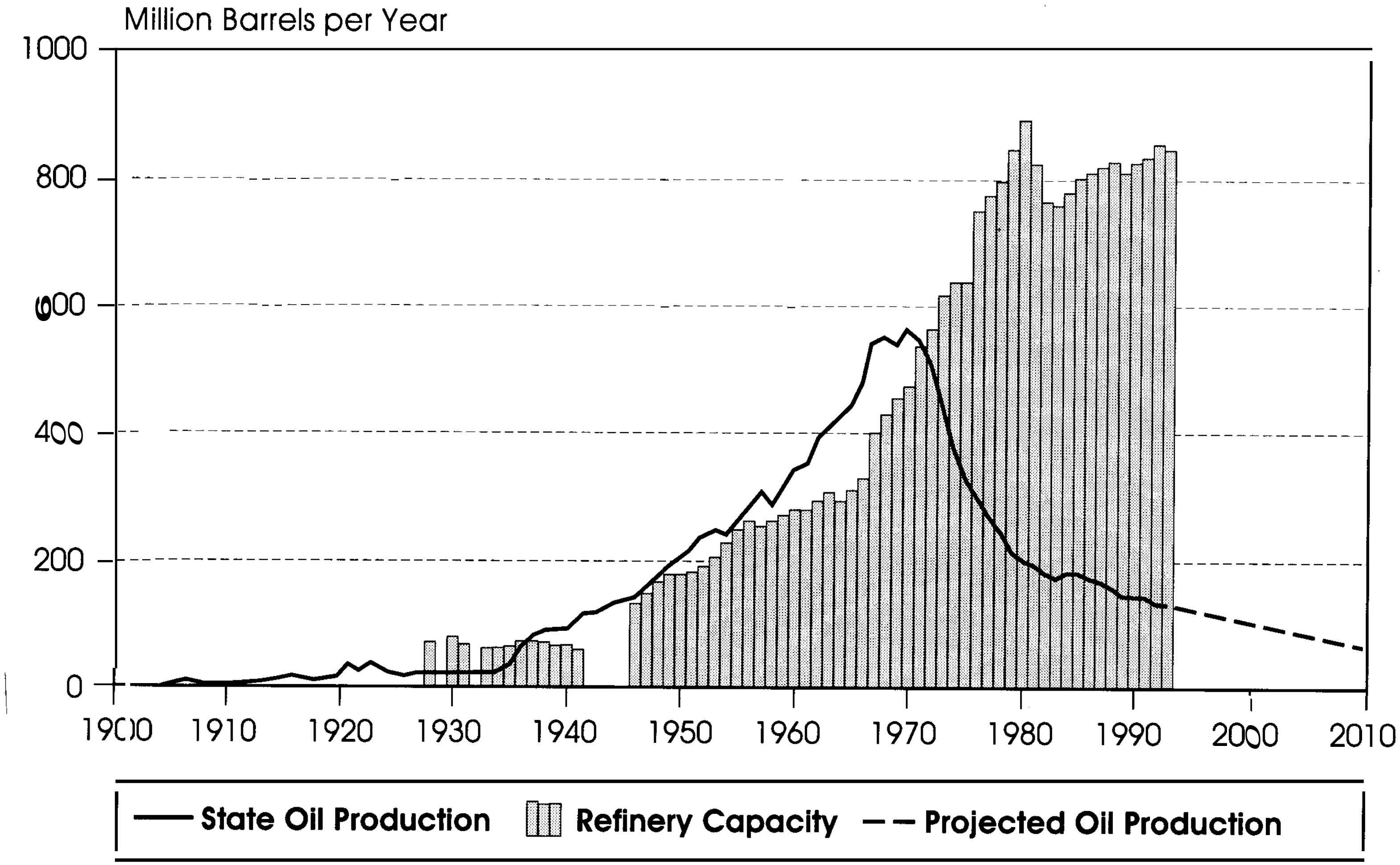
A Non–Operating Refineries

2 Bayou State Oil Corp./Hosston
11 TransAmerica Refining Co./Norco
13 Arcadia Refining & Marketing Co. L.P./Dubach
16 Texas NAPCO, Inc./St. James
18 Tina Resources, Inc./Talen's Landing
20 Petroleum Fuel & Terminal Co./Mt. Airy
25 Britt Processing & Refining Co./Egan
26 Gold Line Refining, Ltd./ Jennings

Note: Numbers **23** and **29** have been removed from the non-operating refinery list because they have been dismantled and the process equipment removed from the site.

Source: Troy, Alan A., **1994,**
Louisiana Crude Oil Refinery Survey Report,
Louisiana Dept. of Natural Resources,
Technology Assessment Division,
Baton Rouge, LA

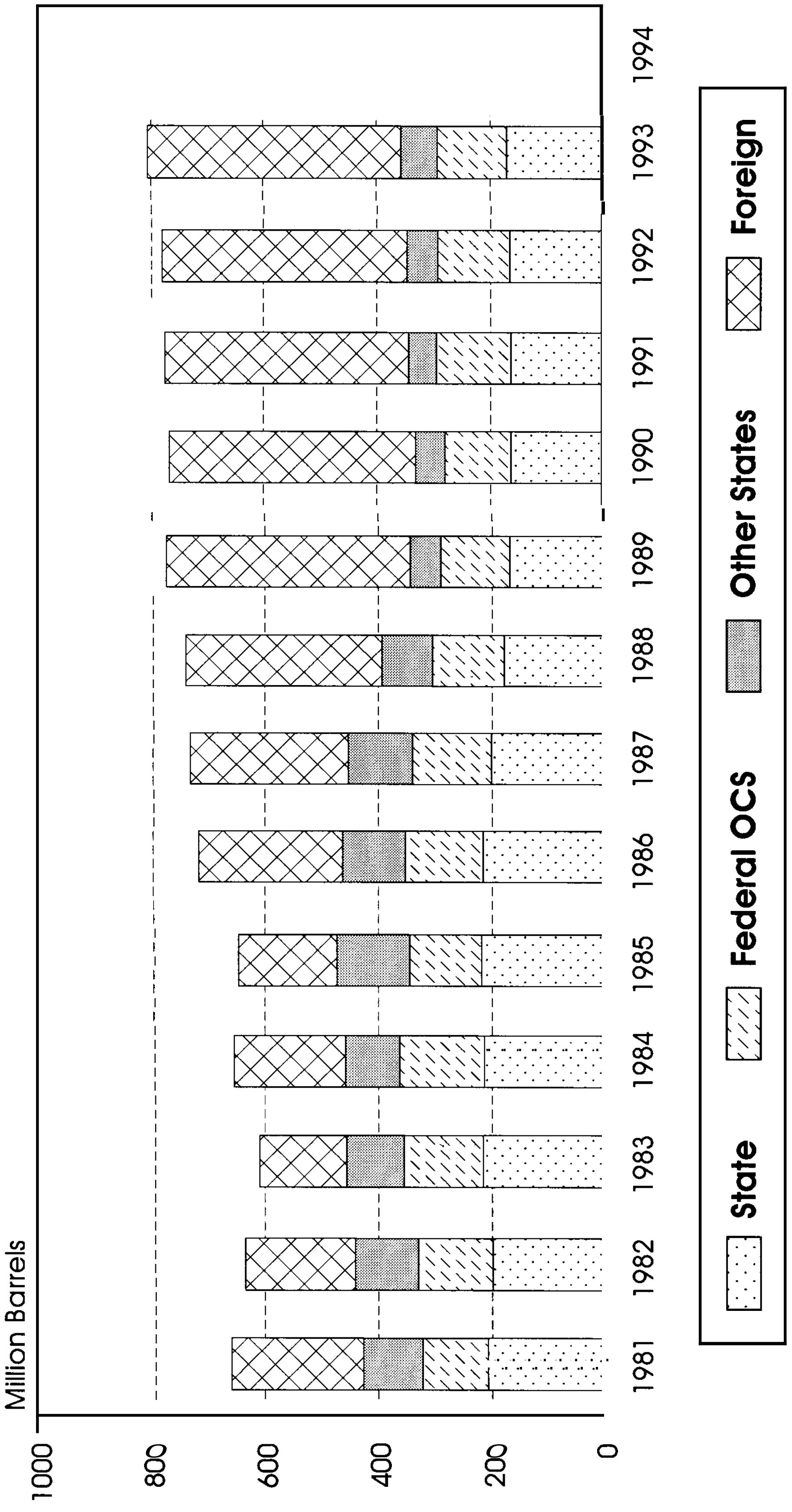
Figure **16.** Location of operating and nonoperating crude oil refineries in Louisiana: 1994.



Source: Oil Production– DNR Database
Refinery Capacity– DNR Energy Database and DOE/EIA Petroleum Supply Annual
NOTE: 1979 Capacity is estimated

(Source: Troy, 1994)

Figure 17. Louisiana oil production and refinery operating capacity.



(Source: Troy, 1994)

Figure 18. Historical refinery input by source, Louisiana.

gas industry in the region. Furthermore, the absence of growth during the 1980s can be linked to the "bust" of the oil and gas industry as reflected by the sharp decline in hydrocarbon prices during the early to mid-1980s (see McKenzie et al. 1993, for additional detail related to the impacts on Louisiana and Texas associated with the decline in OCS oil and gas activities).

As noted by Larson et al. (1980), rural-based industrial complexes, directly related to hydrocarbon exploration and development, are located in small, secondary service centers. Development of these industries resulted in out-migration from rural farm and swamp settlements and in increased urbanization in the region.

The relative increase in per capita income in the region vis-à-vis the state between 1960 and 1979 and decline from 1979 to 1989, again while not empirically verifiable, undoubtedly reflects the growth in the mineral extraction industry in the region during the long period leading up to the early 1980s and its "demise" shortly thereafter. This hypothesis also finds support in unemployment and poverty levels.

In short, the development and expansion of the hydrocarbon industry in the region brought with it high-paying jobs that attracted workers. These jobs and their related income improved the economic welfare of the region until the mid-1980s.

While oil- and gas-related activities bring about improvements in economic welfare, Seydlitz and Laska (1994) found that social costs are also associated with such activities. Specifically, in a study examining the social impacts of petroleum development on local communities in Louisiana, the authors found increased suicides and homicides following rapid expansion in petroleum activities. These social costs were most pronounced immediately following expansion activities and subsided shortly thereafter.

Agriculture

Coastal Louisiana is more dependent on its industrial output than on its farm output (Jones and Rice 1972). Prospects for economic growth and increased output in the state are not highly related to a strong agricultural sector. Nonetheless, agriculture remains essential to the livelihoods of many of the region’s rural residents. Selected statistics related to agricultural practices in the region are presented with the below.[21]

[21]The discussion of status and trends in agriculture does not include Orleans Parish. Agriculture activities in the parish, however, are minimal.

Farm, Operator, and Production Characteristics

Number of Farms and Acres. Following the national trend, the number of farms in the region declined significantly from 1954 to 1992 (table 44). The 2,097 farms reported in the region in 1992 represent just over 25% of the 7,837 farms reported in the region in 1954. Since 1974, however, the decline in the number of farms in the region has diminished. Overall, the number of farms in the region has consistently represented from seven percent to eight percent of the total reported number in the state.

While the number of farms in the region declined by about 75% during the 1954–1992 period, acreage in farming declined only 40%, from about 1.4 million acres in 1954 to slightly more than 800,000 acres in 1992. This disparity reflects an increasing average farm size throughout much of the period of analysis. But farm size in the region has fallen steadily since 1974. Since the average farm size in the region consistently exceeded that reported for the state, acreage in farming in the region relative to the state (10% to 11%) has exceeded the ratio of number of farms (7% to 8%).

Comparison of the 1954 and 1992 agricultural information at the parish level indicates that both the number of farms and the area in farming have declined in all of the region's parishes, though at differential rates (table 45). The number of farms in Lafourche Parish, for example, declined by only 44% compared to almost 80% in neighboring Terrebonne Parish. Similarly, acres in farming in Lafourche Parish fell by 42% compared to 62% in Terrebonne Parish. As one would expect, those parishes experiencing the greatest increase in urbanization generally also experienced the greatest decrease in farming acreage.

Value of Products Sold. The market value of products sold in the region, expressed in current dollars, advanced from $40 million in 1954 to $212 million in 1992 (table 44). Much of the increase, however, was due to inflation. After adjusting for inflation (based on the Consumer Price Index, 1990 = 100), the value of products sold illustrated little upward movement during the period of analysis. Due to the declining farm acreage, however, the real value of products sold advanced from about $145 per acre in 1954 to $237 per acre in 1992. With some exceptions, the value of agricultural output from the region has historically accounted for 12%–13% of the state's output.

Operators. In 1974, the first year for which census data was available on principal occupations, farming was the principal occupation of 57% of the farm operators (table 44). By 1992 it had fallen slightly to about 50%.

Table 44. Selected agricultural statistics by BTES parish: 1954 and 1992.

Location	1954		1992		Percent Change 1954 and 1992	
	No. of Farms #	Acres in Farming (1,000's)	No. of Farms #	Acres in Farming (1,000's)	Percent Change in No. of Farms	Percent Change in Acres in Farming
Ascension	1,283	93.6	325	63.4	- 74.7	- 32.2
Assumption	313	88.3	100	67.9	- 68.0	- 23.1
Iberville	572	134.6	157	81.4	- 72.6	- 39.5
Jefferson	218	21.8	58	4.1	- 73.4	- 81.2
Lafourche	736	230.8	677	87.6	- 44.0	- 42.5
Plaquemines	594	55.2	128	46.1	- 78.5	- 16.5
Pointe Coupee	1,917	240.7	431	193.1	- 77.5	- 19.8
St. Charles	161	64.4	67	23.2	- 58.4	- 64.0
St. James	413	70.2	63	42.9	- 84.8	- 38.9
St. John	141	41.4	26	17.3	- 81.6	- 58.2
St. Mary	417	162.2	101	81.7	- 75.8	- 49.6
Terrebonne	658	116.6	139	44.1	- 78.9	- 62.2
West Baton Rouge	414	55.2	90	38.6	- 78.3	- 30.1

Sources: U.S. Bureau of the Census 1961 and 1994.

Table 45. Selected statistics pertaining to agricultural activities in the region and in Louisiana: 1954–1992.

Location	1954	1959	1964	1969	1974	1978	1982	1987	1992
BTES Region:									
No. of Farms:	7,837	5,592	4,780	3,105	2,340	2,369	2,250	2,093	2,097
Acres (1,000's)	1,375	1,254	1,264	1,135	1,036	1,010	957	852	837
Avg. Size (acres)	175	224	264	365	443	426	425	407	399
Value of Products Sold:									
Current ($ Mill.)	40	41	48	62	---	113	168	169[b]	212
Deflated ($ Mill.)[a]	197	183	204	219	---	227	227	194	198
Operators (Principal Occupation):									
Farming	---	---	---	---	1,264	1,193	1,098	1,032	1,069
Other	---	---	---	---	958	1,176	1,152	1,061	1,028
Louisiana:									
No. of Farms:	111,127	74,438	52,466	42,269	33,240	38,923	31,628	27,350	25,652
Acres (1,000's)	11,441	10,347	10,411	9,789	9,133	9,605	8,929	8,007	7,838
Avg. Size (acres)	103	139	167	232	275	247	282	293	306
Value of Products Sold:									
Current ($ Mill.)	310	335	282	496	1,194	1,230	1,406	1,340	1,607
Deflated ($ Mill.)	1,504	1,502	1,160	1,766	3,158	2,466	1,906	1,542	1,502

[a]Numbers were deflated based on the 1990 Consumer Price Index, i.e., 1990 = 100.
[b]Excludes St. Charles Parish.

Sources: U.S. Bureau of the Census 1961, 1966, 1972c, 1977b, 1981, 1984, 1989, and 1994.

Principal Crops and Livestock

Crops dominate agricultural production in the region, accounting for $190 million of the total $212 million total agricultural sales in 1992 (90%). Livestock and poultry sales of almost $18 million constituted the remaining 10% of total sales. By comparison, livestock and poultry represented more than 30% of the value of the state's total agricultural output by value.

Principal Crops. In the coastal zone, Louisiana's major field crops include rice, soybeans, and sugarcane and to a lesser extent corn and wheat (Coreil and Henning 1995). More than two-thirds of the state's total sugarcane acreage is situated in the region, and it has been a major crop there for almost two hundred years. In 1751 sugarcane was introduced as a crop by the Jesuits who imported stalks from Santo Domingo. However, it is known to have been planted as early as 1733 by Iberville (Calhoun 1992). Prior to the development of successful methods of clarifying and crystallizing sugar in 1795 by Etienne de Bore, sugarcane was used only in the making of a mediocre alcoholic drink, tafia (Calhoun 1992).

Excluding acreage in Pointe Coupee Parish, 90% of the total agricultural crop acreage in the other 12 region parishes was devoted to sugarcane production in 1993 (derived from Coreil and Henning). Iberville Parish (46,300 acres), St. Mary Parish (40,600 acres), Assumption Parish (34,600 acres), Lafourche Parish (30,200 acres), and St. James Parish (23,800 acres) all contributed significantly to total sugarcane acreage. Most remaining crop acreage in the region outside of Pointe Coupee Parish is used in soybeans production.

Pointe Coupee Parish is the exception in crop acreage when compared to the other crop producing parishes in the region and was excluded in the crop analysis to this point because it would skew all figures. This decision reflects the facts that (1) Pointe Coupee accounted for more than a third of the region’s crop acreage in 1993, and that (2) acreage in crops in Pointe Coupee tends to differ from that of other parishes. Specifically, 40% of the 1993 crop acreage in Pointe Coupee was used in the production of soybeans while another 25% was planted in corn.

Livestock. As noted above, livestock production in the region is relatively minor when compared to crops. Coreil and Henning (1995) report slightly more than 80,000 head of cattle and calves on farms in the region parishes in 1994. Lafourche (21,000 head) and Pointe Coupee (19,500 head) account for about one-half of the total. Other region parishes reporting significant quantities include Plaquemines (7,000), Ascension (8,500), and Iberville (10,000).

Other Products. While crops and livestock dominate agricultural statistics in the region, other farm goods are also produced in sizable quantities. Aquaculture production (excluding oysters) in the region, for example, received a farm value of $10.8 million in 1994 (Louisiana Cooperative Extension Service 1994). Crawfish, with a farm value of $5.1 million, represented about one-half of the total. Twenty-four thousand acres in the region were used to produce nine million pounds of crawfish in 1994 with four parishes—Lafourche (6,489 acres), St. James (5,395 acres), St. Mary (3,300 acres), and Iberville (2,650 acres)—accounting for three-quarters of the total acreage. Soft-shell crabs (113,000 dozen valued at $2.0 million) and alligators (14,744 hides) account for much of the remaining value of aquaculture production in the region. Soft-shell crab production is concentrated in Jefferson Parish and St. Charles Parish, while farm-raised alligator production is concentrated in Lafourche Parish (8,054 hides) and St. Charles Parish (4,590 hides).

Citrus products also are produced in limited amounts in the region. Plaquemines Parish, for instance, produced 315,000 bushes of citrus in 1994 valued in excess of $3.0 million. Lafourche Parish produced another 9,800 bushes of citrus valued at more than $30,000.

Transportation

The availability or unavailability of transportation has historically demonstrated significant impact on the economic and social development of communities—their people and their industries. Transportation systems provide access, connection, and expansion. Advances in the methods and modes of transportation have been intrinsically linked to the development and expansion of local communities and economies. In general, "[a]s the economy expands the need for transportation expands; and conversely, as transportation facilities and services increase, the economy is given new impetus" (Wilbur Smith and Associates 1964). In the study region, it has proved true that market demand drives the development of new transportation infrastructures, and increased access in turn stimulates additional economic growth.

Like most early communities in Louisiana, the initial communities of the region were founded along waterways, the most viable transportation system of the time. From these first settlements, inland roads were established. They were followed by the channelization of waterways and the construction of railroads and modern highways. Today, the area is supported by five major modes of transportation: water, roads and highways, rail, air, and pipeline. Historically, each new development in transportation infrastructure and service has initiated opportunities for expanded economic and social growth.

