BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM

Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay and Bar Channel

Base Year 1985 through January 2001

Prepared for

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TABLE OF CONTENTS

INTRODUCTION 1-1
Beneficial Use of Dredged Material Monitoring Program (BUMP) 1-1
Atchafalaya River and Bay Area 1-2
BUMP at Atchafalaya Bay and Bar 1-2

BENEFICIAL USE OF DREDGED MATERIAL DISPOSAL HISTORY 1-6

ATCHAFALAYA BAY AND BAR 1-6

BASIC METHODOLOGY 1-11
Aerial Photographic Analysis and Habitat Determination 1-11
Field Program 1-13
Geographic Information System (GIS) Analysis 1-13
World Wide Web Site 1-14

FIELD SURVEY RESULTS 1-15
Methodology 1-15
Profiles 1-18
Andrew Island 1-18
Horseshoe Island 1-35
Ibis Island 1-48
Long Island 1-62
Vegetative Character 1-72
General Description 1-72
Vegetative Community Types in the Atchafalaya Delta 1-72

GIS ANALYSIS RESULTS 1-74
Shoreline Changes: 1985-January 2001 1-74
Habitat Inventory 1-76
Habitat Change 1-82

CONCLUSIONS 1-86

REFERENCES 1-86

APPENDIX A 1-A1

LIST OF FIGURES

Figure 1. Locations of the beneficial use of dredged material monitoring areas............................1-1

Figure 2. The location of the Lower Atchafalaya River Bay and Bar BUMP study area in Louisiana. 1-4

Figure 3. The Lower Atchafalaya River Bay and Bar BUMP study area showing the minimum coverage of the aerial photo-mosaic and limits of the area digitized. 1-5

Figure 4A. Previous dredged material disposal history for the Lower Atchafalaya River Bay and Bar channel reaches through 1995. 1985 to 1990 data from Van Heerden, 1994; 1991 to 1995 data from USACE-NOD *as-builts*...................................1-9

Figure 4B. Dredged material disposal history for the Lower Atchafalaya River Bay and Bar channel reaches with recent placement detailed FY 1996 through FY 2000. 1985 to 1990 data from Van Heerden, 1994; 1991 to 2000 data from USACE-NOD *as-builts* and aerial photography. 1-10

Figure 5. Location of Andrew Island, Horseshoe Island, Ibis Island, and Long Island at the Lower Atchafalaya River Bay and Bar BUMP study area.................................. 1-17

Figure 6. Schematic diagram of the original configuration of profile transects established at Andrew Island in 1995 of the Lower Atchafalaya River Bay and Bar BUMP study site.. 1-20

Figure 7. Infrared vertical aerial photography taken on January 4, 2001 of the Andrew Island area at the Lower Atchafalaya Bay and Bar study site showing the approximate location of the transects revisited in 2001............................. 1-21

Figure 8. Oblique aerial photograph taken in A) July 1996 and B) June 2001 of Andrew Island. View is to the southeast along the axis of the island. Location Island, to the left of Andrew Island (B) was created in 1997 (Photos courtesy of the LSU Aerial Videotape Survey Program)................................. 1-22

Figure 9. Elevation profile for transect 1-0 at Andrew Island - Lower Atchafalaya BUMP study site with vegetation data illustrated...1-23

Figure 10. Elevation profile for transect 2-3 at Andrew Island - Lower Atchafalaya BUMP study site with vegetation data illustrated... 1-24

Figure 11. Elevation profile for transect 2-0 at Andrew Island - Lower Atchafalaya BUMP study site with vegetation data illustrated... 1-25

Figure 12. A comparison of 1995, 1996, and 2001 elevation data at Andrew Island in the Atchafalaya River delta. A) Profile at stake 2-0. B) Profile at stake 2-3. C) Profile at stake 1-0.. 1-26

Figure 13. Photograph taken October 16, 2001 at transect 2-0 on Andrew Island showing fresh marsh of elephant ears, knotweed and water hyacinth, and willow trees. 1-27

Figure 14. Photograph taken October 16, 2001 at transect 2-0 on Andrew Island showing the shrub zone of groundsel bush and wax myrtle behind the grassland/meadow of goldenrod and broomsedge. 1-27

Figure 15. Photograph taken October 16, 2001 at transect 2-0 on Andrew Island showing the thick tangle of vines that covers everything within reach....1-28

Figure 16. Elevation profile 2-0 from Andrew Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B) 1996 data. C) 2001 data. 1-29

Figure 17. Photograph taken October 16, 2001 along transect 2-0 on Andrew Island, showing the diameter of some of the willow trees that have grown at this site in six years. 1-30

Figure 18. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is of the northeast waterline along the transect looking to the east....1-31

Figure 19. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is to the northeast along the transect....1-32

Figure 20. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is to the southwest along the transect looking toward the instrument (at the arrow). A shrub thicket has replaced the sparse composite zone 1-33

Figure 21. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is to the northeast along the transect looking toward the instrument. Bare land, "aoelian ripples and incipient dunes" has been replaced by a meadow/ grassland 1-34

Figure 22. Schematic diagram of the original arrangement of profiles for the eastern lobe of Horseshoe Island at the Lower Atchafalaya River Bay and Bar BUMP study site. 1-37

Figure 23. Infrared vertical aerial photography taken on January 4, 2001 of the Horseshoe Island area at the Lower Atchafalaya Bay and Bar study site showing the approximate location of the transects revisited in 2001....1-38

Figure 24. Oblique aerial photograph across the two lobes of Horseshoe Island, taken in A) July 1996 before the west lobe extension and B) June 2001. View is to the north showing some of the channels cut through the island (Photo courtesy of the LSU Aerial Videotape Survey Program). 1-39

Figure 25. Elevation profile1-0 from Horseshoe Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated 1-40

Figure 26. Elevation profile 2- 0 from Horseshoe Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated. 1-41

Figure 27. Elevation profile 3-0 from Horseshoe Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated. 1-42

Figure 28. A comparison of 1995, 1996, and 2001 elevation data at Horseshoe Island in the Atchafalaya River delta. A) Profile at stake 3-0. B) Profile at stake 2-0. C) Profile at stake 1-0 1-43

Figure 29. Elevation profile 3-0 from Horseshoe Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B) 1996 data. C) 2001 data. 1-44

Figure 30. Photographs illustrating plant succession at Horseshoe Island. All photos were taken looking east along the transect from stake 3.1 A) April 27, 1995, B) July 3, 1996, C) October 23, 2001 1-45

Figure 31. Photographs illustrating plant succession at Horseshoe Island. All photos were taken looking northwest along the axis of the island from stake 2.1 A) April 5, 1995, B) April 27, 1995 -- 3 weeks later, C) October 9, 1996 – 1.5 years later, D) October 23, 2001 –6.5 years later. 1-46

Figure 32. Photographs illustrating plant succession at Horseshoe Island, taken looking east along the transect at stake 1-0. A) April 5, 1995 B) October 9, 1996 –1.5 years later C) October 23, 2001 1-47

Figure 33. Schematic diagram of the original arrangement of profile transects established at Ibis Island in 1996 at the Lower Atchafalaya River Bay and Bar BUMP study site. 1-50

Figure 34. Infrared vertical aerial photography taken on January 4, 2001 of the Ibis Island area at the Lower Atchafalaya Bay and Bar study site showing the approximate location of the transects revisited in 2001. 1-51

Figure 35. Oblique aerial photograph taken in June 2001 showing East Pass and the many bifurcating shallow channels. The view is to the east with Ibis Island in the upper right of the frame. (Photo courtesy of the LSU Aerial Videotape Survey Program). 1-52

Figure 36. Photograph taken October 2001 during field work at Ibis Island of the boat and pirogue used to access the area. Very shallow bays with a thick, soft, mud substrate made access difficult 1-52

Figure 37. Oblique aerial photograph taken in A) July 1996 and B) June 2001 of Ibis Island. View is to the west across the distal end of the island. Willow trees are evident in the lower photo. (Photo courtesy of the LSU Aerial Videotape Survey Program). 1-53

Figure 38. Elevation profile 1-1 at the southern end of Ibis Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated. 1-54

Figure 39. Elevation profile 2-1 across the central section of Ibis Island at the Lower Atchafalaya River Bay and Bar BUMP study area, with vegetation data illustrated. 1-55

Figure 40. Elevation profile 3-1 on the section of Ibis Island closest to East Pass at the Lower Atchafalaya River Bay and Bar BUMP study area, with vegetation data illustrated. 1-56

Figure 41. A comparison of 1996 and 2001 elevation data at Ibis Island in the Atchafalaya River delta. A) Profile at stake 1-1. B) Profile at stake 2-1. C) Profile at stake 3-1. 1-57

Figure 42. Elevation profile 2-1 from Ibis Island at the Lower Atchafalaya River Bay and Bar BUMP study area showing habitat distribution changes. A) 1996 data. B) 2001 data. 1-58

Figure 43. Photograph taken July 1, 1996 at Ibis Island looking to the north along the axis of the island from stake 3-1 to 3-3, showing the extensive, unvegetated sand flat that dominated the landscape. 1-59

Figure 44. Photographs along profile 3-1 from Ibis Island in the Atchafalaya River delta showing the vast difference 5 years can make in plant succession. A) July 1, 1996 B) October 18, 2001. The view is to the east. 1-60

Figure 45. Photographs along profile 3-1 from Ibis Island in the Atchafalaya River delta showing the vast difference 5 years can make in plant succession. A) July 1, 1996 B) October 18, 2001. The view is to the west. 1-61

Figure 46. Oblique aerial photograph of Long Island taken June 2001. View is to the south east from God's Pass. (Courtesy of the LSU Aerial Videotape Survey Program). 1-63

Figure 47. Infrared, vertical aerial photography taken on January 4, 2001 of the Long Island area at the Lower Atchafalaya River Bay and Bar BUMP study site showing the approximate location of the transects established in 2001 1-64

Figure 48. Oblique aerial photograph taken in June 2001 of Long Island showing the newly created bare land with multiple cross channels. View is to the north along the axis of the island. (Photo courtesy of the LSU Aerial Videotape Survey Program). 1-65

Figure 49. Elevation profile 1-0 on the southern end of Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated. 1-66

Figure 50. Elevation profile 2-0 on Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated. 1-67

Figure 51. Elevation profile 3-0 on the northern portion of Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated. 1-68

Figure 52. Elevation "strike" profile 0 connecting the stakes along the axis of Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated. 1-69

Figure 53. Photographs taken October 26, 2001 along transect 2-0 at Long Island - Lower Atchafalaya River Bay and Bar BUMP study, showing the sparsely vegetated nature of the newly created landscape. A) North, B) South, C) East, and D) West. 1-70

Figure 54. Photograph taken October 26, 2001 along transect 3-0 at Long Island - Lower Atchafalaya River Bay and Bar BUMP study, showing the character of the new habitats that dominate the landscape. 1-71

Figure 55. Graph of the area of the Atchafalaya delta over time 1-74

Figure 56. Land loss/gain map of the Atchafalaya River delta between December 1985 and January 2001. 1-75

Figure 57. Habitat inventory map of the Atchafalaya delta in December 1985. 1-77

Figure 58. Habitat inventory map of the Atchafalaya delta in November 1996 1-79

Figure 59. Habitat inventory map of the Atchafalaya delta in January 2001 1-81

Figure 60. Map of the Atchafalaya delta showing the new habitats that developed between December 1985 and January 2001. 1-83

Figure 61. Time series showing the changes in total area of each habitat in the Atchafalaya River delta between 1972 and January 2001. A) natural habitat changes. B) man-made habitat changes....................1-85

LIST OF TABLES

Table 1. December 1985 Habitat Inventory of the Atchafalaya Delta 1-76

Table 2. November 1996 Habitat Inventory of the Atchafalaya Delta 1-78

Table 3. January 2001 Habitat Inventory of the Atchafalaya Delta 1-80

Table 4. Changes in Total Acres of Each Habitat in the Atchafalaya Delta between December 1985 and January 2001 1-84

INTRODUCTION

Beneficial Use of Dredged Material Monitoring Program (BUMP)

The U.S. Army Corps of Engineers New Orleans District (USACE-NOD) maintains thirteen major navigation channels in Louisiana that require regular maintenance dredging (Figure 1). More than 90 million cubic yards of sediment is dredged annually and the USACE-NOD coordinates with state and federal natural resource agencies to determine the most appropriate methods for the disposal of dredged material and, where possible, to beneficially use this material to create or enhance wetlands and other habitats. The USACE-NOD has developed long-term disposal plans incorporating beneficial use for each of these navigation channels. In 1994, the USACE-NOD, working in cooperation with Louisiana State University - Center for Coastal, Energy and Environmental Resources (LSU), implemented a large-scale monitoring program to quantify the amount of new habitat created and to improve dredged material placement techniques to maximize beneficial use. A contract was awarded to the University of New Orleans in 2000 to continue the monitoring program which is known as the USACE-NOD Beneficial Use of dredged material Monitoring Program (BUMP).

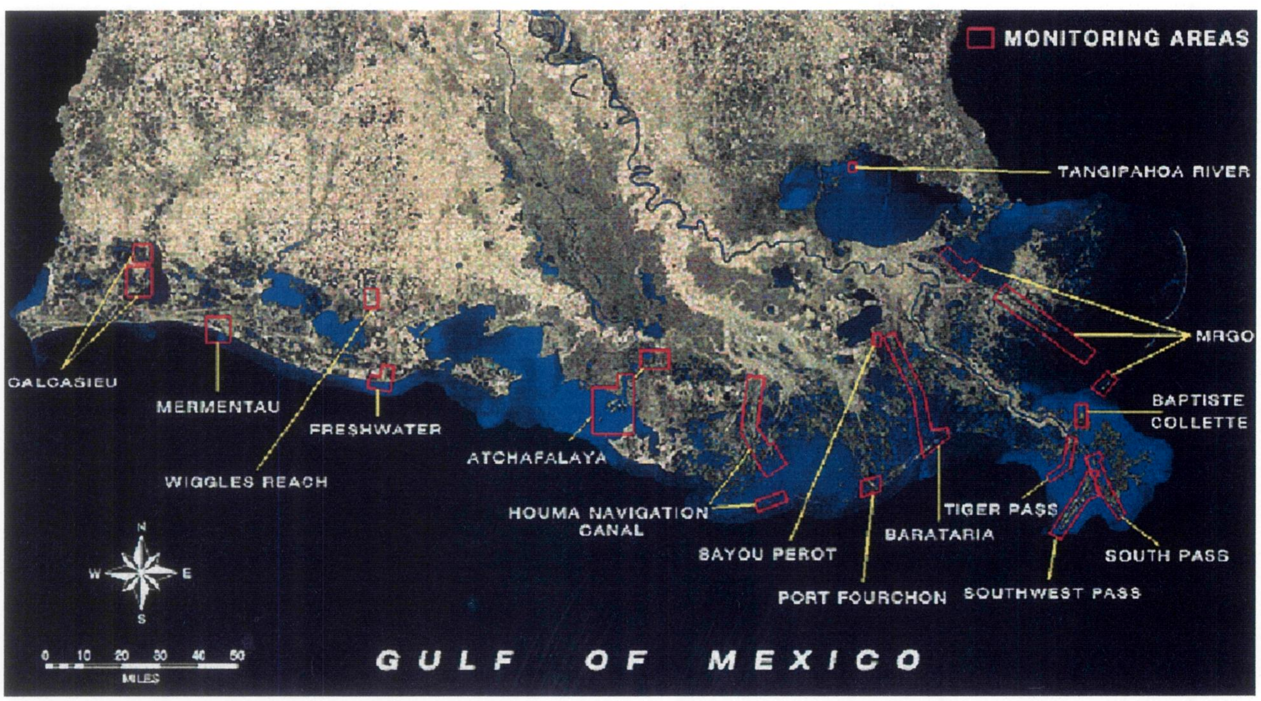


Figure 1. Locations of the beneficial use of dredged material monitoring areas.

Each year, vertical photography is acquired and digital mosaics are produced for each of the study sites listed on Figure 1. GIS habitat analysis and field surveys are conducted on only those sites specified by the USACE-NOD each year. The work products for the sites selected for full monitoring include dredging history maps, habitat maps for the base year, habitat maps for the selected monitoring years, and habitat change maps. From this analysis, coastal change data quantifies the creation of new coastal lands and other habitats at selected navigation channel locations. The field program includes ground truthing operations to verify and update the habitat maps and field surveys to collect information about vegetation, and elevations.

Atchafalaya River and Bay Area

The Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel (Atchafalaya Bay and Bar) is located 20 miles south of Morgan City, in the south central part of Louisiana (Figure 2). The Atchafalaya River basin covers central Louisiana with vast cypress swamps, willow swamps, and freshwater marshes, which drain into the shallow Atchafalaya Bay through the lower Atchafalaya River or Wax Lake Outlet. The Atchafalaya Bay is defined by the mainland to the north, Point Chevreuil and Marsh Island to the west, Four League Bay and Point au Fer Island to the east and the shallow, subaerial ridge or "bar" formed by shell reefs to the south. This area has been dominated by the growth of the Wax Lake and Atchafalaya River deltas over the last 50 years. Although open to the Gulf of Mexico, the river's flow is sufficient to keep the vegetative regime within the Atchafalaya Bay fresh.

The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains the navigation channel 20-ft deep and 400-ft wide through the prograding Atchafalaya delta complex.

BUMP at Atchafalaya Bay and Bar

The USACE-NOD's Beneficial Use of dredged material Monitoring Program (BUMP) is documenting the disposal and beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys. BUMP results are provided in map series, annual reports, and scientific literature.

Historically, most of this material was place in unconfined, disposal areas along the channel, along subaerial levees west of the channel, or in open water south of the "bar." Big Island was formed between 1979 and 1985, as the Corps continued to pile dredge material in the same disposal area. "Beneficial use" of dredged material at this time created a campground at the Louisiana Department of Wildlife and Fisheries Camp; islands for colonial nesting sea birds; and some wetlands on the western side of Big Island (See following section on disposal history for details).

In 1987, at the request of the Louisiana Department of Wildlife and Fisheries (LDWF) and the U.S. Fish and Wildlife Service (FWS), the New Orleans District began placement of dredged material on the east side of the navigational channel in an effort to stimulate growth of the east side of the delta, initiating a new program focused on the use of dredge material for environmental "beneficial use".

This report presents the results of continued monitoring along the Lower Atchafalaya River Bay and Bar navigation channel, representing monitoring results through the USACE-NOD Fiscal Year (FY) 2000 maintenance event.

The natural and man-made habitats in the study area were classified using aerial photography acquired December 1985, November 1994, November 1995, November 1996, and January 4, 2001. Through GIS analysis, these areas were measured and changes calculated. Field surveys were conducted in April 1995, July and October 1996, and October 2001 on the selected beneficial use areas created through FY 2001. Habitats were ground truthed; and survey transects were revisited or established to document vegetation species and stacking elevations as a base for measuring compaction. Figure 3 shows the area of minimum aerial photo-mosaic coverage and the limit of the digitized area.

Atchafalaya Delta Viscinity Map

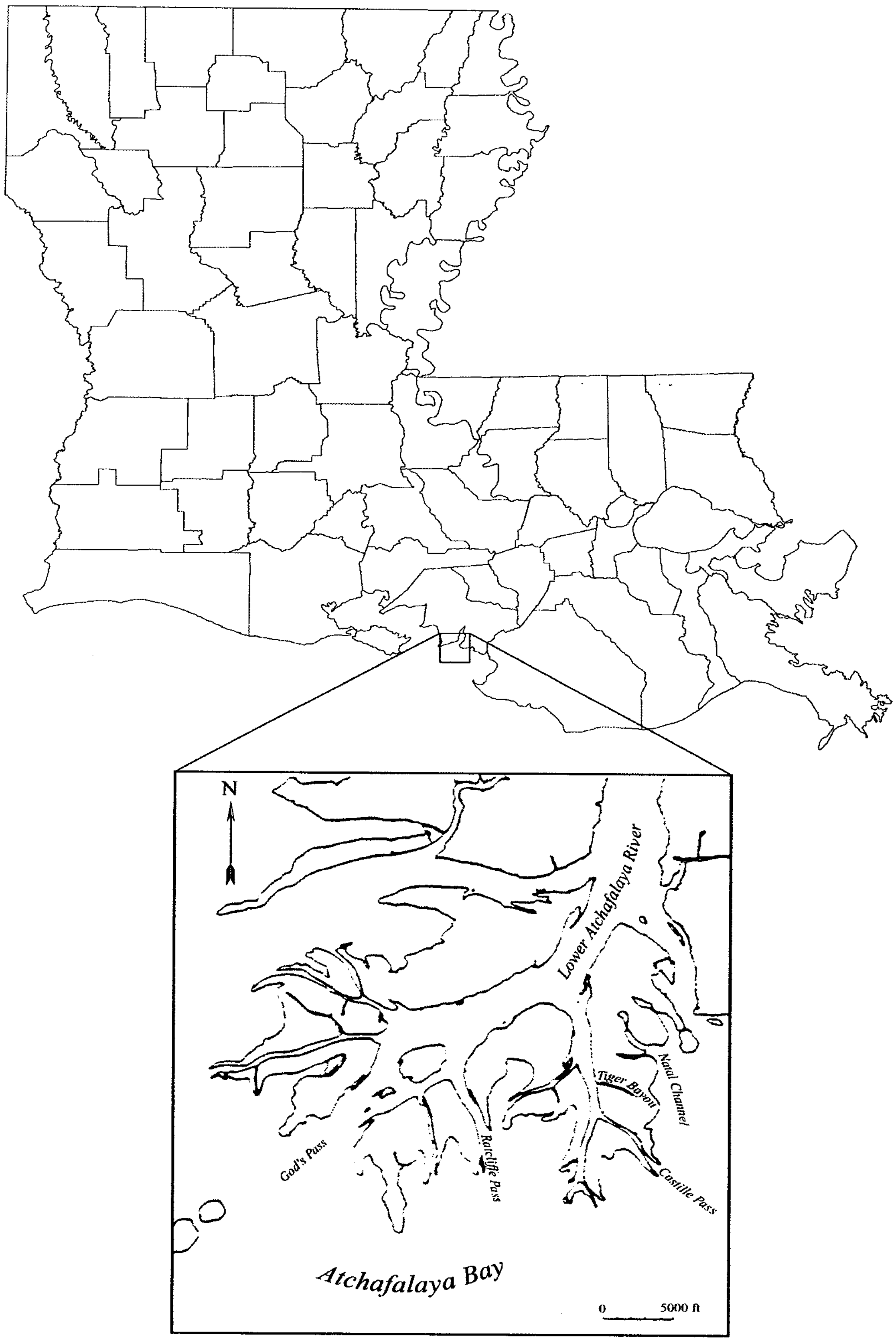


Figure 2. The location of the Lower Atchafalaya River Bay and Bar BUMP study area in Louisiana.

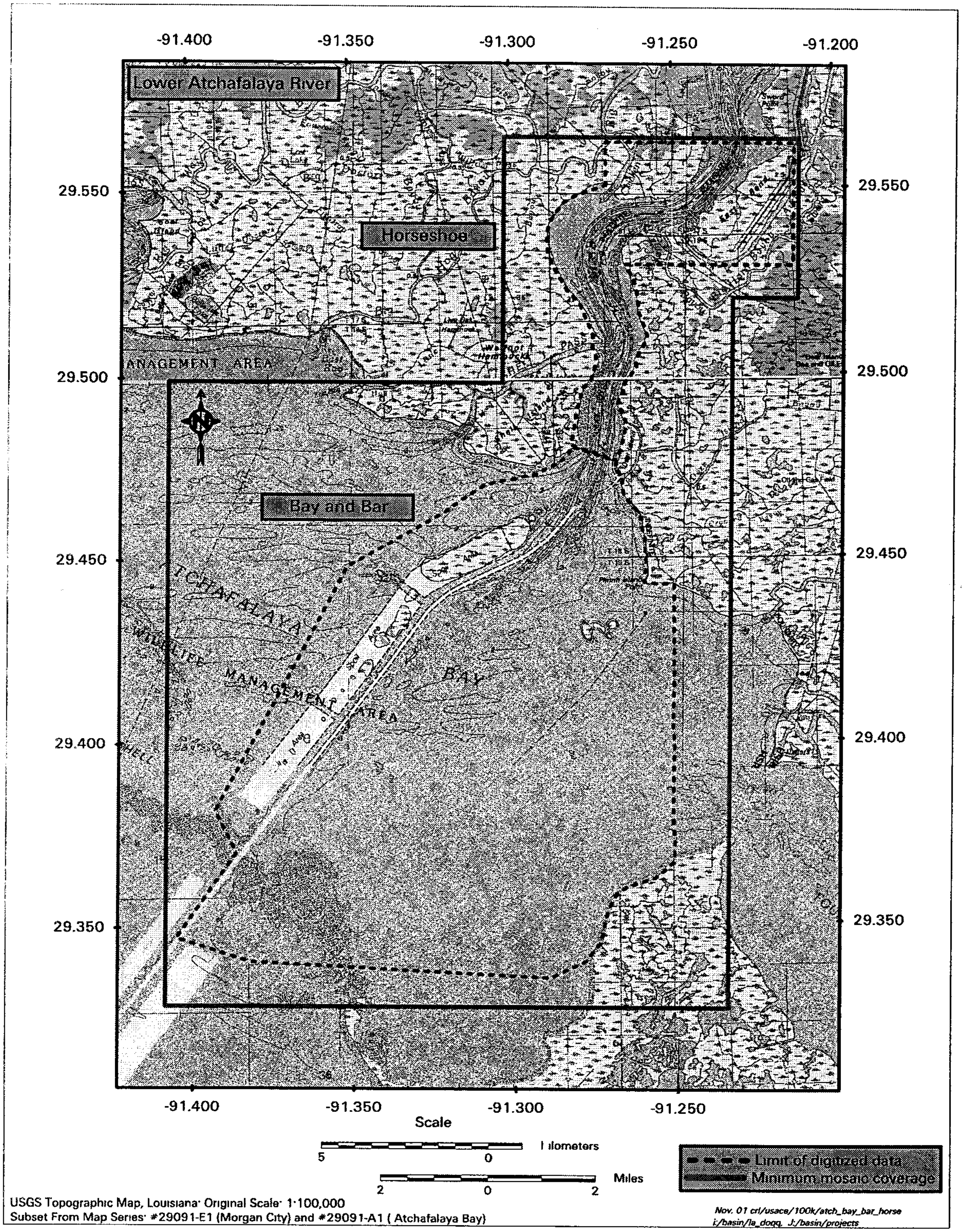


Figure 3. The Lower Atchafalaya River Bay and Bar BUMP study area showing the minimum coverage of the aerial photo-mosaic and limits of the area digitized.

