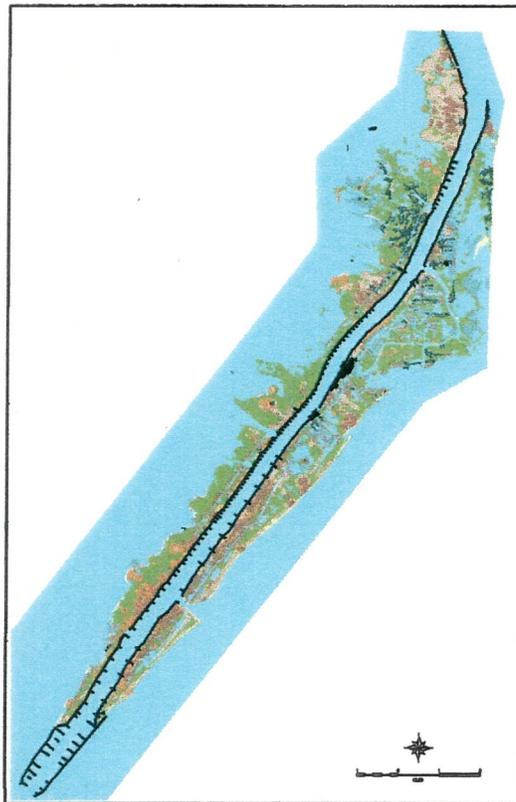


U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass

Base Year 1985 thru Fiscal Year 1996



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TABLE OF CONTENTS

INTRODUCTION 6-1

NAVIGATION AND DREDGING HISTORY 6-4

GIS ANALYSIS RESULTS 6-8

 Shoreline Changes: 1985-1996 6-8

 Habitat Inventory 6-11

 Habitat Change 6-15

SUMMARY 6-19

CONCLUSIONS 6-19

REFERENCES 6-19

LIST OF FIGURES

Figure 1.	Location map of Southwest Pass BUMP study area.	6-2
Figure 2.	The Mississippi River - Southwest Pass BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.	6-3
Figure 3.	The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, 1985 to 1996.	6-7
Figure 4.	Graph of the area of the Mississippi River - Southwest Pass BUMP study area over time, showing the contribution of the beneficial use of dredged material.	6-9
Figure 5.	Shoreline changes of the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996.	6-10
Figure 6.	Habitat inventory map of the Mississippi River - Southwest Pass BUMP study area in December 1985.	6-12
Figure 7.	Habitat inventory map of the Mississippi River Southwest Pass BUMP study area in November 1996.	6-14
Figure 8.	Graph showing the relative change in total area of the major habitat categories: natural, other-made, and BUMP-made, between 1985 and 1996.	6-15
Figure 9.	Map of the Mississippi River - Southwest Pass BUMP study area showing the new habitats created by beneficial use of dredged materials or formed by natural processes between December 1985 and November 1996.	6-16
Figure 10.	Time series showing the changes in total area of each habitat in the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996. A) natural habitat changes. B) Other Man-made habitat changes. C) BUMP-made habitat changes.	6-18

LIST OF TABLES

TABLE 1	Mississippi River - Southwest Pass Area: 1985-1996	6-9
TABLE 2	December 1985 Habitat Inventory of the Mississippi River - Southwest Pass BUMP Study Area	6-11
TABLE 3	November 1996 Habitat Inventory of the Mississippi River - Southwest Pass BUMP Study Area	6-13
TABLE 4	Cumulative Change in Total Areas of each Habitat in the Southwest Pass Study Area between 1985 and 1996 ¹	6-17

INTRODUCTION

Southwest Pass is the main distributary of the Mississippi River which currently carries the majority of the river's flow and is used for national and international shipping traffic (Figure 1). The Mississippi River drains 1.25 million square miles of the North American continent and flows over 3,900 miles from its headwaters to the Gulf of Mexico. Its sediment load of 300,000,000 tons annually has fashioned much of the state of Louisiana, adding some 15,000 square miles of land in the last 6000 years. The Mississippi River deltaic plain is the third largest in the world. The early appearance of the delta with only three major channels prior to extensive crevasse sedimentation led investigators to refer to the modern river mouth as the *birdfoot* delta (Morgan 1977). The major passes of the modern delta used for navigation include Tiger Pass, Southwest Pass, South Pass, Southeast Pass, Northeast Pass, Pass a Loutre, North Pass, Main Pass, and Baptiste Collette Bayou.

Characteristically only a few channels within a delta system will carry the majority of the flow at any one time. These channels advance slowly seaward, while the remainder of the delta system subsides and deteriorates. Subsidence of the natural levees and interlevee basins by compaction of underlying unconsolidated prodelta clays results in rapid enlargement of ponds and lakes within the subdeltas. Crevasses, or breaks in the levees, divert sediment and can result in extensive land building over varying time periods, forming small splays or large subdeltas.

Artificial modifications of the Mississippi River and its delta have contributed to lower rates of land formation and deltaic deterioration in recent years. Artificial levees and revetments have reduced the occurrence of natural crevasses and their associated land-building processes. Lower rates of land progradation at the mouth of major distributaries is the result of channelization and sediment deposition in deeper waters. Artificially created crevasses and the beneficial use of dredged materials by the U.S. Army Corps of Engineers has imitated the role of natural crevasses in diverting sediment from the channels into shallow water for marsh and other habitat creation.

This is the sixth part of the nine part Beneficial Use of dredged material Monitoring Program (BUMP), 1996 Final Report, representing monitoring results through the USACE-NOD Fiscal Year 1996. The nine parts are:

- Part 1: Introduction and Methodology
- Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
- Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
- Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
- Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
- Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass

- Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland
- Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
- Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography LSU classified the natural and man-made habitats in the study area for December 1985 and November 1996 including habitat created during the USACE-NOD FY1996 maintenance event. Through the GIS analysis, the areas of the sites selected were calculated and changes documented. Figure 2 shows the limits of the BUMP study site, including the minimum area of coverage of the aerial photography and the area to be digitized.