Ports and Waterways

The importance of waterways to the region as well as to the state cannot be overemphasized. The state is a focal point for a nationwide inland waterway system directly connected to ocean traffic. The advantages of water for industrial production and for inexpensive transport of bulk freight have made the state one of the South's fastest growing economic regions (Wilbur Smith and Associates 1964). In addition to the Mississippi River, the region is home to an extensive network of waterways, canals, and port facilities. Major canals and navigable waterways in the region include the following: Bayous Boeuf, Black, Chene, and Lafourche; the Houma Navigation Canal; The Barataria Waterway; the Empire Canal; and the Gulf Intracoastal Waterway

Canals. Although the area has had abundant waterways flowing south, the antebellum planter suffered from an east-to-west transportation problem. Canals were constructed to provide lateral movement. Today's system of canals were initiated by early farmers, trappers, fishermen, and loggers to gain access to resources and markets; later they were expanded by the oil and gas industry for the same reasons. The building of this large network of canals over time has caused large-scale hydrologic and sediment modifications.

Because of the unique marshland environment, canals in the Louisiana coastal areas continued to operate long after canals in other areas of the United States had succumbed to railroad efficiencies. Many of these private waterways eventually became free public canals. Most of the present-day Gulf Intracoastal Waterway System (GIWW) was developed by connecting old canals and waterways across Texas, Louisiana, Mississippi, Alabama, and Florida (Becnel 1989).

The GIWW System was begun at the onset of World War II to provide coastal linkage for the shipment of needed petroleum resources. It has become one of the nation's most important inland waterways, second only to the Mississippi River in shipment tonnage (Larson et al 1980).

Ports. Area ports developed out of a fundamental need to provide regional interface between land and water transportation modes. In addition, this interface provided the infrastructure for expanded access to international markets.

Currently, there are 25 active ports or terminals in the state, i.e., both foreign and domestic. Consequently, Louisiana is first in the nation in total shipping tonnage, handling more than 450 million tons yearly. The ports along the Mississippi River in south Louisiana alone provide the world’s largest port tonnage shipping area and account for 87% of the state's total shipping tonnage (Louisiana Office of the Governor 1995).

Of Louisiana's six deep-draft ports, four are located within the region: Port of Baton Rouge; Port of South Louisiana, Reserve; Port of New Orleans; and Plaquemines Parish

Port. Three of the state's 19 shallow-draft ports are located in the region: Morgan City Harbor and Terminal, Terrebonne Port, and Port Fourchon.

The region is also home to the only supertanker port in the United States, the Louisiana Offshore Oil Port (LOOP). Located in the Gulf of Mexico south of Grand Isle, LOOP handles 800,000 barrels of crude oil each day—12% of the nation's daily crude oil imports (Louisiana Office of the Governor 1995).

Freight Activity. Port facilities, the Mississippi River, the GIWW System, and numerous smaller rivers and bayous provide the region with a major role in state, national, and international commerce. The Port of New Orleans and the Port of Baton Rouge are consistently ranked in the top six of all U.S. ports for total tonnage (Ports and Waterways Institute 1986). With some variation among ports, the major transports of the area are petroleum, farm products, coal and chemical products (table 46). Beginning in 1990 the U.S. Army Corp of Engineers began collecting data for the Ports of South Louisiana and Plaquemines Parish and for other areas separately, reducing the tonnage previously reported under the Port of New Orleans boundaries. Their methods limit the comparability of data for continuing trends among certain subdivisions.

Between 1955 and 1969 the Mississippi River and the GIWW experienced substantial growth in total commodity shipments. Between 1969 and 1976 the GIWW experienced continuous declines in crude petroleum shipments. This decline may be partly due to the increasing utilization of pipelines for petroleum transport. For the Mississippi River, crude petroleum shipments decreased in 1971 and 1973 but nearly doubled in 1976 (Larson et al. 1980).

On the Mississippi River total commodities shipped increase continually between 1969 and 1980, but between 1980 and 1984 total tonnage decreased. Between 1985 and 1989 tonnage steadily increased. By 1989 tonnage was comparable to the pre-1980s drop. On the GIWW System, total commodities tonnage increased until 1980 and then decreased until 1983. By 1984 the GIWW reached its pre-drop tonnage and has continued to grow (U.S. Army Corps of Engineers 1991).

Today, the ports of South Louisiana, Baton Rouge, New Orleans, and Plaquemines are all ranked in the top ten leading U.S. ports, making the region the premier area of the nation in total port volume and an integral part of the nation’s international trade network (table 47).

Table 46. Deep draft ports within the region, total freight: 1992.

Port Statistics	Port of New Orleans[a]	Port of Baton Rouge	Port of South Louisiana	Port of Plaque-mines
Total Freight Traffic (Thousand Tons)	66,379	84,699	199,663	58,474
Percent by Commodity:				
Coal and lignite	0.68	11.64	0.08	57.31
Petroleum and petroleum products	36.32	37.31	27.81	20.92
Chemicals and related products	4.38	21.89	4.82	3.68
Crude materials, inedible except fuels[b]	5.61	12.84	5.76	2.60
Primary manufactured goods	8.74	3.71	0.31	0.42
Food and farm products	42.36	12.60	61.21	15.01
Manufactured equipment and machinery	1.83	0.02	0.01	0.02
Waste and scrap	0.01	0.00	0.00	0.03
Unknown/other	0.06	0.00	0.00	0.00
Percent Foreign Imports	17.53	24.47	14.14	7.28
Percent Foreign Exports	25.97	18.51	33.39	23.97
Percent Domestic	56.15	57.03	52.46	68.75

[a]The U.S. Corp of Engineers began collecting data for Port of South Louisiana and Plaquemines Parish Port separately in 1990. This severely reduced the tonnage previously reported under the Port of New Orleans boundaries.
[b]Includes forest products, soil, sand, gravel, iron ore, non-ferrous ores, sulphur, clay, salt, slag, etc.

Source: U.S. Army Corps of Engineers 1994a.

Table 47. Top fifteen U.S. ports in 1991 (millions of tons).

Rank	Port	Foreign	Domestic	Total[a]	% Change From 1990
1	South Louisiana, LA[b]	89.1	100.3	189.4	-2.5
2	Houston, TX	68.3	62.9	131.2	4.0
3	New York, NY and NJ	43.8	83.1	126.9	-9.4
4	Valdez, AK[c]	<0.1	99.6	99.6	3.8
5	Baton Rouge, LA	38.3	49.3	87.6	12.2
6	New Orleans, LA[b]	29.1	31.8	60.9	-2.9
7	Corpus Christi, TX	36.2	22.9	59.1	-4.8
8	Plaquemine, LA[b]	16.6	37.2	53.8	-5.0
9	Norfolk Harbor, VA	44.0	9.5	53.5	-0.5
10	Long Beach, CA	26.1	26.8	52.9	0.9
11	Tampa, FL	21.4	28.2	49.5	-3.9
12	Los Angeles, CA	25.2	21.8	47.0	1.4
13	Texas City, TX	24.0	19.3	43.3	-10.0
14	Mobile, AL	20.6	20.6	41.3	0.3
15	Lake Charles, LA	23.7	17.5	41.2	0.9

[a]Totals may not equal column sums due to rounding.
[b]For 1990, the Port of New Orleans was redefined to include Lower Mississippi River Miles 81 to 115, and two new ports were added: the Port of South Louisiana and the Plaquemines Parish Port.

Source: U.S. Army Corps of Engineers 1994b.

Railroads

Historical Development. Like canals, railroads developed when the market demand increased for access and efficiencies in the transportation of commodities from the field to processing and from processing to consumers. Railroads made their initial appearance in the state in the 1930s. Initially, they were established essentially as feeders to the steamboats on the rivers, replacing early roadways that were often inadequately maintained and unusable in wet weather (Kniffen and Hilliard 1988). Throughout the state, the impetus for early railroads was commercial access to agricultural products, be they cotton, timber, or sugar.

Within the region, the major demand for railroads was initiated by the sugar industry. Beginning in St. James and Ascension parishes, portable wooden tracks were used with mules to pull cars to and from the mill. Eventually, steel rail was laid throughout the area linking plantations and waterways. Between the late 1880s and the early 1920s the

Plantation Railroad became the "lifeline" of every plantation providing transportation of sugarcane from field to mill and from mill to steamboats. In addition, plantation residents used railroads for passenger transport to school, social events, and church (Butler 1980).

With the debut of steam locomotives between 1885 and 1890 came major impacts on the sugar industry. Rapid construction of localized mills was halted. Instead mills with greater capacity requiring transportation from greater distances were constructed. Plantings increased from hundreds of acres to thousands of acres. Processing became centralized. It has been said that the inauguration of the railroad on the plantation was the greatest single impact on the industry since de Bore first successfully granulated sugar (Butler 1980).

While the demise of the private plantation railroad was brought about by the introduction of "farm-to-market" roads and highways, the impetus of gaining economic efficiencies in the distribution of cotton, grain, tobacco and sugar through the development of the "plantation railroads" promoted the expanse of regional and interstate rail connections. By 1909 New Orleans and surrounding areas were well tracked with railroads providing major connections to all points north, south, east, and west (Meyer 1975).

Current Status. As of 1993 there were approximately 2,974 miles of railroads operating in Louisiana. Approximately 360 miles of track (12%) are within the region’s boundaries. Most railroad activity in the region is centered near or within the area's port facilities. Chemicals and allied products are the predominant rail freight commodities originating at the Port of New Orleans, while petroleum and coal products are the third most important commodities in terms of rail tonnage (Larson et al. 1980).

Within Louisiana there has been a steady decline in total miles of tracks since 1947. Between 1979 and 1993, 532 miles of track (or 15%) in the state were abandoned. Approximately 70 miles of abandonments were within the region. Areas losing rail service include the area between Donaldsonville and Schriever, south of Schriever to Houma, all lines south of Raceland, and from Belle Chasse to Buras (Applied Technology Research Corporation 1993).

These abandonments leave the region without any transportation south of the Southern Pacific line from Morgan City, through Thibodaux to New Orleans. The metropolitan area of Houma is currently without rail service. What was once the grand "Warmouth" railroad expanding the length of Plaquemines Parish from New Orleans to Buras now ends just below Belle Chasse.

The one area of recent investment within the region is the construction of a new Union Pacific marshaling yard in Livonia adding 47 miles of track and $55 million to the region's infrastructure.

Roads and Highways

While streams and waterways within the region are abundant, they could not meet all residents' needs for transportation. Local roads were built before the railroads with the earliest roads running along streams and waterways, connecting residents along the levees and providing an easier route for up stream traffic. Early roads also followed old Indian trails and met at stream crossings, or at other topographical centers that attracted early inhabitants. These features are still important control points in highway locations.

Viable roadways developed faster in the northern parishes of the region. Even into the early 1920s, coastal communities were served by an incomplete system of gravel or shell roads with few paved highways (Larson et al. 1980). Pre-1900 responsibility for road development and maintenance was strictly local within each parish. A statewide systematic program of road construction was not initiated until the early 1900s followed by the creation of the state's Highway Department in 1910 and the constitutional authority to give state aid to parishes for the construction and maintenance of state highways.

With the arrival of the automobile and a state interest in road building, the highway system expanded. By the end of the 1940s, the highway system had extended to most coastal communities. Key events in the development of the area highway system include the 1956 federal authorization of the National System of Interstate and Defense Highways, the building of Highway 1, the upgrade of U.S. 90 from New Orleans to Morgan City, the widening of U.S. 190, and the construction of I-310. Critical to the expansion of highways has been the construction of bridges to cross the numerous waterways. Key bridge developments in the area include the Huey P. Long Bridge, the Destrehan Bridge, the Greater New Orleans Bridge, the Sunshine Bridge, and the Wallace Bridge.

Although waterways have always outranked motor freight, by the 1960s motor freight offered the most expansive form of commerce to all Louisiana communities and posed serious competition to rail freight services (Larson et al. 1980).

Air Facilities

Like many of the other transportation systems in the area, air transportation in the region has expanded largely to support oil and gas industry needs. Air transport was further enhanced by the availability of surplus World War II planes and pilots.

Relative to other modes of transportation, air transport is a young industry. Currently, the region encompasses one commercial airport, New Orleans International in Jefferson Parish, but is serviced by two additional air carriers in Lafayette and Baton Rouge. The nine public general aviation airports in the region are False River Airport–New Roads, Louisiana Regional–Burnside, St. John the Baptist Parish Airport–Reserve, Harry P. Williams Memorial–Patterson, Thibodaux Municipal–Thibodaux, South

Lafourche–Galliano, Houma–Terrebonne–Houma, New Orleans International-New Orleans, and New Orleans Lakefront–New Orleans (table 48).

Table 48. Current number of airport facilities in Louisiana and BTES parishes.

Facility Type	Louisiana	BTES Region
Commercial Air Carrier Airports	7	1
Public General Aviation	66	9
Private Airports	121	12
Private Heliport Pads	306	190
Seaplane	21	17
Agriculture	8	2

Source: U.S. Bureau of the Census 1992c.

Pipelines

Historical Development. Pipelines are a direct result of the specific transportation needs of the oil and gas industry. Originally, offshore petroleum was transported on shore through a fleet of reconditioned navy transports and small oil tankers. This was a cumbersome and uneconomical means of moving product to shore and was replaced by pipelines (Davis and Place 1983). Before 1951 no offshore pipelines existed in the region. The only offshore pipeline at that time was in the Vermilion area (Larson et al. 1980). After World War II, the installation of pipelines in the Gulf of Mexico skyrocketed. By the mid-1950s more than 900 miles of pipelines had been laid and a whole new support industry was born. By 1973 more than 4,000 miles of pipelines had been laid on the bottom of the Gulf (Larson et al. 1980).

Current Status. While virtually all pipelines are privately owned and industry specific, pipelines have revolutionized oil and gas transport and continue to provide increase economic opportunities for the region. In addition, the pipeline system is a key link in the Strategic Petroleum Reserve Distribution Systems. There are several facilities within the study area of major significance to Louisiana's pipeline system, including the Capline System in St. James. Capline, a network dedicated to strategic petroleum reserves, encompasses two internodal facilities: Louisiana Offshore Oil Port (LOOP) and the U.S. Department of Energy-owned facility in St. James Parish.

As of January 1993 the offshore floor contained 21,420 miles of pipeline (Minerals Management Service 1993). This interconnected web is utilized by more than 50 companies to move petroleum and natural gas ashore. They tap into a complex network of lines that move product to processing plants, refineries, residential markets, tank storage sites, and ultimately to transport areas where the fluids are shipped nationwide or worldwide (Applied Technology Research Corporation 1994). In Louisiana there are nearly 8,000 miles of intrastate natural gas pipelines (Louisiana Office of the Governor 1995).

Future Trends

While transportation in the region will remain largely dominated by waterway systems, it should continue to develop the necessary linkages between water and land. Two related themes that will shape the future of transportation will be innovations in information technology and the need for intermodalism. "The road and highway system in the United States is so mature (and so expensive to expand) that new infrastructure-based efficiencies for automobile and truck travel are going to come not from building new larger roads, but from using our present road and highway structure more intelligently" (Petersen 1993).

Historical trends in the development of transportation infrastructures and services have been driven by the marketplace need to gain efficiency and reach new areas. It is most probable that transportation developments be prompted by industry and commerce. As industries strive to gain efficiency in transportation through increased technological advances, so will the local region institute changes in the current transportation system.

Tourism

There is interest in further developing tourism in the region as a means of expanding its employment, payroll, and tax base. Such interest emanates from the region’s natural beauty and from wealth of resources facilitating recreational activities.

Estimated expenditures by tourists[22] in the 13-parish region equaled nearly 700 million in 1992 (table 49). Two-thirds of these total expenditures, however, occurred in a single parish, Jefferson. By comparison, expenditures by tourists in the state in 1992 equaled $4.7 billion, more than half of which was generated in Orleans Parish.

[22]Tourists include national and international travelers. U.S. residents include state and out-of-state residents traveling overnight or on day trips 100 miles or more away from home.

Direct employment from tourism in the region was estimated to equal about 10,000 in 1992, with an associated payroll of $115 million. This translates to an average wage or salary of approximately $11,200 per employee. As with expenditures, the majority of the region's employment is based in Jefferson Parish (71%). Overall, the region accounted for about 13% of the state's total employment generated directly from tourism.

Tourist attractions in the basin are plentiful. For example, bird watchers from throughout the country visit the region. Also, visitors can take guided tours through the swamps and marshes, hearing tales of fact and fiction about the land and its people. Many of these journeys provide excellent and inexpensive opportunities for enjoying the aesthetics of the basin. From Greek revival mansions to gracious nineteenth-century Victorian homes and restored Creole cottages, bed-and-breakfast inns of the area offer urban dwellers an escape and introduce them to the basin's culture and people.

Table 49. Economic impact of travel in the region: 1992.

	Expenditures ($ millions)	Payroll ($ millions)	Employment (thousands)
Ascension	33.96	4.07	0.35
Assumption	5.53	0.58	0.05
Iberville	11.12	1.55	0.12
Jefferson	442.43	80.48	7.31
Lafourche	34.29	4.30	0.37
Plaquemines	12.46	1.83	0.14
Pointe Coupee	5.03	0.60	0.05
St. Charles	19.61	2.51	0.22
St. James	4.06	0.44	0.04
St. John	14.39	2.49	0.22
St. Mary	28.59	4.58	0.41
Terrebonne	51.53	7.20	0.62
W. Baton Rouge	26.64	3.93	0.35
Total BTES[a]	689.64	114.56	10.25
Orleans	2,380.91	594.64	47.29
Total BTES	3,070.55	709.20	57.54
Louisiana	4,704.48	977.11	77.48

[a]excluding Orleans Parish
[b]including Orleans Parish
Source: U.S. Travel Data Center 1993.

Effects Of Socioeconomic Events on Priority Problems

Pollution, habitat loss, contamination of shellfish-growing waters, and coastal erosion are problems pertinent to the region (Lousiana Department of Environmental Quality 1994). Specific priority problems have been identified:

Hydrological Modification. The construction of flood protection projects, navigation channels, canals, and spoil banks has resulted in the interruption of seasonal fresh water inputs from the Mississippi and Atchafalaya rivers. This reduction in fresh water and its associated sediments and nutrients has resulted in increased saltwater intrusion, deterioration of wetland vegetation, and habitat loss.

Sediment Loss. Major economic uses of the Mississippi River and coastal zone—including navigation, flood control, and oil and gas exploration—have led to the construction of projects that either reduce seasonal overflow of sediment-rich water into the coastal wetlands or encourage the deposition of sediments in deep Gulf of Mexico waters. Without the seasonal introduction of sediments, wetland soils are more prone to the degenerative processes of subsidence and erosion.

Habitat Loss/Modification. Wetland loss is the most important type of habitat loss or modification. This loss is usually caused by subsidence, which results in the area's conversion to open water, its overlay by fill, or its isolation by spoil banks.

Changes in Living Resources. Estuarine and wetland habitat loss affects fish yields. Salinity intrusion and eutrophication within the basin have reduced nursery grounds for fish, shrimp, and oysters.

Eutrophication. The increase in the level of nutrients in water is characterized by frequent algal blooms, dominance by undesirable fish species, and fish kills from low levels of dissolved oxygen. The major sources of nutrients causing eutrophication in the Barataria-Terrebonne estuarine system are agricultural and urban nonpoint-source runoff.

Pathogen Contamination. Septic tanks, urban and agricultural runoff, outfalls from publicly owned treatment works, and unsewered hunting and fishing camps have the potential to instigate pathogen contamination. This problem in turn causes the loss of designated uses of water bodies in the basin and seriously affects the oyster industry.

Toxic Substances. Pesticides, herbicides, heavy metals, and other toxic materials are introduced into the estuary from a variety of sources including urban areas, petrochemical industries, and agricultural activities.

An examination of these specific priority problems suggests that all are human induced, either partially or entirely.

As defined by Panayotou (1992), environmental degradation is "the diminution of the environment in quantity and its deterioration in quality." Evaluated in this framework, the seven priority issues are viewed as contributing to overall environmental degradation.[23]

According to Panayotou, a "certain level of environmental degradation is an inevitable consequence of human activity." Therefore, the challenge becomes not to prevent or eliminate all environmental degradation, but rather to restrict it to an acceptable level (i.e., one that meets society's objectives). To that end, the state has identified six objectives for the system (Louisiana Department of Environmental Quality 1994).

Manage hydrology to optimize the longevity of estuarine habitats and productivity;

- Reduce habitat loss and degradation;
- Improve and manage environmental quality by controlling the input of toxins and nutrients and by enhancing the ability of the estuary to assimilate wastes;
- Maximize the long-term productivity of fish and wildlife resources;
- Protect human health and welfare by providing storm protection and by minimizing disease risks;
- Inform and educate the public concerning the estuarine environment's problems, indicating the causes and solutions of these problems.