BENEFICIAL USE OF DREDGED MATERIAL DISPOSAL HISTORY
ATCHAFALAYA RIVER AND BAYOUS CHENE, BOEUF AND BLACK, LA
ATCHAFALAYA BAY AND BAR
Through FY 2000

The Rivers and Harbors Act of 25 June 1910 authorized the USACE-NOD to construct and maintain the Atchafalaya River, Morgan City to the Gulf of Mexico, Louisiana, project which provided a navigational channel 20feet deep, 200feet wide and 15.75 miles long from the 20 foot contour in the Atchafalaya Bay, approximately 4 miles beyond the mouth of the Atchafalaya River, to the 20 foot contour in the Gulf of Mexico. Traffic sufficient to warrant maintenance of the authorized navigational channel to full project dimensions did not immediately develop. The channel was progressively enlarged during maintenance events from 10 by 100-feet in 1939 to 20 by 200-feet in 1974.

The Rivers and Harbors Act of 1968 authorized construction and maintenance of the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana, project. It incorporated the existing project and provided an increase in channel width of the navigational channel in Atchafalaya Bay and Bar to 400feet. Construction of the channel in the bay and Gulf was initiated in April, 1974 and was complete in December of the same year.

Dredged material disposal history prior to construction of the enlarged channel in 1974 is sketchy. Dredging records dating back to 1957 indicate that maintenance of *discontinuous* reaches of the bay and/or bar channels occurred on an annual basis from 1957 until 1974 except for 1958. It is likely that dredged material was placed unconfined in open water on either side of the navigational channel.

Dredged material removed during new work dredging associated with construction of the 400 foot navigational channel in 1974 was placed in open water and on subaerial levees of existing delta lobes on the west side of the navigational channel. During maintenance events beginning in 1979 and continuing on an annual basis through 1985, this practice continued. During this period, Big Island was created; dredged material was used to construct a campground at the Louisiana Department of Wildlife and Fisheries Camp; dredged material was used to construct islands for colonial nesting seabirds; and some wetlands were created on the western side of Big Island (Figure 3).

In 1987, at the request of the Louisiana Department of Wildlife and Fisheries (LDWF) and the U.S. Fish and Wildlife Service (FWS), the New Orleans District began placement of dredged material on the east side of the navigational channel in an effort to stimulate growth of the east side of the delta. Disposal plans developed in coordination with the LDWF, FWS, and other state and Federal natural resources agencies, were designed to direct sediment-laden water through existing natural channels, i.e., God's Pass, East Pass, Ratcliffe Pass, to the east side of the delta. In general, dredged material was to be placed as a series of mounds on the eroding subaerial levees of existing delta lobes and on the heads of islands at existing channel bifurcations. The maximum initial height of the dredged material mounds was +5.0feet Mean Low Gulf (+4.2 Mean Sea Level). The mounds of dredged material would refurbish the subaerial levees which would direct flows into the desired locations within the developing delta. During high flow events, the re-furbished levees would be over-topped and sediment-laden waters would drop sediment behind them at elevations suitable for the establishment of fresh marsh (+2.3feet Mean Low Gulf) and/or submerged aquatic vegetation. The refurbished levees also would protect the developing wetlands from wave-induced erosion.

In accordance with the plan during maintenance events in 1987, 1988, 1989, and 1990, in the upper bay/delta, dredged material was placed on the eroded subaerial levees of Roger Brown Island, Poule Deaux Island, and Roseate Island and on the heads of God's Island and Long Island. In the lower bay/delta, dredged material was used to maintain and construct islands for colonial nesting seabirds on the west side of the navigational channel. The initial height of the dredged material for bird island creation was +6.0feet Mean Low Gulf (+5.2 Mean Sea Level).

By 1991 it became obvious that the refurbished levees were not being over-topped during high flow events. At the request of the LDWF, the maximum initial height of the dredged material was changed to +3.78feet Mean Low Gulf (+3.0feet Mean Sea Level). Dredged material from the 1991 maintenance event was placed along the banks of the navigational channel on the east side of Big Island, on both sides of God's Island and Heron Island and on the banks of East Pass and Ratcliffe Pass. Dredged material also was placed behind previously refurbished levees on Paule Deaux and Roger Brown Islands, Long Island, and Roseate Island at an initial elevation of +2.78feet Mean Low Gulf (+2.0feet Mean Sea Level). Islands for colonial nesting seabirds were constructed and/or maintained with dredged material from the lower bay/delta.

Beginning with the 1992 maintenance event and in coordination with LDWF, FWS and other natural resources agencies, the dredged material disposal plan was modified to incorporate use of dredged material from the upper bay/delta to construct artificial delta lobes. The disposal plan developed was designed to direct flows between the lobes and to provide protected, shallow, open water areas within the lobes for the development of fresh marsh and submerged aquatic vegetation. During the 1992 maintenance event, the maximum initial height of the dredged material in that portion of the artificial delta lobes paralleling the channel was +4.0feet Mean Sea Level/National Geodetic Vertical Datum (+4.78feet Mean Low Gulf); the maximum initial height of the dredged material in that portion of the delta lobes perpendicular to the channel was +3.0feet Mean Sea Level/National Geodetic Vertical Datum (+3.78feet Mean Low Gulf). Both Mile Island and Community Island were constructed during the 1992 maintenance event. Islands for colonial nesting seabirds were constructed with dredged material from the lower bay/delta.

During the 1993 maintenance event, the maximum initial height of the dredged material for creation of the artificial delta lobes was +4.0feet Mean Sea Level/National Geodetic Vertical Datum (+4.78feet Mean Low Gulf) for all portions of the lobes. Construction of Andrew Island and Horseshoe Island commenced during the 1993 maintenance event and continued during the 1994 maintenance event. Dredged material also was placed at North Point and on God's Island during the 1993 maintenance event. Islands for colonial nesting seabirds were constructed with dredged material from the lower bay/delta during both 1993 and 1994, and were enlarged in 1995 and 1996. In 1995, a new delta lobe was created on the east side of the delta off of East Pass. Named Ibis Island, the bare, sandy formation was quickly claimed by nesting birds.

No maintenance dredging was necessary in the Atchafalaya Bay channel during 1996.

Dredged material was added to the artificial delta lobes at "A4" Island, Long Island, and Horseshoe Island during the 1997 maintenance event (September 4, 1997 - October 8, 1997). Skimmer Island also was used for dredged material placement during this maintenance event.

In 1998 (September 22, 1998 - December 29, 1998), dredged material from maintenance of the bay channel was placed on Poule Deaux Island, Long Island, and Skimmer Island.

During 1999 (November 26, 1999 - December 22, 1999), a new delta lobe, Natal Island, was created off of East Pass. Dredged material was added to Long Island during the 2000 maintenance event (December 12, 2000 - January 25, 2001).

Figure 4A illustrates the previous dredged material disposal history for the study area through FY 1995. Figure 4B details the recent dredged material disposal history for the study area through FY 2000 (January 2001).

In the bar channel between 1974 and 1991, all of the dredged material removed during routine maintenance was placed in an interim designated ocean dredged material disposal site (ODMDS) located on the east side of the navigational channel. Beginning with the 1991 maintenance event, dredged material suitable for stacking from the upper reach of the bar channel has been placed into an open water disposal area on the east side of the channel in a manner conducive to bird island construction and the material not suitable for stacking has been placed into the ODMDS.

Atchafalaya Bay and Bar
Dredged Material Disposal History

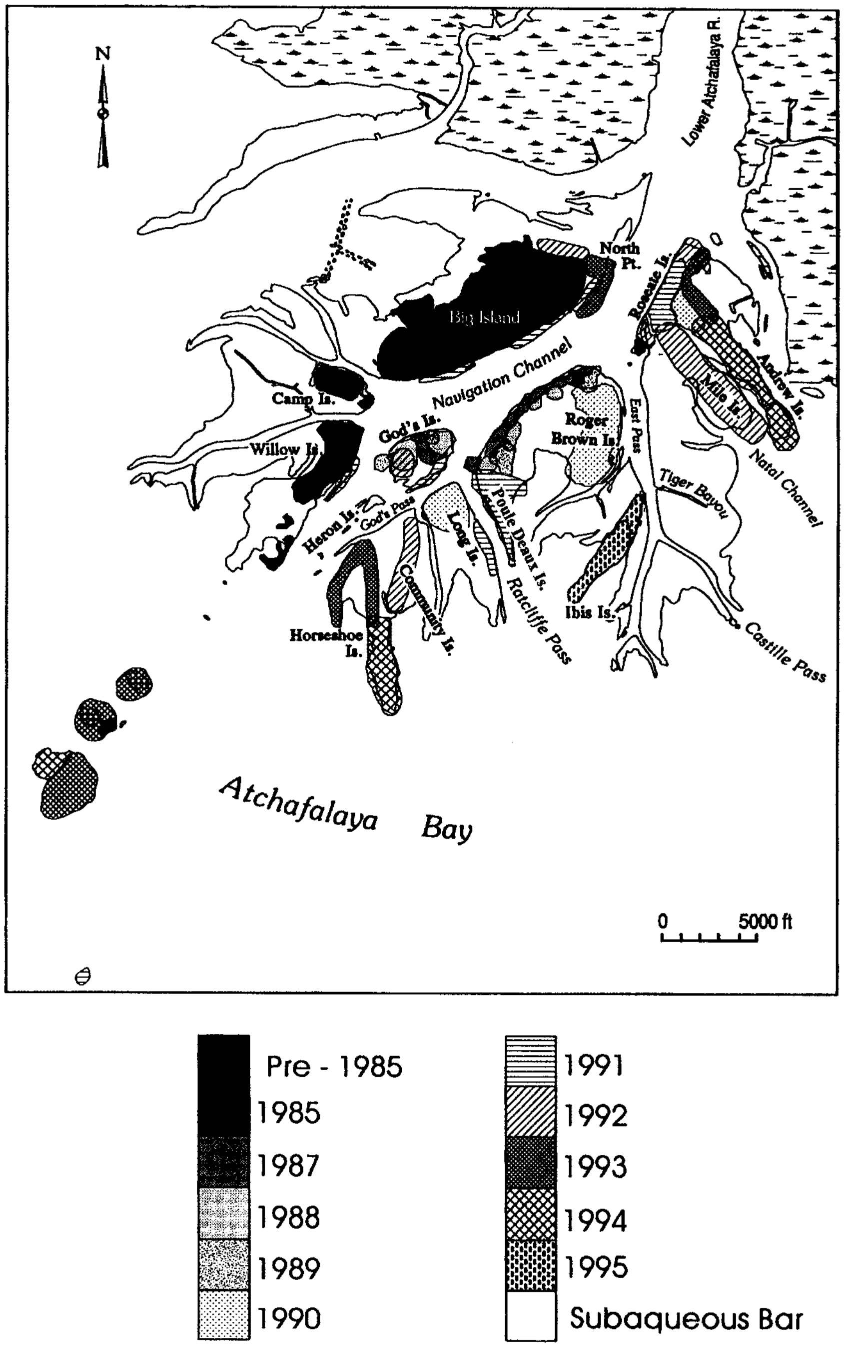


Figure 4A. Previous dredged material disposal history for the Lower Atchafalaya River Bay and Bar channel reaches through 1995. 1985 to 1990 data from Van Heerden, 1994; 1991 to 1995 data from USACE-NOD *as-builts*.

Atchafalaya Bay and Bar
Dredged Material Disposal History

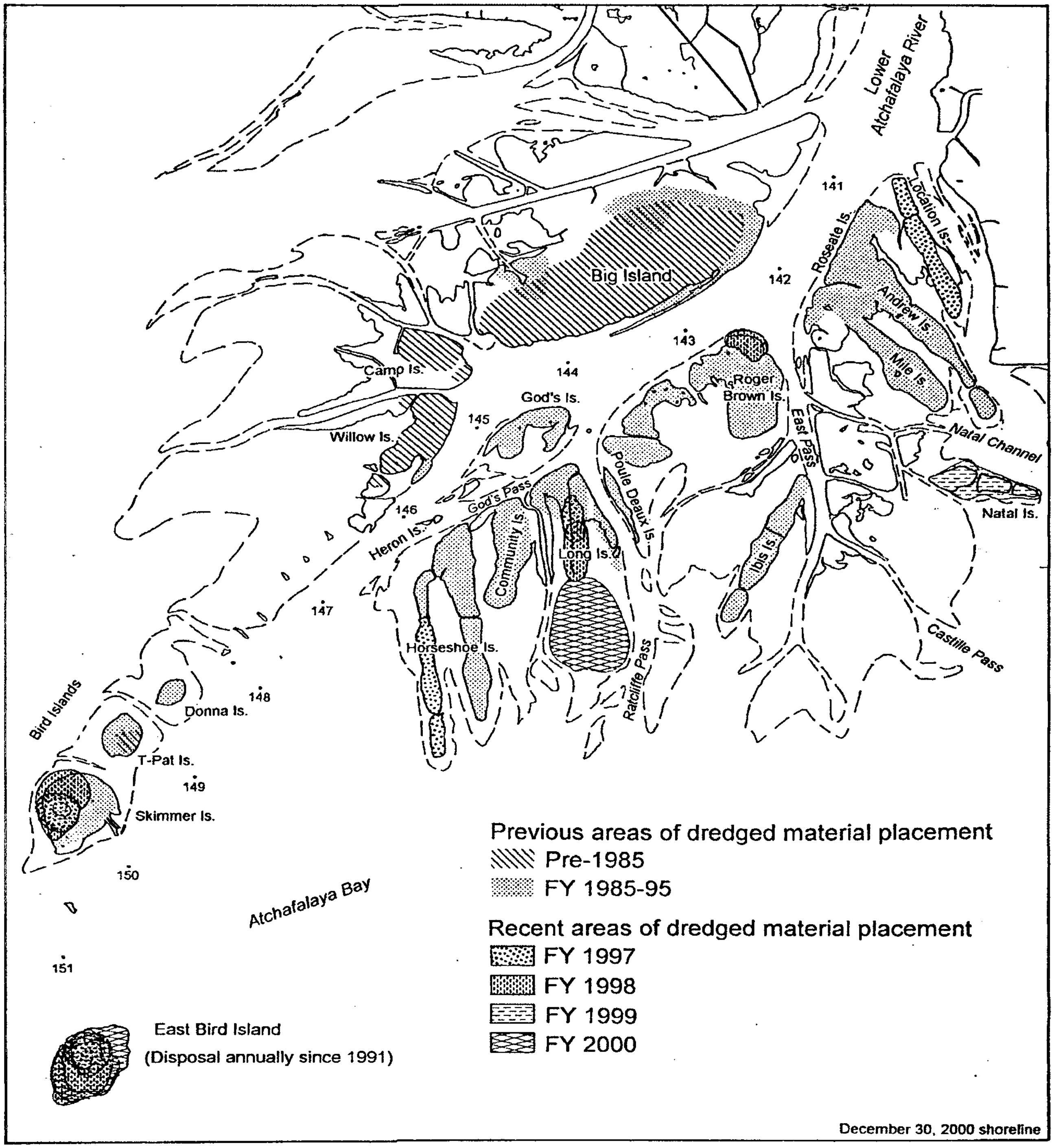


Figure 4B. Dredged material disposal history for the Lower Atchafalaya River Bay and Bar channel reaches with recent placement detailed FY 1996 through FY 2000. 1985 to 1990 data from Van Heerden, 1994; 1991 to 2000 data from USACE-NOD *as-builts* and aerial photography.

BASIC METHODOLOGY

Aerial Photographic Analysis and Habitat Determination

The aerial photographic analysis was the basis for all statistics and analyses. For each monitoring site, a base year was selected against which the assessment of changes were made. The base year for the Lower Atchafalaya River Bay and Bar was 1985 and the historical 1985 aerial photography was acquired from the U.S. Geological Survey Earth Resources Observation Systems (EROS) Data Center. Color infrared photography was acquired at a scale of 1:24,000 by UNO's air photo contractor on November 1994, November 1995, November 1996, and on January 4, 2001. There was a 60 percent forward overlap of the photography which allowed the use of stereo plotting techniques for better accuracy. Color infrared photography was used for mapping and photo-interpretation because it provided a better definition of vegetation types, habitats, and the land/water interface. A copy of the color infrared photography was archived at UNO/LSU and combined into photo-mosaics. A second set of color infrared photography with mosaic was provided to the USACE-NOD.

The study areas were interpreted and mapped from the base year photography and the color infrared aerial photography using a Bausch and Lomb zoom transfer scope. USGS quadrangle maps were used for the initial ground control to set the interpretations in the state plane coordinate system. The absolute accuracy is ±50' and the relative accuracy is ±10'. The shoreline was interpreted according to the location of the wet/dry beach contact visible on aerial photographs, the outer edge of well-established marsh, or the outer edge of organic beaches. An accurate shoreline was important to area calculations and assessments of trends in erosion, accretion, or effects of dredged material disposal.

The interpretations of habitat type were verified by taking the photography or interpreted map into the field to check specific areas against the actual landscape for positive habitat identification and vegetative community composition. Corrections were made where necessary to the map, and the revised map was then submitted for GIS digitization and final analysis.

Habitat types were important to understanding the result of disposal practices. The Appendix of this report lists the species documented during the field visits, including scientific names, common names, type of vegetation and habitat it prefers. This information verifies the habitat interpretations, helps to further characterize the habitat type, and can give further insight to the type of habitats created by the placement of dredged material. The habitats were broken into simple classes and sub-classes based on the types of vegetation present: water, wetlands (marsh and forested wetlands), and land (beach, bare, dune, upland, shrub/scrub, and forest). These very general characterizations necessarily incorporate many other habitats and transition areas.

The habitat categories used are in quotes below and were delineated using the definitions and criteria defined below.

Water (not included in statistics)

"Open water" is water not completely encircled by land, including some intertidal areas.

"Intertidal" is an indistinct, shallow area that indicates natural sediment deposits or dredge material deposits below normal high tide that does not support emergent vegetation. Some of these areas do support submerged aquatic vegetation or can become colonized by marsh vegetation.

Wetlands

"Marsh" for our purpose, is any unforested, vegetated area normally subject to inundation or tidal action at any time, sufficient to support wetland-dependant, emergent vegetation. *High marsh*, an area above normal high tides but inundated frequently by spring and storm tides or seasonally heavy rainfall, can occur in conjunction with any type of marsh, but is associated most commonly along the coast with saline marshes and is dominated there by *Spartina patens* and *Distichlis spicata*. High marsh associated with fresh or brackish marsh is often represented by grasslands and considered "upland".

"Forested Wetlands" is any forested area normally subject to inundation through part of the growing season, or with permanent or near-permanent standing water. This includes swamps, batture communities, bottomland forest, and riparian forest.

Land

"Beach" is an unvegetated area adjacent to open water that is subject to direct wave action at some time during the daily tidal cycle or during average storm surges. This can be sand, shell, organic, or a mixture of sediment types. This area is unlikely to permanently support vegetation because of frequent reworking by wave action. Most colonization occurs on the upper beach area less frequently affected by waves.

"Dune" is an area above the high water line formed by aeolian deposition of sand into ridges or hummocks.

"Bare land" encompasses the areas that are unvegetated and not normally subject to direct wave action. It may be adjacent to open water but in a more sheltered orientation not subject to active wave reworking. Usually it indicates areas of freshly deposited dredged material or recent natural sediment deposition. It may include areas of sparse plant colonizations that may become either upland or marsh.

"Upland" is a natural area or dredged material deposition area that is elevated and not subject to tidal action or inundation under normal circumstances so that upland species (non-marsh species) thrive. For this study, it includes barrier island habitats as well as inland habitats, does not include significant shrub or tree coverage, and usually denotes a grassland, meadow, natural levee or elevated area within a marsh, or some types of agricultural or artificially altered land. Natural succession may lead to shrub/scrub in some areas.

"***Shrub/scrub***" is an area dominated by shrubs or small trees under 20feet tall. This may be within an upland area or within a marsh area. Within a marsh, shrubs usually occupy elevated areas, marking natural levees or areas artificially elevated. Natural succession may eventually lead to forest or forested swamp in some areas.

"***Forest***" is any area dominated by trees, that is not normally subject to inundation during the growing season or is only periodically influenced by flooding. For this study it includes bottomland hardwood areas as well as oak or pine woods.

Field Program

The field program supported the air photo-interpretation and GIS analysis tasks. The field program was comprised of two work efforts. Ground-truthing, verified the interpretation of habitat type based on the density and types of vegetation present, and verified surface morphology from the aerial photographic analysis. Field monitoring, recorded changes in elevation, vegetative species and cover, geomorphic character, and surface texture at selected beneficial use sites in order to assess the best disposal practices. Both groundtruthing and monitoring were for this report conducted during October 2001.

The objective of the field monitoring is to clarify the habitat types by identifying dominant vegetative communities, and to document the results of disposal elevation and placement configuration to assist in the evaluation of the habitat benefits. Monitoring changes in elevation, habitat type and surface morphology at a disposal site identifies the important processes of the specific area. Understanding the relationships between change and process and between habitat and elevation will facilitate better predictions of the potential habitat benefits associated with different placement elevations and configurations.

The field monitoring yielded an updated vegetation list, elevation profiles, and vegetation profiles. The elevation profiles were compared to previous data to illustrate and measure compaction, erosion, and sediment transport. Vegetation profiles were compared to previous data to illustrate habitat succession as the new landscape matures and continues to evolve in response to changing conditions.

Geographic Information System (GIS) Analysis

Once the photography was acquired and interpreted for each site, the digital files were imported into the GIS, ground truthed, and referenced to its true geographic position. The line work was checked for gaps, overshoots and other digitizer errors and edited accordingly. A project schema was created to organize data attributes: area, habitat type, and perimeter. After corrected digital data sets were generated for each USACE-NOD beneficial placement site, two primary forms of GIS analysis were used to quantify and characterize wetland conditions at selected sites. The first form of analysis was the extraction of area measures for each habitat type. Values were generated per type for each year and location. The second form of GIS analysis was the creation of change detection maps and tables for interim periods. These illustrated primary trends in geomorphic change by comparing shoreline configurations and total areas of habitat for the different time periods.

World Wide Web Site

To facilitate the transfer of information to the natural resource trustees and other interested parties, UNO has a World Wide Web site for the dissemination of the beneficial use of dredged material monitoring data. A home page allows the user to click (hyperlink) through data on the beneficial use of dredged material, including scanned aerial photographic mosaics, habitat maps, habitat change maps, habitat data spread sheets, and the results of field investigations. The web site is updated periodically after data has been checked and approved by the USACE-NOD. The site can be found at:

http://BUMP.uno.edu

FIELD SURVEY RESULTS

Andrew Island, Horseshoe Island, Ibis Island and Long Island were selected for the long-term field monitoring sites in the Atchafalaya River bay and bar (Figure 5). Both Andrew Island and the eastern lobe of Horseshoe Island were constructed during the 1993-94 maintenance event. Ibis Island was constructed during the 1995 maintenance event. Long Island was created during the 1997, 1998, and 2000 maintenance events.

Methodology

The collection of elevation and vegetation profile surveys was conducted in two phases. Phase-I involved assessing the characteristics of various beneficial use disposal areas to determine the most appropriate sites to document the beneficial use of dredged material through habitat development. This was accomplished by discussion with the USACE-NOD, reviewing vertical aerial photography, reviewing dredging schedules and history, and defining varying vegetation and site morphology. Based on these factors over three different monitoring periods, four sites were selected on the east side of the navigation channel: Andrew Island, Horseshoe Island, Ibis Island and Long Island. Access to the sites was by airboat, boat or pirogue.

In April 1995, three series of stakes (two groups of four stakes, and a single southern most stake) were positioned along the longitudinal axis (crest) of Andrew Island and eastern Horseshoe Island. In October 1996, three series of stakes (two groups of three stakes, and two stakes on the southern end) were positioned 1000feet apart along the longitudinal axis of Ibis Island. In 2001, 3 sets of stakes were positioned along the longitudinal axis of Long Island. Permanent 1-inch diameter by 6-foot galvanized stakes were driven approximately 3.5-feet into the ground and secured with concrete. Temporary white, ten-foot PVC poles with flagging and neon orange paint were slipped over the galvanized stakes to make profile siting and re-location easier. All stakes were defined spatially using a Global Positioning System (GPS).

Phase-II involved the actual collection of profile data. Survey data were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25feet ± 0.0125feet., with a vertical accuracy of 0.45feet ± 0.0125feet. The maximum horizontal range with tri-prism is 3,525feet. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line, which was perpendicular to the longitudinal axis established by the stakes. The transect data collected were processed, referenced to local benchmarks or to the tide gage at Eugene Island and entered into a graphic software program to produce topographic profiles.

Due to 6 years of vegetative growth, the 2002 field effort required an extensive amount of time clearing the transect of trees and vegetation that obscured the survey instrument line-of-sight.

The earlier profiles were referenced to temporary benchmarks established for the USACE. These benchmarks, and thus the original transects, were reoccupied and surveyed in 2001. Due to 6 years of vegetative growth, the 2001 field effort required an extensive amount of pre-survey time clearing the transect of trees and vegetation that obscured the survey instrument line-of-sight. The only profile that was lost was the southernmost profile at Horseshoe Island, transect 1-0, which was lost due to northward shoreline movement. This transect was reestablished at a new location in 2001.

Field monitoring for vegetative species composition and habitat verification was initially done for Andrew Island and eastern Horseshoe Island in April of 1995 and October 1996. Field monitoring for vegetative species composition and habitat verification of Ibis Island was initially done in July 1996. These sites were revisited in October 2001, and the initial field monitoring for Long Island was added to the database. Species composition was determined within an approximate six-foot swath along each profile, and major divisions between vegetative communities were entered as points on the elevation profile. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens, and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the contractor. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics.

The species list included in the Appendix of this report is not complete; it reflects only those species that were readily observed during the profiling period. Some plants can only be identified during a short flowering period which may not have coincided with the ground truthing or the profile data collection, and therefore can not be included in the list other than by a broad classification. Many opportunistic annuals may be present in large numbers one year and absent the next. Therefore, revisited transects can exhibit vast differences in species composition along the vegetation profiles, not necessarily due to plant succession.