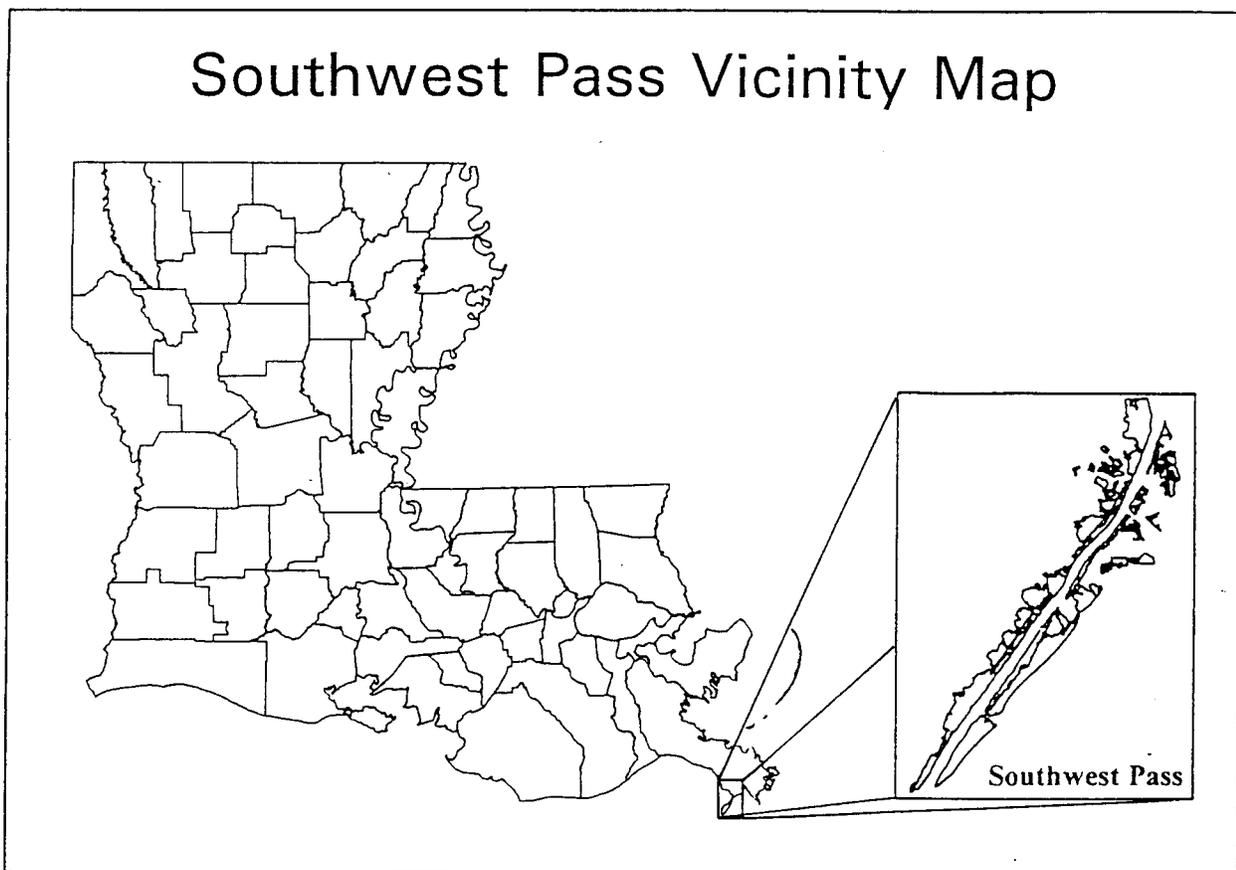


Figure 1. Location map of Southwest Pass BUMP study area.

NAVIGATION AND DREDGING HISTORY

The natural distributaries of the Mississippi River have been used as navigation channels by Europeans since 1682 when La Salle explored the mouth of the river. The site of New Orleans was selected in the early 1700s, and levee construction began as early as 1717 at New Orleans to control flooding. By 1726 a levee 5400 feet long, 18 feet wide and 3 feet high had been constructed. By 1735, levees extended on both sides of the river from 30 miles above New Orleans to 12 miles below, and by 1858 extended to the Ohio River. The effect of the levee system was largely to contain floodwaters within the river channel. Although the levees decreased the number of crevasses that occurred during flood stage of the river, it increased the intensity of the crevasses which did occur, and the modern delta experienced an overall growth in area between 1890s to the mid 1920s.

In 1720, only South Pass of the Mississippi River was utilized for navigation. However, since most commerce came from an easterly direction, a pilot station known as *Balize* was established on an island off of Balize Bayou which was a distributary of Northeast Pass. The Balize settlement was destroyed before 1767 by a flood and the pilot station was moved to the north shore of Northeast Pass. By the late 1700s, Northeast Pass was being surpassed by Pass a Loutre as a main navigation channel, and South Pass had shoaled considerably. Southwest Pass had the greatest water depth over the distributary mouth bar, and by 1813, had become the major channel. Between 1852 and 1869, attempts to increase the depth of the channel at Southwest Pass and Pass a Loutre included jettying, dredging the channel mouth bar, blasting mudlumps, agitation of the bottom with steam-driven propellers, and dragging iron harrows across the bar. None of these techniques were successful and bar deposits soon reformed when attempts ceased. The building of jetties at Southwest Pass commenced in 1902 and was largely completed in 1908, although work on the project continued for nearly another decade, including damming of upstream subsidiary channels (Morgan 1977).

During the first half of the 1900's, the Mississippi River's Southwest Pass (SWP) navigation channel was maintained to a 35-foot depth. The Rivers & Harbors Act of 1945 authorized a 40-foot deep by 800-foot wide navigation channel, and in 1961 the SWP navigation channel was enlarged to achieve a 40-foot depth. The Rivers & Harbors Act of 1985 authorized a 55-foot deep channel. The SWP navigation channel is currently maintained by the USACE-NOD at a 45-foot depth and 750-foot width between mile 4.0 Above Head of Passes (AHP) to mile 17.5 Below Head of Passes (BHP). Between mile 17.5 BHP and mile 22.0 BHP the navigation channel is maintained to a 45-foot depth and 600-foot width. Construction to enlarge the channel dimensions to the current 45-foot maintained depth began in 1987.

Although dredging records prior to 1956 are sketchy, records indicate that SWP has been dredged annually in discontinuous reaches since at least 1945. Currently, SWP is dredged annually in discontinuous reaches from Mile 4.0 AHP to Mile 22.0 BHP. Both hopper and hydraulic cutterhead dredges are used to maintain the Mile 4.0 AHP to Mile 18.8 BHP reach, and hopper dredges are used to maintain the Mile 18.8 BHP to Mile 22.0 BHP reach.

Hopper-dredged material from the upper half of the Mile 4.0 AHP to Mile 18.8 BHP reach is deposited at the entrances to Pass-a-Loutre and South Pass. Current plans call for hydraulically dredging the Pass-a-Loutre open water disposal area to allow hopper dredges the continued use of this site. Material excavated from this site would be placed unconfined in shallow open water adjacent to and north of Pass-a-Loutre Bayou for wetlands development. The maximum initial height of this material would be +3.0 feet Mean Low Gulf (MLG) with an expected final material height, following compaction and dewatering, of +1.0 to +0.5 feet MLG. Hopper-dredged material from the lower half of the Mile 4.0 AHP to Mile 18.8 BHP reach through the lower jetty and bar channel of the river is either agitation dredged or deposited in a designated ocean dredged material disposal site.

Hydraulically-dredged Southwest Pass shoal material has historically been placed into one of three different categories of disposal areas: 1) unconfined into the open waters located on either side of Southwest Pass (including East Bay and West Bay), 2) behind existing foreshore dikes for bank stabilization purposes, and 3) shallow open water areas for wetland creation.

Since 1975, and probably earlier, open water placement of dredged material into East Bay was restricted to a maximum initial discharge height of +10.0 feet MLG to offset the erosive effects of the high energy wave environments. Placement of dredged material into other open water habitats was restricted to a maximum initial height of +6.0 feet MLG. Subsequent consultation with the U.S. Fish and Wildlife Service led to the determination that dredged material placed at these heights did not result in the formation of intertidal marshland. In 1988, the maximum height restriction was changed to +6.0 feet MLG for East Bay disposal and to +4.5 feet MLG (with an expected final height of +3.0 feet MLG) for other open water disposal areas to facilitate intertidal marsh formation. Further consultation with various State and Federal resource agencies resulted in another modification of the initial height restriction for material placed in these other open water areas to +4.0 feet MLG in 1996.