Socioeconomic changes throughout the region can be used to help identify causes of environmental degradation in the region and, more importantly, to help identify the probability of achieving the six objectives for the region as identified by the state. Some important socioeconomic findings and projections of relevance to the priority issues are examined in the following.

Population. Population in the region advanced from less than 400,000 in 1950 to almost one million in 1990.[24] While estimates of future growth vary widely due to the economic instability in the region during the 1980s and an inability to accurately project population changes under such conditions, the most recent estimate (Irwin 1994) indicates moderate

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[23]For discussion purposes, "environmental degradation" refers to undesirable changes in the physical environment and does not account for changes in the human environment.

[24]Excluding Orleans Parish.

population growth by the year 2010. The potential impacts associated with population growth are, to some extent, self-evident. The system is a fragile ecosystem. Increasing population without establishing adequate safeguards (see land use section for some of the institutional safeguards) places additional demands on the system. Demand, taken to its natural conclusion, implies use (which will be exacerbated for those common property or public good resources for which no price system exists). The use can vary from increased recreational activities to increased use of the environment to dispose of wastes. Without adequate safeguards, increased population will almost certainly contribute to intensification of most, if not all, of the priority problems. Even with appropriate safeguards, intensification of the priority issues may not be altogether reduced but simply slowed.

Urbanization. In 1950, 42% of the population in the 13-parish region (i.e., excluding Orleans) resided in an urban setting. By 1980 the proportion had increased to almost 75%. Because population changed only marginally between 1980 and 1990, the degree of urbanization in the region remained relatively constant during this 10-year interval.

Forecasting future levels of urbanization in the region is extremely complicated, and most predictions will probably prove inaccurate ex post facto. Reasons for making this statement are twofold. First, changes in urbanization are generally associated with changes in population. Changes in population, in turn, are tied directly to economic conditions. These conditions are difficult to forecast with accuracy over any length of time due to unknown exogenous shocks that may be placed on a system. The population changes in the region during the mid-1980s, due to the decline in oil and gas prices, are an example of how economic conditions affect population levels.

A second factor that makes it difficult to forecast future changes in urbanization with any accuracy involves the land loss in the region. Specifically, as wetlands diminish in quantity, the population center will naturally progress to the ridges. The rate of progression, however, will depend on the rate of land loss, which is variable over time and subject to further change in association with state and federal sponsored wetlands creation projects.

These qualifications notwithstanding, it appears most likely that the level of urbanization in the region will increase in the long run as a result of an increased population base and loss of habitable land. However, the extent of the increase is unpredictable and may be only marginal if economic conditions are not favorable.

Urbanization brings with it, however, its own set of environmental problems. With respect to the region’s priority problems, increased urbanization can have pronounced impacts on hydrological modification, sediment loss, eutrophication, and pathogen contamination. Associated with increased urbanization will be an increasing demand for protection levees, resulting in hydrological modifications and subsequently the potential for increased sediment loss. Increased concentration of the population in urban areas may also lead to increased concentration of nonpoint-source runoff. Without an adequate chance to assimilate into the environment, this runoff may result in eutrophication and pathogen contamination.

Nevertheless, urbanization can be an impetus for environmental improvement. For example, urbanization brings with it the economies of scale needed to undertake certain environmental enhancement activities, such as the construction of sewerage systems.

Income. Expressed in real terms, per capita income in the 13-parish region more than doubled between 1960 and 1979. During the next 10-year period, however, it fell sharply. This decline was at least partially in response to declining oil- and gas-related activities in the region.

Predicting future income growth is inherently problematic due to the fact that it entails predicting several exogenous and often global factors. For example, the decline in real income in the region during the 1980s, as noted, was at least partially in response to oil and gas prices. These prices are determined in a global setting influenced by world demand and supply of oil at any given point in time. Therefore, exogenous shocks that influence the world's demand or supply of oil will impact income in Louisiana and thus in the basin.

While predicting long-range income growth in the region with precision may be impossible, some generalizations can be made. Specifically, prolonged (e.g., 1950–1990) growth in real per capita income has occurred in the region, the state, and the country. While short-term declines are not unusual, there is little reason to believe that future long-term trends will not be positive, though the rate of increase may be somewhat lower than historical trends would indicate.

While some negative environmental consequences are associated with increased income—such as the generation of larger amounts of solid waste (Jenkins 1993), environmental quality throughout the world generally correlates positively with income. To some extent, this correlation reflects the fact that increased income yields a higher tax base with which to implement environmental enhancement activities.

Overall, the relevance of income growth to the priority issues cited above is tenuous. To the extent that income is positively related to recreational activities, increasing income levels may result in more pressure being put on living resources. This increased pressure, however, should not result in unacceptable changes in the levels of these renewable resources if sound management practices are implemented that ensure their long-run sustainability.

Increased income also suggests increased investment in a given region. This increased investment ensures higher benefits in comparison to fixed costs when conducting a benefit/cost study to determine the feasibility of a proposed action.[25] This action might take the form of building flood protection levees, which could result in hydrological modifications. Alternatively, the proposed action might be wetlands creation that could protect investments in lieu of levees.

Education. In 1950 only about 18% of the population ($\geq$ 25 years of age) in the 13-parish region had completed high school. By 1990 the proportion had advanced to about 70%.

[25]Not considering is the relation between income and political clout. If income relates positively with political clout, projects may be implemented regardless of the economic feasibility.

While these figures suggest an increasingly more educated population and workforce, the 1990 figure remains below comparable figures for the state and nation. There is little reason to suggest that the overall education level will not continue to increase in the region and state, as well as in the nation.

Overall, increased education is positively correlated with income. Some potential impacts of increased income in relation to the priority issues were assessed above. In addition, increased education allows the general population to better comprehend environmental problems and react accordingly.

Employment. In 1965 almost 60% of the total labor force in the region's private sector was concentrated in three business sectors: manufacturing (23.8%), retail trade (19.1%), and mining (14.9%). Contract construction accounted for another 13.8% of the total labor force employment; transportation/utilities, finance/insurance/real estate, and services each contributed another 9% of the employment base.

By 1990 employment in the services sector advanced to about 25% of the total employment base in the region while employment in the retail trade sector increased to almost 24% of the total. Conversely, employment in manufacturing fell to about 16% of the total, and employment in mining fell to less than 4% of the private sector employment.

Identifying future changes in the employment base can help to determine associated impacts related to the priority issues. One generally accepted change reflects the fact that mining (i.e., primarily oil and gas activities) is based on extraction of finite quantities of natural resources. As this natural resource base declines, there will be a concomitant decline in employment opportunities in this sector. Because extraction activities along the coast are known to compromise environmentally sensitive areas, reduction in these activities should result in a reduction in environmental degradation in these areas.[26]

Manufacturing activities are recognized as a major source of point-source pollution throughout the Gulf of Mexico region. Assuming the current trend continues, future reductions in the region's manufacturing activities imply lower levels of point-source pollution. With respect to the priority issues, point-source pollution[27] can result in eutrophication, reduction in fish yields (i.e., changes in living resources), and the release of toxic substances (e.g., heavy metals).

Retail trade- and services-related activities are likely to be somewhat less environmentally compromising than either mining or manufacturing activities. Employment in the former two sectors has historically been increasing, and most evidence suggests that expansion will continue into the foreseeable future.

Natural resources. Natural resources can be classified as either renewable or nonrenewable.

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[26]Various regulations have also been instituted to ensure lower amounts of environmental damage (see land-use section).

[27]See previous footnote.

Renewable resources. As noted earlier, the wealth of renewable resources in the region lends itself to a wide variety of commercial and recreational activities. Demand for recreational activities is related to absolute population size and income. Given increases in these two factors, demand for recreational activities in the region is expected to rise in the foreseeable future. This increase may in turn place additional pressure on some of the living resources, such as fisheries. Hence the need for effective management.

The commercial harvest of natural resources depends on several interrelated economic factors, including (1) output price, (2) input price, and (3) opportunity cost associated with time. Any opportunity cost in turn depends on job opportunities in alternative employment sectors.

Output prices (adjusted for inflation) of many of the renewable resources commercially harvested in the region have fallen over time. The real dockside shrimp price in the Gulf region, for example, has fallen over the past decade. This decline is due to a sharp increase in imported products following the expansion of farm-raised shrimp production in foreign countries. Similarly, fur prices have fallen over the past decade due to changes in demand for products made from fur (likely a response to the anti-fur movement).

As documented earlier, shrimp represents the primary species harvested by the commercial fishing sector in the region. Assuming the long-run real dockside shrimp price continues to decline in association with continued expansion of farming activities, commercial pressure is likely to dwindle.[28] An analogous argument can be made with respect to the fur-bearing animals.

Nonrenewable resources. Because of their contribution to the region's economy, oil and natural gas have been considered in some detail in this document. Production of these nonrenewable resources has been declining throughout the state for several decades now. While an increase in price may result in short-term production increases, the long-run prospect suggests further decline in production as reserves are drawn down. Reduction in oil and gas production has affected and will continue to affect the region.

The environmental impacts associated with oil-and gas-related activities in the region are covered in other status and trends reports and thus are not considered here. Of some relevance to the current subject is the fact that the decline in these activities reflects a long-run decline in profitability in the industry as reserves are drawn down and ongoing activity moves further offshore. The offshore movement brings with it different infrastructure needs and a potentially different set of environmental concerns. These concerns, however, may not be significant to the region.

Agriculture. Acreage in agriculture in the region has exhibited a long-run decline, with the total equaling only about 840,000 acres in 1992 compared to 1.3 million acres in 1964 (a reduction of almost 40%). The reduction in the number of farms during the same period was almost 75%, from about 7,900 to 2,100. Despite the sharp decline in number

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[28]*Not* taken into consideration in this discussion is demand. If global demand increases sufficiently to offset supply increases, the real dockside shrimp price may increase in the long-run.

of farms and total acreage, the real value of output remained relatively constant during the study period, most likely indicating increased output per acre (assuming the real price of the output has not increased, which seems unlikely).

Sugarcane currently dominates crop production in the region (excluding Pointe Coupee Parish). A long-standing, complex set of programs—including import restrictions and price-support systems—help to ensure price and production stability in this agricultural sector. These programs have recently come under attack, and there exists some question whether they will extend into the foreseeable future. If they do not, it is likely that sugarcane production in the region will decline significantly. Currently, agricultural runoff is cited as contributing to many of the region's priority problems, including eutrophication, pathogen contamination, and toxic substance introduction. If federal programs supporting production of sugarcane are curtailed, the impact of farming activities on the priority issues will likely decline by a significant amount.

SOCIETAL AND INSTITUTIONAL INTERACTIONS

Introduction

This section considers two fundamental issues: the status of present government-sponsored environmental programs in addressing priority problems affecting the basins (table 50); and the institutional trends that indicate where economic development (residential, commercial, agricultural, and industrial) could reasonably be expected to occur, in view of these programs.

The only constant in the Barataria and Terrebonne basins is change: the cyclic progradation and degradation of the delta, the migration of human occupancy, and the institutional programs that shape lives and jobs. The Mississippi River shifted seven times during the past 6,500 years and continues today in the Atchafalaya bay, producing a landscape of natural levees, wetlands, bays, and barrier islands. As one deltaic lobe builds, an older complex disappears into the geologic record. Marshes or swamps lost south of Houma are replaced by wetlands in the Atchafalaya basin or bay. Likewise, lakes fill and convert to swamps as bottomland hardwoods become open water. Fish, shrimp, and crabs follow the transition of habitats. While ambulatory species swim, seeking preferred salinity regimes, established shellfish are buried, only to have spats colonize hard bottoms and grow to commercial size.

Generations of residents in the region lived and adjusted to these physical processes. Deltas historically took hundreds of years to complete a cycle from open water to open water. Protracted schedules allowed families to adjust their activities incrementally and subconsciously to prepare for inevitable relocation. However, when rapid change occurred, it had the cataclysmic consequences of instantaneous displacement and loss of livelihood. For example, Cheniere Caminada was never reoccupied after the 1893 hurricane nor did Manila Village recover from Hurricane Betsy in 1965. As recently as 1993 families decided after Hurricane Andrew to leave the low-lying coastal ridges of south Terrebonne and seek higher ground in the Houma region. Beginning in the 1920s, general occupancy patterns began to show a slower but just as dramatic evolution. Isolated villages founded by the Acadians in the eighteenth century disappeared. A younger population preferred the larger communities: access to roads, availability of electricity, the many and varied economic opportunities, and better flood protection. Today, however, in addition to natural processes and human desires for amenities, governments affect how and where development may occur in the basins.

Incremental federal involvement in local growth issues has a long history that peaked in the last decade. One of the first efforts to stimulate economic development was through

Table 50. Comparison of priority problems between the BTNEP Policy Committee and the CCMP Management Conference.

BTNEP POLICY COMMITTEE Priority Problems	**CCMP MANAGEMENT CONFERENCE Programmatic Problems**
1. Hydrologic Modification	Human activities have disrupted estuarine ecological balances through habitat loss/modification and altered hydrology to an unacceptable degree
2. Reduction in Sediment Availability	Human activities have disrupted estuarine ecological balances through habitat loss/modification and altered hydrology to an unacceptable degree
3. Habit Loss/Modification	Conversion and loss of land resulting from human activities and natural processes Human activities have disrupted estuarine ecological balances through habitat loss/modification and altered hydrology to an unacceptable degree
4. Changes in Living Resources	The basin contains finite renewable and non-renewable resources
5. Eutrophication	Pollutants introduced faster than the ecosystem can acceptably assimilate them
6. Pathogen Contamination	Pollutants introduced faster than the ecosystem can acceptably assimilate them
7. Toxic Substances	Pollutants introduced faster than the ecosystem can acceptably assimilate them
	Inadequate, unbalanced management and regulation of natural resources that results in loss of revenue, employment, and sustainability of our estuarine basin
	Adequate resources (funding?) are not currently available because of a lack of understanding of national impact
	No true product delivery (education and awareness programs)
	Lack of clearly defined data needs and lack of access, suitability, and availability to users
	Public does not understand the benefits of regulation and government does not implement and enforce existing laws and regulations consistently and thoroughly
	Lack of integrated common goals and priorities (comprehensive watershed plan)
	Humans must adjust to natural processes
	A large variety of interests are often in conflict with each other at a time when the entire system is in need of a unified solution

Sources: Barataria-Terrebonne National Estuary Program 1993 and 1995.

water resource projects, initially the responsibility of states and the private sector. In 1826 Congress passed the first omnibus Rivers and Harbors Act authorizing navigation projects and surveys. To maximize development opportunities meant not only clearing channels in the lower Mississippi River valley and maintaining the river's mouths, but also protecting against high water. Flood control within the Mississippi valley became a national issue after the devastating 1874 flood. In 1879 Congress created the Mississippi River Commission to prepare plans for improving navigation and preventing floods (Holmes 1972).

As a result of the record Mississippi flood of 1927, which inundated most of the lowlands from valley wall to valley wall, the Rivers and Harbors Act of 1928 shifted responsibility for flood control from state and local interests to the federal government. The U.S. Army Corps of Engineers standardized levee design and construction, created floodways, and eventually incorporated reservoirs into the flood fight, providing a sense of security in the basins. But the speed at which the wetlands were lost and new programs were introduced into every sector of their lives unnerved many residents, who preferred the status quo and an unaltered landscape. During the last 25 years, legislation has reached to address new issues related to population growth, a more complex economy, and a publicly expressed concern for the adverse consequences of growth and development.

Beginning with the National Environmental Policy Act of 1970, Congress passed significant legislation mandating the incorporation of the consequences of a project into its design and construction. In the past, if an idea was technologically possible, economically feasible, and socially acceptable, it was built. Today, the same proposal must meet these three criteria and be environmentally suitable or it will not be realized. Future development within the Terrebonne and Barataria basins no longer rests solely on physical processes or economic factors, but includes government decisions. Social issues (see previous chapter)—such as unemployment, welfare, education, small business incentives, taxes, and similar health, family, or civic programs— remain the responsibility of other reviewers and do not appear here.

Priority Problems

The scientific community has identified priority problems in the Terrebonne and Barataria basins (Louisiana Office of the Governor 1989). Hydrology has been modified and water movement blocked or impeded by road and railroad embankments as well as by levees. Navigation and access canals accelerate runoff or impound water and allow saltwater intrusion. In all cases, the basins are further compartmentalized. Second, the basins no longer receive the sediment required to maintain healthy wetlands. Flood protection levees along the Mississippi River and a decrease of sand, silt, and clay in the river from inland watersheds reduces the volume of material—the basic building blocks of the landscape—from reaching the wetlands. Third, the basins continue to lose wetlands because of filling, impoundment, dredging, subsidence, and erosion. This decrease in acreage affects the living resources by destroying the habitat for fish, waterfowl, wildlife, and shellfish. Finally, the basins suffer from water quality impairment. Eutrophication results from fertilizers and nitrogen running off fields and lawns. Untreated and undertreated sewage from urban areas, camps, and boats contaminate numerous water bodies. Toxic substances from streets, parking lots, storm drains, agricultural activities, industry, and individuals contribute pollutants to the basins' waterways and wetlands.

Tables 51–54 present information on existing federal and state programs that address these priority problems. Most programs treat many problems to some degree and thus appear several times.

As an independent exercise, the Management Conference of the Barataria-Terrebonne National Estuary Program also compiled a list of priority problems facing the people of the basins (table 50). Their list expanded beyond the physical and biological issues that the scientists had identified and included many institutional and social concerns. In addition to the above described federal and state programs, a discussion of the trends in economic development must consider two other environmental programs more closely related to the Management Conference concerns. First, the *National Historic Preservation Act of 1966* (16USC470 and *Preservation of Historical and Archaeological Data Act of 1974* (16USC469 et seq.) require cultural resource surveys and recovery of data and materials. The presence of a National Register property usually means avoidance of the site. The presence of an archeological site and/or a National Register site can cause delays in the project and redesign of the layout to avoid the location. And second, *the Clean Air Act* (42USC7401 et seq.) protects human health and the outdoors from pollution. Requirements of the Act may affect where industries can locate in the basins.

Existing regulatory programs do not address several priority problems identified by members of the BTNEP Management Conference (Barataria-Terrebonne National Estuary Program 1991):

- Inadequate, unbalanced management and regulation of natural resources result in loss of revenue, employment, and sustainability of the estuarine system.
- Adequate resources are currently unavailable because of a lack of understanding of national impact.
- No true product delivery.
- Lack of clearly defined data needs and lack of access, suitability, and availability to users.
- The public does not understand the benefits of regulation and government does not implement and enforce existing laws and regulations consistently and thoroughly.
- Lack of integrated common goals and priorities.
- Humans must adjust to natural processes.
- A large variety of interests are often in conflict with each other at a time when the entire system is in need of a unified solution.

Table 51. Federal and state laws and programs addressing modification of hydrology.

Federal—Regulatory

The National Environmental Policy Act (42USC4321-4375) (NEPA) forces federal agencies and applicants for federal permits, funding, or approvals to employ the skills of scientists from different disciplines during project design. The NEPA planning process includes assessing environmental impacts of alternatives and presenting the consequences in an environmental impact statement or environmental assessment. New environmental disclosure procedures have greatly changed the traditional methods for designing and implementing both government and private projects.

Section 404 of the Clean Water Act (33USC1251 et seq.) controls the deposition of dredged and fill material in waters of the United States including wetlands. The Act does not affect normal (ongoing) farming, silviculture, and ranching practices. However, it does influence the location, design, construction, operation, and maintenance of activities involving wetlands. For example, a project may be relocated to a site that avoids wetlands. The design may be reconfigured to avoid or to minimize impacts on wetlands. Construction practices may be modified to reduce impacts. Operations of the activity may now eliminate some elements, such as a fueling station at a marina. Finally, maintenance practices may now include erosion prevention along watercourses and the regular collection of pollutants. These practices are designed to protect water quality and, consequently, the associated renewable resources.

The National Flood Insurance Program (42USC4001-4128) limits development in floodways and mandates construction standards for flood plains and for areas subject to hurricane storm surge.

Federal—Nonregulatory

Large federal flood control, hurricane protection, and navigation projects—such as those along the Mississippi and Atchafalaya rivers and the West Bank of Jefferson, Orleans, and Plaquemines parishes—prevent annual introduction of river water and sediment into the basins similarly the Houma Navigation Canal, Barataria Waterway, and Bayous Boeuf, Black, and Chene disrupt the natural water-circulation patterns.