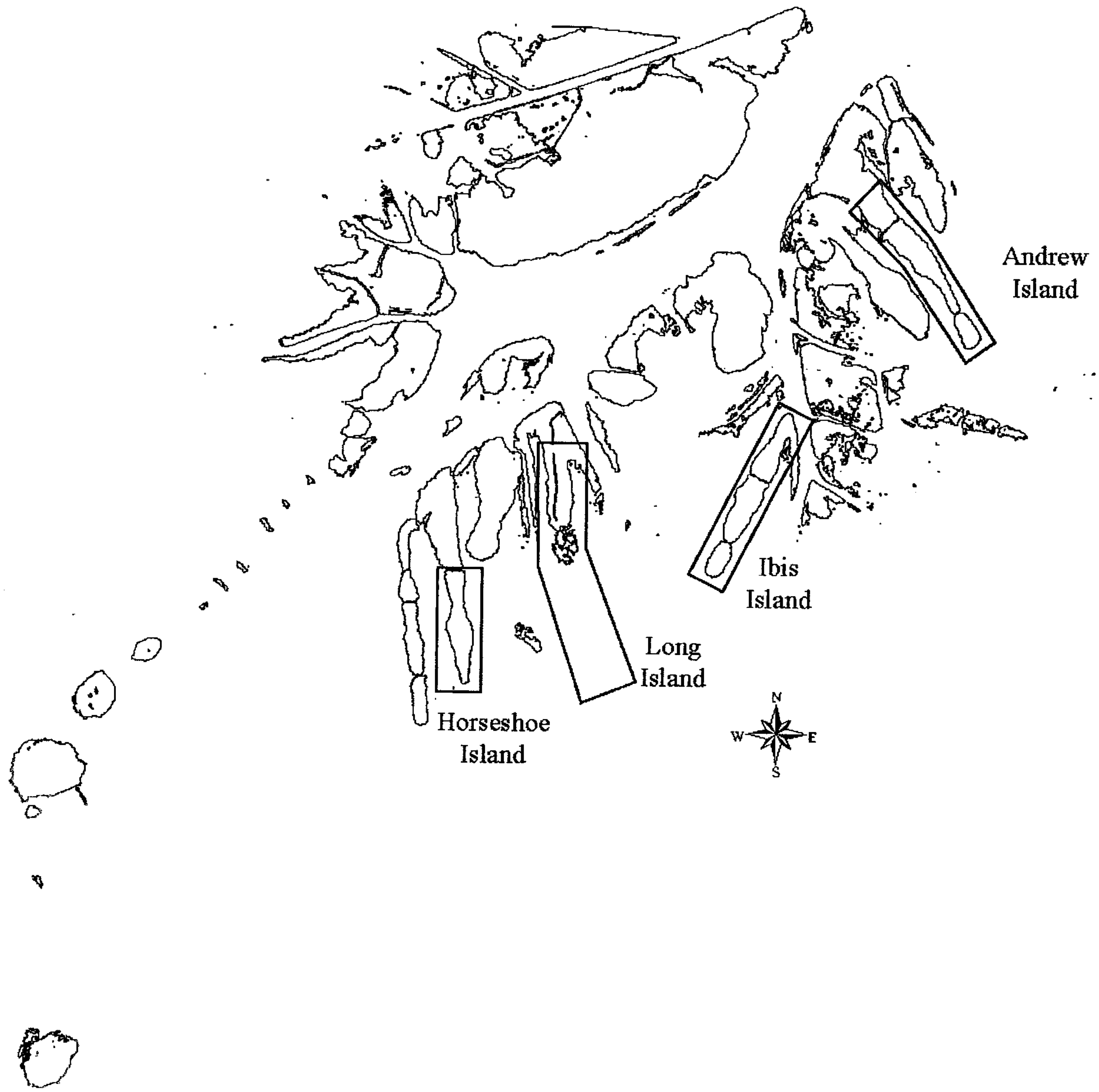


Figure 5. Location of Andrew Island, Horseshoe Island, Ibis Island, and Long Island at the Lower Atchafalaya River Bay and Bar BUMP study area.

Profiles

The field monitoring area included four long spits created by dredged material placement; Andrew Island at the north end of the Atchafalaya delta, Ibis Island and Long Island at the central area, and the eastern lobe of Horseshoe Island at the south end. Each island is long, narrow, and of very low relief, bisected by 1-4 ditches or channels perpendicular to the axis of the island. A matrix of cross-island, elevation profiles was established at each spit by a series of metal poles partially buried and anchored with concrete.

The older profile matrix at each island, excluding Long Island, consisted of three sections each, labeled 3-0 to 3-3 for the channel section, 2-0 to 2-3 for the middle section, and 1-0 to 1-1 for the distal end. One elevation and vegetation profile was acquired for each transect when the matrix was established. Three profiles from each established matrix were selected to revisit for comparison data. Comparison between time periods illustrates the general trends in sediment compaction, sediment transport, vegetative colonization and succession.

Monitoring at Long Island was initiated in October 2001, with only 3 cross-island transects and one transect along the axis of the island. Therefore, there is no comparison data for Long Island.

Andrew Island

Andrew Island is located along the northeastern side of the Atchafalaya River delta near Mile 141.5 (Figure 5). The channel end of the island, named "Roseate Island," was established by placement of dredged material on a natural subaerial levee to +5feet MLG (4.2feet NGVD) during 1990 in an effort to direct sediment laden water through existing natural channels. During 91, material was placed behind this levee at an elevation below +3feet MLG (2.2feet NGVD) to allow for overtopping by high water events. During the 1993 and continuing during the 1994 maintenance event, an "artificial delta lobe" named "Andrew Island" was constructed with elevations no higher than +4feet NGVD (4.8feet MLG) to protect the shallow, open water areas for fresh marsh and submerge aquatics development (Figures 4A & 4B). Two channels flanked by levees were cut through the island to provide freshwater flow and aquatic access to the protected area, and effectively divided the island into 3 sections. The disposal material was made up of fine silty sand.

Figure 6 is a schematic diagram of the original arrangement of profile transects established at Andrew Island in 1995. The initial data was acquired on April 26, 1995 and access was by boat. Five of the ten cross-island or "dip" topographic profiles for Andrew Island were repeated on October 31, 1996 accessed by airboat, and three of the five were revisited in October 2001 by boat and piroque. The approximate location of the most recent transects surveyed are shown in Figure 7. Due to 6 years of vegetative growth, the 2001 field effort required an extensive amount of pre-survey time clearing the transect of trees and vegetation that obscured the survey instrument line-of-sight. Oblique aerial photography illustrates changes in vegetation as plant succession between 1996 and 2001 took advantage of the new land created in 1994 (Figure 8).

The profiles at Andrew Island in 2001 ranged in lateral length from 759.4feet to 1018.5feet. The habitats and dominant vegetative species are indicated on the profiles, referenced to the elevation. Transect 1-0 located at the southern tip of Andrew Island had a maximum elevation of 2.3feet NGVD (3.0feet MLG), with an average elevation of 1.1feet NGVD (1.8feet MLG)

(Figure 9). Transect 2-3 along the central crest had a maximum elevation of 4.3feet NGVD (5.1feet MLG), with an average elevation of 2.7feet NGVD (3.4feet MLG) (Figure 10). Transect 2-0 had a maximum elevation of 3.7feet NGVD (4.5feet MLG), with an average elevation of 3.0feet NGVD (4.0feet MLG) (Figure 11).

A comparison of the elevation data collected in 1995, 1996, and 2001 shown in figure 12 reveals an interesting pattern of compaction, aeolian transport, sediment accretion and overwash processes for Andrew Island in cross section. The profiles show an overall decrease in elevation and area of the island, with overwash and general migration to the southwest. Transect 2-3 shows an elevation increase due to sediment accumulation with accompanying marsh growth on the intertidal flanks. Additionally, in 1996 Andrew Island was sparsely vegetated with the densest vegetation occurring on the shoulder of the island. This would provide a trap for Aeolian transported material to accumaulate. The profiles in 1996 had a lateral length range of 790-1450feet with the range in 2001 reduced to 760-1019feet, which is 3.8-29.7% reduction in length.

The profiles were typically more densely vegetated at the either end where the substrate was either intertidal or very wet, with a dramatic drop in density and vegetative height toward the center axis of the island that corresponded to an increase in substrate elevation and decrease of soil moisture. The landscape was dominated by fresh marsh, willow swamp, shrub thicket, grassland meadow, and wetland border species. The fresh marsh was mostly cattail, elephant ears, scirpus, or grasses, with a thick raft of water hyacinth at the water line (Figure 13). Trees observed in the area were willow (*Salix nigra*), and the shrubs were predominately groundsel bush (*Baccharis halimifolia),* wax myrtle *(Myrica cerifera),* or *Sesbania* spp. The higher elevations were occupied by extensive, goldenrod *(Solidago sempervirens*) and broomsedge (*Andropogon spp.*) grassland/meadows (Figure 14), sometimes covered thickly by a dense tangle of vines (Figure 15).

A comparison of the vegetation data collected in 1995, 1996, and 2001 at transect 2-0 is shown in figure 16 to illustrate the changes that took place in the general distribution of habitats. Changes were observed in vegetative cover as annuals and opportunistic species changed between profile periods, and plant competition and succession processes progressed. Vegetative succession for a 6-year period was pronounced, illustrated dramatically by the size of the willow trees that were seedlings in 1995 (Figure 17). Some bare areas had been colonized, and habitats have become more established or shifted as the elevation varied over time. The island crest that was described in 1995 as of "bar aeolian type sand features (ripples and dunes)", was an upland grassland/meadow in 2001, and the 1995 marsh fringe was a dense willow swamp/marsh in 2001.(Figures 18-21)

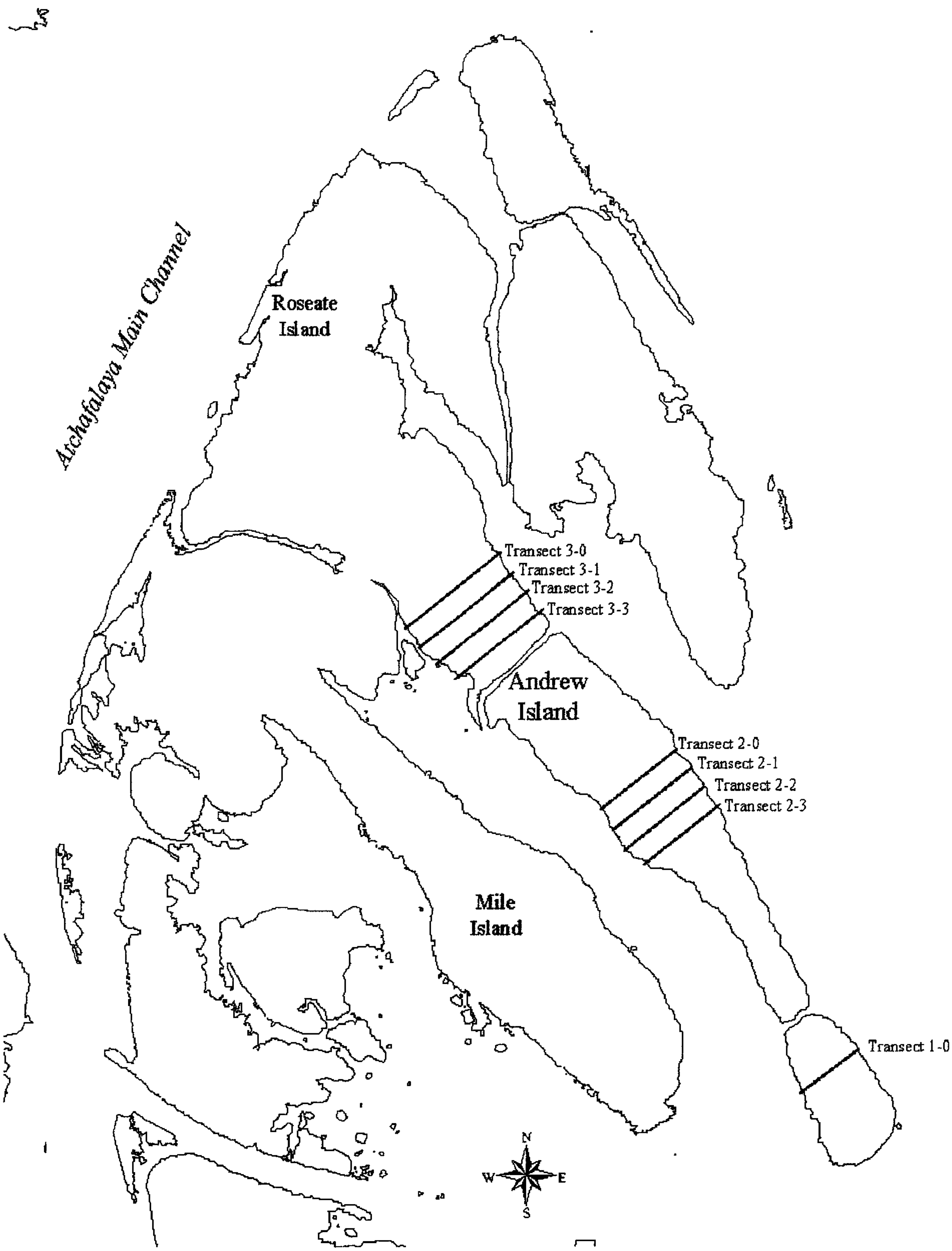


Figure 6. Schematic diagram of the original configuration of profile transects established on Andrew Island in 1995 at the Lower Atchafalaya River Bay and Bar BUMP study site.

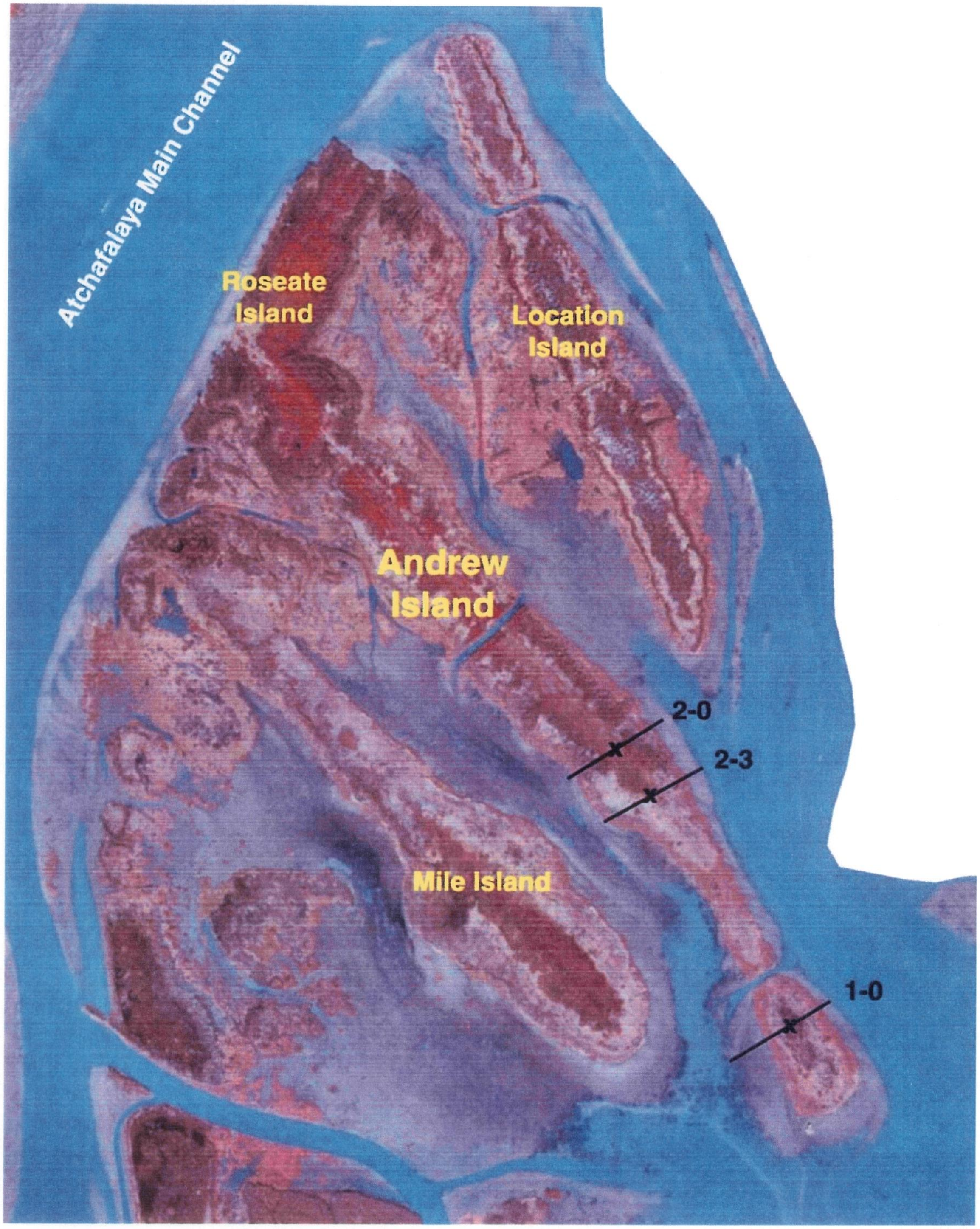


Figure 7. Infrared vertical aerial photography taken on January 4, 2001 of the Andrew Island area at the Lower Atchafalaya Bay and Bar study site showing the approximate location of the transects revisited in 2001.

A)

B)

Figure 8. Oblique aerial photograph taken in A) July 1996 and B) June 2001 of Andrew Island. View is to the southeast along the axis of the island. Location Island, to the left of AndrewIsland (B) was created in 1997 (Photos courtesy of the LSU Aerial Videotape Survey Program).

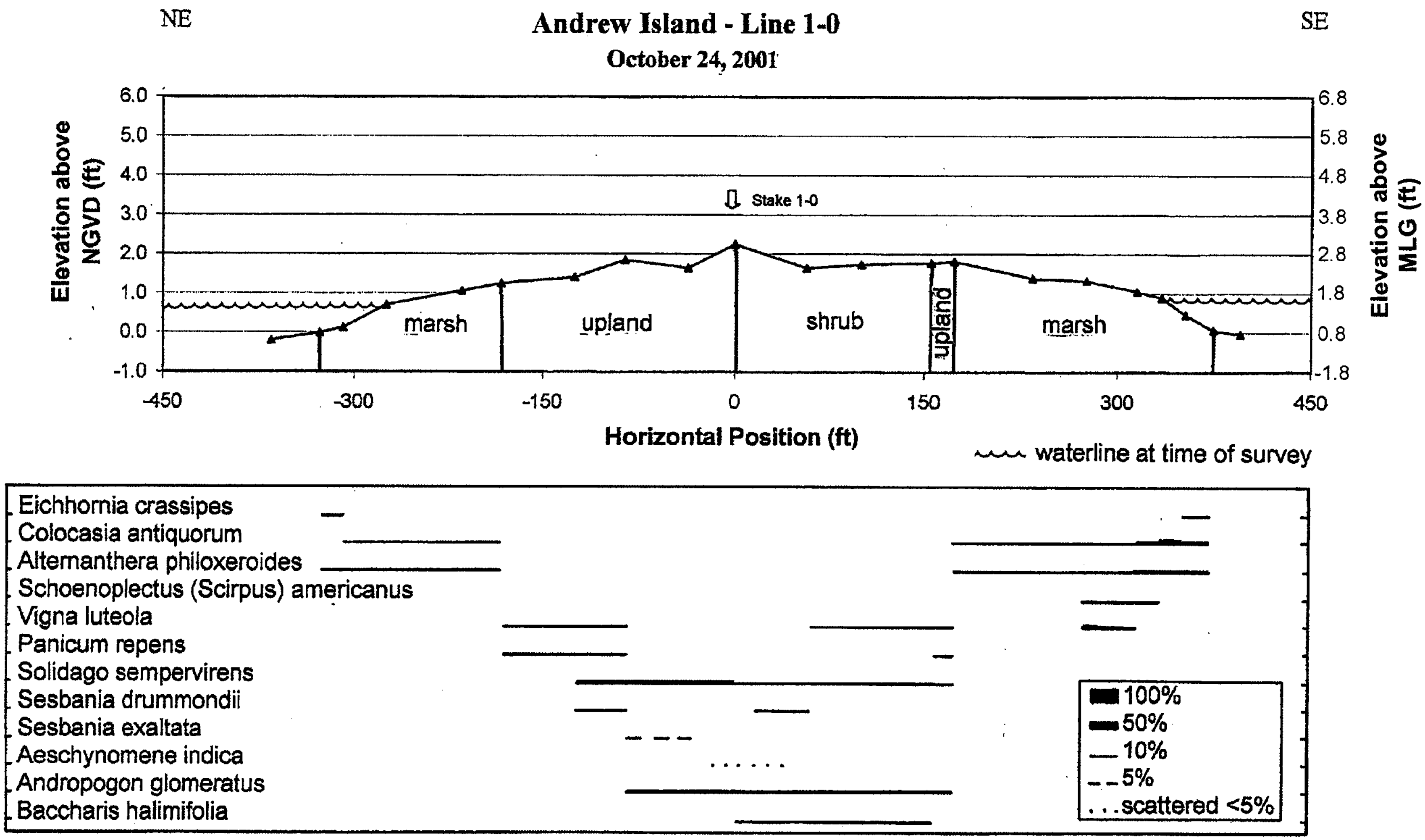


Figure 9. Elevation profile for transect 1-0 at Andrew Island - Lower Atchafalaya BUMP study site with vegetation data illustrated.

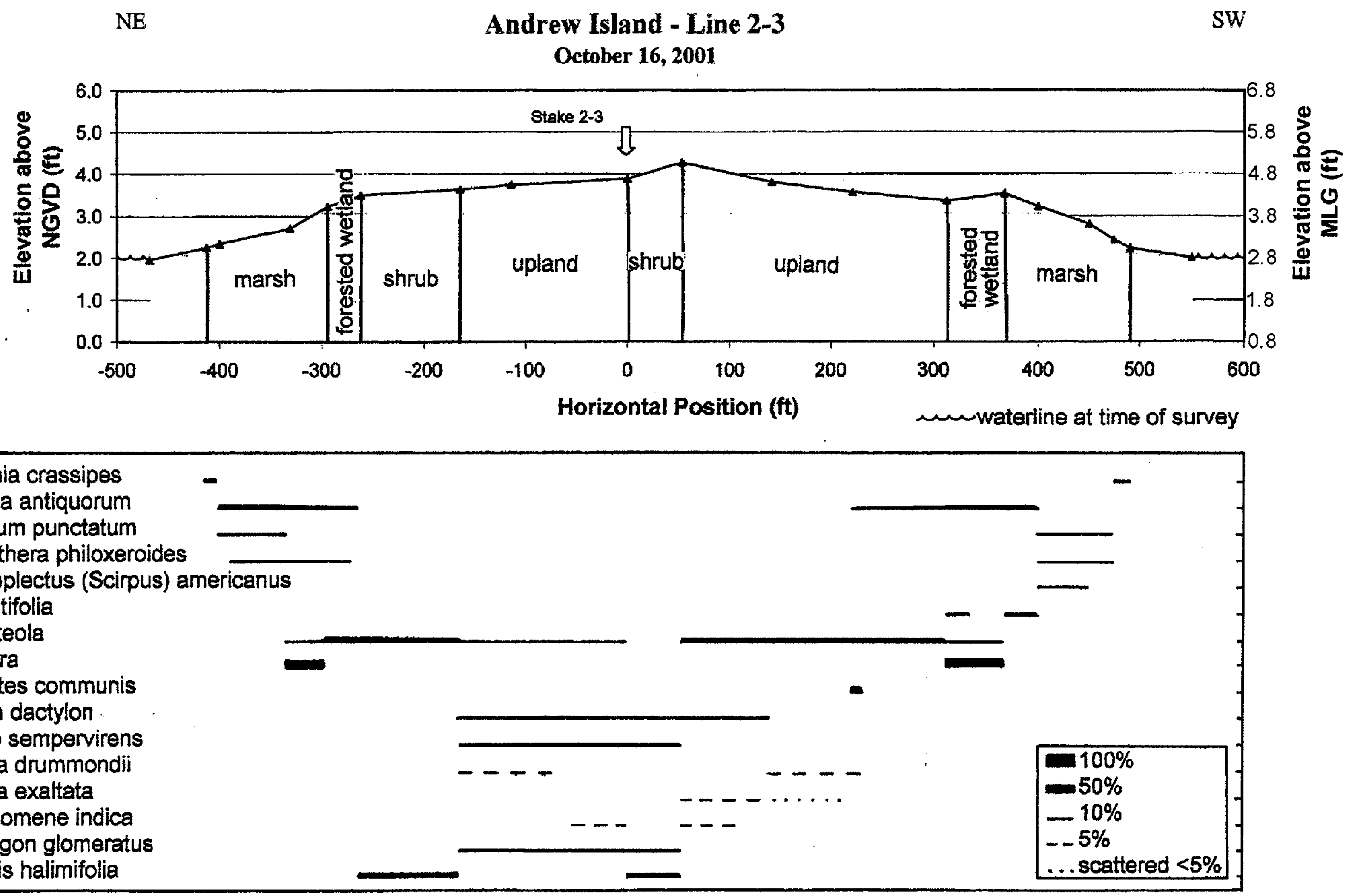


Figure 10. Elevation profile for transect 2-3 at Andrew Island - Lower Atchafalaya BUMP study site with vegetation data illustrated.