The 1985 Mississippi River, Baton Rouge to the Gulf of Mexico FEIS Supplement 2, discussed the utilization of material dredged from the Mile 11.6 AHP to Mile 20.1 BHP for bank nourishment and marsh creation. Placement of dredged material behind foreshore dikes for bank nourishment between Mile 11.6 AHP to Mile 0.0 would be to a maximum initial height of +7.5 feet National Geodetic Vertical Datum (NGVD) to achieve a maximum final height of +4.5 feet NGVD. Between Mile 0.0 and Mile 20.1 BHP, dredged material placed for bank nourishment would be discharged to a maximum initial height of +7.0 feet NGVD to achieve a final height of +4.0 feet NGVD. This maximum initial height restriction of dredged material was changed to +6.0 feet MLG in 1987. Material excavated during maintenance dredging that was not used for bank nourishment would be discharged unconfined into open water habitats for marsh creation.

Since 1975, material hydraulically dredged from Southwest Pass has been utilized to create marsh. The 1976 Mississippi River, Baton Rouge to the Gulf of Mexico Final Environmental Impact Statement (FEIS) Supplement, and the 1982 Deep-Draft Access to the Ports of New Orleans and Baton Rouge, Louisiana FEIS, both outlined placement of dredged material in open water habitats for marsh creation purposes. In 1975, a marsh creation experiment was conducted at East Bay. In coordination with the Louisiana Department of Wildlife and Fisheries, the NOD developed a

plan in which approximately 4,000,000 cubic yards (CY) of dredged material was placed into the open water of East Bay to create marshland.

Open water disposal areas dedicated to wetland creation were established in 1992 at specific locations in the West Bay (West Bay Mandatory Disposal Area (WBMDA) at Mile 14.5 BHP) and in the East Bay (East Bay Mandatory Disposal Area (EBMDA) at Mile 9.5 BHP) of Southwest Pass. Initial plans for the WBMDA called for a crescent-shaped design to extend into West Bay in order to help retain dredged material from subsequent placements. Prior to 1996, a maximum discharge height for dredged material placed at the West Bay site was +6.0 feet MLG with an expectation that, following dewatering and compaction, a final height of +3.0 feet MLG would be achieved. This maximum elevation height restriction was chosen to offset the erosive effects of the high energy wave environment present in West Bay. The WBMDA design plan was altered in 1996 to create a continuous spit to be angled away from the existing shoreline. The maximum initial height of dredged material placed at this site was also changed to +4.5 feet MLG (with an expected final height of +3.0 feet MLG). Approximately 1,460,000 cy of dredged material have been placed at the WBMDA since 1992.

The EBMDA was authorized under Section 150 of WRDA of 1976. Prior to 1996, material placed at the EBMDA was not to exceed a maximum initial height of +4.5 feet MLG. This maximum height restriction was changed to +4.0 feet MLG in 1996. Approximately 827,000 cy of dredged material have been placed at this site since 1992. Once this site has been filled to capacity, plans call for placing material into the open water of East Bay. The EBMDA was determined to be filled to its maximum capacity in 1996.

Figure 3 illustrates the dredged material disposal history for the Southwest Pass study area between 1985 and 1996 based on aerial photographic data.

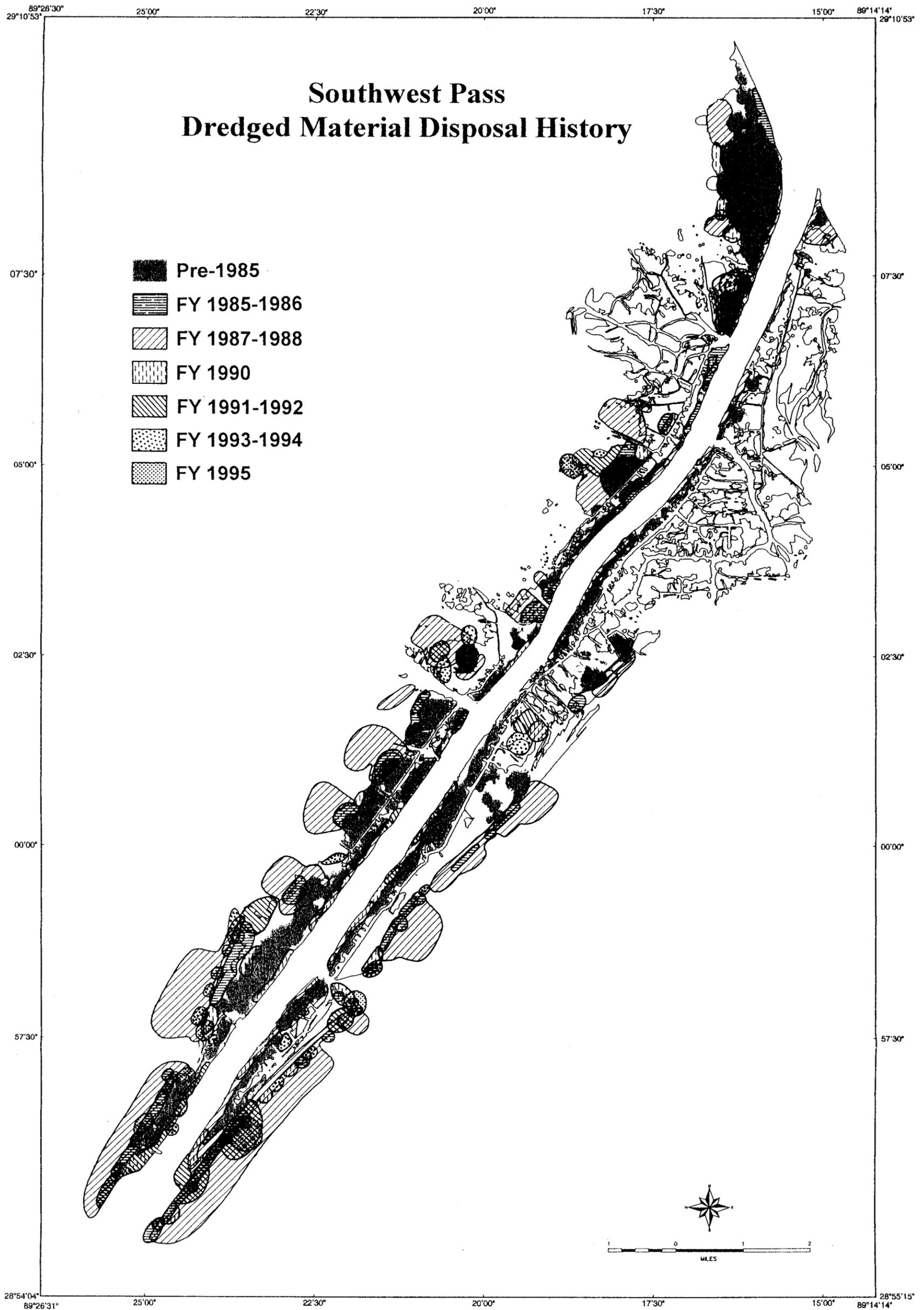


Figure 3. The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, 1985 to 1996.