The Coastal Zone Management Act (16USC1451-1464) provides support for the Louisiana coastal zone management program. Refer to the following state section.

Table 51. Cont.

The Coastal Wetlands Planning, Protection and Restoration Act (the Breaux-Johnston Act) (16USC3951 et seq.) provides funds for planning projects that restore coastal wetlands by manipulation of hydrology, sediment, and biology.

The Fish and Wildlife Coordination Act (16USC661-668) gives the Fish and Wildlife Service, the National Marine Fisheries Service, and state conservation agencies the opportunity to comment on federal permit actions to protect biological resources. These comments must be considered by the lead federal agencies.

Louisiana—Regulatory

The Department of Natural Resources administers the Louisiana Coastal Management Program (LRS49:214.21-49:214.40). Through application of coastal use guidelines, the Coastal Management Division works to minimize the adverse impacts of projects—such as hydrologic modification—in the Louisiana Coastal Zone. General and special conditions on the coastal-use permit affect the location, design, construction, operation, and maintenance of projects.

The Department of Transportation and Development (DOTD) moves people and goods safely and efficiently on a statewide transportation network. DOTD builds and maintains roads to distal communities and across wetlands, modifying the hydrology. DOTD works with levee districts and drainage boards providing flood control and drainage of enclosed lands.

Louisiana—Nonregulatory

Louisiana Act 645 allows a landowner to reclaim or recover land lost through erosion if the land was contiguous to and abutting navigable water bottoms and if erosion occurred after July 1, 1921.

The Coastal Wetlands Conservation and Restoration Program (Act 6 of the 2nd Extraordinary Legislative Session of 1989) established the Governor's Office of Coastal Activities to coordinate the state's position on coastal issues, such as hydrology.

Table 52. Federal and state laws and programs addressing lack of sediment.

Federal—Regulatory

None

Federal—Nonregulatory

Large federal flood control, hurricane protection, and navigation projects—such as along the Mississippi and Atchafalaya rivers and the West Bank of Jefferson, Orleans, and Plaquemines parishes—prevent annual introduction of river water and sediment into the basins similarly the Houma Navigation Canal, Barataria Waterway, and Bayous Boeuf, Black, and Chene disrupt the natural water circulation patterns.

The Coastal Wetlands Planning, Protection, and Restoration Act (the Breaux-Johnston Act or CWPPRA) (16USC3951 et seq.) provides funds for planning projects that restore coastal wetlands by manipulation of hydrology, sediment, and biology.

Louisiana—Regulatory

None

Louisiana—Nonregulatory

The Coastal Wetlands Conservation and Restoration Program (Act 6 of the 2nd Extraordinary Legislative Session of 1989) established the Governor's Office of Coastal Activities to coordinate the state's position on coastal issues, such as the need for sediment in particular areas.

Table 53. Federal and state laws and programs addressing habitat loss and changes in living resources.

Federal—Regulatory

The National Environmental Protection Act (42USC4321-4375) forces federal agencies and applicants for federal permits, funding, or approvals to employ the skills of scientists from different disciplines during project design. The NEPA planning process includes evaluating alternatives and presenting the consequences in an environmental impact statement or environmental assessment. New environmental disclosure procedures resulted in major changes to the traditional methods for designing and implementing both government and private projects.

Section 404 of the Clean Water Act (33USC1251 et seq.) controls the deposition of dredged and fill material in waters of the United States including wetlands. The Act does not affect normal (ongoing) farming, silviculture, and ranching practices. However, it does affect the location, design, construction, operation, and maintenance of activities involving wetlands. For example, a project may be relocated to a site that avoids wetlands. The design may be reconfigured to avoid or to minimize impacts on wetlands. Construction practices may be modified to reduce impacts. Operations of the activity may now eliminate some elements, such as a fueling station at a marina that could indirectly contribute to habitat loss and a reduction in living resources. Finally, maintenance practices may now include erosion prevention along watercourses and the regular collection of pollutants. These practices are designed to protect water quality and, consequently, the associated renewable resources.

The Coastal Zone Management Act (16USC1451-1464) provides support for the Louisiana Coastal Zone Management Program. Refer to the following state section.

The National Flood Insurance Program (42USC4001-4128) limits development in floodways and mandates construction standards for flood plains and areas subject to hurricane storm surge.

Executive Order 11988 (Floodplain Management) and *Executive Order 11990* (Protection of Wetlands) encourage federal agencies to avoid flood plains and protect wetlands in their projects and programs.

The Endangered Species Act (16USC1531-1544) protects plants and animals and their critical habitat. Provisions of the Act affect siting, design, construction, operation, and maintenance of a project. For example, some areas must be avoided either completely or during part of the year.

Table 53. Cont.

The Food Security Act of 1985, as amended (Swampbusters) (16USC3821-3824), keeps wetlands that are marginal agricultural lands from being cleared and drained for agricultural purposes. Through the Food, Agricultural, Conservation, and Trade Act of 1990 (Wetlands Reserve Program), the U.S. Department of Agriculture may acquire easements on eligible lands cleared for agriculture that will be restored to wetlands. Both acts affect decisions on conducting agricultural business by eliminating lands from production and increasing acres of wetlands. Drainage districts, levee boards, parishes, and municipalities must be careful with their storm and flood projects. If a public project adversely impacts wetlands on an agricultural parcel, the farmer may lose federal benefits even though he was not responsible for the wetlands conversion.

The National Pollution Discharge Elimination System (NPDES) (Section 402 of the Clean Water Act) sets effluent limitations from point sources of discharge.

Federal—Nonregulatory

The Natural Resources Conservation Service (formerly the Soil Conservation Service) through the Small Watershed Protection Act (16USC1001-1009) provides technical and financial assistance in planning and implementing activities for conserving, protecting, developing, and utilizing land and water resources in a small watershed. Their revised mission now focuses on working with landowners to protect and enhance wetlands.

Two Department of Agriculture programs compensate landowners for protecting wetlands: the *Water Bank Program* (16USC1301-1311) and the *Wetlands Reserve Program* (16USC3837A-3837I). Both programs involve landowners in wetlands conservation in eligible areas.

The Coastal Barrier Resources Act (16USC1301-1305) restricts federal subsidies for development of undeveloped coastal barriers, thereby protecting the barrier vegetation and surrounding water bodies.

The Fish and Wildlife Coordination Act (16USC661-668) gives the Fish and Wildlife Service, the National Marine Fisheries Service, and state conservation agencies the opportunity to comment on federal permit actions in order to protect biological resources. These comments must be considered by the lead federal agencies.

Table 53. Cont.

The Coastal Wetlands Planning, Protection and Restoration Act (the Breaux-Johnston Act or CWPPRA) (16USC3951 et seq.) provides funds for planning projects that restore coastal wetlands by manipulation of hydrology, sediment, and biology.

Louisiana—Regulatory

The Department of Natural Resources administers the Louisiana Coastal Management Program (LRS49:214.21-49:214.40). Through application of coastal use guidelines, the Coastal Management Division works to minimize the adverse impacts of projects—such as habitat modification—in the Louisiana Coastal Zone. General and special conditions on the coastal-use permit affect the location, design, construction, operation, and maintenance of projects. St. James, Jefferson, Lafourche, and Orleans parishes each have a Local Coastal Management Program that affects activities of local concern.

Louisiana Act 645 allows a landowner to reclaim or recover land lost through erosion if the land was contiguous to and abutting navigable water bottoms and if erosion occurred after July 1, 1921. Basically, habitats revert to subaerial from subaqueous.

The Scenic Rivers program (LRS56:1841-1849) through the Department of Wildlife and Fisheries includes a permit procedure for protecting the banks of state scenic rivers.

Louisiana—Nonregulatory

The Coastal Wetlands Conservation and Restoration Program (Act 6 of the 2nd Extraordinary Legislative Session of 1989) established the Governor's Office of Coastal Activities to coordinate the state's position on coastal issues, such as wetlands.

Table 54. Federal and state laws and programs addressing water quality.

Federal—Regulatory

The National Environmental Protection Act (42USC4321-4375) forces federal agencies and applicants for federal permits, funding, or approvals to employ the skills of scientists from different disciplines during project design. The NEPA planning process includes evaluating alternatives and presenting the consequences in an environmental impact statement or environmental assessment. New environmental disclosure procedures greatly changed the traditional methods for designing and implementing both government and private projects.

Section 404 of the Clean Water Act (33USC1251 et seq.) controls the deposition of dredged and fill material in waters of the United States including wetlands. The act does not affect normal (ongoing) farming, silviculture, and ranching practices but does affect the location, design, construction, operation, and maintenance of activities involving wetlands. For example, a project may be relocated to a site that avoids wetlands. The design may be reconfigured to avoid or minimize impacts on wetlands. Construction practices may be modified to reduce impacts. Operations of the activity may now eliminate some elements, such as a fueling station at a marina that could cause degradation of water quality. Finally, maintenance practices may now include erosion prevention along watercourses and the regular collection of pollutants. These practices are designed to protect water quality and, consequently, the associated renewable resources.

Section 402 of the Clean Water Act (33USC1251 et seq.) requires a discharge permit for any point source discharge: e.g., from industrial sites, dairy lagoons, sewage treatment plants, and manufacturing or processing facilities.

The Coastal Management Act (16USC1451-1464) provides support for the Louisiana Coastal Management Program. Refer to the following state section.

The National Flood Insurance Program (42USC4001-4128) limits development in floodways and mandates construction standards for flood plains and for areas subject to hurricane storm surge.

The Resource Conservation and Recovery Act (RCRA) (42USC6901 et seq.) regulates the disposal of hazardous and solid waste. The Department of Environmental Quality emphasizes regional landfills, prohibits open solid waste dumps, and regulates the handling of hazardous wastes.

Table 54. Cont.

The Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA) (42USC9601-9675) for the cleanup of abandoned hazardous waste sites, may affect future uses of selected tracts and associated water quality.

The Federal Insecticide, Fungicide, and Rodenticide Act as amended (FIFRA) (7USC136 et seq.) regulates the registration and use of these products in order to protect human health and the environment. The Louisiana Department of Agriculture and Forestry and the Cooperative Extension Service provide training programs to certify pesticide applicators.

Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 directs that states with approved coastal programs develop and implement a coastal nonpoint pollution abatement program. “Best management practices” are the primary vehicles for reducing or eliminating nonpoint pollution from activities affecting the coastal zone. Best management practices are “practices or combination of practices that are determined to be the most effective and practicable (including technological, economic, and institutional considerations) means of controlling point and nonpoint pollutants at levels compatible with environmental quality goals” (Soil Conservation Society of America, 1982). “Mandatory best management practices” will modify the design, construction, operation, and maintenance of projects.

Federal—Nonregulatory

Section 319 of the Clean Water Act focuses on voluntary efforts to reduce nonpoint pollution throughout Louisiana. The Louisiana Department of Environmental Quality provides grants, educational material, and personal contact with parishes and municipalities.

The Coastal Barrier Resources Act (16USC1301-1305) restricts federal subsidies for development of undeveloped coastal barriers, thereby protecting adjacent water bodies from point and nonpoint pollution.

Table 54. Cont.

Louisiana—Regulatory

The Department of Natural Resources administers the Louisiana Coastal Management Program (LRS49:214.21–49:214.40). Through application of coastal use guidelines, the Coastal Management Division works to minimize projects' adverse impacts—such as reduced water quality—in the Louisiana Coastal Zone. General and special conditions on the coastal-use permit affect the location, design, construction, operation, and maintenance of projects. St. James, Jefferson, Lafourche, and Orleans parishes each have a Local Coastal Management Program that affects activities of local concern.

The Louisiana Department of Environmental Quality (LDEQ) administers the Section 401 Water Quality Certification provisions of the Clean Water Act (33USC1341). The process is another method for protecting the state's water resources. LDEQ also administers permit programs on point source discharges, hazardous waste sites, and solid waste facilities.

The Department of Health and Hospitals oversees the state sanitary code, including the regulation of discharges from onsite wastewater treatment facilities (septic systems and mechanical plants) not regulated by the LDEQ. This program affects water quality in the basins.

DOTD moves people and goods safely and efficiently on a statewide transportation network. DOTD constructs public works (levees, roads, and dams) projects that could affect water quality during construction or operation.

Louisiana—Nonregulatory

The LDEQ has established a program within the Office of Water to address nonpoint pollution. The nonpoint pollution program provides grants, educational material, and personal contact with parishes and municipalities.

The Department of Health and Hospitals can provide educational materials on sanitation.

A major role of BTNEP is to begin to resolve these problems through a Comprehensive Conservation Management Plan (CCMP). The draft CCMP was available for general review by fall 1995.

The results of any study assessing the effectiveness of existing regulatory programs in dealing with the priority problems depend on (1) the study's sponsors, (2) the vested interest of all participants, and (3) the methodology of analysis. A range of conclusions appears. Only one known study (Laska et al. n.d.) reports on the status of most of the environmental programs applicable to the basins. This study, sponsored by BTNEP, found that one-quarter of the respondents gave a neutral assessment of their program while one-half rated their programs as quite effective (Laska, et al. n.d.). The study of agencies was based on interviews with management-level personnel administering each program.

Evaluations of specific programs were conducted by agencies or third parties. An article in the *Tulane Law Review* (Houck 1983) discussed freshwater diversions, the effectiveness of the Section 404 program in south Louisiana, and the Louisiana Coastal Management Program. Houck (1983) concludes: "The regulatory programs to date have done little more than preside over, somewhat retard, and give a false perception of the loss of the coastal zone."

Houck's study is over ten years old. The Coastal Management Division, Louisiana Department of Natural Resources (1991), argued that the outlook has changed for the better. The Coastal Management Division presented data to refute Houck's claim about the Louisiana Coastal Management Program.

Houck (1985) reviewed the National Flood Insurance Program (NFIP) in Louisiana. He concluded that its effect was undetermined as of 1985. L. R. Johnston Associates (1992) reports that from a national perspective the: "NFIP experience is beginning to yield evidence that the flood loss reduction standards are preventing flood damages and that the insurance mechanism is shifting a significant amount of flood damage costs from disaster assistance programs to floodplain occupants."

L. R. Johnston Associates' nationwide conclusion seems applicable to Louisiana. Storm damage from Hurricane Andrew in 1992 in lower Terrebonne Parish was mainly attributable to wind and not flooding. Little if any water damage was reported to structures built to Federal Insurance Administration's specifications. The Federal Emergency Management Agency (1992) reported that "Most storm-related damage was caused by wind, wind-blown rain, and tornadoes." In addition, "In all areas where flooding occurred, structures built to or above NFIP minimum standards received little or no damage. In coastal velocity zones, all structures that were properly anchored, cross-braced and clipped received minor or no damage."

Wascom (1982) concludes that the Section 404 permitting process can cause significant project modifications that protect coastal wetlands. Emmer (1980) determined that the National Environmental Policy Act can likewise have a dramatic effect on project location, design, and construction, in particular when the agencies are responding to court orders or to the prospect of public action. However, in both the case of Section 404 decisions and the influence of the NEPA process, there is little information on the regulations' effects on cumulative impacts. More importantly, there are known examples where neither process has protected wetlands. Effective programs depend on the will of decision-makers as they manage specific permit applications.

In 1991 the National Marine Fisheries Service (NMFS) (Hartman et al. 1993) reviewed the effectiveness of its wetlands conservation efforts in Louisiana. They found that the lead federal agency accepted the NMFS recommendations on 43% of the permit applications. On 34% of the permit applications, the lead agency accepted some of the NMFS recommendations. These statistics suggest the NMFS efforts are effective in protecting tidal wetlands in those instances where they became involved.

Recently, the W. Alton Jones Foundation (Boesch et al. 1994) sponsored a review of the federal approach to coastal wetlands loss through the Coastal Wetlands Planning, Protection, and Restoration Act of 1990. The report (Boesch et al. 1994) concludes that

> The planning activities conducted under this act are off to a good start but will have to more effectively: (1) integrate regionwide strategies with those developed locally (within hydrologic basins), (2) moderate the self-interests of performing parties (e.g., federal and state agencies) by objective technical and policy review, (3) balance private land rights with the greater public interest in the integrity of coastal wetlands, and (4) attain financing for the large-scale reintroduction of fresh water and sediments which must be the backbone of effective restoration in the deltaic plain.

In 1992, 49,888 acres on 265 farms in Louisiana bid for acceptance into the Wetlands Reserve Program established in 1990 (Payne 1993). Only 20% (14,075 acres from 43 farms) were approved and received an average of $491/acre for participation in the program. With this type of positive response, the Wetlands Reserve Program appears very effective in Louisiana and is limited only by the availability of federal support. An incentive program for wetlands protection is a preferred alternative to regulatory actions.

The Secretary of the Interior recently submitted an evaluation of the impact of federal programs on wetlands. The report (U.S. Department of the Interior 1994) concludes that:

> Urban development remains an important threat to the wetlands in southern Louisiana. Enforcement of the Floodplain Management and Wetland Protection Executive Orders could help to alleviate urban development problems. Moreover, wetland loss could be stayed by denying federal subsidies—. . . and National Flood Insurance—to developments in flood plains and other wetlands. . . Agricultural conversion, once a serous (sic) threat to Louisiana's coastal wetlands, no longer appears as such because of the 1985 FSA and the 1990 amendments to the FSA in FACTA.[29]

[29]FSA = Food Security Act; FACTA = Food, Agriculture, Conservation, and Trade Act

The Threatened and Endangered Species Act affects project location, design, and construction. The author has been a consultant on projects that were changed to avoid endangered species nests and critical habitat. One project which required a U.S. Army Corps of Engineers Section 404 permit incorporated acreage for a red-cockaded woodpecker nest and critical habitat into redesign of a residential development. A transportation study eliminated alternatives that would adversely impact eagle nests.

The state evaluates the status of its environmental programs (Louisiana Office of the Governor 1995). Statistics for the period 1987–1992 show a reduction in total toxic releases from 856 million tons to 476 million tons, a decrease of approximately 44%. The document reports (Louisiana Office of the Governor 1995): that, for the Baton Rouge Nonattainment Area,

> Increased controls on ozone-forming emissions sources in the Baton Rouge area have contributed to a significant decline in the number of days when ozone levels exceed federal limits. ...the steep drop from 15 days of excedances in 1990 to only three days in 1993 indicates a strong trend toward improving air conditions in the capital city area.

Many of the cited studies were self-examinations, a fact which causes one to be cautious about the conclusions. It would be informative to compare results of the above references with the annual technical reviews of state agencies prepared by federal managers who are very familiar with program requirements and how state departments actually implement or accomplish federal mandates and goals. The Environmental Protection Agency performs such reviews on its many programs in Louisiana.

For an evaluation of federal offices, perhaps the General Accounting Office (GAO) or the Inspector General for each department has critiques and opinions they could share. The GAO periodically undertakes studies (General Accounting Office 1977, 1980, and 1988). Their methodology includes a review of records, instructions, guidelines, regulations, and laws governing the activities; examination of agencies for processing actions; and interviews with national, state, and local officials and applicants. Agencies occasionally contract for a program management study, which may include an evaluation of effectiveness. For example, the National Marine Fisheries Service contracted with W. J. Chandler Associates (Chandler 1991) to investigate the legal authorities through which the NMFS operates: the Service's policies, guidelines, objectives, and strategies, as well as its organizational structure, implementation activities, and accomplishments. A fourth option would be to convene an independent panel of professionals from outside Louisiana who have no vested interest in the federal or state agencies or research conclusions and ask them to critique each program. Such a practice is consistent with the method of the W. Alton Jones Foundation research. Similarly, at a city's invitation, representatives from professional organizations might visit and critique the city's planning process and master plans. Valuable insights are often gained through third party reviews. The studies available give some indication of effectiveness, but more independent agency performance evaluations need to be done by third parties.

Where Economic Development Could Occur

Inevitably, those who live and work in the Terrebonne and Barataria basins express concerns about trends in environmental regulatory programs and their effect on development, jobs, and lifestyles. In order to provide an effective response, this discussion builds on the status of the programs (Section Two) and identifies the trends in these programs that can reasonably be anticipated. The discussion then focuses on the impacts federal and state programs may have on where economic development could occur in the basins.