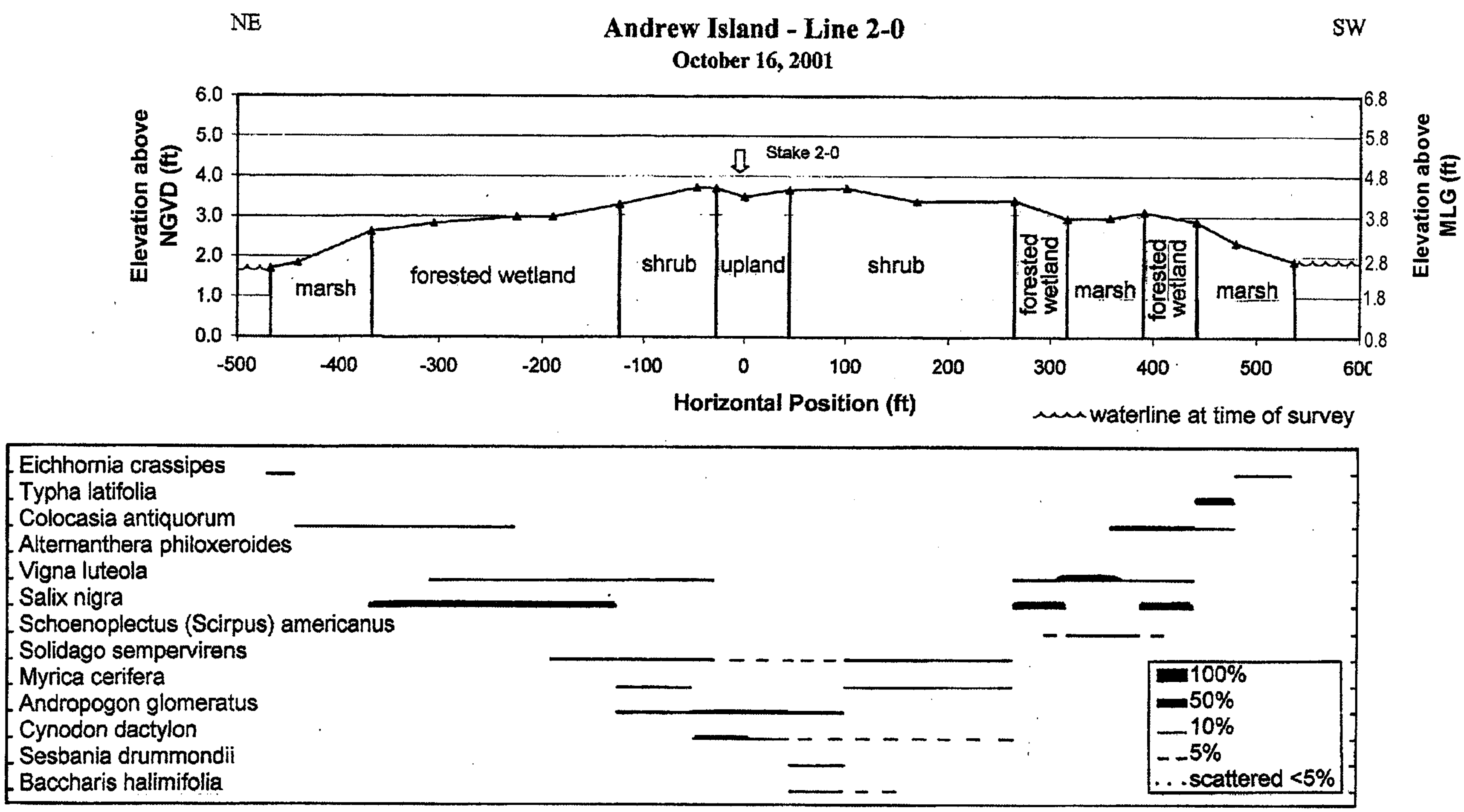


Figure 11. Elevation profile for transect 2-0 at Andrew Island - Lower Atchafalaya BUMP study site with vegetation data illustrated.

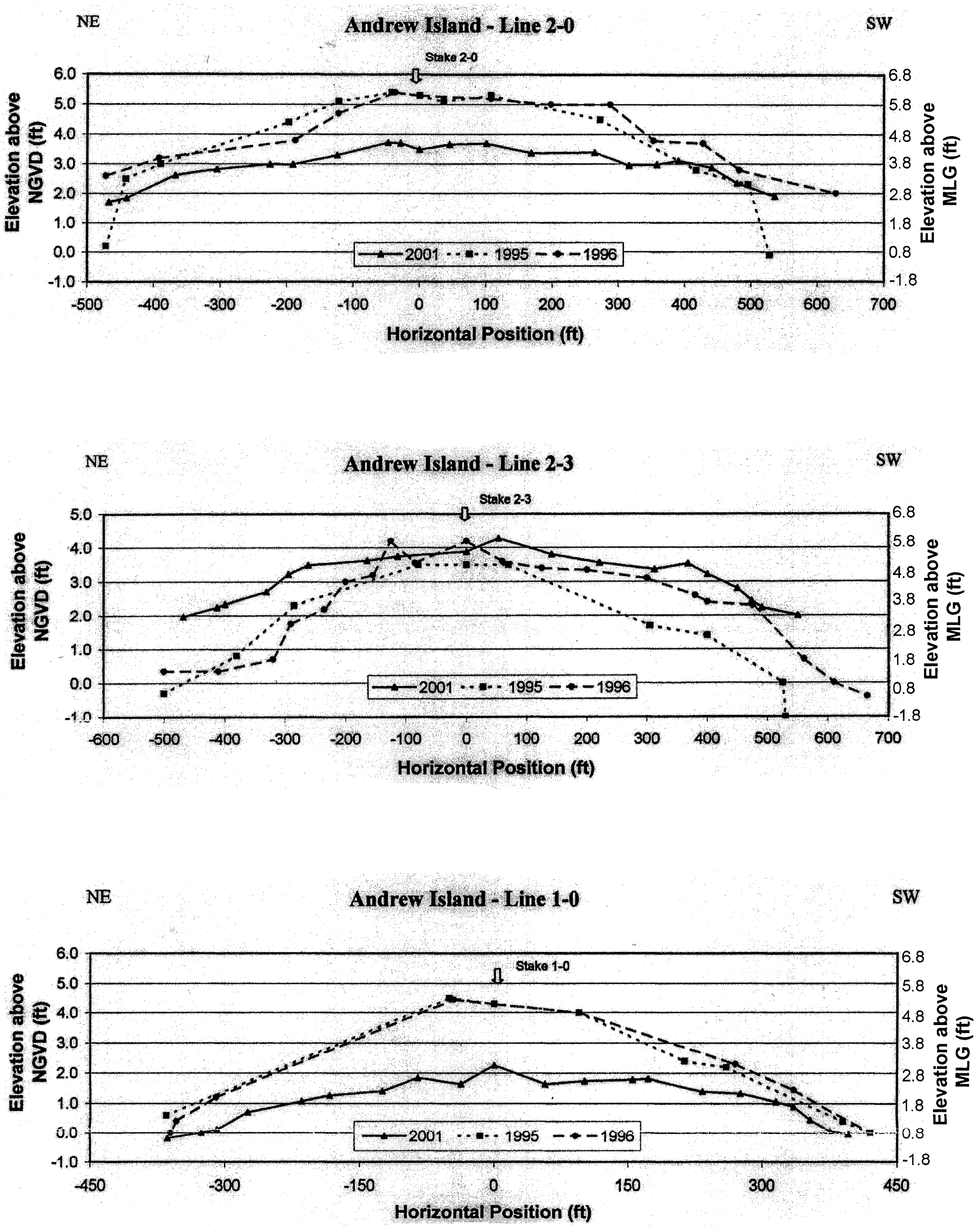


Figure 12. A comparison of 1995, 1996, and 2001 elevation data at Andrew Island in the Atchafalaya River delta. A) Profile at stake 2-0. B) Profile at stake 2-3. C) Profile at stake 1-0.

Figure 13. Photograph taken October 16, 2001 at transect 2-0 on Andrew Island showing fresh marsh of elephant ears, knotweed and water hyacinth, and willow trees.

Figure 14. Photograph taken October 16, 2001 at transect 2-0 on Andrew Island showing the shrub zone of groundsel bush and wax myrtle behind the grassland/meadow of goldenrod and broomsedge.

Figure 15. Photograph taken October 16, 2001 at transect 2-0 on Andrew Island showing the thick tangle of vines that covers everything within reach.

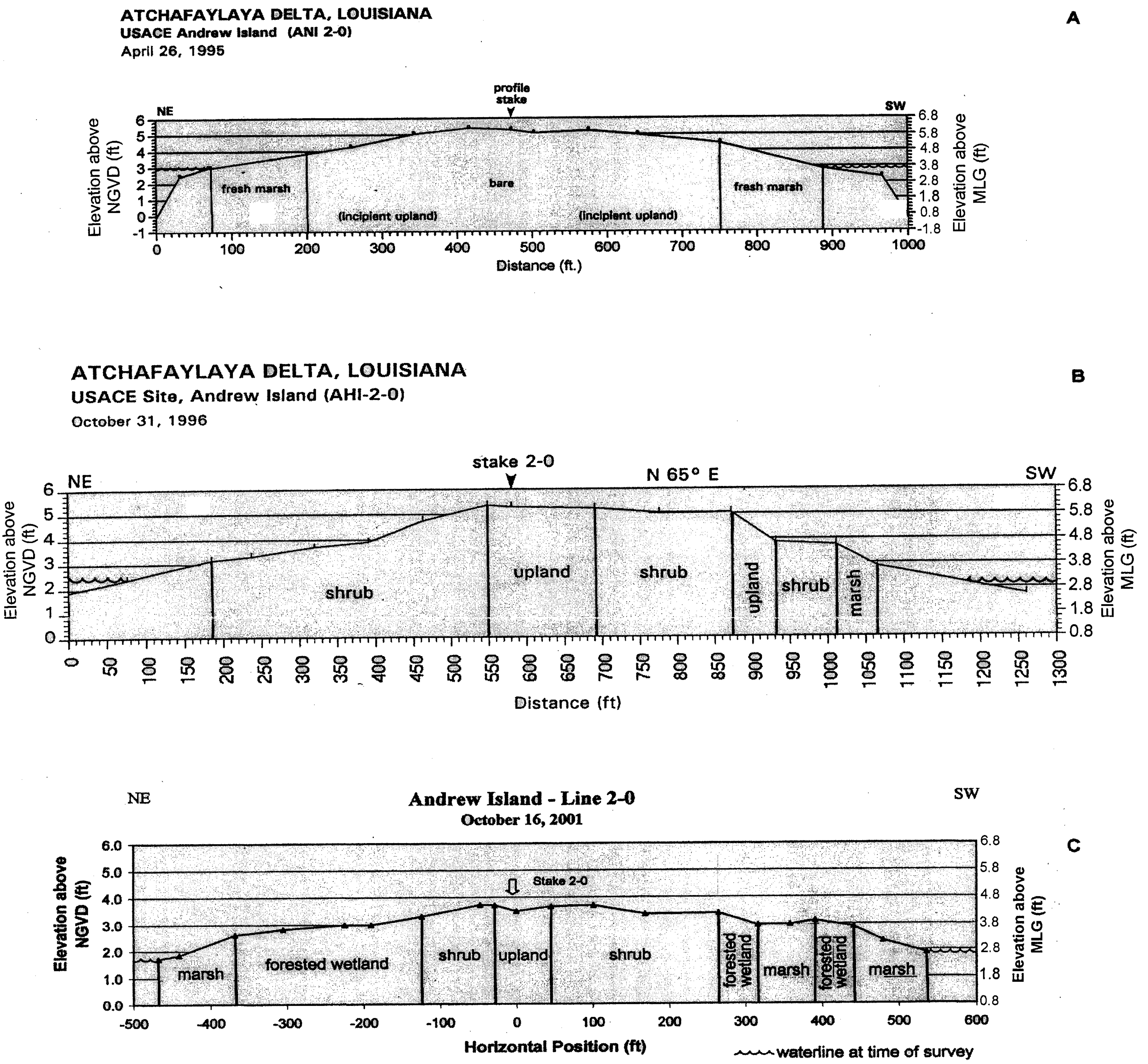
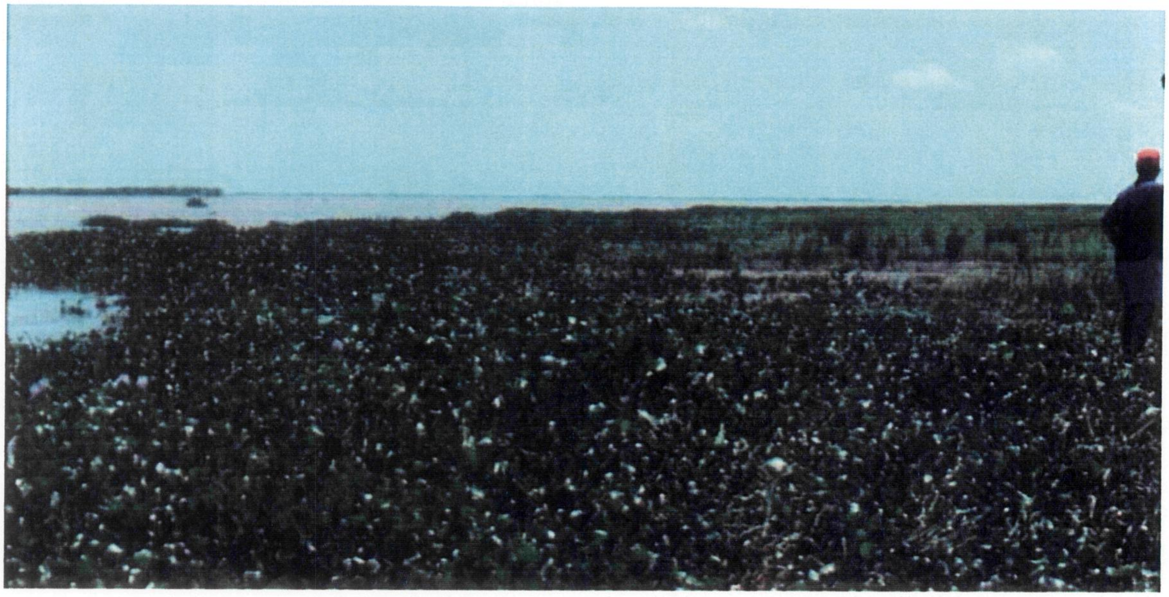


Figure 16. Elevation profile 2-0 from Andrew Island in the Atchafalaya River Delta showing habitat distribution changes. A) 1995 data. B) 1996 data. C) 2001 data.

Figure 17. Photograph taken October 16, 2001 along transect 2-0 on Andrew Island, showing the diameter of some of the willow trees that have grown at this site in six years.



A

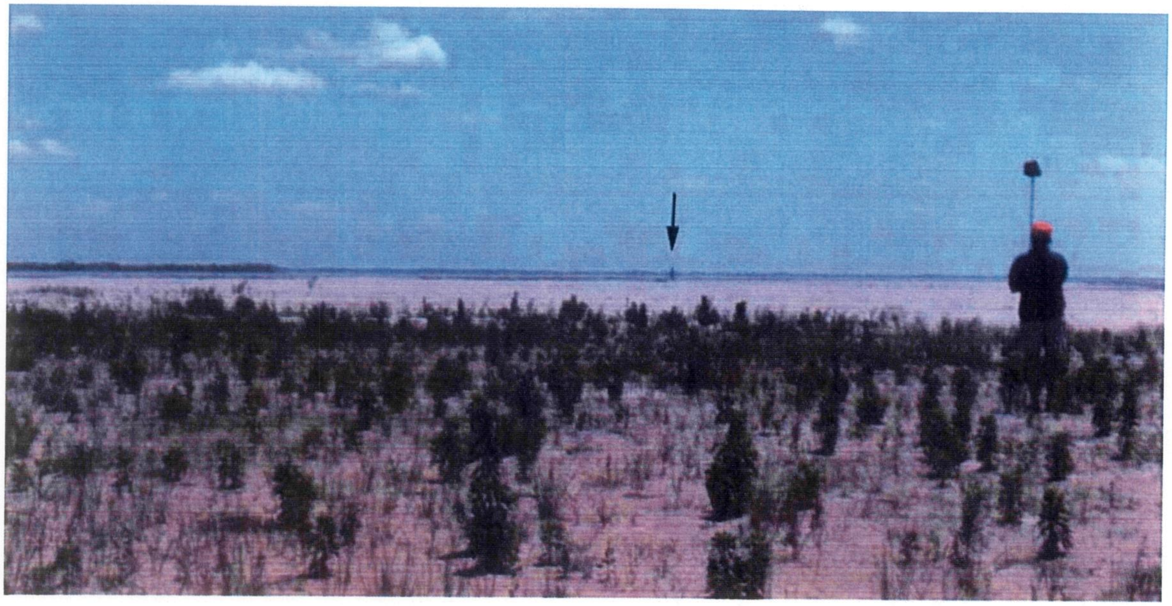
B

Figure 18. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is of the northeast waterline along the transect looking to the east.

A

B

Figure 19. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is to the northeast along the transect.



A

B

Figure 20. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is to the southwest along the transect looking toward the instrument (at the arrow). A shrub thicket has replaced the sparse composite zone.

A

B

Figure 21. Photographs from Profile 2-0 from Andrew Island in the Atchafalaya River delta showing landscape changes over time. A) Taken April 26,1995. B) October 16, 2001. The view is to the northeast along the transect looking toward the instrument. Bare land, "aoelian ripples and incipient dunes" has been replaced by a meadow/ grassland.

Horseshoe Island

Horseshoe Island is located along the southeastern side of the Atchafalaya River delta near Mile 146 (Figure 5). The creation of Horseshoe Island was initiated in 1993 as an "artificial delta lobe" intended to shelter shallow open water at the south end of the delta to promote fresh marsh and submerged aquatics development (Figure 4A). Dredged material was placed to +4feet NGVD (4.8feet MLG) maximum height in a "horseshoe" configuration. The northeast lobe was extended during FY 1994, and the southwest lobe extended during 1997 (Figure 4B). One channel was cut through the northeast lobe, another cut through the part parallel to the channel, and two cuts were placed on the southwest lobe to allow water exchange and aquatic access.

Figure 22 is a schematic diagram of the original arrangement of cross-island profile transects established at Horseshoe Island during the 1995 monitoring. These nine topographic profiles were constructed from the data collected in reference to the U. S. Army Corps of Engineers benchmarks #DA-8-3 and #DA-8-4. The initial data was acquired on April 27, 1995 and access was by boat. Three of the nine profiles were repeated on July 3 and October 9, 1996, and again on October 23-26 , 2001. In 2001, one stake could not be found and the transect had to be re-established. The approximate location of the most recent transects surveyed are shown in Figure 23. Due to 6 years of vegetative growth, the 2001 field effort required an extensive amount of time clearing the transect of vegetation that obscured the survey instrument line-of-sight. Figure 24 shows some of the channels cut through the island before the south lobe of Horseshoe Island was extended.

The profiles at Horseshoe Island in 2001 ranged in lateral length from 437 to 996feet. The habitats and dominant vegetative species are indicated on the profiles, referenced to the elevation. The stake for transect 1-0, located at the southern tip of eastern Horseshoe Island, was missing and had to be re-established. Transect 1-0 had a maximum elevation of 3.3feet NGVD (4.1feet MLG), with an average elevation of 2.75feet NVGD (3.5feet MLG) (Figure 25). Transect 2-0 (E-E') along the central crest had a maximum elevation of 2.6feet NGVD (3.4feet MLG), with an average elevation of 1.8feet NGVD (2.6feet MLG) (Figure 26). Transect 3-0 (A-A') along the crest of the north end of the section, had a maximum elevation of 2.6feet NGVD (3.3feet MLG), with an average elevation of 1.5feet NGVD (2.3feet MLG) (Figure 27).

A comparison of the elevation data collected in 1995, 1996, and 2001 shown in Figure 28 reveals a pattern of compaction, aeolian transport, sediment accretion and overwash processes for Horseshoe Island in cross section. Transect 1-0 was reestablished so there was no relevant comparison for this profile. The profiles in 1996 had a lateral length range of 1045-1445feet with the range in 2001 reduced to 437-996feet, which is a -58.2% to -31.1% reduction in length for this site. The profiles show an overall decrease in elevation, and a general migration to the east.

The cross-island profiles were typically more vegetated at either end where the substrate was either intertidal or very wet, and generally decreased in density and vegetative height toward the center of the island that corresponded with an increase in elevation and decrease of soil moisture. This island is less sheltered than the others in the study area, and more affected by erosional forces and environmental stress. Although well vegetated, Horseshoe Island did not support the extensive willow thickets found elsewhere. Fresh marsh, shrubs, and goldenrod meadows/vine terraces, that are considered upland for this report, dominated the landscape. The fresh marsh was mostly cattail, elephant ears, scirpus, or grasses, with a thick raft of water hyacinth at the water line. Trees observed in the area were willow (*Salix nigra)* and the shrubs were groundsel bush (*Baccharis halimifolia)*, wax myrtle *(Myrica cerifera)*, and *Sesbania* spp. The higher elevations were occupied by extensive, grass, goldenrod *(Solidago sempervirens*) and broomsedge (*Andropogon spp.*) meadows, sometimes covered by a thick tangle of vines (*Vigna luteola*).

A comparison of the vegetation data collected in 1995, 1996 and 2001 at transect 3-0 is shown in Figure 29 to illustrate the changes that took place in the general distribution of habitats. Changes were observed in vegetative cover as annuals and opportunistic species changed between profile periods, and plant competition and succession processes progressed. Some bare areas had been colonized, and habitats have become more established or shifted as the elevation varied over time. Photographs taken during field monitoring illustrate changes in vegetation as plant succession between 1995 and 2001 took advantage of the new land created in FY 1994. (Figures 30-32)

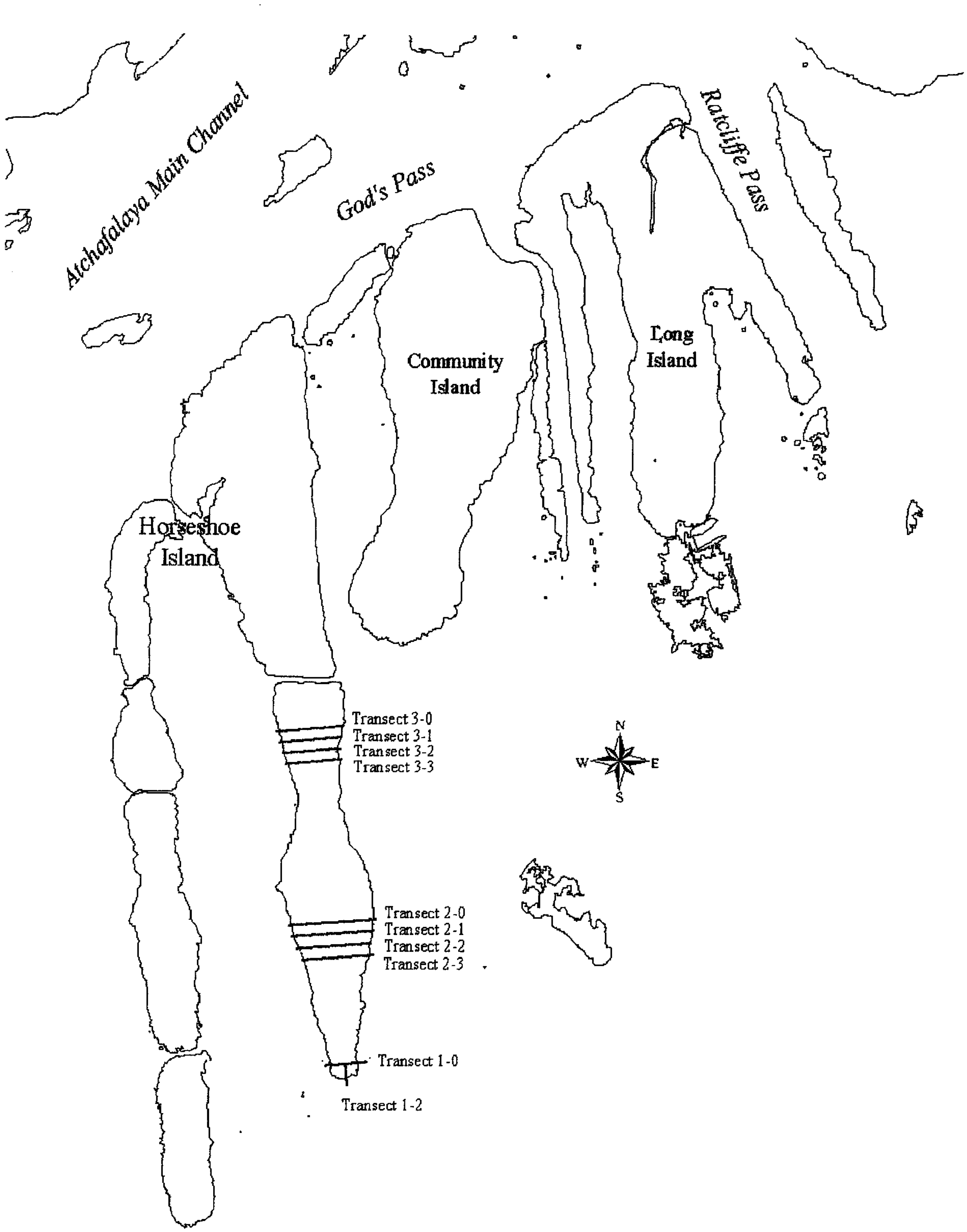


Figure 22. Schematic diagram of the original arrangement of profiles established on the eastern lobe of Horseshoe Island in 1995 at the Lower Atchafalaya River Bay and Bar BUMP study site.

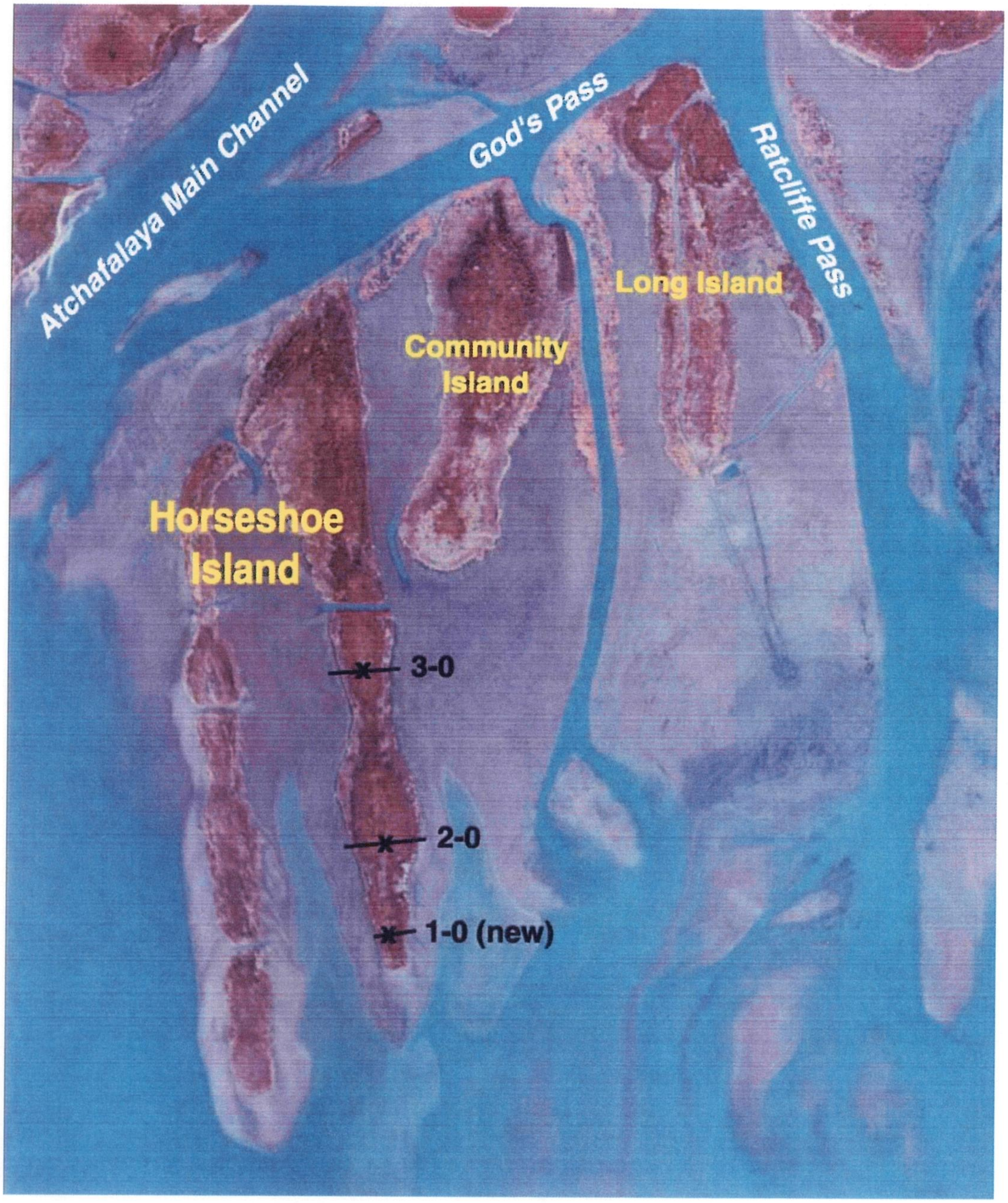


Figure 23. Infrared vertical aerial photography taken on January 4, 2001 of the Horseshoe Island area at the Lower Atchafalaya Bay and Bar study site showing the approximate location of the transects revisited in 2001.