GIS ANALYSIS RESULTS

Shoreline Changes: 1985-1996

Figure 4 graphs the spatial history of the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996. Table 1 documents the changes and Figure 5 illustrates the changes that took place at Southwest Pass between 1985 and 1996. In December 1985, the Southwest Pass study area was measured at 9389.5 acres. The study area in November 1996 measured 13,026.9 acres. This is a cumulative area increase of +3637.4 acres at a rate of +333.7 acres per year for this 10.9 year period. The total area of the Southwest Pass BUMP study site increased by 39 percent between 1985 and 1996. There was an overall increase in the area of Southwest Pass of +756.9 acres in the natural areas. The contribution of BUMP related and other man-made areas accelerated the rate of growth by +2880.5 acres. BUMP-made land totaled +2491.6 acres and other man-made land totaled +388.9 acres. The BUMP-made habitats accounted for 68 percent of the increase in area of the Southwest Pass Study area between 1985 and 1996.

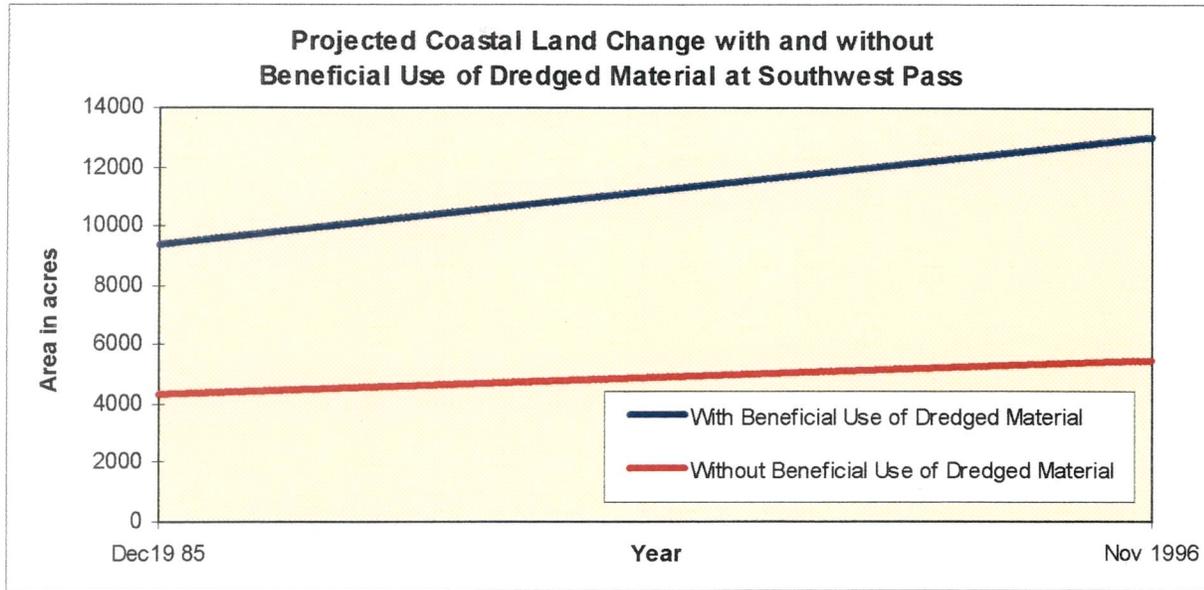


Figure 4. Graph of the area of the Mississippi River - Southwest Pass BUMP study area over time, showing the contribution of the beneficial use of dredged material.

TABLE 1
Mississippi River - Southwest Pass Area: 1985-1996

Area in acres	Dec 1985	Nov 1996	Area Change
Natural Areas	3327.5	4084.4	+756.9
Other Man-made Areas	1001.3	1390.2	+388.9
BUMP-made Areas	5060.7	7552.3	+2491.6
Total	9389.5	13,026.9	+3637.4

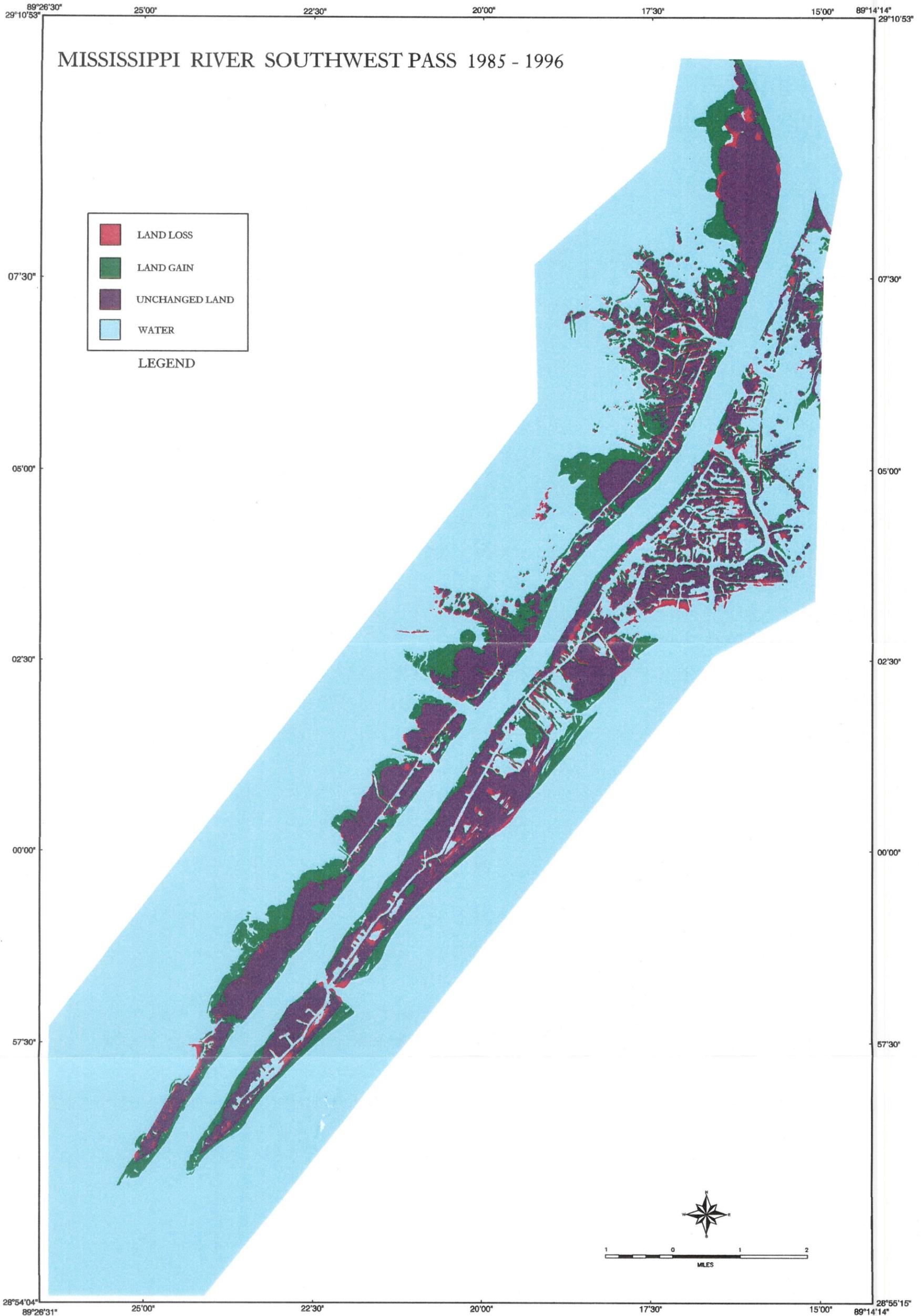


Figure 5. Shoreline changes of the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996.