For planning purposes, the future is divided into short and long terms. “Short term” means the next four to five years, a period corresponding to a common reauthorization frequency for federal legislation, the driving force behind most state environmental programs. In addition, radical changes in government decision-making processes or procedures are highly unlikely without wholesale abolishment of programs. Even if laws are significantly modified, the federal and state implementation systems do not allow for overnight changes. New rules must be prepared, reviewed internally, and submitted for public consideration and comment. Legislative and regulatory decisions from Washington, D.C., require months, if not years, depending on how the bureaucracy chooses to respond. Even after promulgation of a program—such as revisions to wetland protection laws—special interests may challenge the new directions in court, adding years to the time before a program finally reaches the basins.

“Long term” refers to the next 20–30 years, a time frame governed by several criteria. First, federal programs have established basic tenets that have become entrenched in the country's approach to environmental concerns. These principles state that:

- unconstrained growth is neither desirable nor acceptable;
- wholesale release of wastes into the air, water, or land pollutes these resources, adversely affects the public, and will no longer be tolerated;
- a project must benefit the community and not just the special interest proposing it; and
- landscape elements have intrinsic value and perform functions that should be conserved because they are in the best interest of the whole community.

Second, the programs that institutionalize these tenets—such as NEPA, Clean Water Act, CERCLA, and the Coastal Zone Management Act—will remain conceptually unchanged through the first quarter of the twenty-first century.

Third, flood and hurricane protection levees, navigation projects, roads, and the public infrastructure will be maintained through the first quarter of the twenty first century.

Fourth, the institutional trends will be influenced by the people on the Management Conference who have expressed a strong desire to continue living and working in the basins. In other words, the basins will not be treated as a preserve, such as a national park, but rather as a valuable national treasure that can accommodate urban, industrial, commercial, and agricultural interests while conserving the natural resources, amenities, and culture that make it home.

Finally, no one can foresee, much less control, national and international economic conditions or elections. Both directly impact development in the basins. It would be misleading to suggest to basin residents that a prediction beyond the first quarter of the next century has validity.

Short Term

The short term receives initial consideration because it is easier to evaluate. During the next four to five years, the effect of basic environmental programs (Section Two) on the landscape of the Terrebonne and Barataria basins will not dramatically change. Significant program modifications made by Congress will take more than four or five years to complete and to have significant impact on the basins. Several reasons lead to this conclusion. First, national debates on the merits of the programs that set environmental policy have historically been lengthy. Second, the inevitable negotiations on programs take years before a compromise is reached. Third, once laws are passed, the processes and procedures for implementation must be revised and reviewed before publication of final rules, regulations, guidelines, and standards. Finally, if there should be any dramatic changes, the group feeling wronged may file suit. The courts will make the ultimate decision, a time-consuming exercise.

Therefore, those areas that are available for development today will remain opportunities in the short term. Some modification to regulatory programs may occur. Regulatory reform in certain instances is anticipated because of a perceived problem with the Section 404 permitting process and procedures. In all likelihood, individually owned small acreage (less than 2–3 acres), particularly those within platted and established subdivisions and business parks or those that are surrounded by development, will be exempt from the detailed processing by the U.S. Army Corps of Engineers. Exceptions may be made for endangered species (sites and critical habitat) and for actions that adversely affect levees or navigation routes.

State programs may well be the most affected over the next four to five years because they are unstable and can be easily eliminated or amended by the legislature. For example, the Scenic Rivers program (LRS56:1841–1849) through the Department of Wildlife and Fisheries includes a permit procedure for protecting the banks of scenic rivers. The primary deficiency is that the legislature has the potential for deleting scenic rivers from this program. Historically, influential individuals and groups have had little difficulty eliminating the classification when the designation "scenic" has conflicted with their interests.

Stability and longevity of many state programs depend on federal funding. As long as federal funds are available, the state will probably continue to participate. Such is the case with the nonpoint pollution efforts in the Department of Environmental Quality (Section 319 of the Clean Water Act, PL100–4) and the Department of Natural Resources (The Coastal Management Act 16USC 1451–1464 and Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990, respectively). Without federal interest, neither the Department of Environmental Quality nor Department of Natural Resources programs would exist. If the federal government implements provisions of the Coastal Zone Act Reauthorization Amendments of 1990, and the state cannot comply with federal guidelines, Department of Environmental Quality and Department of Natural Resources may lose funding in 1996. Water quality in the basins will suffer. In a similar manner, the Louisiana Coastal Zone Management Program depends heavily on federal funds to maintain its activities. Should the federal coastal program be reduced in scope, the Department of Natural Resources will be forced to reduce its efforts in Baton Rouge as well as in the parishes.

Long Term

Federal programs will affect where development may occur in the long term (20–30 years). Congressional direction for the placement of dredged and fill material into wetlands or the draining of wetlands (Section 404 of the Clean Water Act) will be adjusted to reflect a growing discontent with the Section 404 program. Congress will temper the stark and impersonal scientific definition of wetlands based on hydric soils, hydrophytic vegetation, and saturation during the growing season with folkways. A revised wetland definition will limit regulatory actions to those areas that traditional social customs define as wetlands. In the basins, regulatory wetlands would include swamps or first-bottom and the marshes (Kniffen and Hilliard 1988).

Areas protected by levees and pumps will not be expanded if the increase requires draining or filling of wetlands meeting the cultural definition (traditional swamps and marshes). Alignments for flood-protection levees will follow the swamp-natural levee interface. Therefore, future urban and industrial economic activities may occur on the natural levees already cleared for agriculture and within the present levied and drained areas. The natural levees may be best approximated by using the habitat maps developed from 1978 aerial photographs. Interpretations were based on the signature of the landscape and not the detailed criteria of hydric soils, hydrology during part of the growing season, and hydrophytic vegetation that were not available during the preparation of the maps. Existing maps depict the drainage districts and the areas already protected by levees and pumps and, therefore, define what acreage is available for growth.

Transportation networks will not expand into new regions characterized by cultural wetlands. This is particularly true for navigation channels. At a minimum, existing navigation channels and public roads will be maintained at their present levels. Mitigation projects for creating wetlands with dredged material and controlling saltwater intrusion will be implemented as part of any transportation projects. Upgrading of roads and railroads will follow existing rights-of-way where they pass through wetlands (traditional swamps and marshes). All other activities will occur on the natural levees or the barrier beaches classified for development by the Coastal Barrier Resources Act.

Increased enforcement of design and construction requirements of the National Flood Insurance Program will reduce federal exposure to claims after a disaster. Policyholders having repetitive or substantial losses will be offered relocation assistance. In some instances, flood proofing may be acceptable. Those who do not cooperate will lose their subsidized insurance coverage. In the future, the individual will be held more responsible for the consequences of her/his actions. As a result, more people will leave the distal natural levees and relocate in Houma, Raceland, Thibodaux, and Belle Chasse. The wetlands restoration and enhancement projects under the CWPPRA and Act 6 will protect these more inland communities from storm surge and provide habitat to support those parts of the basins' economy dependent on natural resources.

Agricultural activities will remain on the cleared natural levees and within existing levied and pumped areas. As the market demand for selected commodities either decreases or increases, agricultural lands will be converted to industrial sites, commercial strips, or subdivisions. Tracts that have a high potential for reestablishing wetlands will be offered to the Wetland Reserve Program, providing income to the landowner and habitat for the public.

Industries and individuals will be held more accountable for discharging or releasing pollutants into the basin, i.e., the air, the water, or the land. Public pressure from an awakening constituency will finally force legislators to increase budgets so agencies can enforce programs that protect the public health, safety, and welfare. Camps will have mechanical sewage treatment systems, parishes and municipalities will adopt nonpoint pollution programs, and releases from industries will continue to decrease.

Properties that are now part of an industrial facility or that include a closed landfill will not be marketable for other uses, such as a business complex, school, park, or residential subdivision. Fear of what these sites hide (buried, stored, or dispersed on the surface) and a desire to avoid liability for cleanup costs for actions not related to the new owner will leave vast tracts of natural levee vacant but polluted. A cavalier attitude today supporting jobs at any cost has shifted the burden of rehabilitation and remediation to the next generation if they want to use these same lands.

Conclusions

The economy and lifestyle of the Barataria and Terrebonne basin residents have always been closely related to the landscape and the dominant culture. The physical and biological zones in the basins are intrinsically suited for specific types of development. As the highest and driest landforms, natural levees offer the most fertile soils for agriculture and the best foundation conditions for intensive development. The wetlands—in Louisiana traditionally thought of as swamps (low, wet, forested areas) and marshes (low, wet, treeless, grass covered areas)—function as habitats for wildlife, waterfowl, and fish; protect inland areas from hurricane storm surge; clean up pollutants; collect and hold storm water; and serve as recreation areas. Bayous, lakes, and bays are important habitats for fish, shellfish, and waterfowl and are extensively used by commercial and recreational fishermen. Finally, barrier islands and beaches—the elongated sand ridges—protect the wetlands from the direct energy of the Gulf of Mexico, provide habitat, and regulate the amount of saltwater and wetland-dependent species entering the estuary.

Flooding and storm surge are regional problems, but they have their least impact on natural levees. Agriculture, industrial facilities, and urban sprawl are possible almost anywhere in the basins with an infusion of excessive amounts of capital and a willingness to obligate future generations to pay millions of dollars for operations and maintenance. In fact, marshes are now subdivisions, swamps are fields, and water bottoms are filled for industrial sites. But the realization that these actions were costly mistakes may help us avoid repetition. The trend is to accept the constraints imposed by natural conditions and to adjust to the realities of a dynamic delta system. Existing regulations, environmental programs, and the Barataria-Terrebonne Program Comprehensive Conservation and Management Plan will be embraced and readily accepted as contributing to the conservation of basin resources and the protection of people.

Organizations and Public Participation

Many organizations are important activists in the Barataria and Terrebonne basins, and they are heavily involved in shaping public opinion and policies. Everyone living and/or working in the basins belongs to a special interest, and most special interests are represented by organizations (table 51) established to forward the group's goals and objectives. These organizations influence what takes place in the community in a number of ways. First, members work with and through legislators, police jurors, planning commissions, and agency staffs trying to convert anyone who will listen to the group's philosophy. Second, the organizations convene conferences, in most cases open to everyone where attendees have the opportunity to hear the group's positions and perhaps opposing views. Third, representatives of the organization may provide testimony at public meetings or before congressional hearings and share the views of a greater population who cannot attend. Fourth, organizations are not constrained by legislated policy or by as much political pressure as are government agencies; therefore, they may generate information that supports their positions even if it is contrary to current political doctrine. Fifth, organizations may independently evaluate government programs and officials and offer opinions on both. In some cases, programs and officials may change as a result of independent analysis and public exposure in the newspapers or other media.

The material supplied by organizations should be viewed very carefully. These groups are, after all, special interests with their own goals and objectives. In many instances, the presented material loses utility by being distorted, biased, or self-serving. It is important to understand what an organization says as well as what it does not say.

Summary

In 1900 the typical basin dweller would be born, grow up, live, and die in the same community and expect that his/her children and their children would always be next door. No one could have predicted the international forces that have transformed south Louisiana from a rural economy to a petrochemical and industrial center. Today, even with computers, foreseeing the future defies absolute accuracy. In retrospect, "irrefutable experts" helped render communities blind with rigid predictions of the inevitable. Public officials were crippled in their inability to adjust to events, always waiting in anticipation of the prophecy’s realization. To avoid perpetuating paralysis, this discussion prognosticates conservatively and strongly encourages periodic reviews of events to set the most advantageous directions for the people in the basins. Adjustments can be made as information becomes available, ideas are accepted, and issues gain in importance. Only highly probable estimates of the future are possible, and they are limited to the next four to five years. Some guesses can be made through the first quarter of the next century. Forecasting further into the next century is highly speculative and really impractical.

Priority problems identified by the scientific community are addressed by existing institutional programs. Responses to issues of concern to management conference participants must appear in the Comprehensive Conservation and Management Plan

Table 55. Selected organizations with interests in the Barataria and Terrebonne basins.

Louisiana Landowner's Association
Chambers of Commerce
Louisiana Association of Business and Industry
Mid-Continent Oil & Gas Association
Terrebonne Fisherman's Association
Ports Association of Louisiana
Gulf Intracoastal Canal Association
Louisiana Chemical Association
Louisiana Farm Bureau
New Orleans Steamship Association
Louisiana Oyster Growers and Dealers Association
Louisiana Travel Promotion Association
Louisiana Police Jury Association
Louisiana Municipal Association
Coalition to Restore Coastal Louisiana
Sierra Club
Orleans Audubon Society
Women for a Better Louisiana
Louisiana Wildlife Federation
Gulf Coast Conservation Association

through BTNEP. Opinions on the effectiveness of the federal and state programs in dealing with priority problems range from excellent to less than desirable. Reality lies somewhere in between, but could be established by considering agency management documents or convening third parties to critique the programs. It appears the criteria are in place to reduce adverse impacts. The future relies on better inspection and enforcement.

Higher paying jobs have drawn men and women from the traditional occupations of agriculture, trapping, and fishing. But the south Louisiana native never strays very far from family, her/his love of the land, and the abundance accessible to those who will work. When the oil and gas industry plummeted in the 1980s, people returned to their traditional occupations. Independence and self-sufficiency characterize the people. Unemployment forced many to seek jobs in other parts of the country or in the international market. However, as the economy stabilized and newer opportunities replaced lost jobs, those who left quickly returned to their families and a cherished way of life. People born in south Louisiana find it difficult to leave because they have strong ties to family and to the unique culture. It is not uncommon for those who moved for economic reasons to return when there is an opportunity. Many who come for a visit, stay for a lifetime.

CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

The future system will have more people and less land. The amount of land in the system is decreasing due to coastal erosion and wetland loss. Natural processes of subsidence and rising sea level contribute to wetland loss and coastal erosion, and so do humans by building levees that deprive coastal wetlands of alluvial sediment and fresh water; by building canals in coastal wetlands, which accelerates saltwater intrusion and physically converts wetlands to water; by clearing forests for development; and by dredging and depositing fill adjacent to canals, which disrupts the hydrologic flow in wetlands.

The amount of land suitable for development in the system is limited. Most (77.93%) of today's region is classified as wetland or water. A large portion (93.74%) of Terrebonne Parish, home of the Houma urbanized area, is classified as either wetland or water as is 84.19% of Lafourche Parish (Louisiana State Planning Office n.d.). The amount of undeveloped land in the system continues to decrease as agricultural and urban areas expand. The most recent projections indicate the population within basin parishes will increase from 1,558,031 in 1990 to 1,696,190 by the year 2010: an increase of 183,178 people (table 56, Irwin 1994). Demands on land, water, and other natural resources will accompany the population increase.

The population growth experienced during the 1970s was stifled during the 1980s due to the price-related decline in oil and gas activities (McKenzie et al. 1993). The population peak reached in 1980 is not expected to be reached again until the year 2000. During the next decade, population growth rates will vary substantially from parish to parish.

Human activities of habitation, work, commerce, and socialization are all parts of community. As the population increases, so will the demand for a comparable proportion of land for "urban" purposes. The local demand for urban land differs from the demands for other developed land such as agricultural land. Agricultural products can be grown in a variety of places far beyond the local community. The agricultural market is a global market. Community, however, is localized. People tend to live near their work and to shop, socialize, worship, educate, and commune where they live.

When sufficient land is available, urbanization expands outward, as evidenced by suburban development around a central core. Urban development will continue to expand until the supply of land diminishes to the point where only vertical development into multistory structures is feasible. Few areas within the system have urbanized to the point where vertical development is preferred in place of horizontal development.

Because the amount of land in the basin is decreasing, the demands of the increased population will have to be absorbed by a diminishing quantity of land. Estimates based

Table 56. Parish population projections.

Parish	Population[1]			Population Projections[2]		
	1970	1980	1990	1995	2000	2010
Ascension	37,086	50,068	58,214	64,180	67,410	74,440
Assumption	19,654	22,084	22,753	24,100	24,970	27,150
Iberville	30,746	32,159	31,049	31,390	32,050	24,100
Jefferson	337,568	454,592	448,306	465,560	478,190	513,980
Lafourche	68,941	82,483	85,860	92,610	96,090	104,810
Orleans	593,471	557,927	496,938	481,820	487,770	514,740
Plaquemines	25,225	26,049	25,575	26,850	27,630	29,820
Pointe Coupee	22,002	24,045	22,540	22,210	22,500	23,670
St Charles	29,550	37,259	42,437	46,290	48,390	53,200
St James	19,733	21,495	20,879	21,160	21,650	23,140
St John	23,813	31,924	39,996	43,360	45,380	49,950
St Martin	32,453	40,214	43,978	46,270	47,810	51,710
St Mary	60,752	64,253	58,086	57,440	57,950	60,780
Terrebonne	76,049	94,393	96,982	102,060	105,140	113,280
W. Baton Rouge	16,864	19,086	19,419	19,700	20,120	21,420
BTES Parishes	1,393,907	1,558,031	1,513,012	1,545,000	1,583,050	1,686,190

[1]U. S. Bureau of the Census--1970,1980 and 1990.
[2]Irwin, 1994. Louisiana Office of Planning and Budget, Louisiana Division of Administration.

on 1978 land use data and the 1980 Census of Population indicate that 0.18 acres of urban land are developed for each person (table 57). This urban land requirement accounts for land needed for residential, commercial, and transportation activities. The increased population is expected to cause the amount of urban land to increase by as much as 32,972 acres. This increase will likely be at the expense of agricultural land, which in turn will encroach further on forest land.

The increased population will create more demand for consumables and services. The demand for potable water will increase. The increased population will generate more landfill waste and waste water. The presence of more people has the potential to impact the identified priority problems in the following ways:

- hydrologic modification—increased urban development leading to accelerated runoff; increased demand for forced drainage and flood protection levees; increased extraction of water for residential, commercial, and industrial uses;

- reduction in sediment availability—increased demand for flood control structures, which inhibit lateral discharge and sediment replenishment;

- habitat loss/modification—increased pressure to encroach into sensitive habitat, especially wetlands;

- changes in living resources—more people boating, fishing, hunting, and recreating outdoors; and

- eutrophication, pathogen contamination, and toxic substances—increased waste water and runoff; increased generation of landfill waste.

Contending with these problems will not be easy, but solutions can be found.

Table 57. Projected urban acreage by parish.

Parish	Measured Urban Acres 1978[1]	UrbanAcres Per Persons 1980	Projected Urban Acreage 1995	2000	2010	%Change 1978 to 2010
Ascension	20,787	0.42	26,646	27,987	30,906	48.68
Assumption	6,997	0.32	7,636	7,911	8,602	22.94
Iberville	16,232	0.50	15,844	16,177	12,164	-25.06
Jefferson	53,127	0.12	54,409	55,885	60,068	13.06
Lafourche	17,250	0.21	19,368	20,096	21,919	27.07
Orleans	47,149	0.08	40,717	41,220	43,499	-7.74
Plaquemines	19,290	0.74	19,883	20,461	22,083	14.48
Point Coupee	12,818	0.53	11,840	11,994	12,618	-1.56
St Charles	12,632	0.34	15,694	16,406	18,037	42.79
St James	10,069	0.47	9,912	10,142	10,840	7.66
St John	10,656	0.33	14,473	15,148	16,67	56.47
St Martin	15,227	0.38	17,520	18,103	19,580	28.59
St Mary	16,572	0.26	14,815	14,946	15,67	-5.41
Terrebonne	19,536	0.21	21,123	21,760	23,445	20.01
W. Baton Rouge	9,499	0.50	9,805	10,014	10,661	12.23
BTES Parishes	287,841	0.18	299,685	308,250	326,771	13.52

[1]Louisiana State Planning Office. Louisiana Areal Resources Information System.

The people of the system can control future scenarios. Quality land use and a viable socioeconomic environment can be achieved through the actions of individuals, organizations and governments. Implementation of the following recommendations will contribute substantially to building a better future:

- Educate people on the consequences of their actions. Well-intended actions have in the past led to unintentional, detrimental consequences. This principle applies to actions on the physical, societal, and economic environment. A desired self-discipline can likely be achieved through information that cultures, among other things, an appreciation of fish and game laws, sanitary codes, and economic adaptability of the population.

- Review and revise legislation to meet contemporary issues and problems in the system. Recent events in the system—e.g., mariculture, freshwater diversion, oyster leases, ownership disputes involving mineral rights and public access on wetland reclamation projects—highlight the problem of inadequate legislation. Existing legislation should be periodically reviewed and revisions posed to address contemporary issues.