A)

B)

Figure 24. Oblique aerial photograph across the two lobes of Horseshoe Island, taken in A) July 1996 before the west lobe extension and B) June 2001. View is to the north showing some of the channels cut through the island (Photo courtesy of the LSU Aerial Videotape Survey Program).

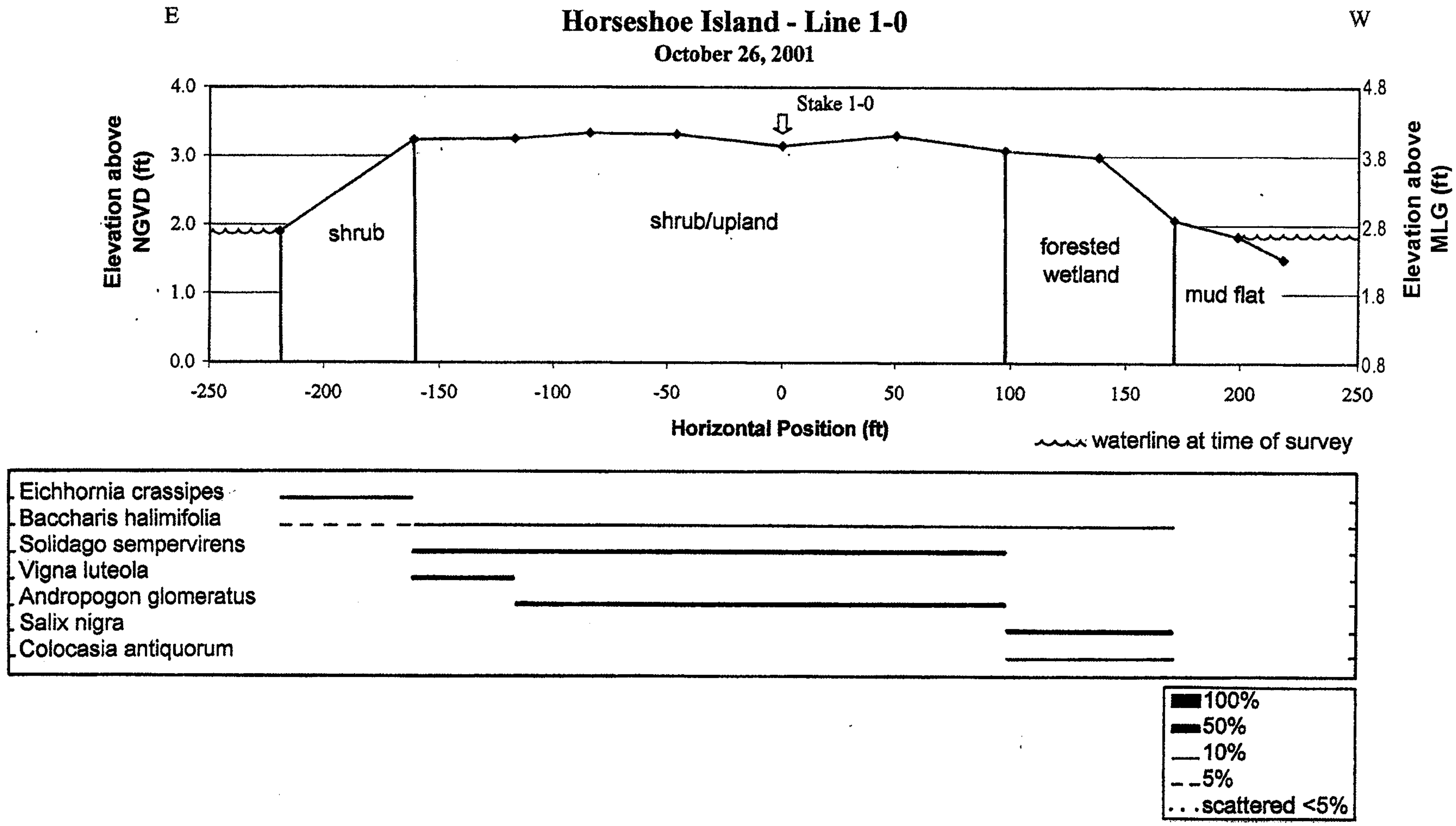


Figure 25. Elevation profile1-0 from Horseshoe Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated.

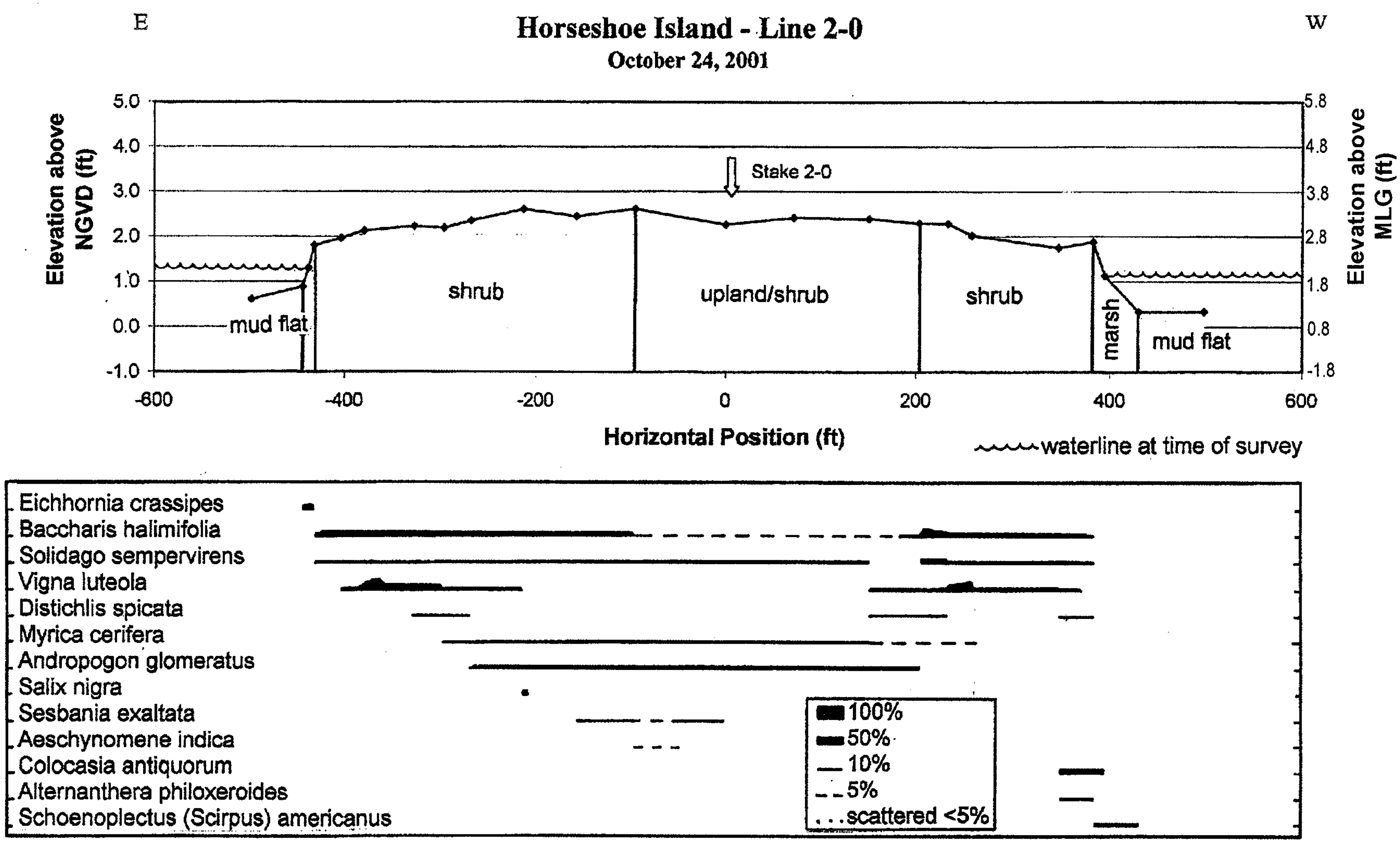


Figure 26. Elevation profile 2-0 from Horseshoe Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated.

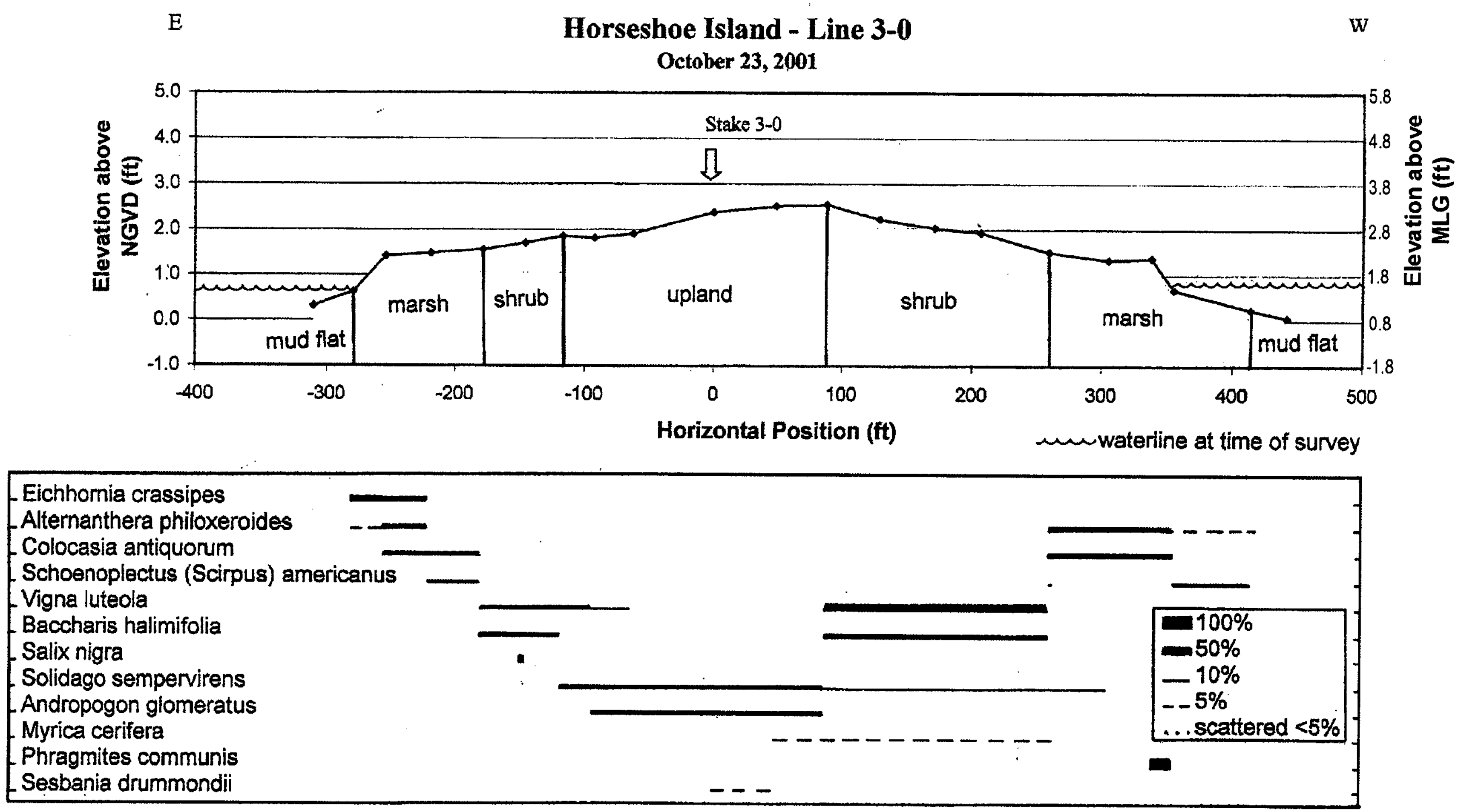


Figure 27. Elevation profile 3-0 from Horseshoe Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated.

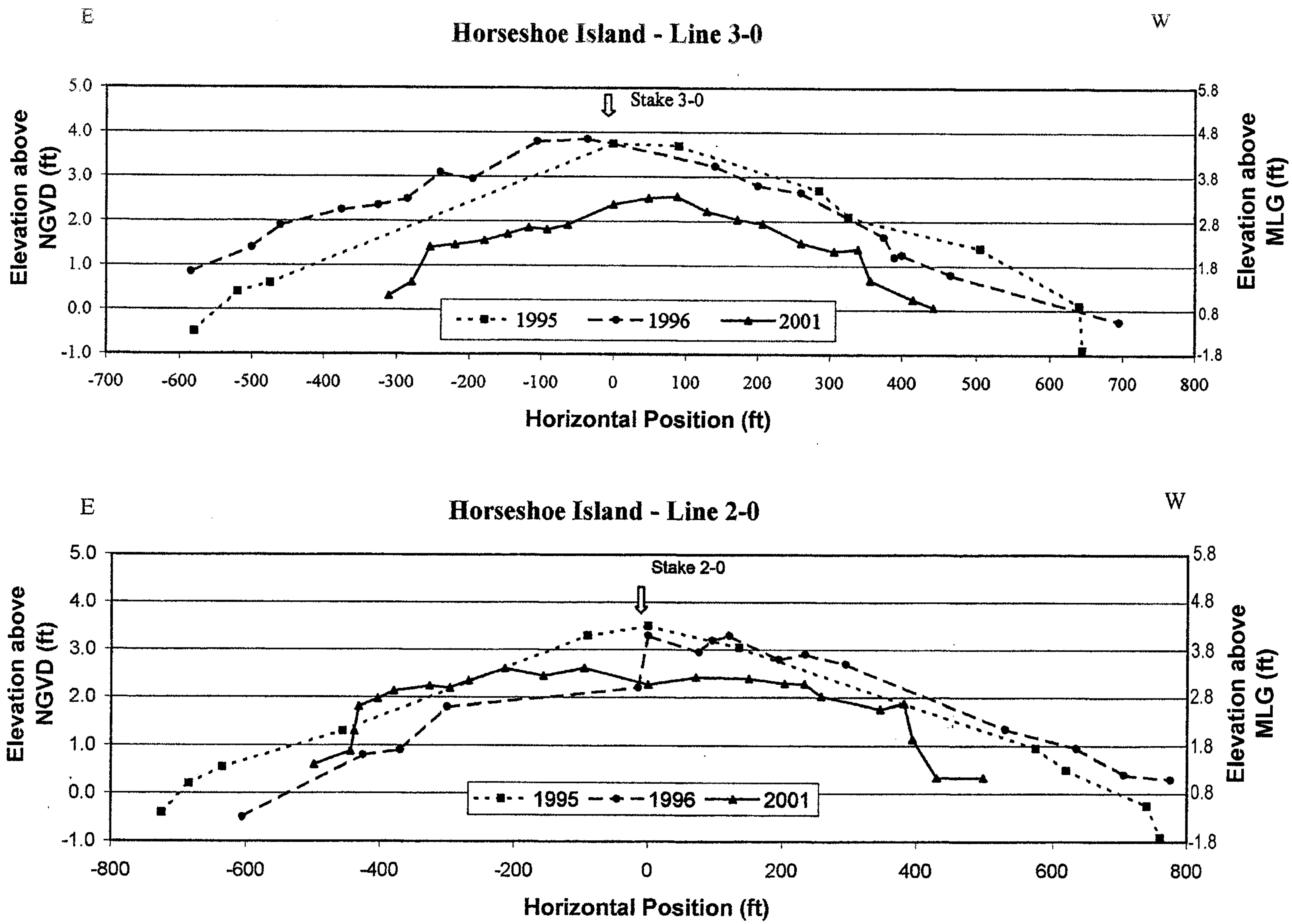


Figure 28. A comparison of 1995, 1996, and 2001 elevation data at Horseshoe Island in the Atchafalaya River delta. A) Profile at stake 3-0. B) Profile at stake 2-0.

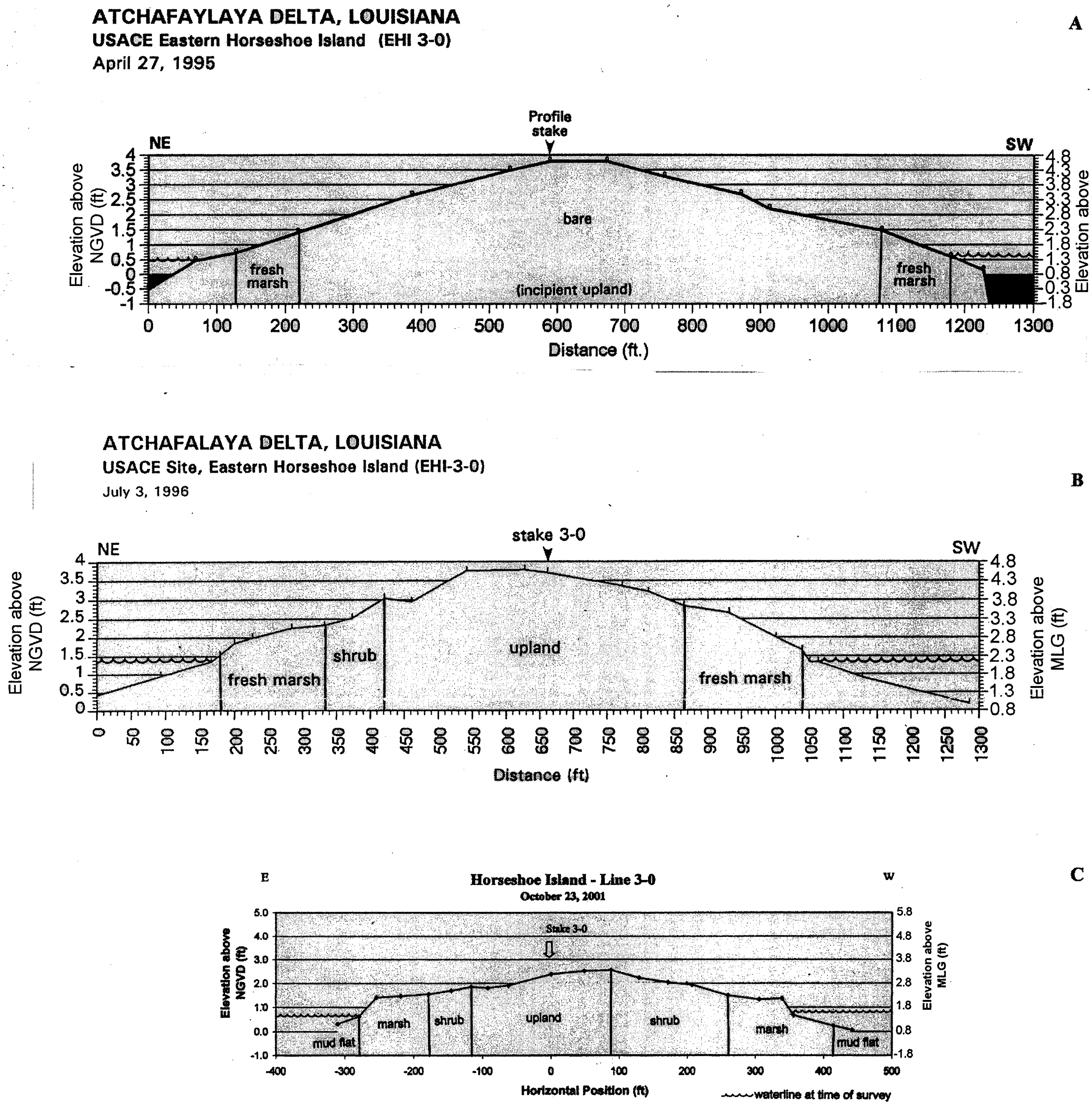


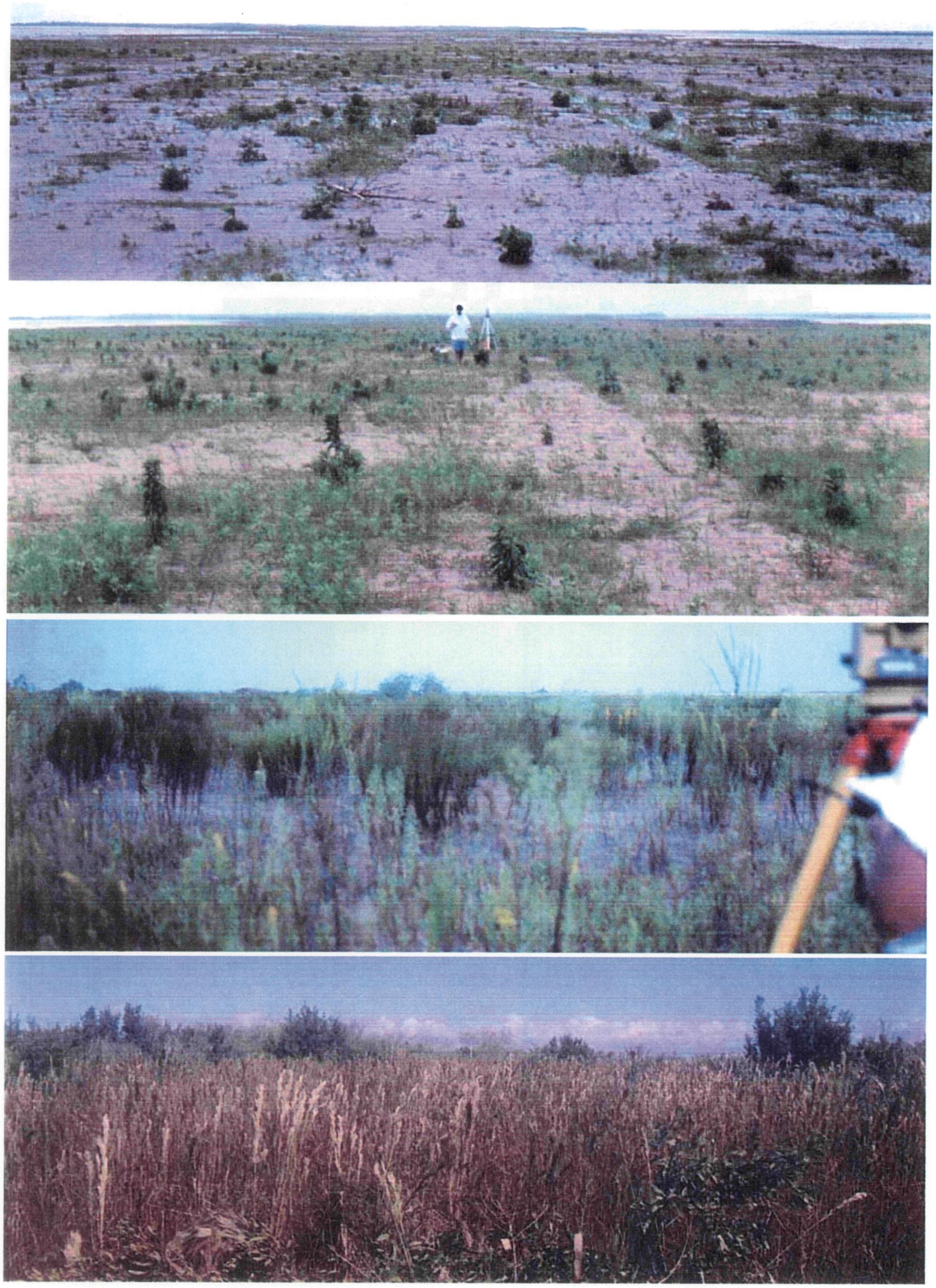
Figure 29. Elevation profile 3-0 from Horseshoe Island in the Atchafalaya River delta showing habitat distribution changes. A) 1995 data. B) 1996 data. C) 2001 data

A)

B)

C)

Figure 30. Photographs illustrating plant succession at Horseshoe Island. All photos were taken looking east along the transect from stake 3.1 A) April 27, 1995, B) July 3, 1996, C) October 23, 2001.



A)

B)

C)

D)

Figure 31. Photographs illustrating plant succession at Horseshoe Island. All photos were taken looking northwest along the axis of the island from stake 2.1 A) April 5, 1995, B) April 27, 1995 -- 3 weeks later, C) October 9, 1996 –1.5 years later, D) October 23, 2001 –6.5 years later.

A)

B)

C)

Figure 32. Photographs illustrating plant succession at Horseshoe Island, taken looking east along the transect at stake 1-0. A) April 5, 1995 B) October 9, 1996 –1.5 years later C) October 23, 2001 –6.5 years later.

Ibis Island

Ibis Island is located along the southeast-central side of the Atchafalaya River delta, well south of the main channel, off the west bank of East Pass (Figure 5). Over a mile long, this "artificial delta lobe" was constructed during the USACE-NOD 1995 maintenance event, to protect the shallow open water areas for fresh marsh and submerge aquatic development (Figures 4A & 4B). Dredged material was placed no more than +4feet NGVD (+4.8 MLG) in height and two channels flanked by levees were cut through the island to allow water exchange and aquatic access, and effectively divided the island into three sections. The material consisted of fine silty sand.