Habitat Inventory

The aerial photographic interpretation combined with field surveys identified six major habitat types in the Mississippi River - Southwest Pass BUMP study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial-placement of dredged material. The Non-BUMP man-made class (other-made) separates areas created that were not related to the beneficial use of dredged material such as areas created in association with the oil industry access and pipeline canals. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Table 2 lists the areas of the six habitat types found in the Mississippi River - Southwest Pass BUMP study area in December 1985. The location and arrangement of these habitats is presented in figure 6. The total area of the Southwest Pass study site was 9,389.5 acres. Of this total, 3,327.5 acres were natural and 6,062.0 acres were man-made including 5,060.7 acres of BUMP-made and 1,001.3 acres of other-made, or 35.4 percent were natural, 53.9 percent were BUMP-made and 10.7 percent were other-made.

In order of decreasing size and importance, the largest habitats found were natural marsh (2,964.2 acres) and BUMP-made marsh (2,049.7 acres), followed by BUMP-made upland (1,636.6 acres), BUMP-made bare land (1,250.5 acres), other-made marsh (417.0 acres), and other-made shrub/scrub (326.6 acres).

In terms of habitat totals, marsh (5,430.9 acres or 57.8%) dominated the Mississippi River - Southwest Pass landscape.

TABLE 2
December 1985 Habitat Inventory of the
Mississippi River - Southwest Pass BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	5430.9	2964.2	417.0	2049.7
Upland	1762.8	68.5	57.7	1636.6
Shrub/Scrub	422.0	3.7	326.6	91.7
Forest	139.8	36.6	78.7	24.5
Bare Land	1388.6	16.8	121.3	1250.5
Beach	245.4	237.7	0.0	7.7
Habitat Total	9389.5	3327.5	1001.3	5060.7

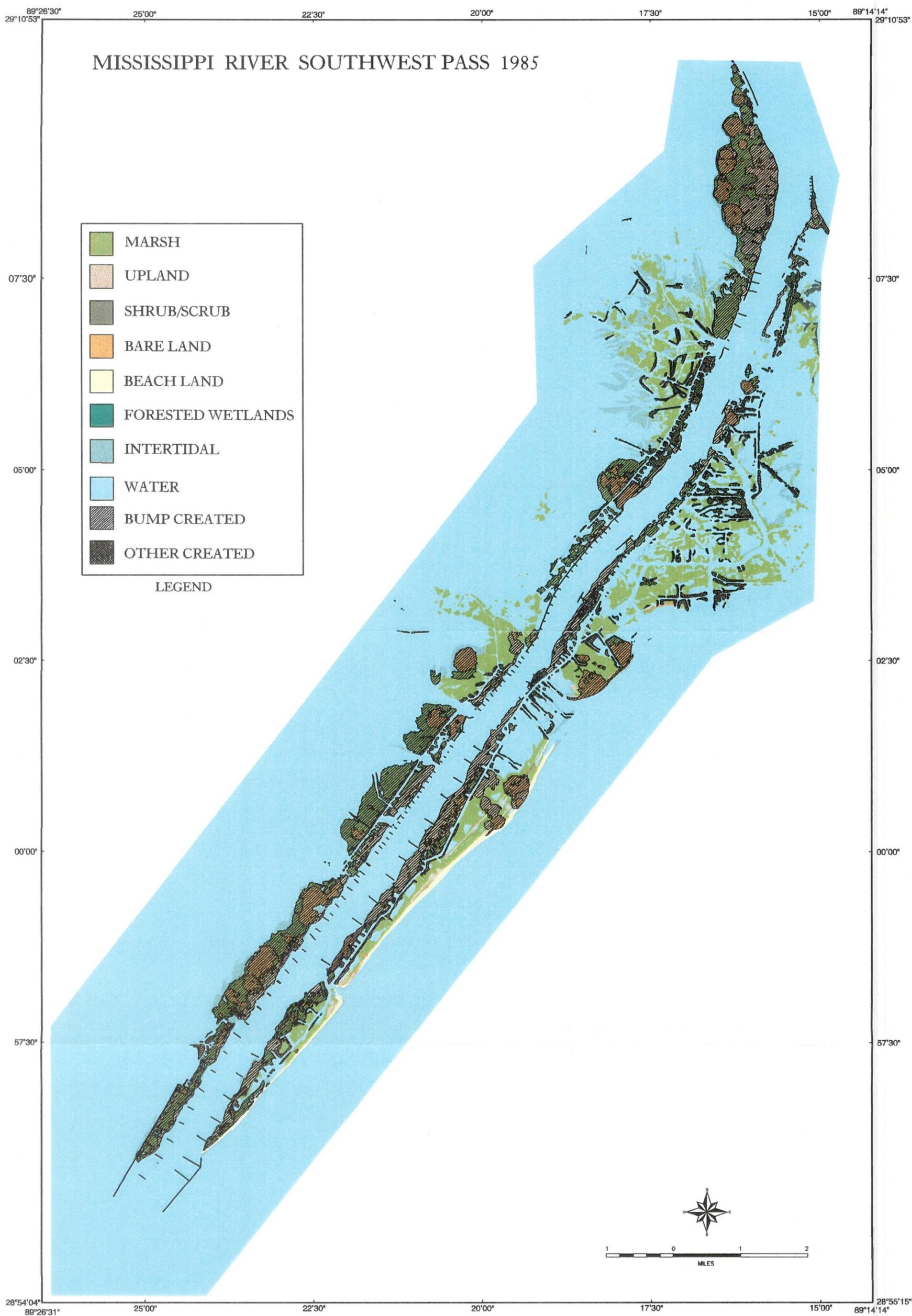


Figure 6. Habitat inventory map of the Mississippi River - Southwest Pass BUMP study area in December 1985.

Table 3 lists the areas of the six habitats found in the Mississippi River - Southwest Pass BUMP study area in November 1996. The location and arrangement of these habitats is presented in figure 7. In 1996, the total area of the Mississippi River - Southwest Pass BUMP study area was calculated at 13,026.9 acres. Of this total, 4,084.4 acres were natural and 8,942.5 acres were man-made including 7,552.3 acres BUMP-made and 1,390.2 acres other-made, or 31.3 percent was natural, 58.0 percent was BUMP-made and 10.7 percent was other-made.