- Encourage state, parish, and local agencies to take the initiative and manage available resources, including resources through federally funded programs. State and local agencies are in position to creatively combine existing program funds and to pursue new or expanded funding sources to attain larger objectives that may be beyond the limited scope of individual programs.

- Develop better mechanisms for balancing competing interests. The richness of resources, limited land availability, and increasing population in the system contribute to individual and group conflicts. It will become increasingly important to balance competing interests through planning, implementation, and enforcement actions.

The mechanisms necessary to achieve what the people of the system desire are available within the existing societal and institutional framework. They have to be put to wise and prudent use.

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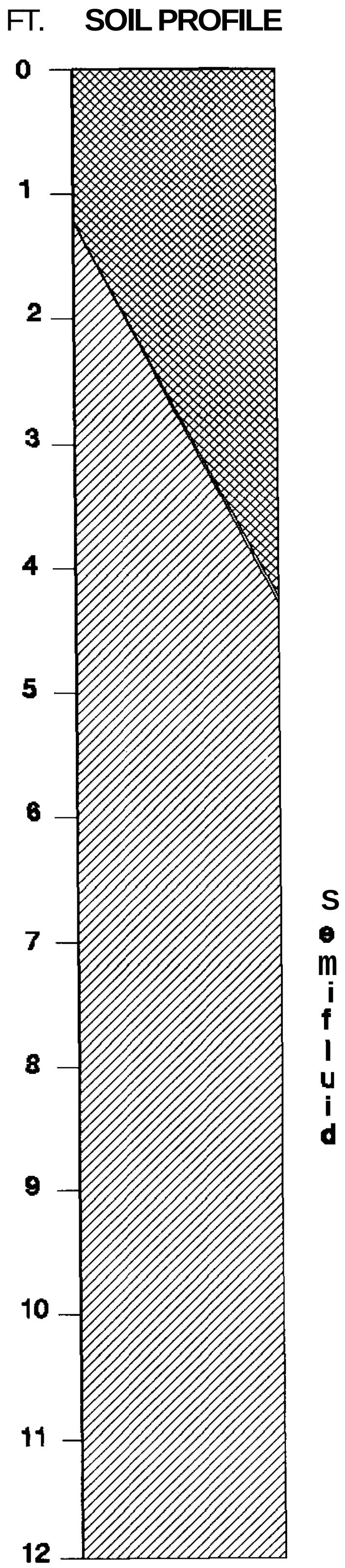
APPENDIX

BARATARIA TERREBONNE ESTUARINE SYSTEM
SOIL PROFILES



ALLEMANDS SERIES

This series consists of very poorly drained semifluid organic soils which occupy large freshwater marsh areas. These soils are near mean sea level along the landward side of marshes or along distributary channels buried under the marsh. The salinity ranges from 0–5 ppt.

Allemands soils are geographically associated with the Kenner, Larose, Barbary, Clovelly, and Lafitte soils. The Barbary and Larose soils have thin organic surface layers. The Kenner and Lafitte soils have thicker organic layers, and Lafitte and Clovelly occupy brackish marsh rather than fresh.

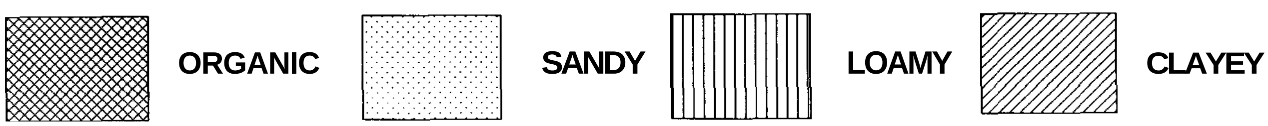
Soil Characteristics

The organic surface layers are black peat or muck **16–51** inches thick. The underlying mineral layers are gray semifluid clayey material. The reaction of the organic layers ranges from neutral to strongly acid and the mineral layers range from strongly acid to moderately alkaline. After drainage, the upper 15 inches range to extremely acid and the organic layer will be firmer.

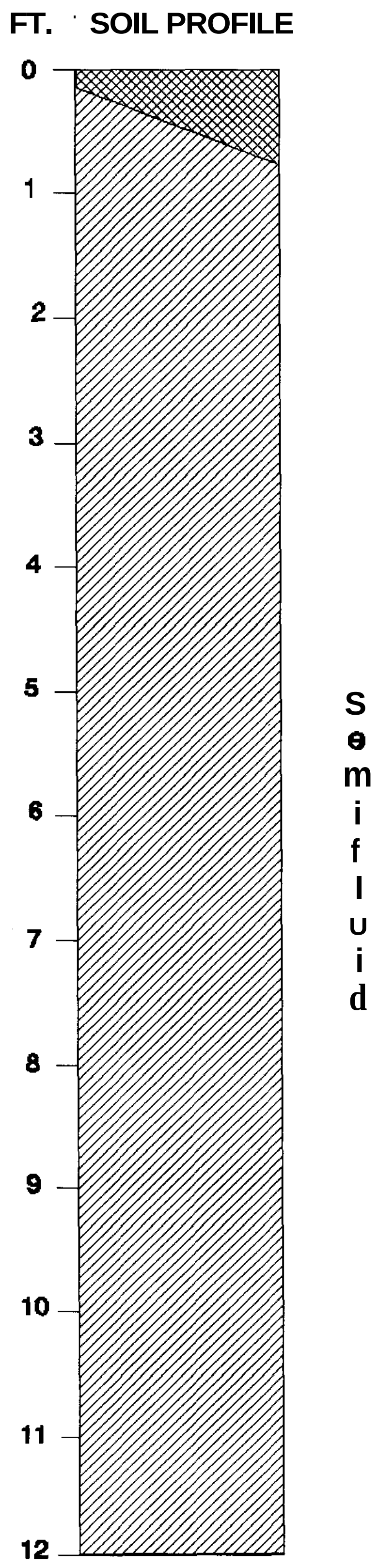
Use and Management

The major land use for this soil is related to wildlife. Most of it is managed for hunting, trapping, and fishing. Deer, alligator, crawfish, rabbit, nutria, and duck populations are usually high. The typical plants growing on this soil are maidencane, bulltongue, alligator weed, cattail, giant cutgrass, pickerelweed, smartweed, and common rush. Scattered bald cypress trees are on this soil adjoining swamps.

The dominant limitations influencing the use and management of the Allemands soil are its high subsidence potential and low bearing strength, the danger of deep flooding during storms, and the threat of saltwater intrusion changing the vegetative type. Structures such as weirs require piling due to the low soil strength. When these soils are drained they become extremely acid and subside below sea level. Maintenance cost of urban and residential development are high due to pumping costs and damage to sidewalks, driveways, porches, and underground utilities.



BARBARY SERIES



This series consist of very poorly drained, semifluid, clayey soils on low, broad, ponded backswamps of the Mississippi River alluvial plain. These soils are nearly continuously flooded. Slope is less than 0.1 percent. The salinity is less than 1.25 ppt.

Barbary soils are geographically associated with the Allemands, Fausse, Maurepas, and Sharkey series. Allemands and Maurepas soils have organic layers that are more than 16 inches thick. Fausse and Sharkey soils have firm underlying layers.

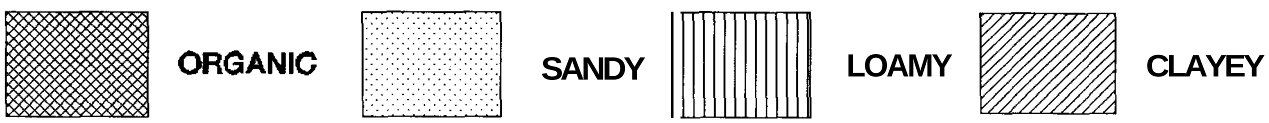
Soil Characteristics

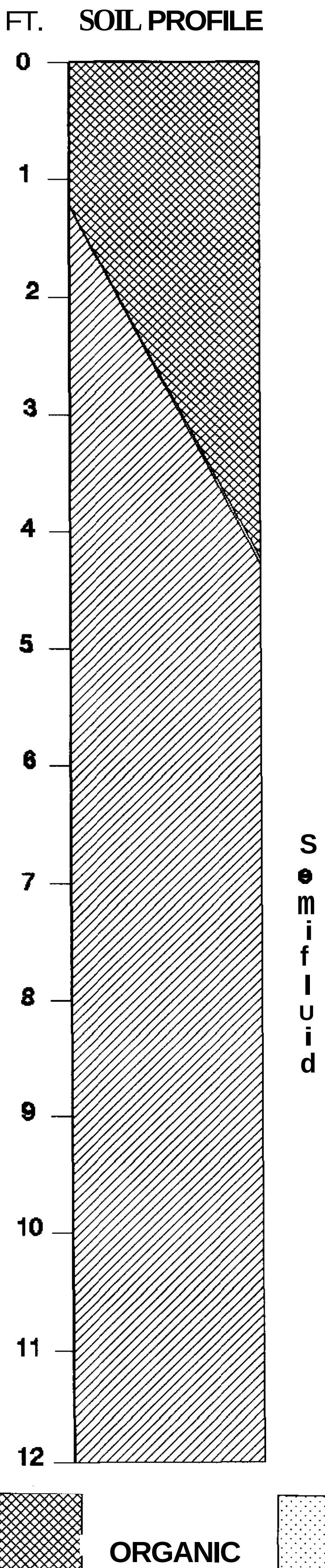
These soils have organic surface layers 4–15 inches thick over semifluid dark gray to greenish gray clay layers with a mat of logs and wood fragments in the lower part. The reaction of the organic layers range from medium acid to mildly alkaline and the mineral layers range from neutral to moderately alkaline. After drainage, the upper 15 inches range to extremely acid and the organic will be firmer.

Use and Management

These soils are used mainly for timber production and wildlife habitat. The potential woodland production is moderate. The site index for water tupelo is 60. These soils provide roosting areas and limited food supply for ducks and other waterfowl. They also provide a food supply for deer and squirrel as well as habitat suitable for mink, alligator, crawfish, and raccoon. The dominant overstory is bald cypress, water tupelo, and Drummond red maple. Typical understory and aquatic vegetation include smartweed, alligator weed, buttonbrush, duck weed, and water hyacinth.

The dominant limitations influencing the use and management of Barbary soils are the medium subsidence potential, low bearing strength, flooding potential, and buried logs and stumps. Most structures require piling due to the low soil strength. These soils will consolidate and shrink when drained.





BELLPASS SERIES

This series consists of deep, very poorly drained organic soils which occupy low elevations in saline marshes. These soils formed in moderately thick herbaceous materials overlying semifluid clayey sediments. This soil is almost continuously flooded with several inches of floodwater. Salinity is high or very high and ranges from **8–20** ppt. (i.e., salt content is moderate to high).

Bellpass soils are associated with Clovelly and Lafitte soils, which have salinity contents less than 8 ppt. in their control section. Bellpass is adjacent to Scatlake and Timbalier soils in a few places. Scatlake is a very poorly drained, semifluid, mineral soil which occupies slightly higher elevations. Timbalier soils are on similar parts of the landscape and have deeper organic layers.

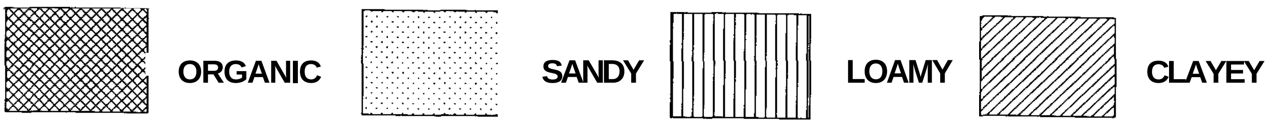
Soil Characteristics

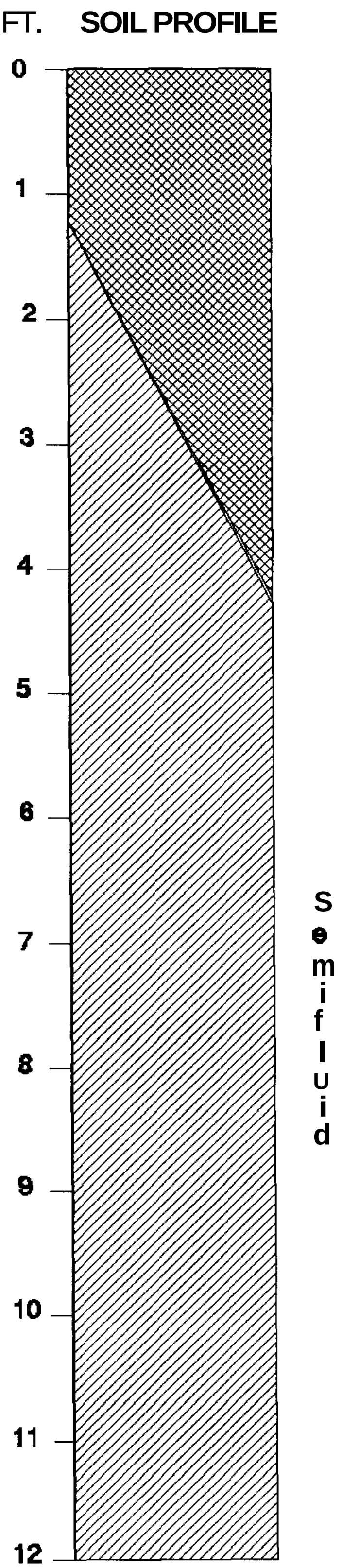
Typically the Bellpass soils have a surface layer of dark grayish brown and dark gray moderately alkaline semifluid muck 15–50 inches thick. The underlying layers are moderately alkaline, dark gray semifluid clay with layers of fine gray sand in some places.

Use and Management

These soils are not well suited to cultivated crops, pasture, urban uses, intensive recreation, and woodland. Wetness, flooding, salinity, low strength, and poor accessibility are the main limitations. These soils are part of an environment that supports marine life in the Gulf of Mexico. They also provide excellent habitat for muskrat, nutria, geese, mink, duck, otter, and raccoon. Typical plants are smooth cordgrass, seashore saltgrass, needlegrass rush, bushy sea-oxeye, marshhay cordgrass, saltwort, and Virginia samphire.

The dominant limitations influencing the use and management of the Bellpass soils are the low bearing strength, danger of deep flooding during storms, salinity, and poor trafficability. When drained, these soils have extreme acidity, subsidence, and underlying clays with very high shrink-swell potential.





CLOVELLY SERIES

This series consists of very poorly drained semifluid organic soils that occupy moderately large brackish marsh areas. These soils are near mean sea level in the interior part of the marshland. In a few places this marshland adjoins the Gulf of Mexico. The mean salinity is 8 ppt.

Clovelly soils are found in association with the Lafitte soils in the brackish marsh. They may also be near Allemands and Kenner in the fresh marsh and Timbalier and Bellpass soils in the salt marsh. The Kenner and Lafitte soils have thicker organic layers at the surface. The Allemands and Kenner soils are less saline than Clovelly, and the Timbalier and Bellpass soils are more saline.

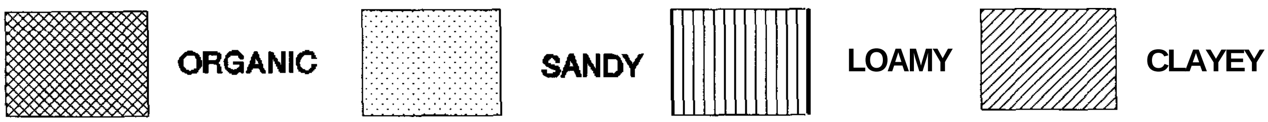
Soil Characteristics

Typically, the Clovelly soils have black alkaline organic layers 16–51 inches thick overlying gray semifluid alkaline clay. If drained, the upper 15 inches will become extremely acid and more firm.

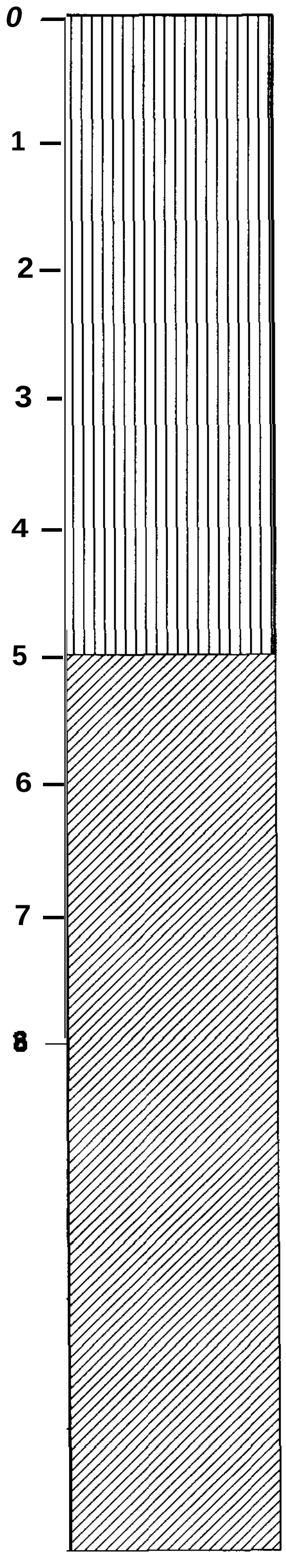
Use and Management

The major land use for this soil is related to wildlife. Most of it is managed for hunting, trapping, and fishing. This soil provides habitat for large numbers of geese and furbearers such as mink, muskrat, otter, and raccoon. The typical vegetation include marshhay cordgrass, coastal waterhyssop, dwarf spikerush, Olney bulrush, and saltmarsh morning glory.

The dominant limitations influencing the use and management of Clovelly soils are the high subsidence potential low bearing strength, the dangers of deep flooding during storms, salinity, and saltwater intrusion changing the vegetative types. Structures such as weirs require piling for stability. When these soils are drained, they become extremely acid and subside below sea level. Maintenance costs of urban development are high due to pumping costs and damage to sidewalks, driveways, porches, and underground utilities.



COMMERCE SERIES



This series consists of level, somewhat poorly drained, firm mineral soils which occupy the highest parts of the alluvial plains of the Mississippi River and its distributaries. These soils formed in loamy alluvial sediments. Slope ranges from 0–5% and is undulating in some areas. Flooding ranges from none to frequent.

Commerce soils are associated with Sharkey and Tunica soils, which have more than **35**% clay within their control sections and are poorly drained. In some places, Commerce is adjacent to Mhoon and Convent soils in the landscape. Mhoon is somewhat finer in texture and is poorly drained. Convent is somewhat coarser in texture in its control section. Some areas of Commerce soils have silty clay loam surface textures.

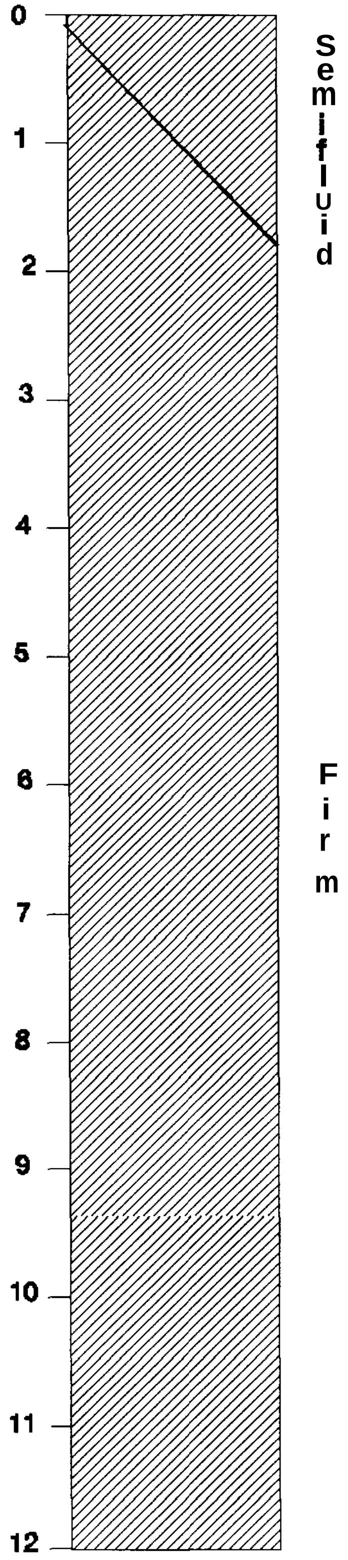
<u>Soil Characteristics</u>

Typically, the Commerce soils have a slightly acid, dark grayish brown silt loam surface layer about 10 inches thick. The subsoil is neutral grayish brown silt loam and silty clay loam.