Figure 33 is a schematic diagram of the original arrangement of profile transects established at Ibis Island in 1996. The initial data was acquired on July 2, 1996, and access was by boat. Three of the nine cross-island, topographic profiles for Ibis Island were repeated in October 2001 to acquire comparative data. The approximate location of the most recent transects surveyed are shown in Figure 34. Access was by small boat through East Pass and shallow channels (Figure 35) and then by pirogue up to shore (Figure 36). Due to 5 years of vegetative growth, the 2001 field effort required an extensive amount of time clearing the transect of trees and vegetation that obscured the survey instrument's line of sight. Oblique aerial photography illustrates changes in vegetation as plant succession between 1996 and 2001 took advantage of the new land (Figures 37).

The profiles at Ibis Island in 2001 ranged in lateral length from 773feet to 1265feet. The habitats and vegetative species are indicated on the profiles, referenced to the elevation. Transect 1-1 located at the southern tip of eastern Ibis Island had a maximum elevation of 3.6feet NGVD (4.4feet MLG), with an average elevation of 2.6feet NGVD (3.4feet MLG) (Figure 38). Transect 2-1 along the central portion of the island had a maximum elevation of 4.5feet NGVD (5.3feet MLG), with an average elevation of 3.0feet NGVD (3.8feet MLG) (Figure 39). Transect 3-1 on the portion of the island near East Pass had a maximum elevation of 3.9feet NGVD (4.7feet MLG), with an average elevation of 2.1feet NGVD (2.9feet MLG) (Figure 40).

A comparison of the elevation data collected in 1996 and 2001 shown in Figure 41 reveals an interesting pattern of compaction, aeolian transport, sediment accretion and overwash processes for Ibis Island in cross section. The profiles show a relatively stable elevation and area of the island. The profiles in 1996 had a lateral length range of 921 to 1237feet, with the range in 2001 reduced to 773 to 1265feet, which corresponds to a range of -16.1% loss in length to a +2.3% increase.

The profiles were typically more densely vegetated at the either end where the substrate was either intertidal or very wet, with a decrease in density and vegetative height toward the center axis of the island that corresponds to an increase in elevation and decrease of soil moisture. The landscape was dominated by a fresh marsh fringe at the waterline, extensive willow swamp along the saturated soil zone, shrub zone bordering drier ground, and goldenrod/broomsedge meadow along the higher axis of the island. The fresh marsh was mostly elephants ear, cattail, wild rice, alligator weed or dogtooth grass. Trees observed in the area were predominantly willow (*Salix nigra and Salix interior)* with scattered cottonwood *(Populus heterophylla*) on "high" ground. Some of the trees were 6" in diameter and over 25-ft tall. The shrubs were typically groundsel bush (*Baccharis halimifolia)* and wax myrtle *(Myrica cerifera)* with an understory of various herbs and grasses. The higher elevations were occupied by extensive, goldenrod *(Solidago sempervirens)* and broomsedge (*Andropogon spp.*) meadows, sometimes covered by a tangle of vines *(Vigna luteola)*.

A comparison of the vegetation data collected in 1996 and 2001 shown in Figure 42 illustrates changes in the general distribution of habitats. The island was created approximately one year before the initial elevation/vegetation survey in 1996. Vegetation colonization was well under way along the waterline at that time, but the island was basically bare with extensive sand flats and aeolian dunes (Figure 43). The plant succession evident in the five years since last surveyed was extensive (Figures 44-45). Changes were observed in vegetative cover as annuals and opportunistic species changed between profile periods, and plant competition and succession processes progressed. Vegetative succession for the 5-year period was pronounced, illustrated dramatically by the size of the willow trees that were saplings in 1996. Some bare areas had been colonized, and habitats have become more established or shifted as the elevation varied over time (Figures 38). The island crest that was described in 1995 as of "bar aeolian type sand features (ripples and dunes)", was a thickly colonized meadow in 2001 (Figure 39), and the sparse 1996 marsh fringe was a dense willow swamp/marsh in 2001.

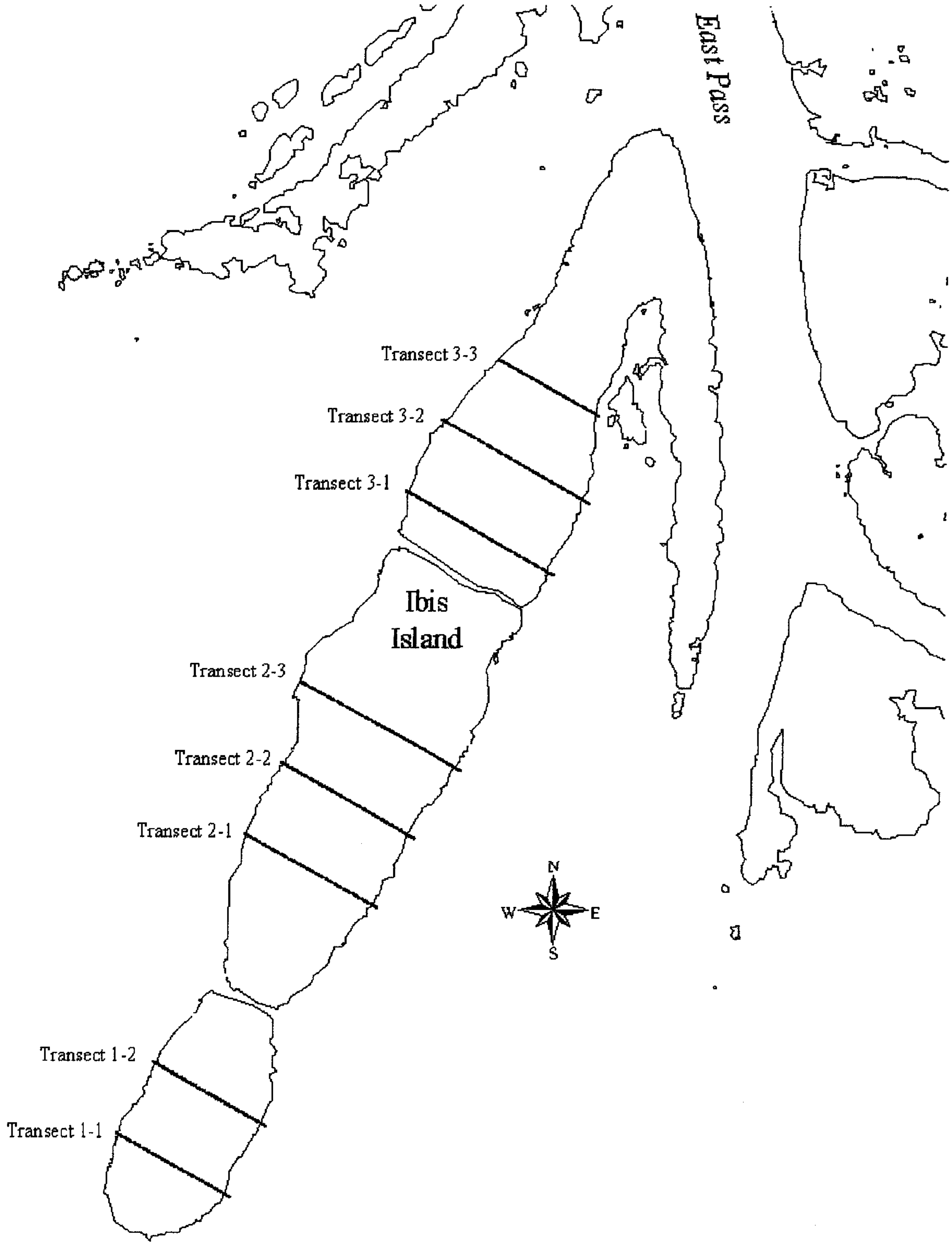


Figure 33. Schematic diagram of the original arrangement of profile transects established at Ibis Island in 1996 at the Lower Atchafalaya River Bay and Bar BUMP study site.

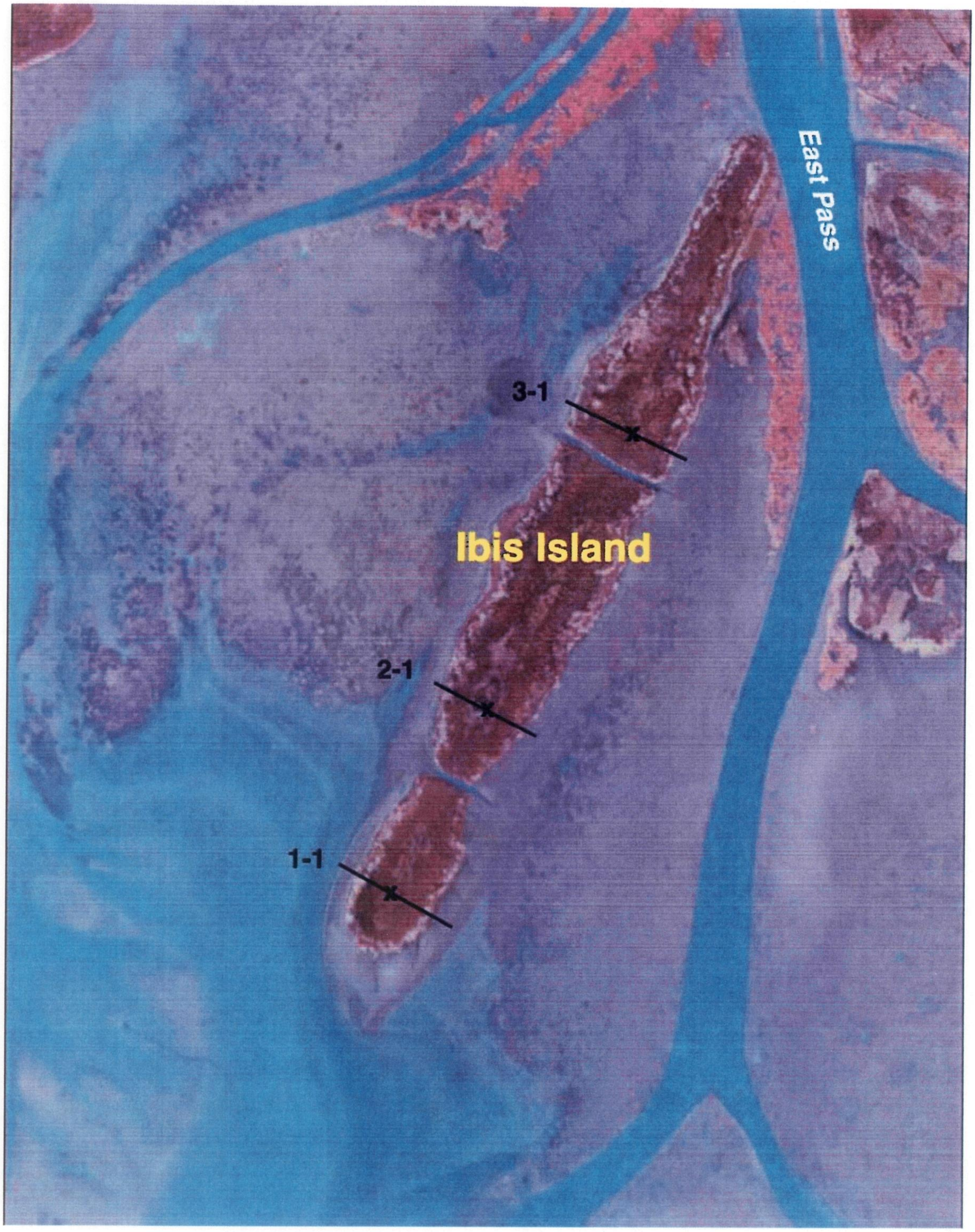


Figure 34. Infrared vertical aerial photography taken on January 4, 2001 of the Ibis Island area at the Lower Atchafalaya Bay and Bar study site showing the approximate location of the transects revisited in 2001.

Figure 35. Oblique aerial photograph taken in June 2001 showing East Pass and the many bifurcating shallow channels. The view is to the east with Ibis Island in the upper right of the frame. (Photo courtesy of the LSU Aerial Videotape Survey Program).

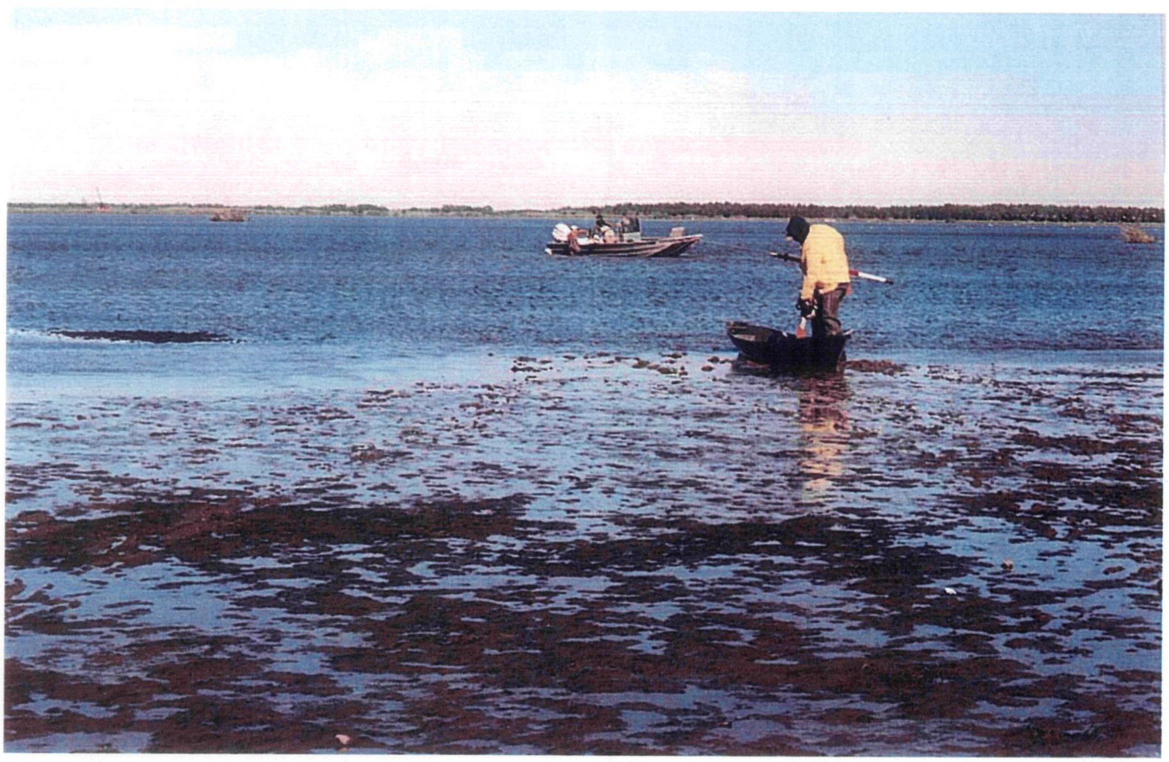
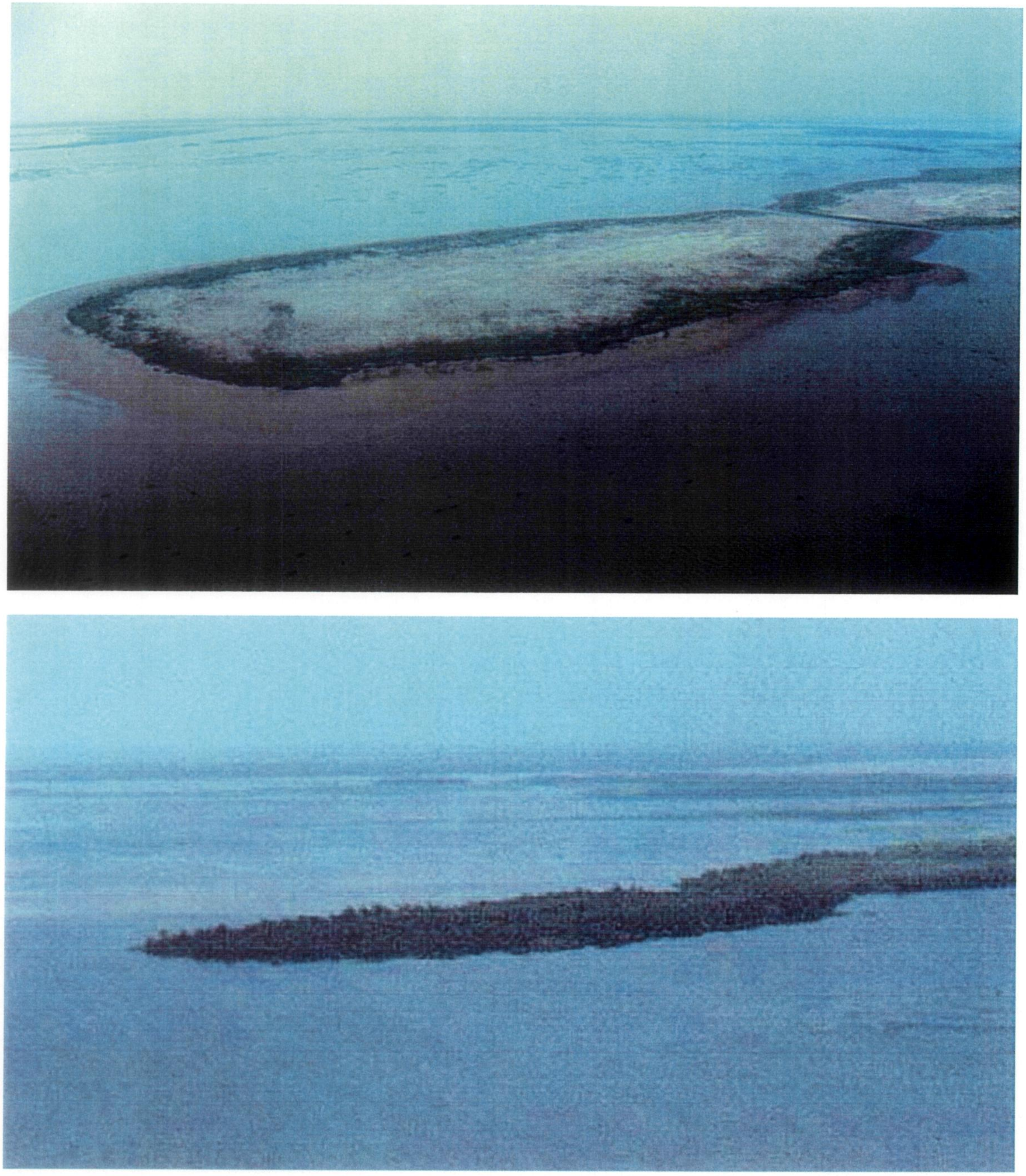


Figure 36. Photograph taken October 2001 during field work at Ibis Island of the boat and pirogue used to access the area. Very shallow bays with a thick, soft, mud substrate made access difficult.



A)

B)

Figure 37. Oblique aerial photographs taken in A) July 1996 and B) June 2001 of Ibis Island. View is to the west across the distal end of the island. Willow trees are evident in the lower photo. (Photo courtesy of the LSU Aerial Videotape Survey Program).

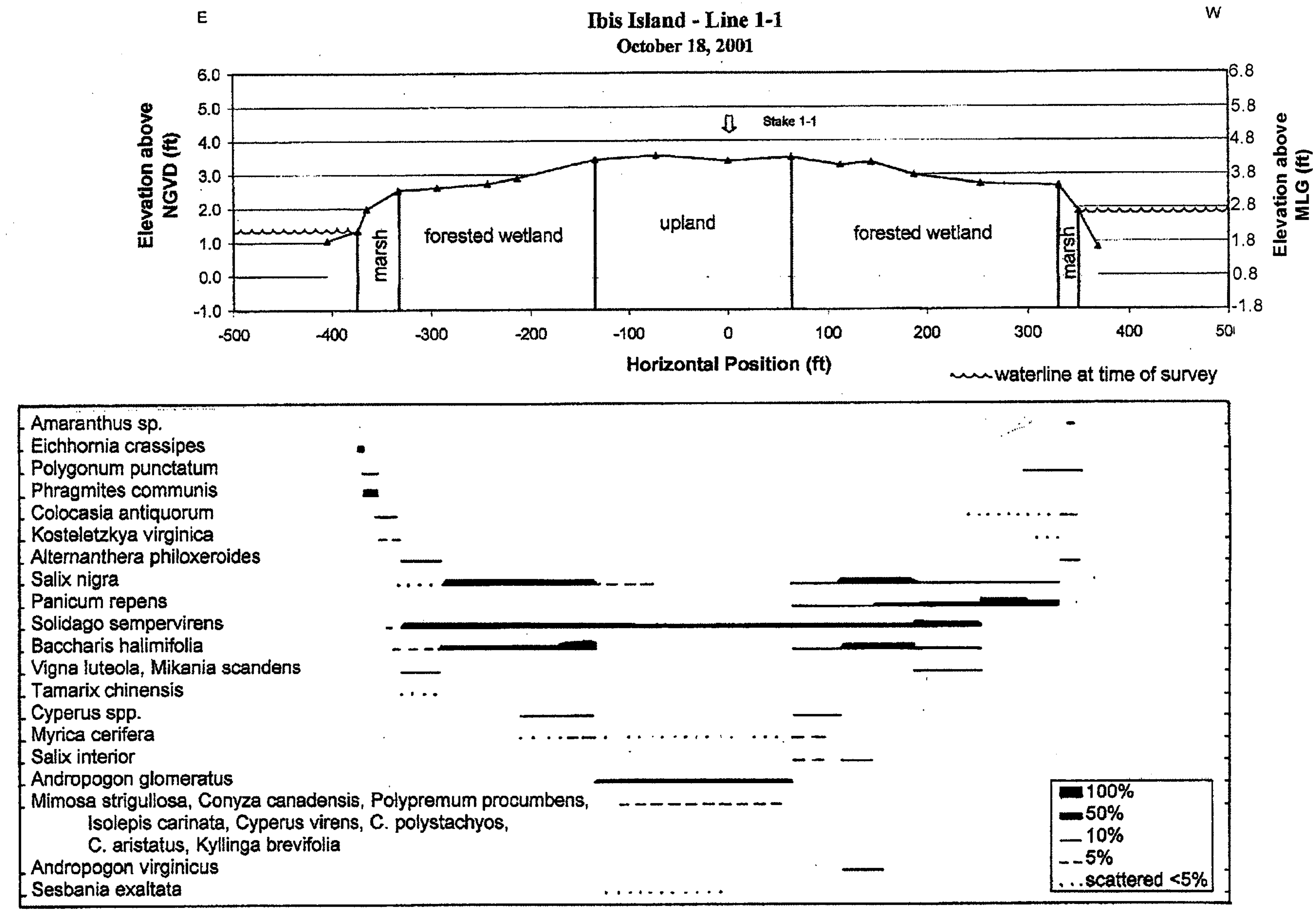


Figure 38. Elevation profile 1-1 at the southern end of Ibis Island at the Lower Atchafalaya River Bay and Bar BUMP study area with vegetation data illustrated.

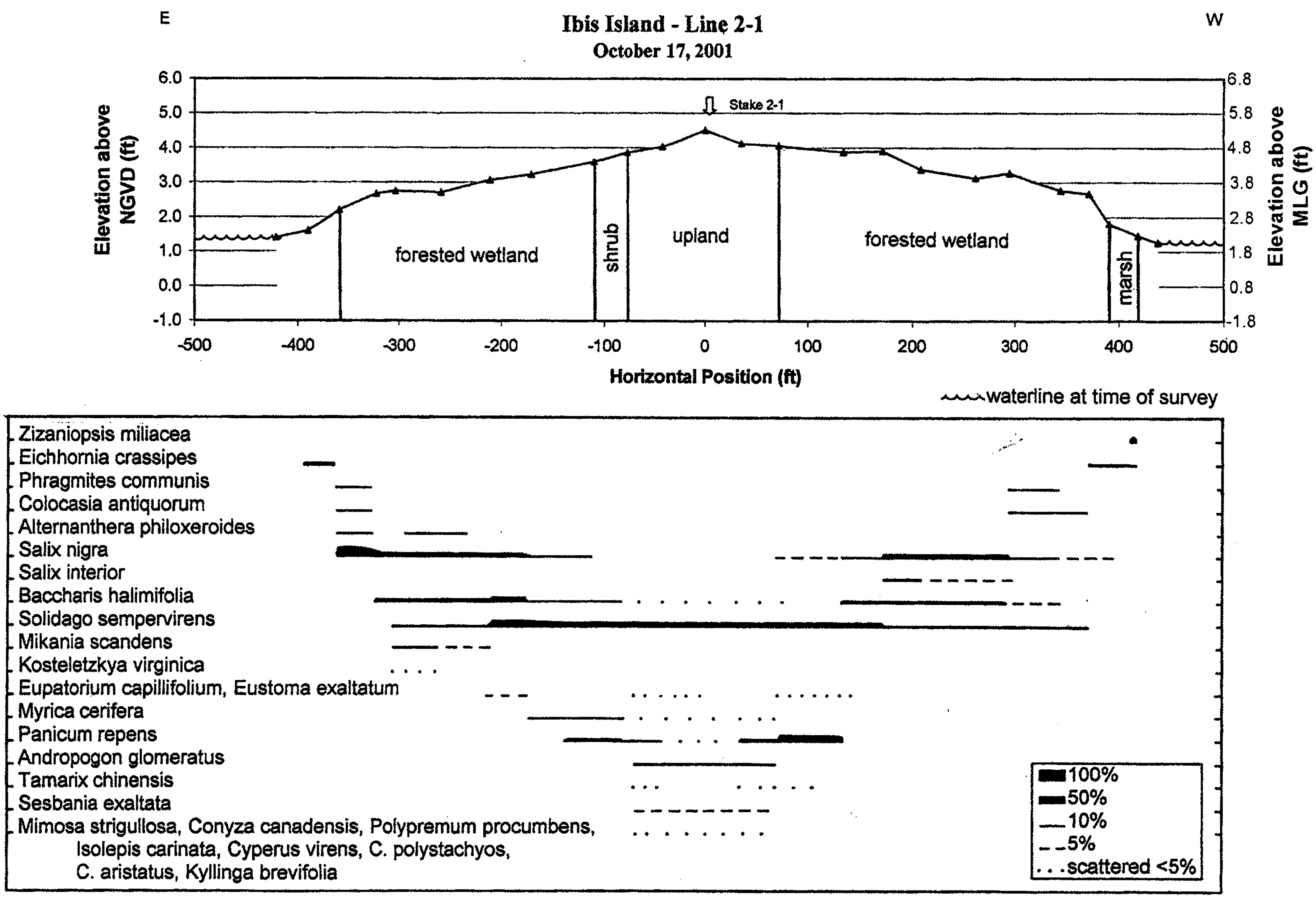


Figure 39. Elevation profile 2-1 across the central section of Ibis Island at the Lower Atchafalaya River Bay and Bar BUMP study area, with vegetation data illustrated.