In order of decreasing size and importance, the largest habitats found were natural marsh (3607.9 acres) followed by BUMP-made marsh (3602.5 acres), BUMP-made upland (1855.1 acres), and BUMP-made shrub/scrub (1383.9 acres).

In terms of total area, marsh (7680.0 acres or 58.0%) dominated the landscape of the Mississippi River - Southwest Pass BUMP study area.

TABLE 3
November 1996 Habitat Inventory of the
Mississippi River - Southwest Pass BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	7680.0	3607.9	469.6	3602.5
Upland	2141.3	220.1	66.1	1855.1
Shrub/Scrub	1875.1	21.4	469.8	1383.9
Forest	416.2	54.6	317.7	43.9
Bare Land	704.9	2.2	65.4	637.3
Beach	209.4	178.2	1.6	29.6
Habitat Total	13026.9	4084.4	1390.2	7552.3

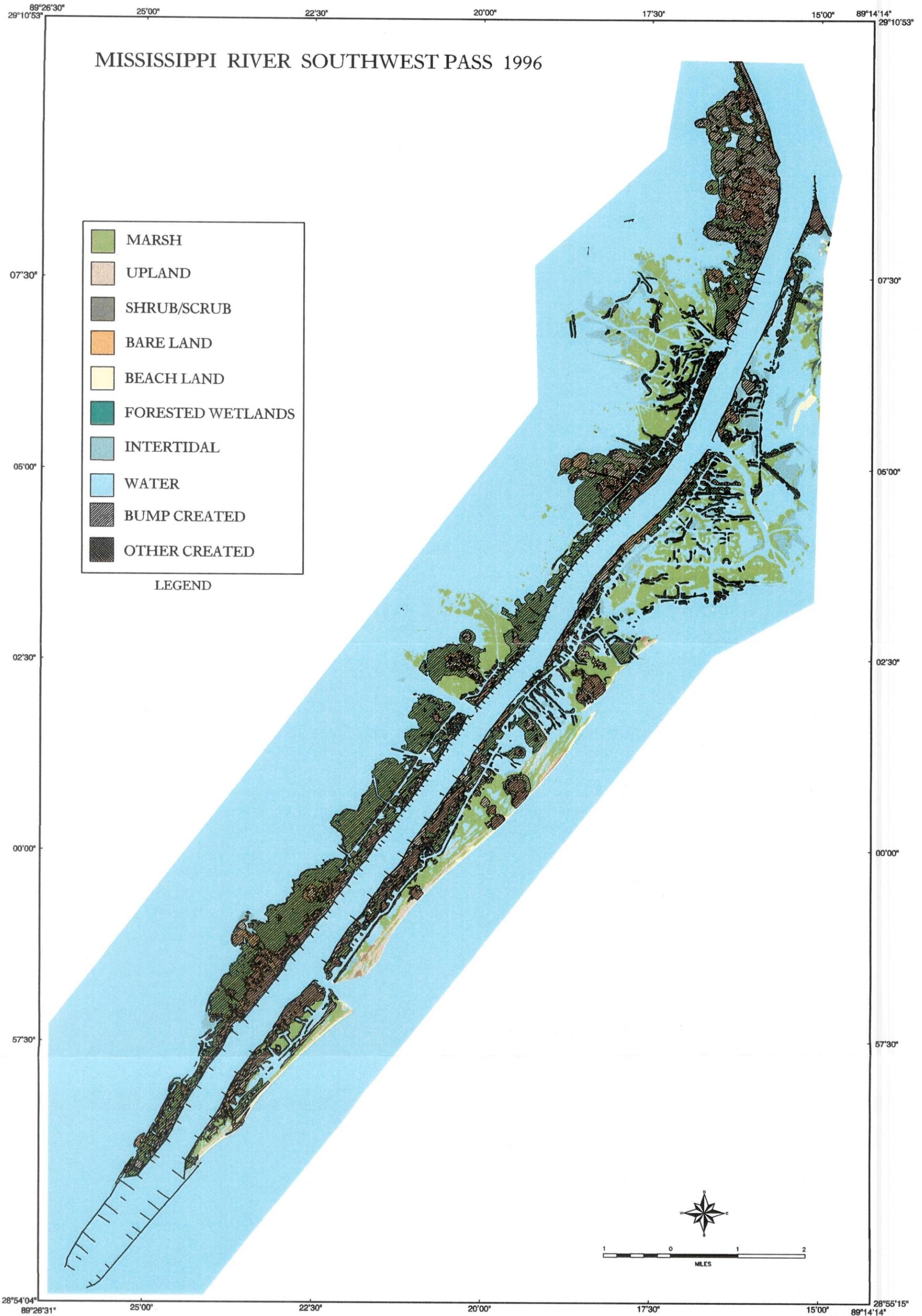


Figure 7. Habitat inventory map of the Mississippi River Southwest Pass BUMP study area in November 1996.

Habitat Change

Figure 8 shows changes over time of the major habitat categories: natural, other-made and BUMP-made. Figure 9 shows the creation of new habitat, both natural and man-made, along the Mississippi River - Southwest Pass BUMP study area by comparing December 1985 and November 1996. Land gain due to beneficial use of dredged materials dominates the processes of this area. The total area increased by +3637.4 acres which represents a +39 percent increase in area between 1985 and 1996. There was an overall increase of +756.9 acres of the natural habitats, an increase of +388.9 acres in other-made habitats, and an increase of +2491.6 acres of BUMP-made habitats. Table 4 lists the major habitat changes during the period between December 1985 and November 1996.

The greatest cumulative habitat changes between 1985 and 1996 were the increase of BUMP-made marsh (+1552.8 acres) and BUMP-made shrub/scrub (+1292.2 acres). For the natural areas, there was a gain of +643.7 acres of marsh and +151.6 acres of upland. The overall change in natural and man-made habitats was an increase of +3637.4 acres.

Figure 10 shows a time series of habitat changes along the Mississippi River - Southwest Pass BUMP study area. 10A graphs the natural habitat changes over time. Natural land building and erosion dominates the processes effecting the natural habitat class. 10B graphs the other-made habitat changes over time. Marsh and shrub/scrub creation by beneficial use of dredged material dominates the man-made class. 10C graphs the BUMP-made changes over time.