<u>Use and Management</u>

These soils have excellent potential for cropland and pastureland. The high fertility, loamy texture, and nearly level slope make them among the choice soils of the state for these uses. The main suitable crops are cotton, soybeans, corn, sugar cane, grain sorghum, and truck crops. The main suitable pasture plants are improved bermudagrass, common bermudagrass, bahiagrass, ryegrass, dallisgrass, tall fescue, and white clover. Traffic pans develop easily but can be broken by chiseling or deep plowing. **A** drainage system is generally needed to remove excess surface water. Land leveling or smoothing will improve surface drainage and increase the efficiency of farm equipment. Crop residues on the surface will help maintain organic content, reduce crusting, and reduce soil losses by erosion. Most crops, other than legumes, respond well to nitrogen fertilizers. Lime and other fertilizers generally are not needed.

FT. **SOIL PROFILE**



FAUSSE SERIES

This series consists of very poorly drained clayey soils on low, ponded backswamps of the Mississippi River alluvial plain. These soils are flooded annually. Slope is less than one percent. The salinity is less than **1.25** ppt.

Fausse soils are geographically associated with the Barbary and Sharkey series. Barbary soils are semifluid throughout. Sharkey soils are poorly drained and occur at higher elevations.

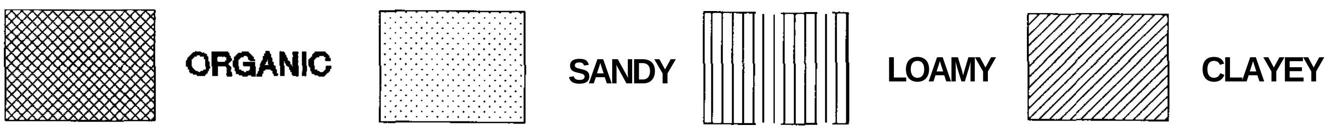
Soil Characteristics

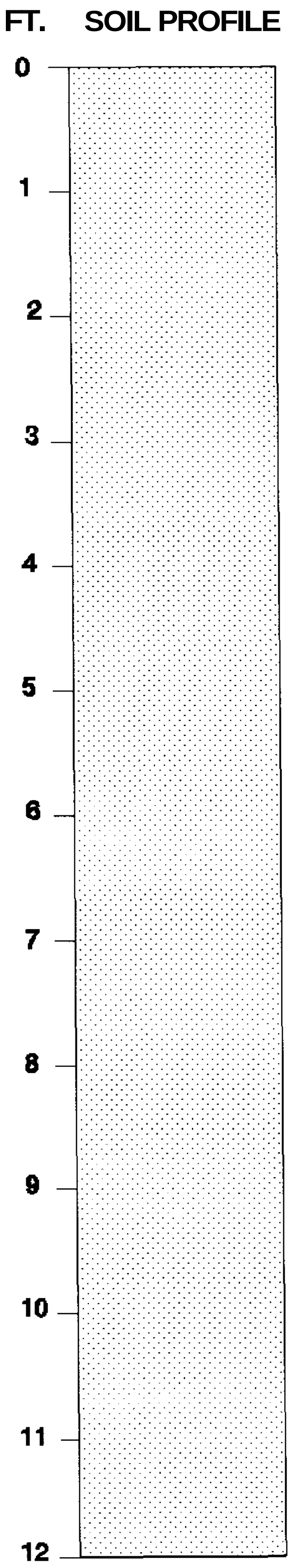
These soils have a surface layer that is overlain with very dark grayish brown muck about two inches thick. The surface layer is dark gray clay about nine inches thick. The subsoil is gray clay mottled in shades of brown. The underlying material is gray clay. The reaction of the surface layer ranges from medium acid to neutral. The reaction of the subsoil and underlying layers range from slightly acid to moderately alkaline.

Use and Management

These soils are used mainly for timber production and wildlife habitat. The potential for hardwood timber production is moderate. While flooded, these soils provide roosting areas and a limited food supply for duck and other waterfowl. They provide a limited food supply for deer and squirrels and a habitat for crawfish, alligator, mink, and raccoon. The dominant overstory vegetation is bald cypress, water tupelo, pumpkin ash, blackwillow, and water elm. Typical understory and aquatic vegetation include buttonbrush, swamp privet, water hyacinth, duck weed, and lizardtail.

The dominant limitations influencing the use and management of the Fausse soils are low bearing strength, high shrink-swell potential, and flooding. These soils remain stable and do not subside after drainage. When protected and drained, these soils have moderate potential for cropland and pastureland.





FELICITY SERIES

This series consists of somewhat poorly drained soils which occupy nearly level to gently undulating areas adjacent to Gulf coastal beaches. These soils formed in sandy coastal sediments. Slopes range from 0–3%.They are subject to flooding by salt water during high storm tides.

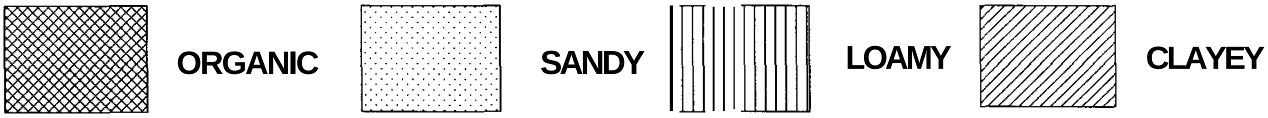
Felicity soils are associated with Bellpass and Scatlake soils. Both the organic Bellpass soils and the semifluid, clayey Scatlake soils occupy lower elevations on broad tidal marshes. In a few places, Felicity soils are adjacent to Placedo soils on the landscape. The clayey Placedo soils are also in lower positions of the landscape than Felicity soils.

Soil Characteristics

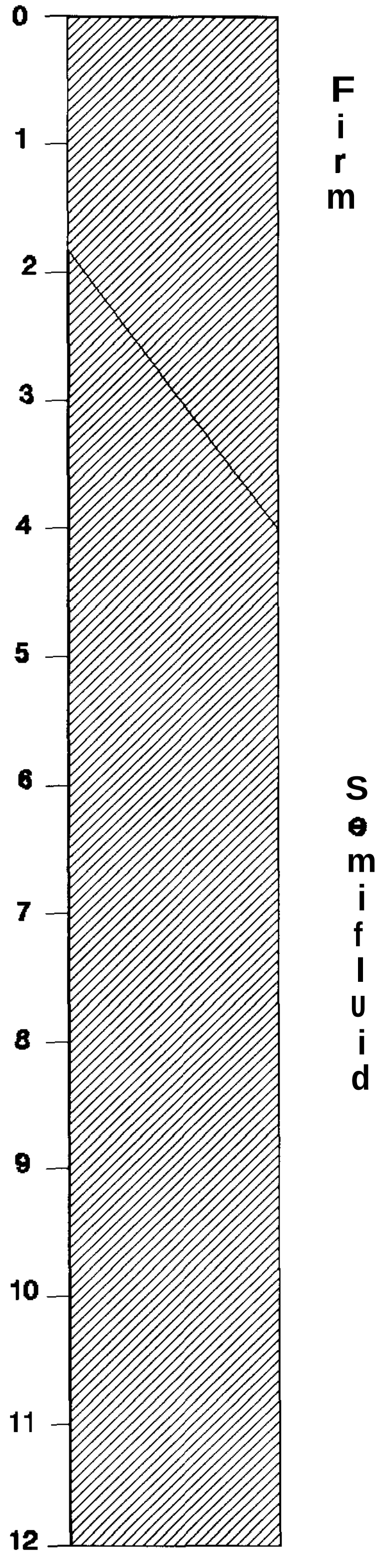
Typically the Felicity soils have a surface layer of grayish brown, moderately alkaline loamy fine sand about 13 inches thick. The underlying layers are moderately alkaline dark brown, dark grayish brown, or dark gray loamy fine sand.

Use and Management

This series is not suited for cultivated crops, pasture, and woodland. It is very poorly suited to use as wetland wildlife habitat. It provides only a limited food supply and is used mainly as a resting area by ducks and shore birds and as sites for summer cottages. The natural vegetation commonly is sparse and consists mainly of marshhay cordgrass, black-mangrove, bigleaf sumpweed, bitter panicum, seashore saltgrass, saltwort, and smooth cordgrass. Felicity soils are not suited for urban uses and intensive recreation.



FT. **SOIL PROFILE**



HARAHAN SERIES

This series consists of level, poorly drained soils which occupy low positions on the natural levees of the lower Mississippi River flood plain. These soils formed in moderately thick firm clayey alluvium overlying semifluid clayey sediments. These soils are protected from flooding by levees and are artificially drained by pumps. Flooding can occur when severe storms occur and when pumps or levees fail.

Harahan soils are associated with Sharkey, Commerce, and Vacherie soils, which occur in higher positions of the landscape. Commerce and Vacherie soils are loamy in their upper part and firm throughout. Sharkey soils are firm and clayey throughout. In some areas, Harahan is adjacent to Barbary and Westwego soils which occupy lower positions. Barbary formed in semifluid clayey sediments in ponded backswamps. Westwego soils contain buried layers of organic material.

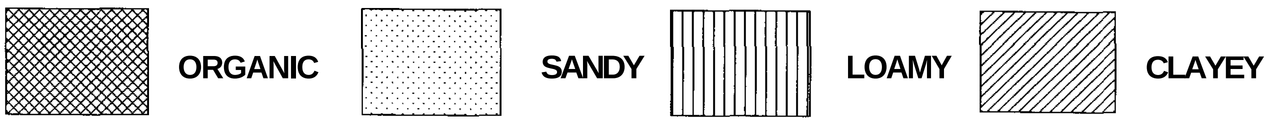
Soil Characteristics

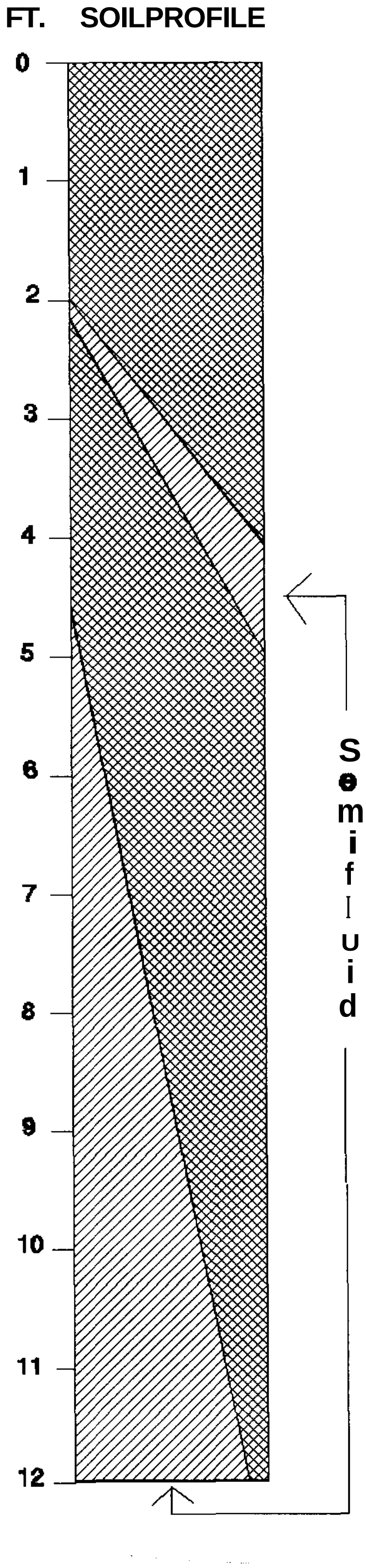
Typically the Harahan soils have a surface layer of very dark gray, medium acid clay. The subsoil is firm dark gray or black, slightly acid clay to a depth of about **32** inches. The underlying material is gray or dark gray semifluid clay.

Use and Management

This soil is well suited for pasture and moderately well suited for crops. Water control is a major concern. Suitable pasture plants are common bermudagrass, dallisgrass, tall fescue, and white clover.

This soil is poorly suited for urban uses and intensive forms of recreation. The main limitations are flooding, wetness, very slow permeability, subsidence, low strength, and the very high shrink-swell potential. Pilings and specially constructed foundations are needed if buildings are constructed on Harahan soils. Additional support for roads and buildings can be provided by fill material. Adequate water control is needed to reduce wetness and to control the rate of subsidence. Shallow excavations are difficult to construct because of the buried stumps and logs in the soil and the semifluid nature of the underlying material.





KENNER SERIES

This series consists of very poorly drained semifluid organic soils which occupy moderate to large freshwater marsh areas. These soils are near mean sea level on the inland edge of the marsh adjoining the swamps and small distributary channels. The salinity ranges from 0–5 ppt.

Kenner soils are usually near the Allemands, Larose, Barbary, Clovelly, and Lafitte soils. The Barbary, Larose, and Allemands have thinner organic surface layers. The Clovelly and Lafitte soils have higher salinity values and are found in brackish marshes.

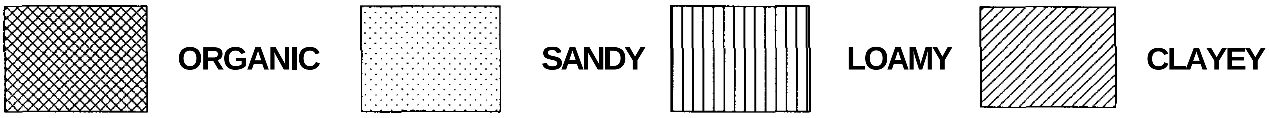
<u>Soil Characteristics</u>

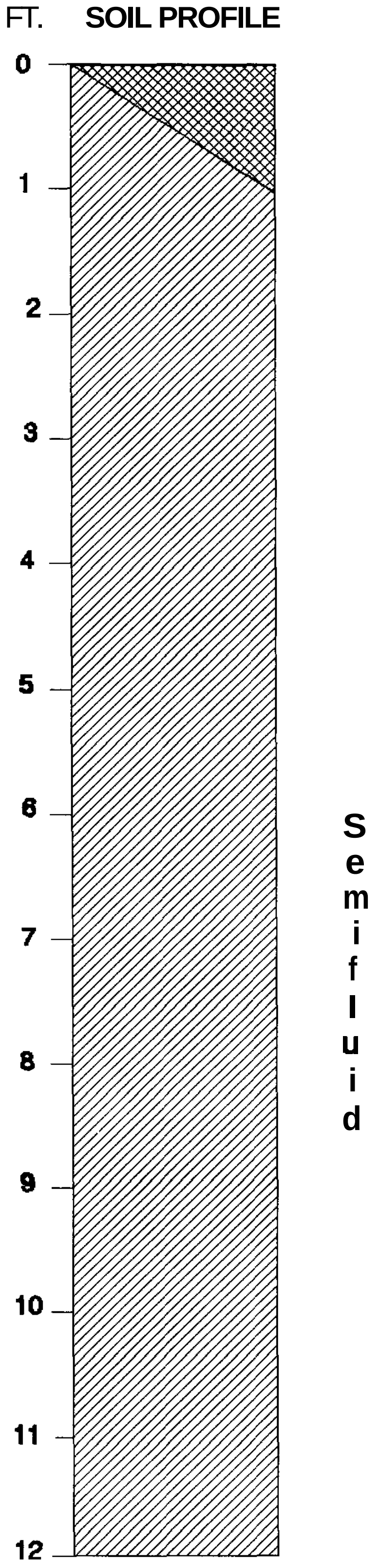
The organic surface layers are black or very dark gray peat and muck with thin strata of semifluid gray clay. These layers are several feet thick and overlie semifluid gray clayey layers. The reaction of the organic layers ranges from strongly acid to neutral in the upper part and from neutral to moderately alkaline in the lower part. After drainage, the upper 15 inches range to extremely acid and become more firm.

<u>Use and Management</u>

The major land use for this soil is related to wildlife. Most of it is managed for hunting, trapping, and fishing. Deer, alligator, crawfish, rabbit, nutria, and duck populations are usually high. The typical plants growing on this soil are maidencane, bulltongue, alligator weed, cattail, giant cutgrass, pickerelweed, smartweed, and common rush. Scattered bald cypress trees are on this soil adjoining swamps.

The dominant limitations influencing the use and management of the Kenner soils are the very high subsidence potential, low bearing strength, danger of deep flooding during storms, and the threat of saltwater intrusion changing the vegetative type. Structures such as weirs require piling due to the low soil strength. When these soils are drained, they become extremely acid and subside several feet below sea level. Maintenance cost of urban and residential development is high due to pumping costs and damage to driveways, sidewalks, porches, and underground utilities.





LAFITTE SERIES

This series consists of very poorly drained semifluid organic soils which occupy large brackish marsh areas. These soils are near mean sea level in the interior part of the marshland, or may occur adjacent to the Gulf. The mean salinity is **8** ppt.

Lafitte soils are found in association with the Clovelly soils in the brackish marsh. They may also adjoin Allemands and Kenner in the fresh marsh and Timbalier in the salt marsh. The Clovelly soils have thinner organic surface layers. The Allemands and Kenner soils are less saline, and the Timbalier soils are more saline.

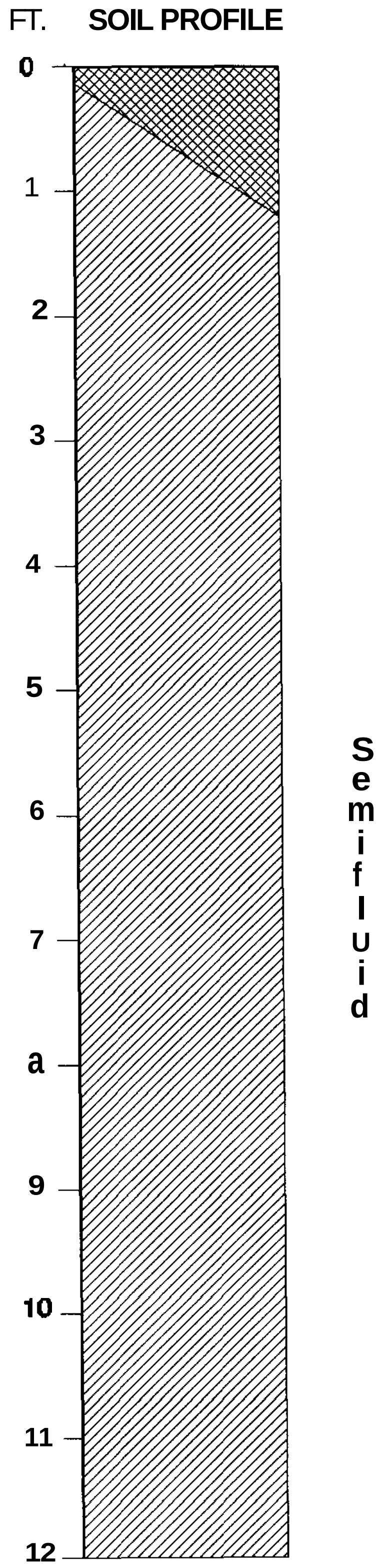
Soil Characteristics

Typically the Lafitte soils have black alkaline organic layers 5–6 feet thick overlying gray semifluid alkaline clay. If drained, the upper 15 inches will become extremely acid and more firm.

Use and Management

The major land use for this soil is related to wildlife. Most of it is managed for hunting, trapping, and fishing. This soil provides habitat for large numbers of geese and for furbearers such as mink, muskrat, otter and raccoon. The typical vegetation is marshhay cordgrass, coastal waterhyssop, dwarf spikerush, Olney bulrush, and saltmarsh morning glory.

The dominant limitations influencing the use and management of the Lafitte soils are its very high subsidence potential, low bearing strength, and the danger of deep flooding during storms, salinity, and salt water intrusion which could change vegetative types. Structures such as weirs require piling for stability. When these soils are drained, they become extremely acid and subside below sea level. Maintenance costs of urban development are high due to pumping costs and damage to sidewalks, driveways, porches, and underground utilities.



LAROSE SERIES

This series consists of very poorly drained, semifluid clayey soils in freshwater coastal marshes. These soils are subject to flooding by runoff from higher areas and tides from freshwater lakes. Slope is less than 0.1%. The salinity is less than 1.25 ppt.

Larose soils are geographically associated with the Allemands, Barbary, Kenner, and Sharkey soils. Allemands soils have organic layers thicker than 16 inches. Kenner soils have organic layers thicker than 51 inches. Barbary soils have buried logs and stumps. Sharkey soils are at higher elevations and are firm throughout.