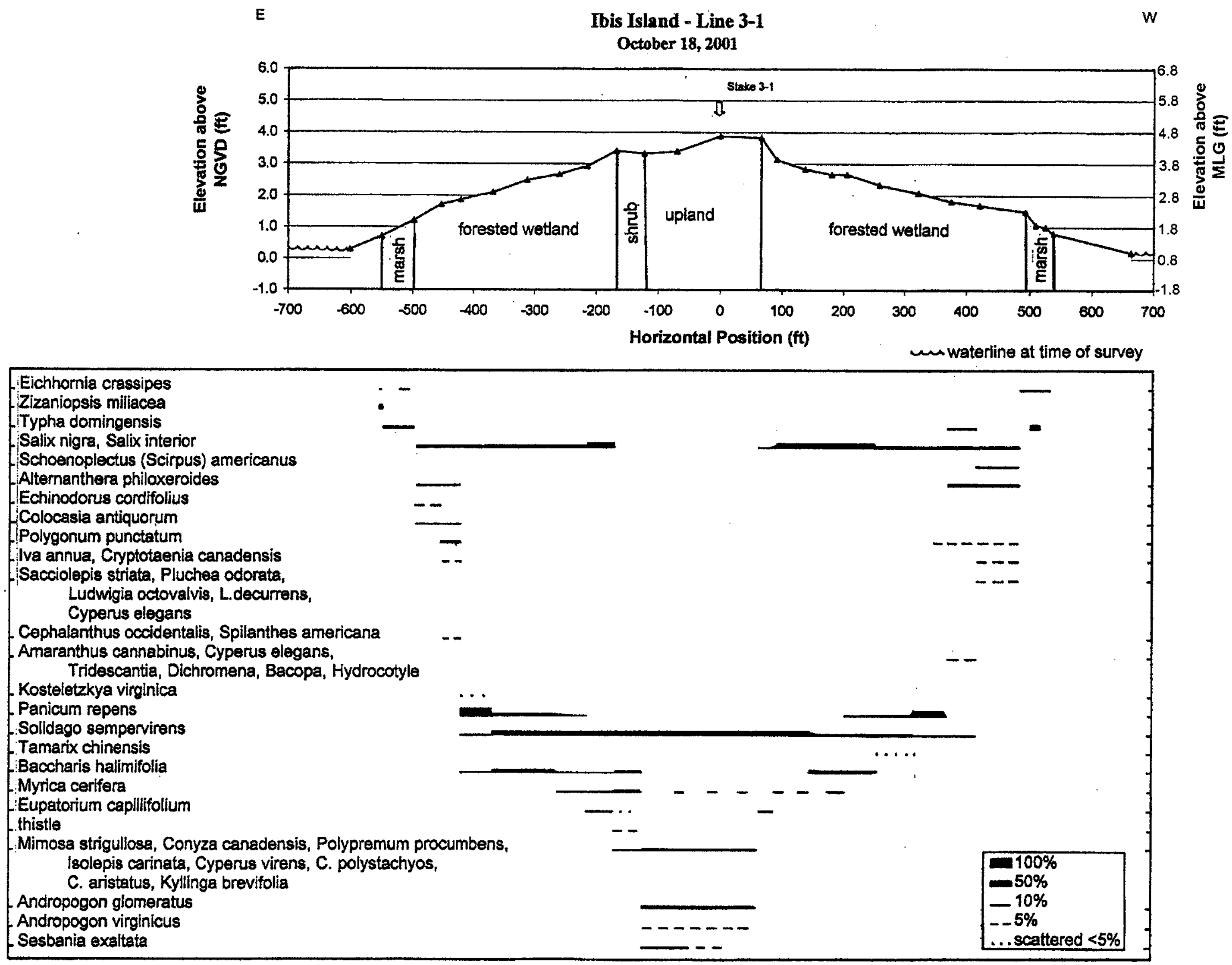


Figure 40. Elevation profile 3-1 on the section of Ibis Island closest to East Pass at the Lower Atchafalaya River Bay and Bar BUMP study area, with vegetation data illustrated.

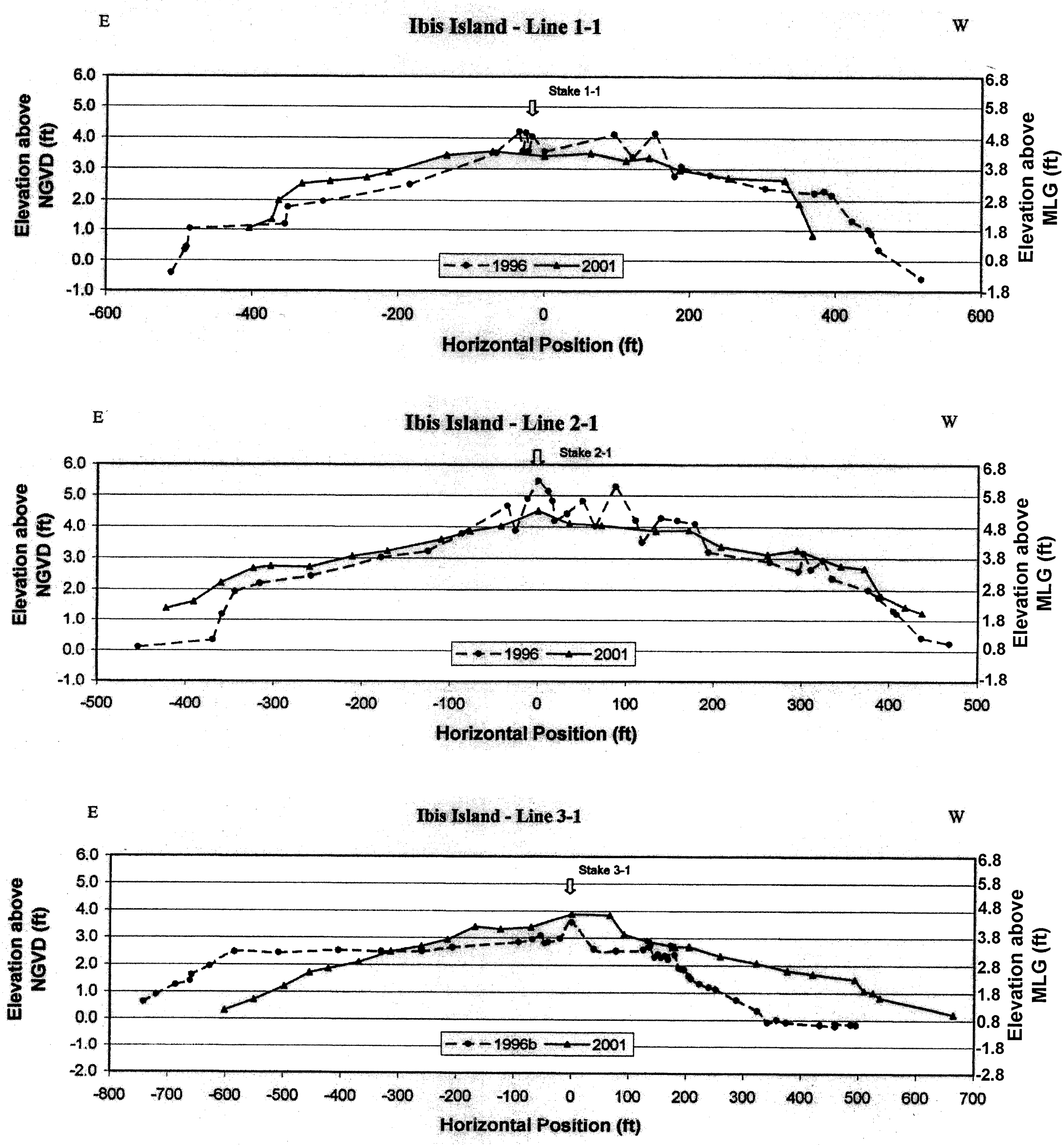


Figure 41. A comparison of 1996 and 2001 elevation data at Ibis Island in the Atchafalaya River delta. A) Profile at stake 1-1. B) Profile at stake 2-1. C) Profile at stake 3-1.

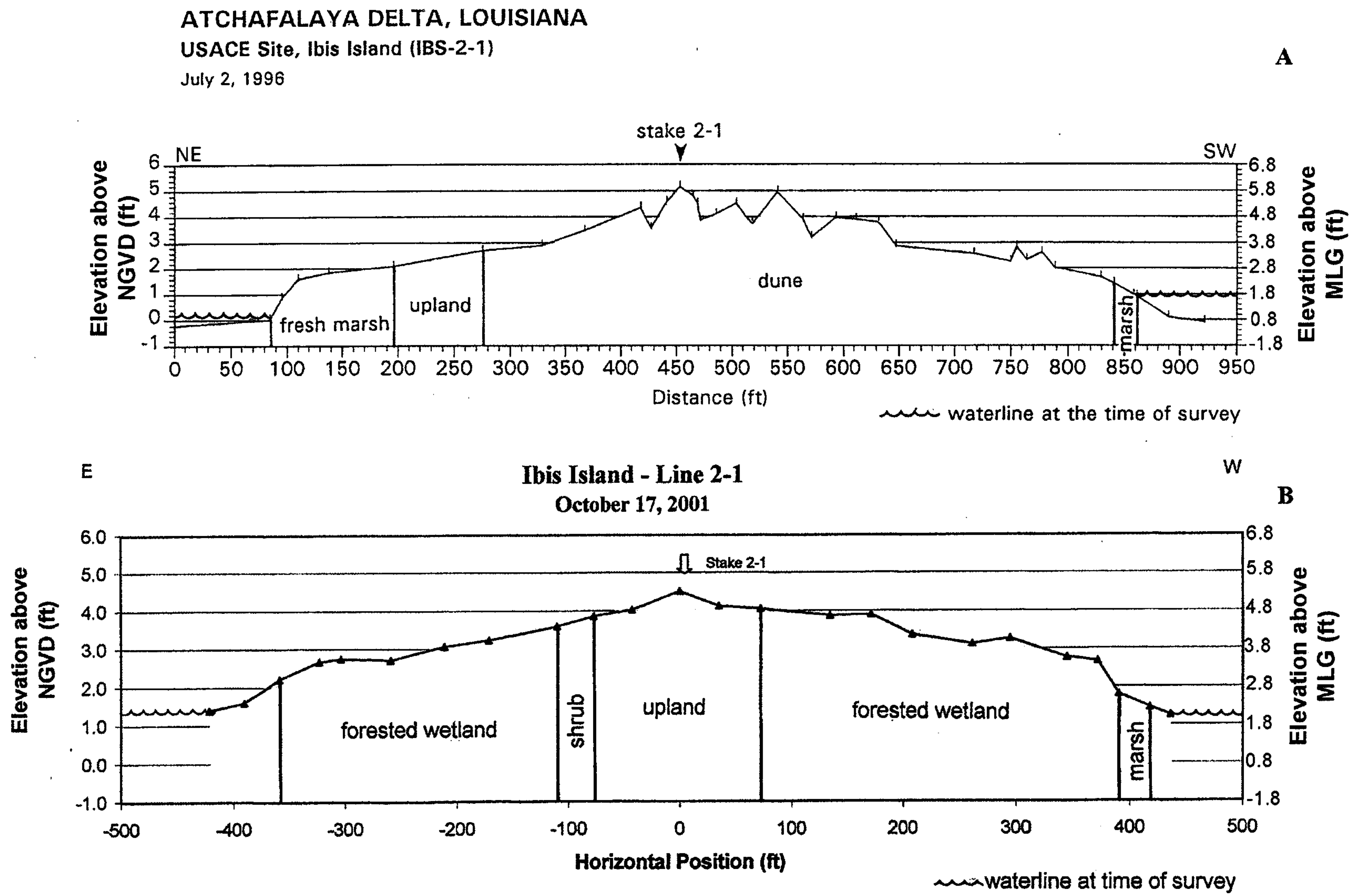
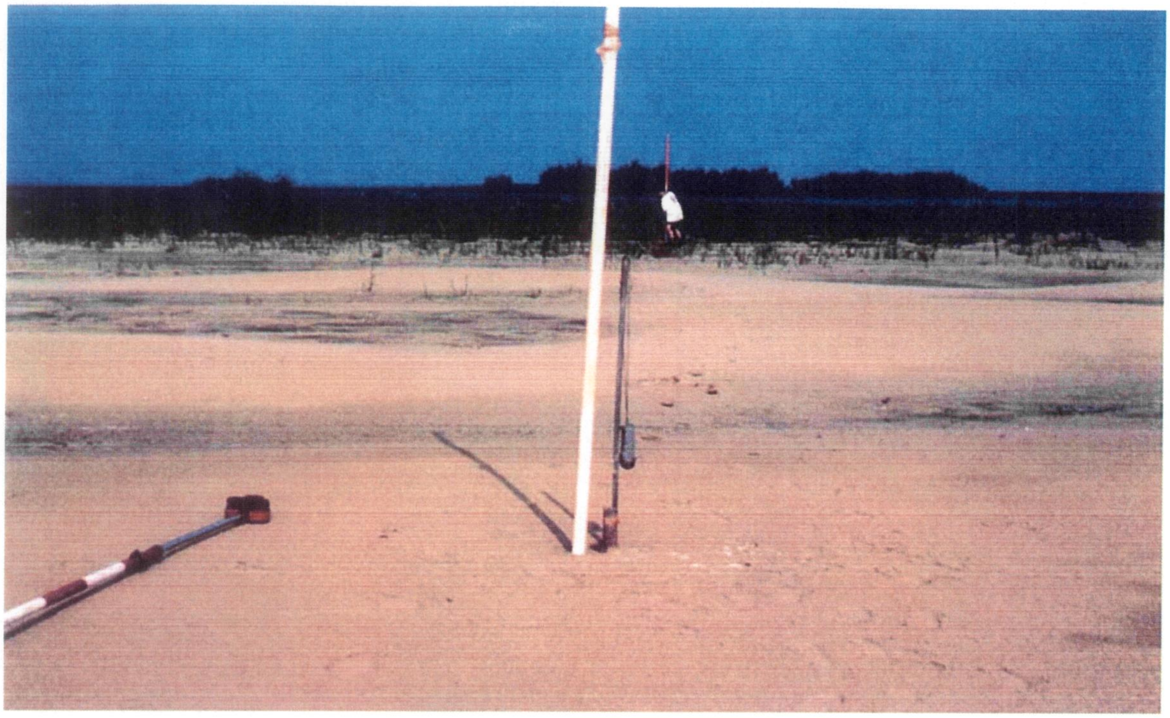


Figure 42. Elevation profile 2-1 from Ibis Island at the Lower Atchafalaya River Bay and Bar BUMP study area showing habitat distribution changes. A) 1996 data. B) 2001 data.

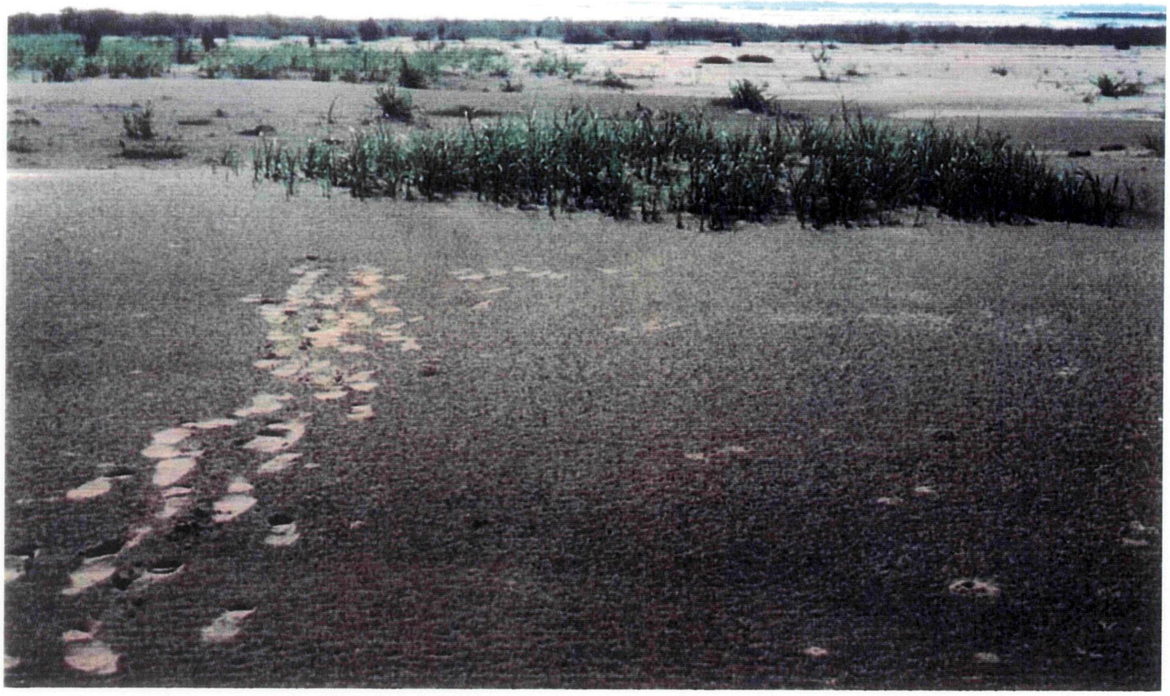
Figure 43. Photograph taken July 1, 1996 at Ibis Island looking to the north along the axis of the island from stake 3-1 to 3-3, showing the extensive, unvegetated sand flat that dominated the landscape.



A

B

Figure 44. Photographs along profile 3-1 from Ibis Island in the Atchafalaya River delta showing the vast difference 5 years can make in plant succession. A) July 1, 1996 B) October 18, 2001. The view is to the east.



A

B

Figure 45. Photographs along profile 3-1 from Ibis Island in the Atchafalaya River delta showing the vast difference 5 years can make in plant succession. A) July 1, 1996 B) October 18, 2001. The view is to the west.

Long Island

Long Island is located along the southeast-central side of the Atchafalaya River delta, at the juncture of East Pass with God's Pass (Figures 5 & 46). The channel end was established by placement of dredged material on a natural subaerial levee to +5 feet MLG (+4.2 feet NGVD) during 1990 in an effort to direct sediment laden water through existing natural channels. During 1991, material was placed behind Long Island along Ratcliffe Pass to a height of +2.8 feet MLG (+2.0 feet NGVD) to begin the formation of an "artificial delta lobe." The lobe was then extended southward in 1997, 1998 and again in 2000 (Figures 4A & 4B).

In 2001, four new topographic profiles were constructed from the data collected in reference to the tide gage for Eugene Island, Louisiana. Figure 47 shows the study site on the infrared photography and illustrates the arrangement of profile transects. Figure 48 shows the unvegetated nature of the southeast section of the island. Access was by small boat and pirogue. One transect (3-1) was placed across a vegetated part of the island created in 1998, two were placed across the mostly unvegetated part created in 2000, and a strike profile 0 connected the three.

The cross-island profiles ranged in lateral length from 1011 to 1840feet. The habitats and dominant vegetative species are indicated on the profiles referenced to the elevation. Profile 1-0 (A-A') across the southern portion of Long Island had a lateral length of 1840feet, and a maximum elevation of 3.8feet NGVD (4.5feet MLG), with an average elevation of 2.1feet NGVD (2.9feet MLG) (Figure 49). Profile 2-0 (B-B') across the more recent portion of the island near the vegetated part had a lateral length of 1664feet, and a maximum elevation of 3.2feet NGVD (4.0feet MLG), with an average elevation of 2.3feet NGVD (3.1feet MLG) (Figure 50). Profile 3-0 (C-C') across the more vegetated, older part of the island had a lateral length of 1011feet and a maximum elevation of 3.9feet NGVD (4.7feet MLG), with an average elevation of 2.7feet NGVD (3.4feet MLG) (Figure 51). The strike profile 0 connected all stakes and gave an overall profile of the axis of the island. Profile 0 had a lateral length of 7739feet, and a maximum elevation of 7.1feet NGVD on the top of a ridge adjacent to a cut south of stake 1-0 (Figure 52). This is the initial survey for this site so there is no comparison data.

The end of the island was created approximately one year before the initial elevation/vegetation survey in 2001, and the habitats were very similar to those found on Ibis Island one year after creation. Vegetation colonization was under way along the waterline at that time, but half of the island was basically bare with extensive sand flats and incipient, aeolian dunes. The landscape of the newer part was dominated by sparse grassland with composites, and fresh marsh. The older part found near transect 3-0 was dominated by fresh marsh, shrubs, and goldenrod/broomsedge meadows. Views of the landscape surrounding the profiles are shown in figures 53-54.

Figure 46. Oblique aerial photograph of Long Island taken June 2001. View is to the south east from God's Pass. (Courtesy of the LSU Aerial Videotape Survey Program).

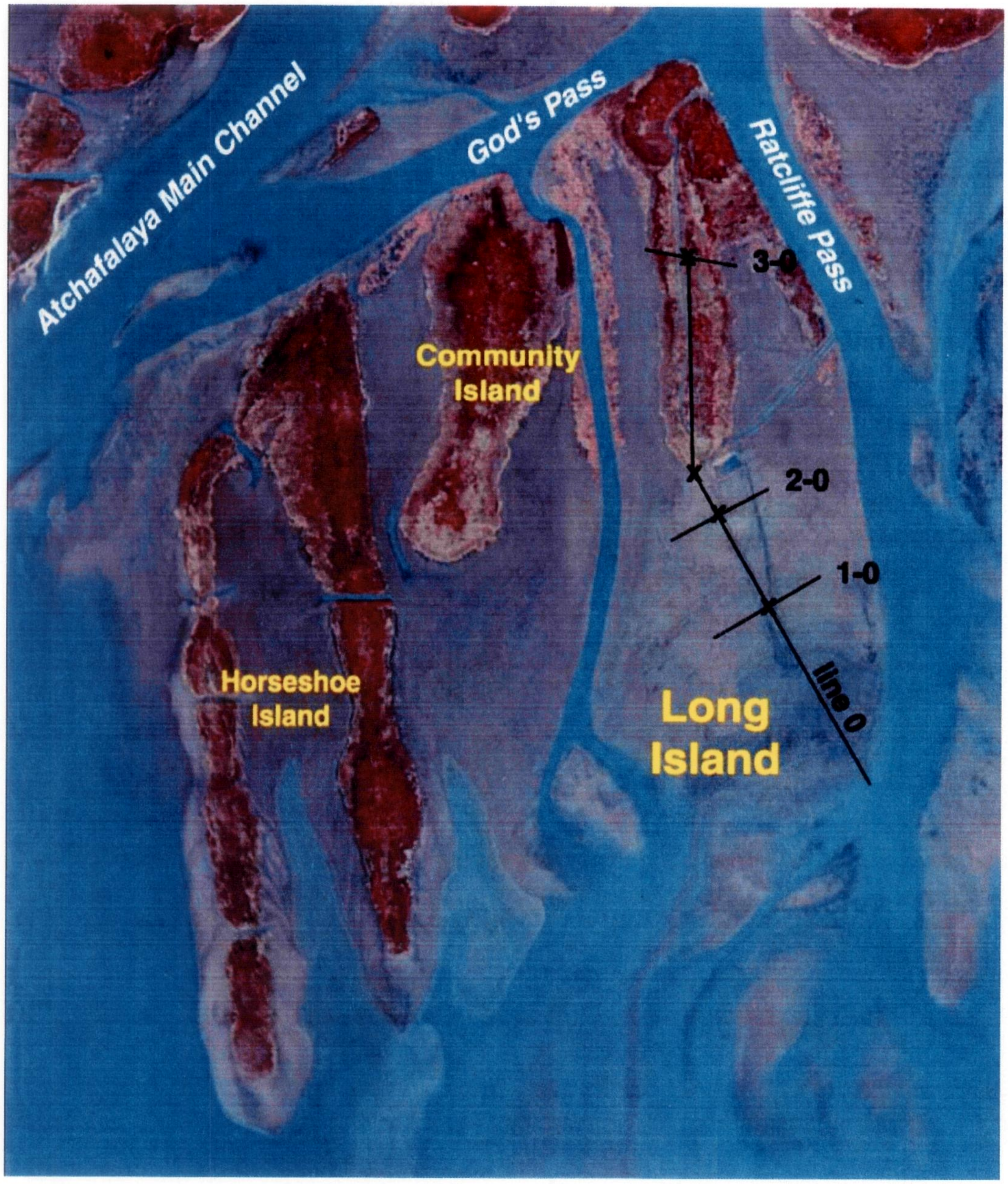


Figure 47. Infrared, vertical aerial photography taken on January 4, 2001 of the Long Island area at the Lower Atchafalaya River Bay and Bar BUMP study site showing the approximate location of the transects established in 2001.

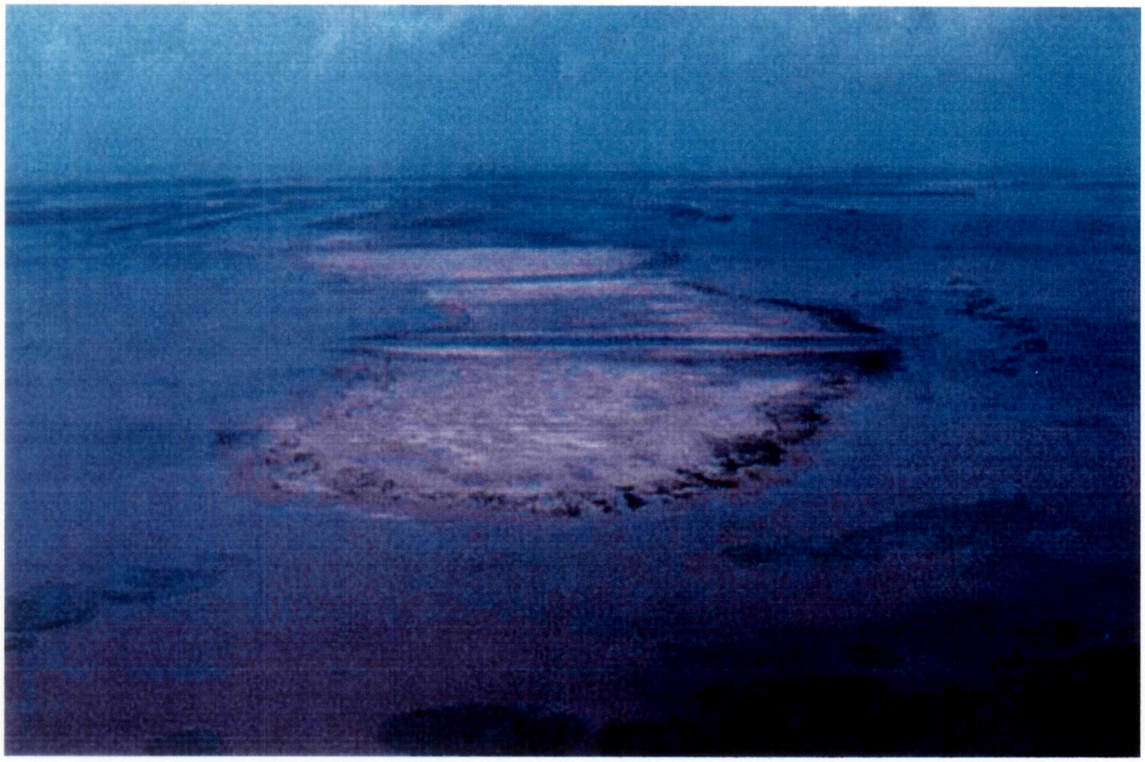


Figure 48. Oblique aerial photograph taken in June 2001 of Long Island showing the newly created bare land with multiple cross channels. View is to the north along the axis of the island. (Photo courtesy of the LSU Aerial Videotape Survey Program).