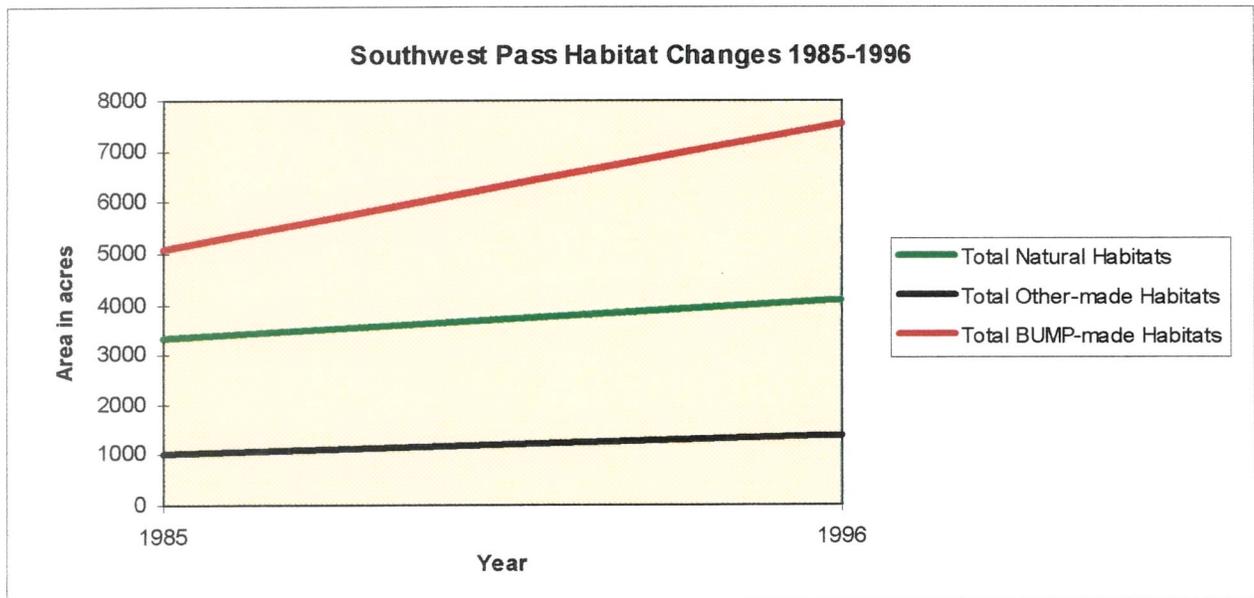


Figure 8. Graph showing the relative change in total area of the major habitat categories: natural, other-made, and BUMP-made, between 1985 and 1996.

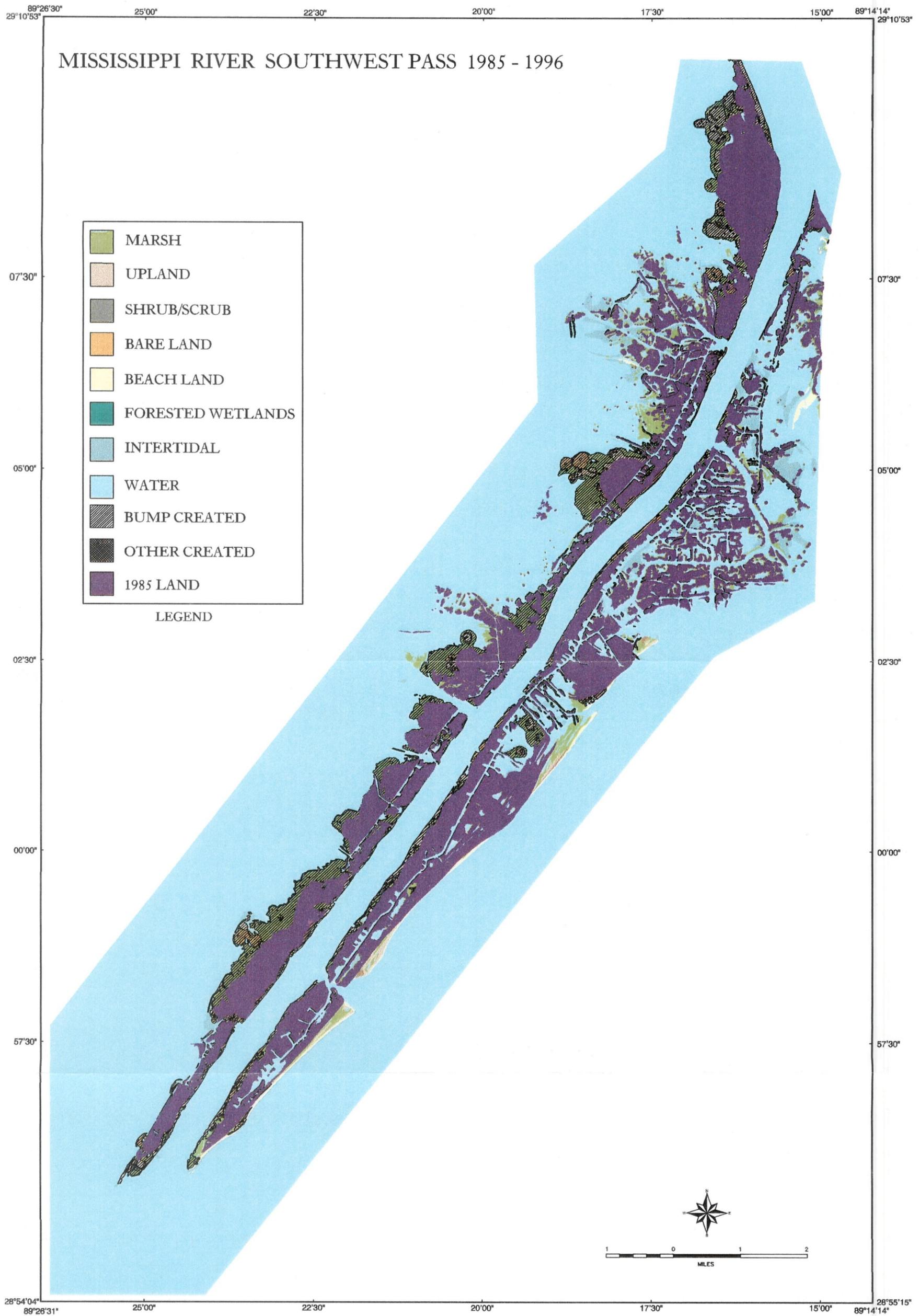


Figure 9. Map of the Mississippi River - Southwest Pass BUMP study area showing the new habitats created by beneficial use of dredged materials or formed by natural processes between December 1985 and November 1996.

TABLE 4
Cumulative Change in Total Areas of each Habitat
in the Southwest Pass Study Area between 1985 and 1996¹

HABITAT	Dec 1985	Nov 1996	AREA CHANGE
Natural Marsh	2964.2	3607.9	+643.7
Natural Upland	68.5	220.1	+151.6
Natural Shrub/Scrub	3.7	21.4	+17.7
Natural Forest	36.6	54.6	+18.0
Natural Bare Land	16.8	2.2	-14.6
Natural Beach	237.7	178.2	-59.5
Total Natural Habitats	3327.5	4084.4	+756.9
Other-made Marsh	417.0	469.6	+52.6
Other-made Upland	57.7	66.1	+8.4
Other-made Shrub/Scrub	326.6	469.8	+143.2
Other-made Forest	78.7	317.7	+239.0
Other-made Bare Land	121.3	65.4	-55.9
Other-made Beach	0	1.6	+1.6
Total Other-made Habitats	1001.3	1390.2	+388.9
BUMP-made Marsh	2049.7	3602.5	+1552.8
BUMP-made Upland	1636.6	1855.1	+218.5
BUMP-made Shrub/scrub	91.7	1383.9	+1292.2
BUMP-made Forest	24.5	43.9	+19.4
BUMP-made Bare Land	1250.5	637.3	-613.2
BUMP-made Beach	7.7	29.6	+21.9
Total BUMP-made Habitats	5060.7	7552.3	+2491.6
HABITAT TOTAL	9389.5	13026.9	+3637.4