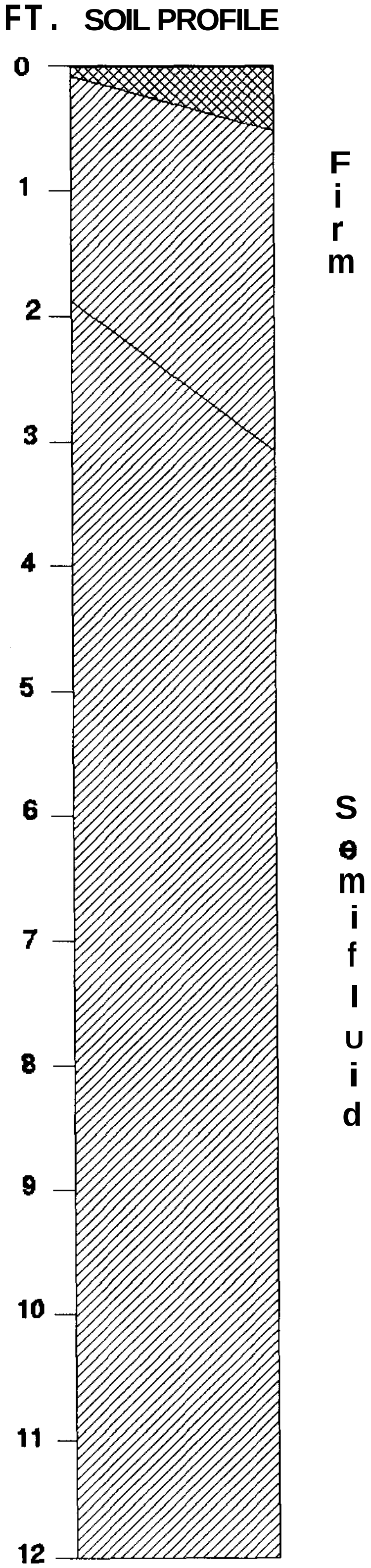
Soil Characteristics

These soils have organic layers 2–15 inches thick over semifluid dark gray and gray clay. The reaction of the organic layers range from medium acid to mildly alkaline, and the mineral layers range from slightly acid to moderately alkaline. After drainage, the upper 15 inches range to extremely acid and the organic layer will be firmer.

Use and Management

These soils are used mainly for wildlife habitat. They provide feeding and roosting areas for ducks, geese, and other waterfowl. They provide a good food supply for muskrat and nutria. Water-control structures for intensive wildlife management are difficult to construct and maintain because of the instability of the semifluid soil material. Trafficability is poor, and when the surface-root mat is broken, the soil is too soft to support livestock. The typical vegetation includes maidencane, bulltongue, alligator weed, cattail, giant cutgrass, and swamp smartweed.

The dominant limitations influencing the use and management of the Larose soils are the medium subsidence potential, low bearing strength, and flooding. Most structures require piling due to the low soil strength. These soils will consolidate and shrink when drained.



RITA SERIES

This series consists of poorly drained mineral soils in freshwater coastal marshes that have been protected from flooding by a system of levees and pumps. They formed in a thin layer of herbaceous organic material overlying semifluid clayey sediments that have consolidated and cracked as a result of artificial drainage. Slopes range from 0–0.5%. The salinity ranges from 0–2.5 ppt.

Rita soils are geographically associated with Allemands, Fausse, Kenner, and Sharkey soils. Allemands and Kenner soils are organic soils. Fausse and Sharkey soils lack irreversible cracks.

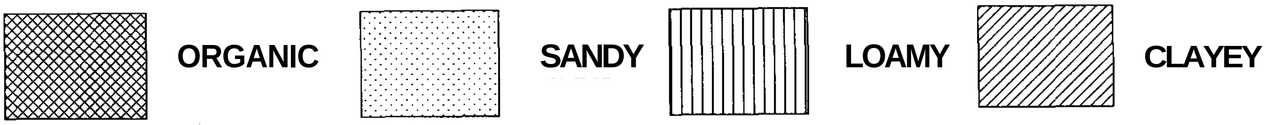
Soil Characteristics

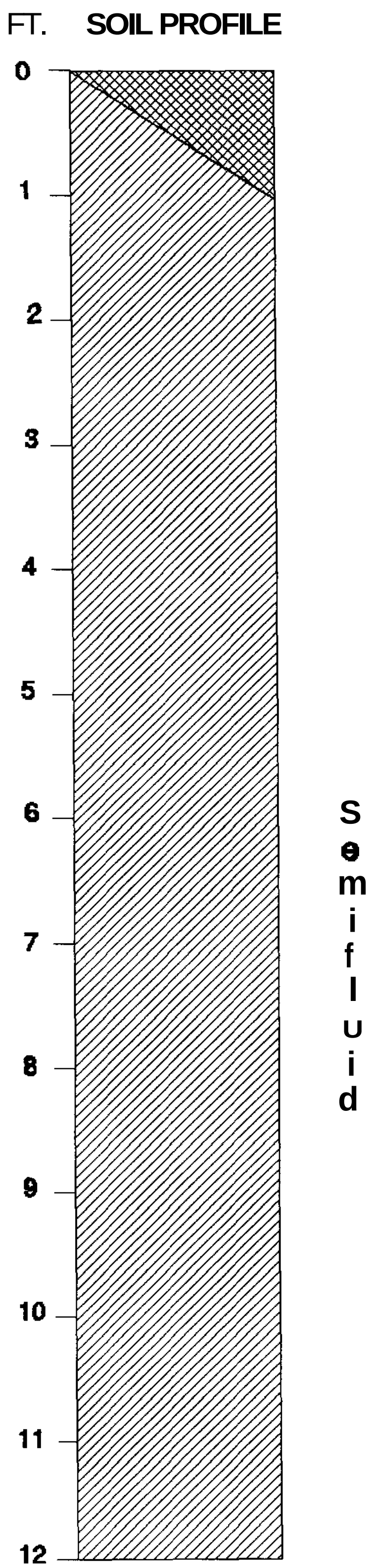
The surface layer is black muck about **4** inches thick. Reaction ranges from extremely acid to slightly acid. The subsoil is gray and greenish gray clay. Its reaction ranges from extremely acid to neutral. The underlying layers are dark greenish gray silty clay loam and loamy very fine sand. Their reaction ranges from neutral to moderately alkaline.

Use and Management

The potential for cropland and pastureland is fair. The main limitations influencing the use and management of the Rita series are wetness, low pH of the surface layer, and the need for protection from storm tides. The main suitable crops are rice, soybeans, and sugarcane. Land grading or smoothing will improve surface drainage and increase the efficiency of farm equipment. The main suitable pasture plants are common bermudagrass, dallisgrass, white clover, and tall fescue.

The potential for urban use is poor. Flooding, wetness, subsidence, low strength, and very high shrink-swell potential are the main limitations. If this soil is used for dwellings, pilings and specially constructed foundations are needed.





SCATLAKE SERIES

This series consists of very poorly drained semifluid mineral soils that occupy large saltwater marsh areas. These soils are near mean sea level along the seaward side of the marshland. The mean salinity is 16 ppt.

Scatlakesoils are geographically associated with the Felicity, Bellpass, and Timbalier soils of the salt marsh, and less commonly adjoin Lafitte and Clovelly soils of the brackish marsh. Bellpass, Timbalier, Lafitte, and Clovelly soils are organic. The Felicity soils are sandy beach ridges.

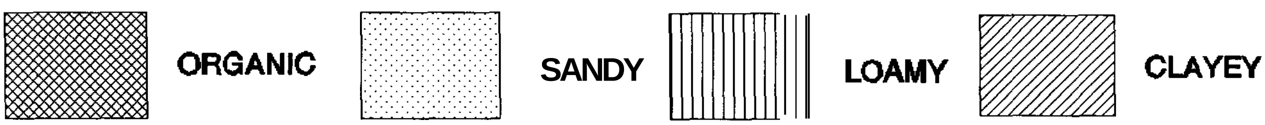
Soil Characteristics

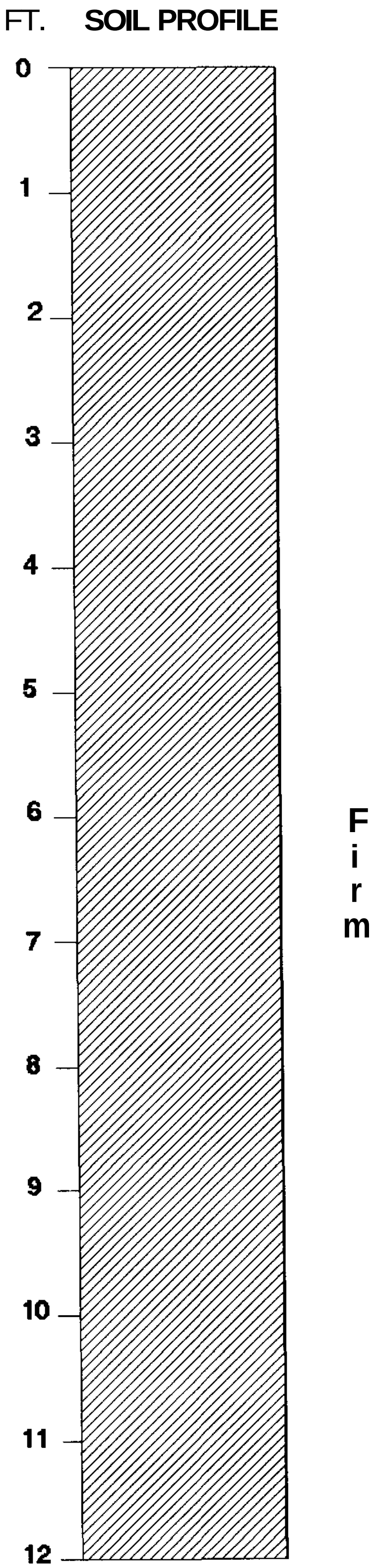
Typically, the surface layer is very dark gray muck about 6 inches thick. The underlying layers, to a depth of 60 inches or more, are semifluid gray alkaline clay.

Use and Management

The major land use for this soil is related to wildlife and recreation. The area is commonly used for hunting, trapping and fishing. It provides habitat for moderate concentrations of geese, muskrat, mink, otter and raccoon. This soil is part of an estuary that provides a nursery for saltwater fish and crustaceans. These fish and estuarine larval forms are the basis for a large fishing industry. The typical plants growing on this soil are marshhay cordgrass, needlegrass rush, seashore shortgrass, smooth cordgrass, bushy sea-oxeye, salt wort, and Virginia samphire.

The dominant limitations influencing the use and management of this soil are low bearing strength, deep flooding during storms, very high shrink-swell potential, and salinity. Structures such as weirs require piling due to the low soil strength. If the soil is drained, it will lose 3–15 inches elevation from subsidence and will become acid. The upper 20–30 inches of the soil will become firm a few years after drainage; but below this depth, the soil will remain semifluid.





SHARKEY SERIES

This series consists of poorly drained mineral soils that formed in clayey Mississippi River alluvial sediments. These soils are on the lower parts of natural levees and in backswamps on the alluvial plain of the Mississippi River and its distributaries. Slope is less than one percent.

Sharkey soils are geographically associated with the Commerce, Mhoon, Tunica, Barbary, and Fausse. Commerce and Mhoon soils are at higher elevations and are loamy throughout. Tunica soils have loamy underlying layers. Barbary and Fausse soils are at lower elevations and are very poorly drained.

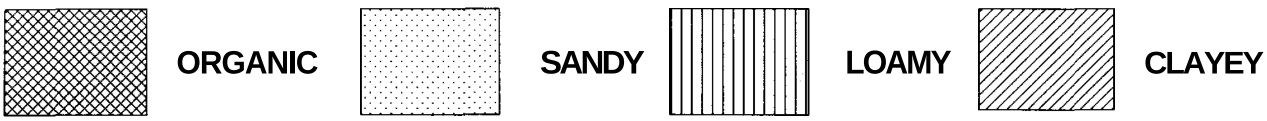
Soil Characteristics

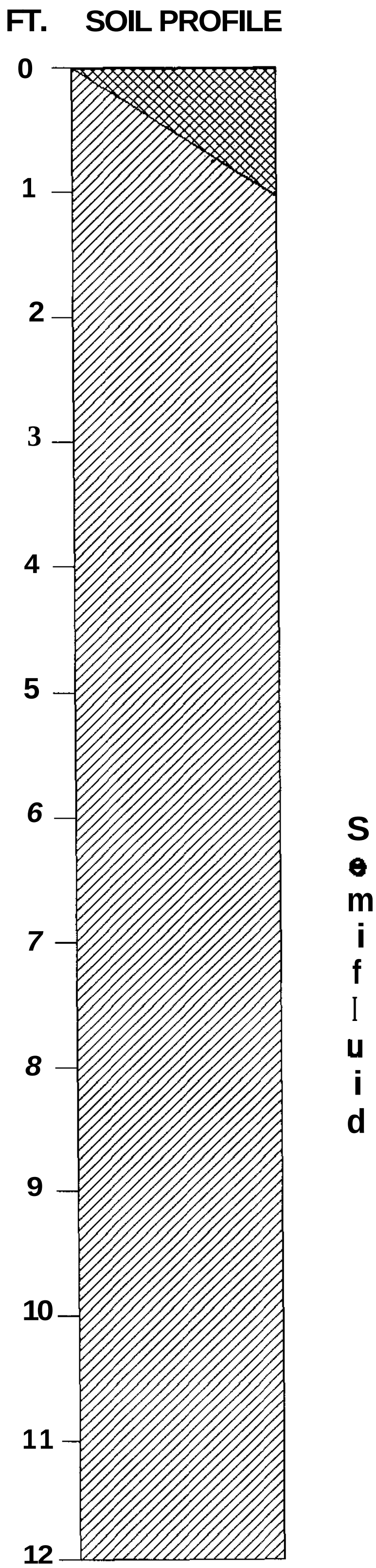
Typically, the surface layer is dark grayish brown clay or silty clay loam about nine inches thick. Reaction ranges from strongly acid through moderately alkaline. The subsoil is dark gray clay mottled with yellowish brown. Its reaction ranges from medium acid through moderately alkaline.

This poorly drained soil is high in fertility. Runoff is slow. Plant roots penetrate the soil with some difficulty. Wetness causes poor aeration and restricts root development. Water and air move at a slow rate through the soil. The seasonal high water-table fluctuates between a depth of 1.5 feet and the surface during the months of December through April. This soil has a very high shrink-swell potential. It cracks when dry and seals over when wet. Adequate water is available to plants in most years.

Use and Management

Potential for cropland and pastureland is good. Its level slopes and high fertility make this series favorable for growing crops; however, its wetness and clayey texture are less favorable features for this use. The main suitable crops are soybeans, cotton, sugar cane, grain sorghum and rice. The main suitable pasture plants are common bermudagrass, dallisgrass, ryegrass, tall fescue, and white clover. This soil can be worked only within a narrow range of moisture content. It becomes cloddy when worked.





TIMBALIER SERIES

This series consists of very poorly drained, semifluid organic soils which occupy large saline marsh areas. These soils are adjacent to the open Gulf or saltwater bays and are flooded frequently with salt water.

Timbalier soils are geographically associated with the Lafitte and Scatlake series. Lafitte soils have less salinity and occupy brackish marshes. Scatlake soils occupy higher elevations and are mineral soils.

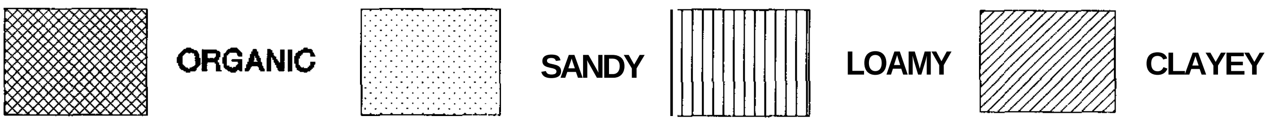
<u>Soils Characteristics</u>

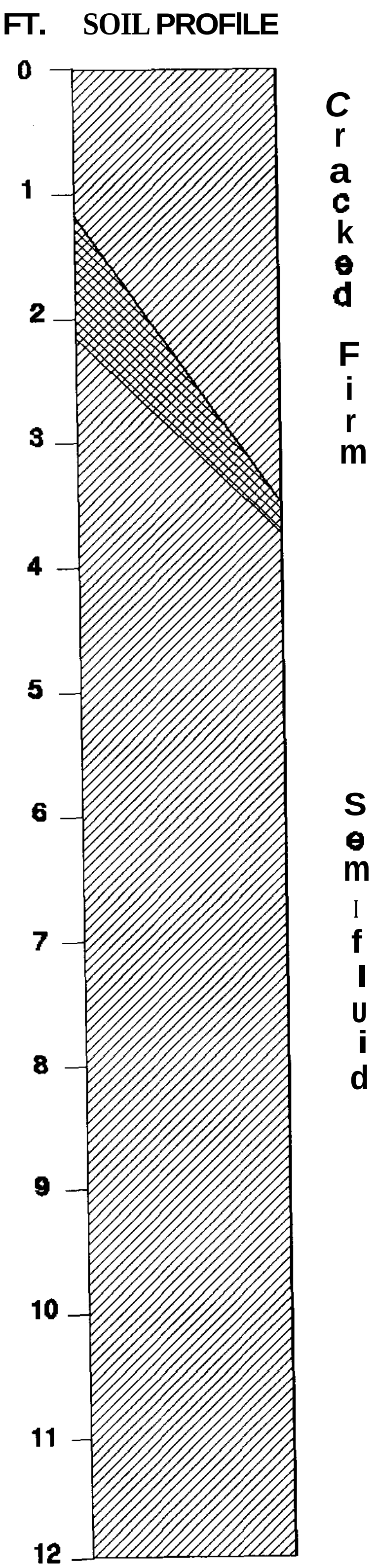
Typically the Timbalier soils have very dark grayish brown to dark brown alkaline organic layers 5 or *6* feet thick, overlying dark gray to dark greenish gray semifluid alkaline clay. If drained, the upper 15 inches will become extremely acid and more firm.

<u>Use and Management</u>

The major land use for this soil is related to wildlife. Most of it is managed for hunting, trapping, and fishing. This soil provides habitat for moderate numbers of geese and for furbearers such as mink, muskrat, otter and raccoon. The typical vegetation is marshhay cordgrass, smooth cordgrass, saltgrass, needlegrass rush, bushy sea-oxeye, and woody glasswort.

The dominant limitations influencing the use and management of Timbalier soils are the very high subsidence potential, low bearing strength, danger of deep flooding during storms, and salinity. Structures such as weirs require piling for stability. When these soils are drained, they become extremely acid and subside below sea level. Maintenance costs of urban development are high due to pumping costs and to damage to sidewalks, driveways, porches, and underground utilities.





WESTWEGO SERIES

This series consists of level, poorly drained mineral soils which occupy broad, drained former swamps along the lower Mississippi River and its distributaries. These soils formed in semifluid clayey alluvium and organic material that dried and shrank irreversibly as the result of artificial drainage. These soils are protected from flooding by levees and are artificially drained by pumps. Flooding can occur when severe storms occur and when pumps or levees fail.

Westwego soils are associated with the Barbary and Harahan soils. Barbary soils formed in semifluid clayey sediments in ponded backswamps, while Harahan soils are drained and formed in moderately thick firm clayey sediments overlying semifluid clayey sediments. In a few places, Westwego is adjacent to Sharkey soils in the landscape. Sharkey series is firm mineral soil throughout and occupies higher elevations. The slightly lower lying Allemands soils have organic layers 16 – 51 inches thick.

Soil Characteristics

Typically the Westwego soils have a surface layer of very dark gray, medium acid clay. The subsoil is a dark gray firm clay to a depth of about 21 inches. The next layer is black muck to a depth of about 36 inches. The underlying material to a depth of about 68 inches is semifluid dark gray clay. Below that to a depth of 80 inches is stratified dark gray semifluid clay and very dark brown semifluid mucky clay. In places, many logs and stumps are buried in the underlying material.

Use and Management

This soil is well suited for woodland and pastureland and moderately well suited for crops. Maintaining adequate control is the main concern. Suitable pasture plants are bahiagrass, common bermudagrass, coastal bermudagrass, dallisgrass, tall fescue, and white clover. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pasture and soil in good condition.