¹ in acres

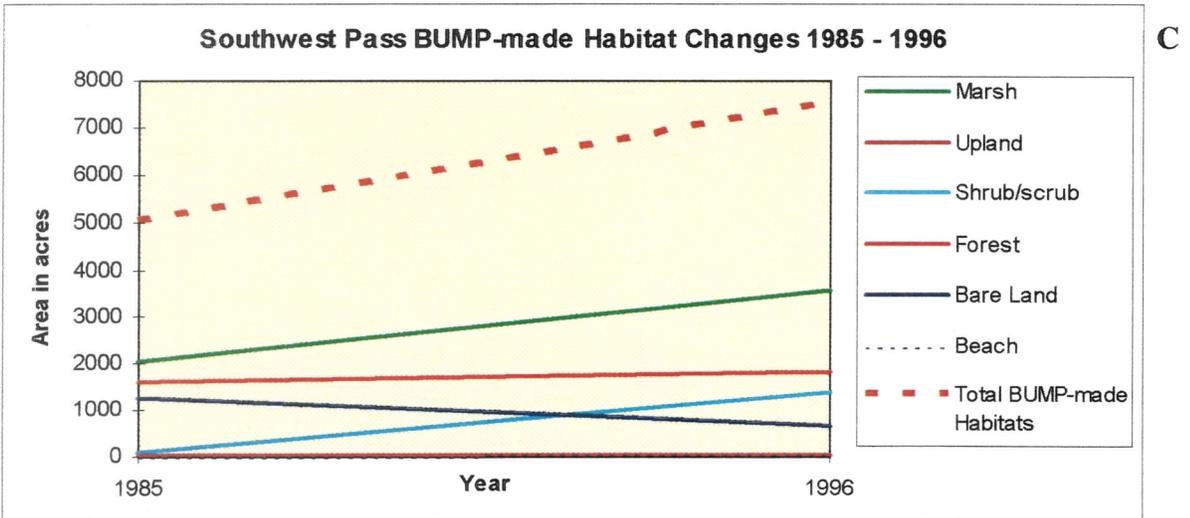
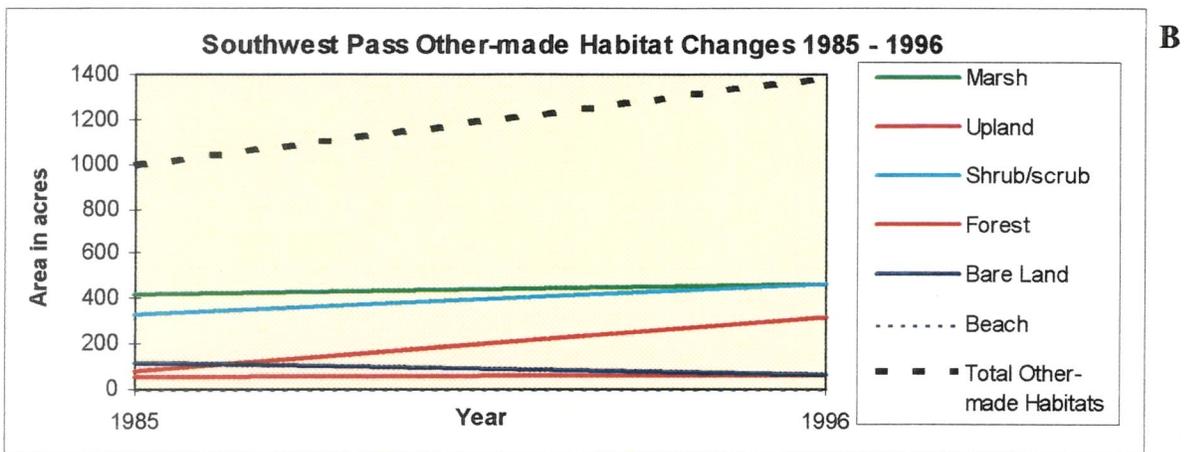
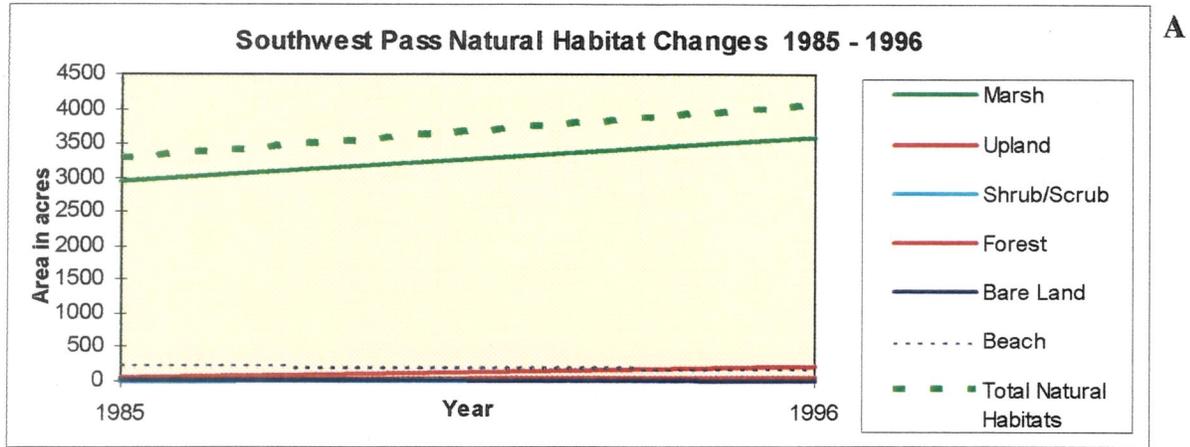


Figure 10. Time series showing the changes in total area of each habitat in the Mississippi River - Southwest Pass BUMP study area between December 1985 and November 1996. A) natural habitat changes. B) Other Man-made habitat changes. C) BUMP-made habitat changes.

SUMMARY

1. The habitat inventory documented that the study area is primarily dominated by man-made habitats. In 1985, the study area contained 9389.5 acres of which 35 % was natural and 65 % was man-made. In 1996, the study area contained 13,026.9 acres of which 31 % remained natural and 69% remained man-made.
2. The habitat change analysis indicated that +1552.8 acres of marsh was created between 1985 and 1996 through the beneficial use of dredged material. Other significant habitat increases include +1292.2 acres of BUMP-made shrub/scrub and +218.5 acres of BUMP-made upland.
3. The beneficial use of dredged material has created a total of +2491.6 acres of man-made habitats between 1985 and 1996. Other man-made habitat creation account for an increase of +388.9 acres. Currently, the natural habitats in the study area have slowly increased by +756.9 acres.

CONCLUSIONS

1. The beneficial use of dredged material at the Southwest Pass navigation channel has been very successful in creating new habitats and has accelerated the growth of this Mississippi River distributary between 1985 and 1996.
2. The rapid increase in area of Southwest Pass is a result of natural processes accelerated by wetland and other habitat creation as a result of the beneficial use of dredged material.

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