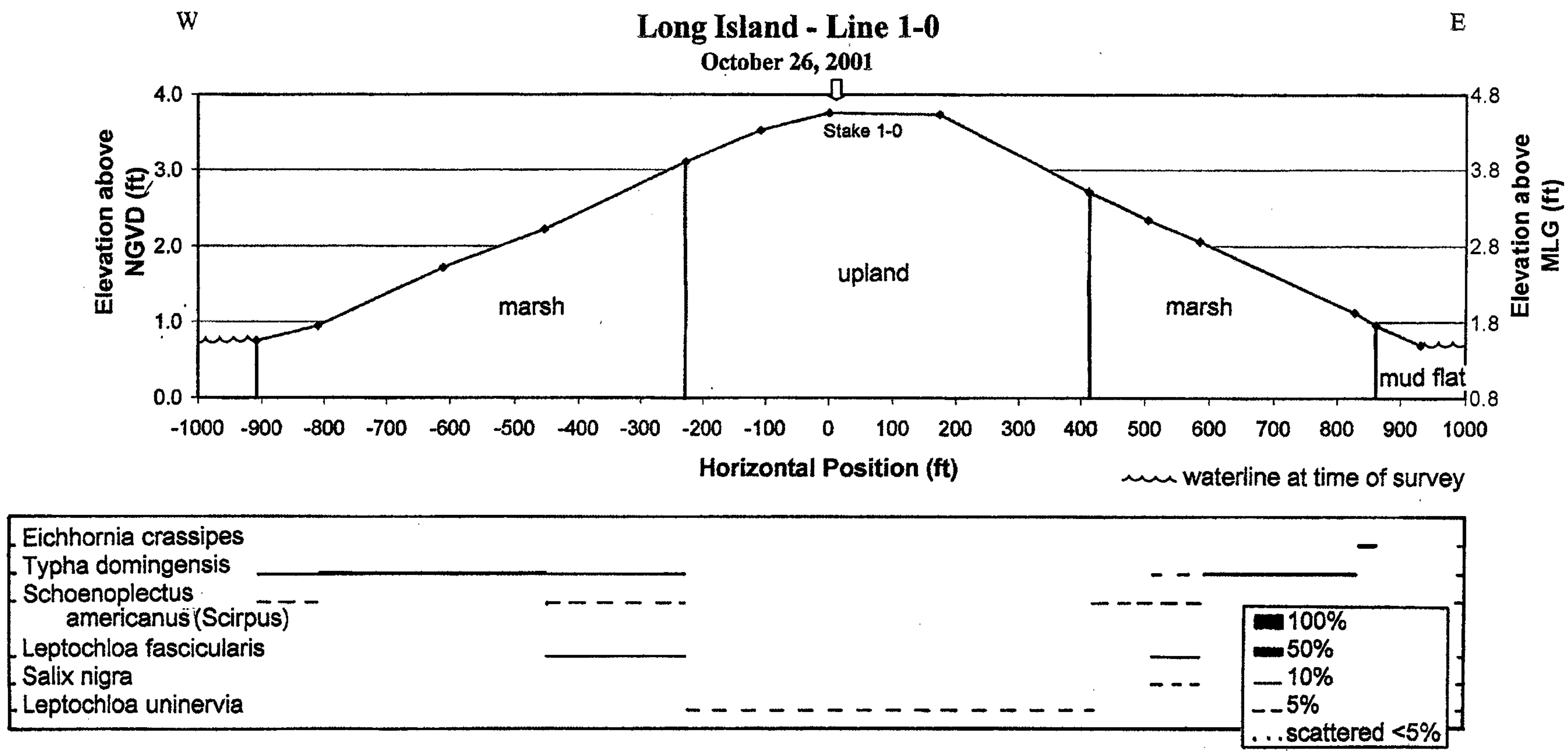


Figure 49. Elevation profile 1-0 on the southern end of Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated.

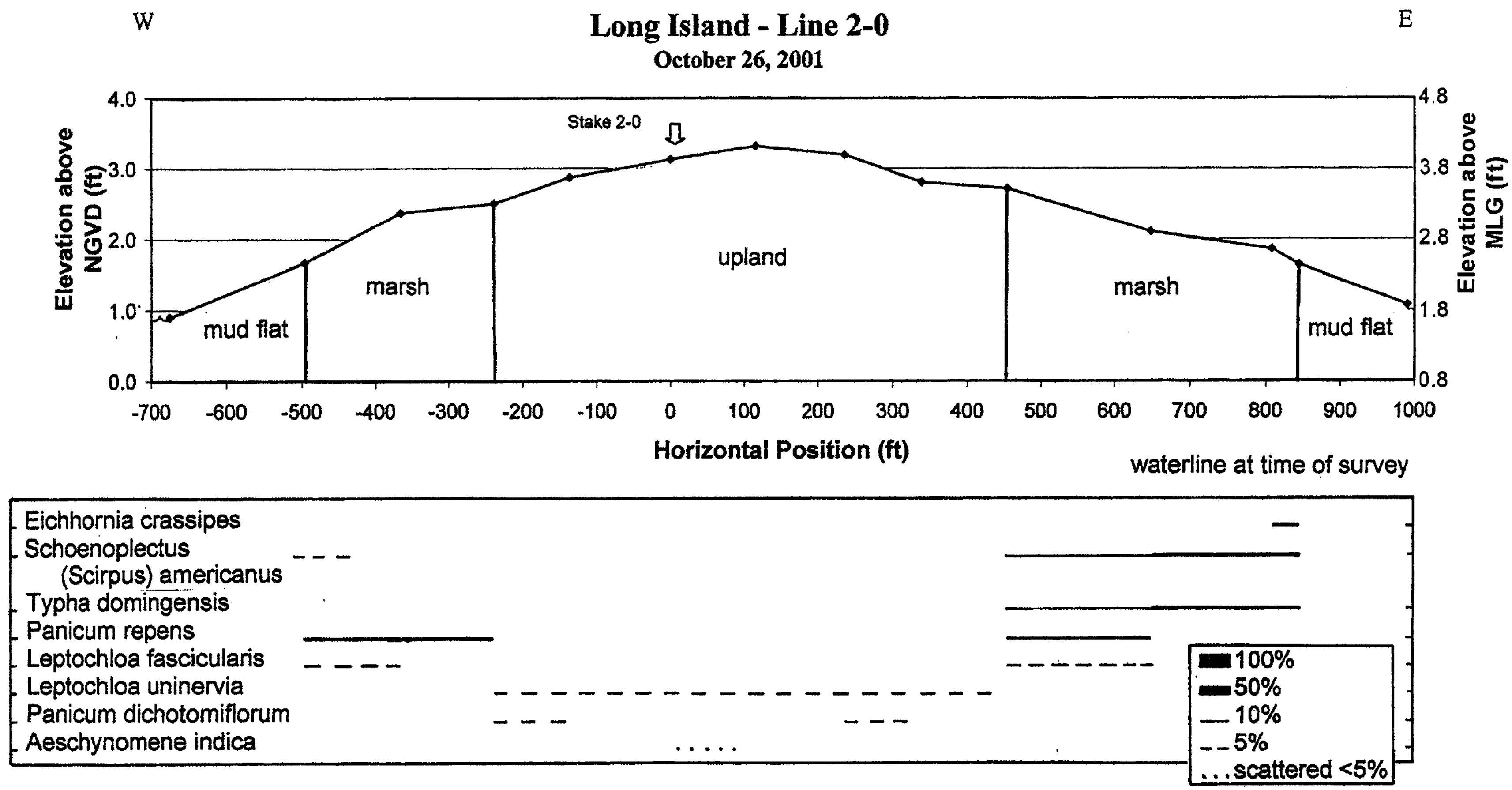


Figure 50. Elevation profile 2-0 on Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated.

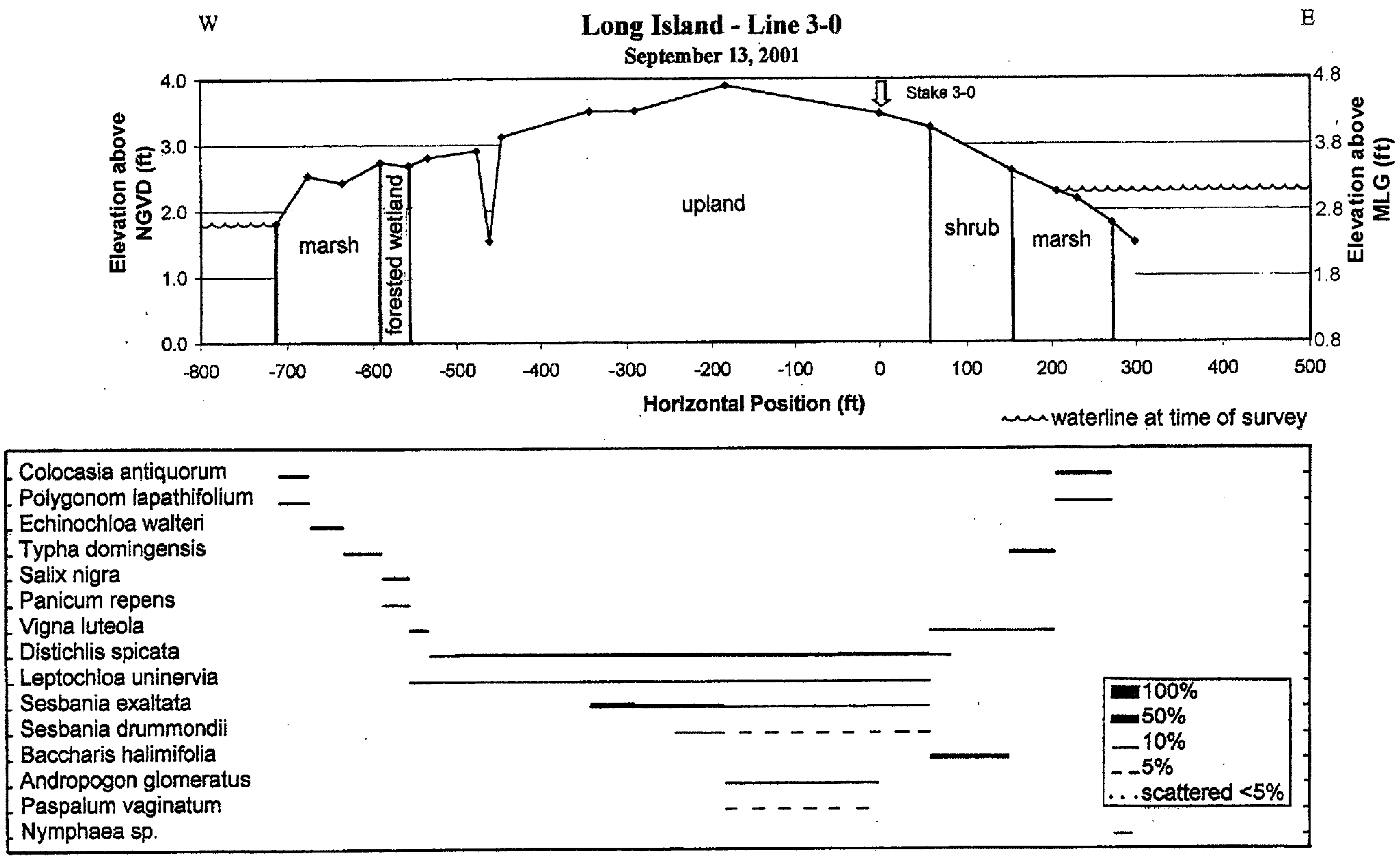


Figure 51. Elevation profile 3-0 on the northern portion of Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated.

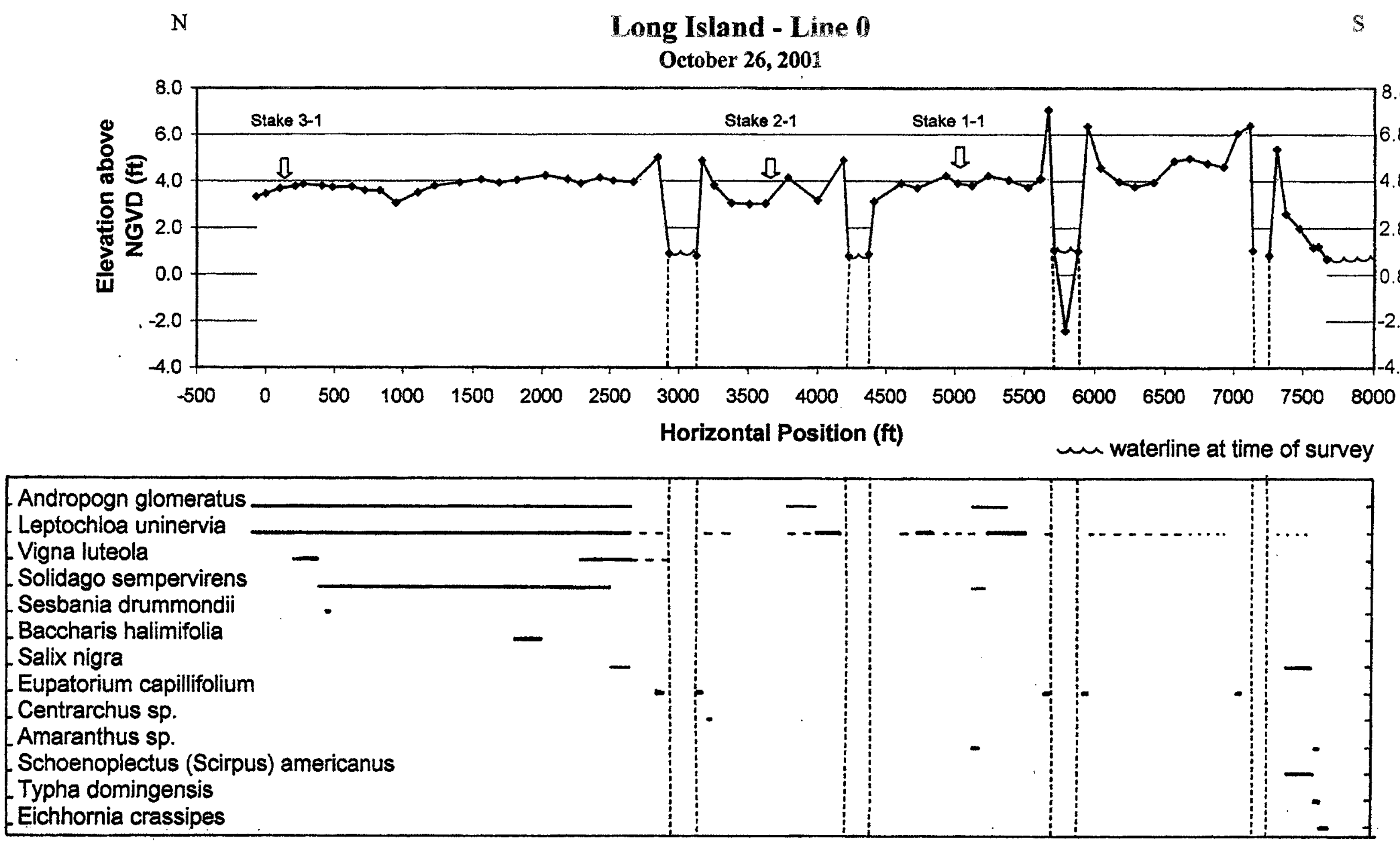
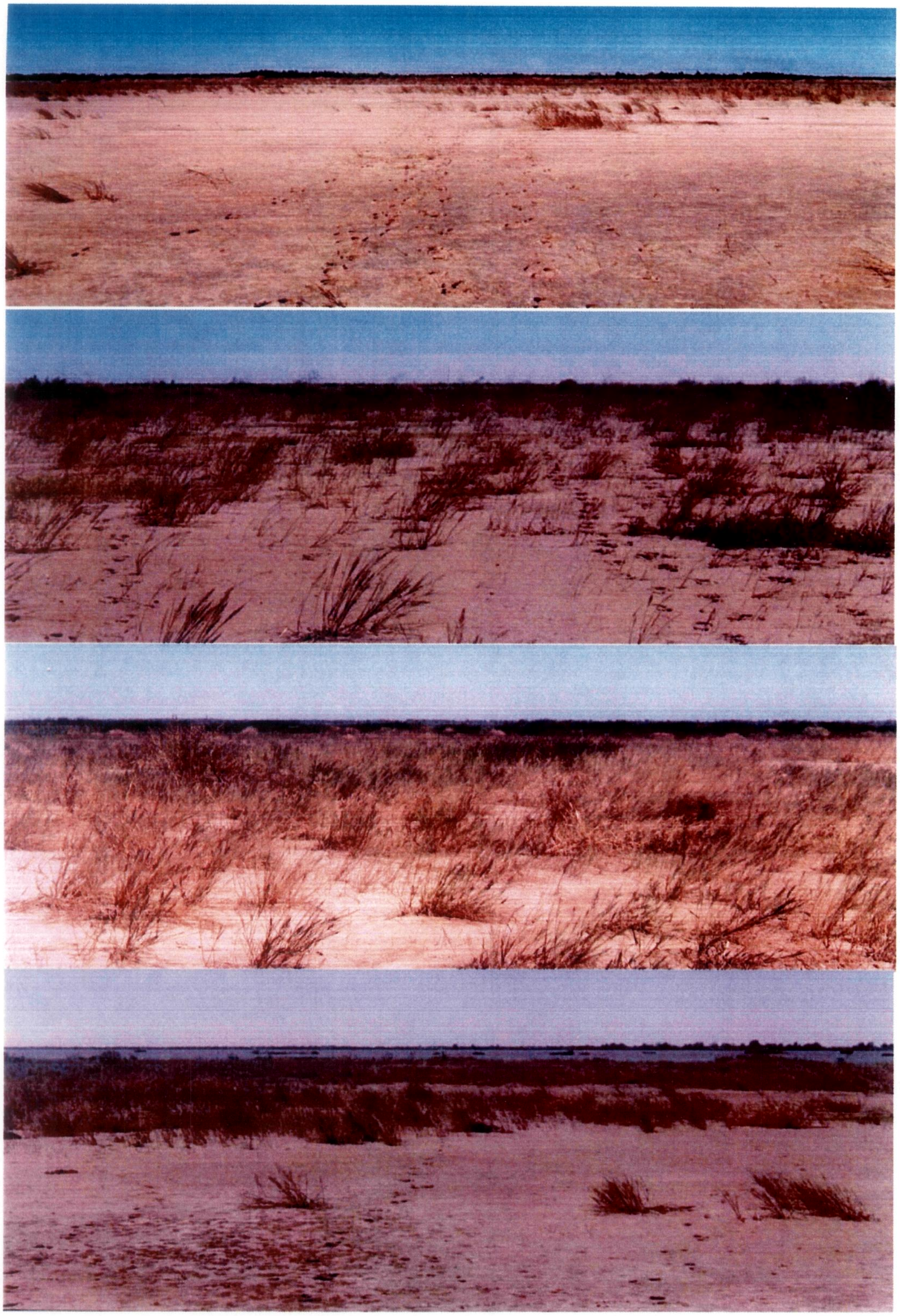


Figure 52. Elevation "strike" profile 0 connecting the stakes along the axis of Long Island at the Lower Atchafalaya River Bay and Bar BUMP study site with vegetation data illustrated.



A)

B)

C)

D)

Figure 53. Photographs taken October 26, 2001 along transect 2-0 at Long Island - Lower Atchafalaya River Bay and Bar BUMP study, showing the sparsely vegetated nature of the newly created landscape. A) North, B) South, C) East, and D) West.

A)

B)

C)

D)

Figure 54. Photograph taken October 26, 2001 along transect 3-0 at Long Island - Lower Atchafalaya River Bay and Bar BUMP study, showing the character of the new habitats that dominate the landscape.

Vegetative Character

General Description

The delta within the Atchafalaya River Bay and Bar supports a freshwater dependant vegetation system. This is predominately fresh marsh, batture communities dominated by black willow, and upland/grassland habitats. The delta area is exposed to the daily tides as well as to elevated water levels during high river conditions. Source material for colonization is predominantly from the extensive Atchafalaya River swamp system that lies upstream from the dredged material disposal sites. Longshore drift or aeolian transport of some vegetative material could be expected from other nearby areas.

Each plant species has a habitat preference, and when taken as a community, the type of vegetation present is an indication of habitat type. Major changes in plant communities delineate boundaries between habitats. The study sites in 2001 exhibited four basic zones of plant communities, indicating the predominant moisture regime. A central, elevated, drier grassland/meadow flanked by shrubs, then an extensive willow swamp thicket outlined by a fresh marsh fringe was the common arrangement of habitats. There was extensive overlap of plant communities across these zones.

Vegetative Community Types in the Atchafalaya Delta

Most of the plants observed within the study sites are of riparian or wetland habits (See specific species habitat descriptions in the Appendix). Other species are listed as occupying "disturbed" or "waste" places and are species that take advantage of newly created or exposed ground with rapid growth and can withstand some inundation by fresh water. Opportunistic species will occupy a new area quickly, but will eventually be replaced by plants most suited for long term survival in a specific habitat.

Marsh species within the study sites at occurred most commonly at an elevation below 2feet NGVD. The fresh marsh was represented by cattail (*Typha* spp), alligator weed *(Alternanthera philoxeroides*) and elephant ears (*Colocasia antiquorum*) most often, with occasional stands of wild rice (Zizania aquatica), or bulltongue (*Sagittaria* spp.). Water hyacinth (*Eichhornia crassipes)* was found along the shore, rafted against the windward side and stranded thickly by a previous high water. High marsh or marsh-margin species *Scirpus* spp., *Cyperus* sp., *Ranunculus sceleratus*, *Polygonum* spp., *Rorippa palustris*, and *Senecio glabellus*, were also locally abundant, though inland of the lower marsh. The low relief of the study sites allowed a complex mixing of various species types.

"Forested Wetland" indicated by willow trees (*Salix nigra* and *Salix interior*) seemed to dominate the landscape throughout the study area, making thickets with other shrubs, scattered in many areas of the marsh, along low energy beaches, or even within the grasslands. Fresh marsh formed the understory at the lower extent, and shrubs and grasses occured at the upper extent. The willow "forested wetland" zone occurred most commonly at an elevation between 2 and 3.5feet NGVD, $\pm$ 0.5feet (2.8 and 4.3feet MLG).

Shrub communities usually indicate older, more stable, elevated area. In the Atchafalaya area, this community overlaps greatly with the willow "forested wetland" zone, and the species present must be able to withstand periods of inundation. Young willows below 15feet tall are also considered "shrubs". *Baccharis halimifolia* occurred throughout the profile, but it attained its most dense presence usually between 2.5 and 4.0feet NGVD (3.3 and 4.8feet MLG) of elevation. Wax myrtle (*Myrica cerifera*) seemed to prefer less soil moisture and occurred along the more elevated parts of the shrub zone, above 3.5feet, and scattered across the grassland areas. The understory toward lower elevations held bulltongue (*Sagittaria* sp), butterweed (*Senecio glabellus)*, dog-tooth grass (*Panicum repens*), and goldenrod (*Solidago sempervirens*), and the upper elevations held goldenrod, broomsedge *(Andropogon glomeratus*), thoroughwort (*Eupatorium capillifollium*), and other grasses.

"Upland" areas along the profiles within the study sites were represented by grasslands/meadows, predominantly goldenrod (*Solidago sempervirens*) and broomsedges (*Andropogon glomeratus* and *A.virginicus*), sometimes completely covered by vines (*Vigna luteola* or *Mikania scandens*). The elevation of these areas varied, occurring in the central areas even when the maximum elevation never attained more than 3feet NGVD (3.8feet MLG). Even though the dominant vegetation was considered marsh-margin, this area was designated "upland" because it supported some upland species and no wetland obligates. There was a complex understory of smaller species between the stalks of goldenrod and broomsedge, represented by *Mimosa strigosa*, several small Cyperus species, and several species which are not very common. Tall stands of the annual *Sesbania exaltata* were found in scattered groups. An occasional cottonwood tree (*Populus deltoides*) was discovered on the higher elevations of Ibis Island.

At Long Island, the newest site, grasses established quickly on well-drained, freshly deposited materials and formed grasslands that help to quickly stabilize the new material. This site was very similar to Ibis Island in 1996. *Leptochloa uninervia*, *Panicum repens*, and *Cynodon dactylon* tend to be the most common grass species, with *Cyperus elegans*, *Acnida tamariscina*, *Conyza bonariensis* as common herbaceous plants. Older deposits support additional species and the beginnings of shrub habitats with an understory of grasses.

Low wet areas within the upland areas of the study sites were colonized by *Bacopa monnieri*, *Polygonum lapathifolium*, and tiny *Eleocharis parvula*.

GIS ANALYSIS RESULTS

Shoreline Changes: 1985-January 2001

Figure 55 graphs the spatial history of the Atchafalaya delta between 1970 and January 2001. The area of the Atchafalaya delta in 1985 was measured at 1,339.3 acres. The area of the Atchafalaya delta in January 2001 was measured at 6,043.2 acres. This is an area increase of +4,703.9 acres or an increase in area of 351 percent. Figure 56 shows the shoreline change history of the Atchafalaya delta between 1985 and January 2001. Between 1972 and 1985, the rate of area gain was about 100 acres per year. Since the shift of dredged material placement to the east side of the navigation channel with concomitant changes in placement techniques, the rate of growth has accelerated to 314 acres per year between 1985 and January 2001.

The areas of greatest shoreline progradation are found east of the navigation channel. The shoreline has been pushed seaward up to 3 miles in some areas and an average of 2.5 miles. These measurements yield rates of shoreline progradation of 880feet per year. These high rates of shoreline progradation are found mainly in areas of dredged material placement. West of the navigation channel in natural deltaic areas, the rate of progradation is much less and averages 0.5 miles. This yields a progradation rate of about 300feet per year in areas of natural deltaic processes.

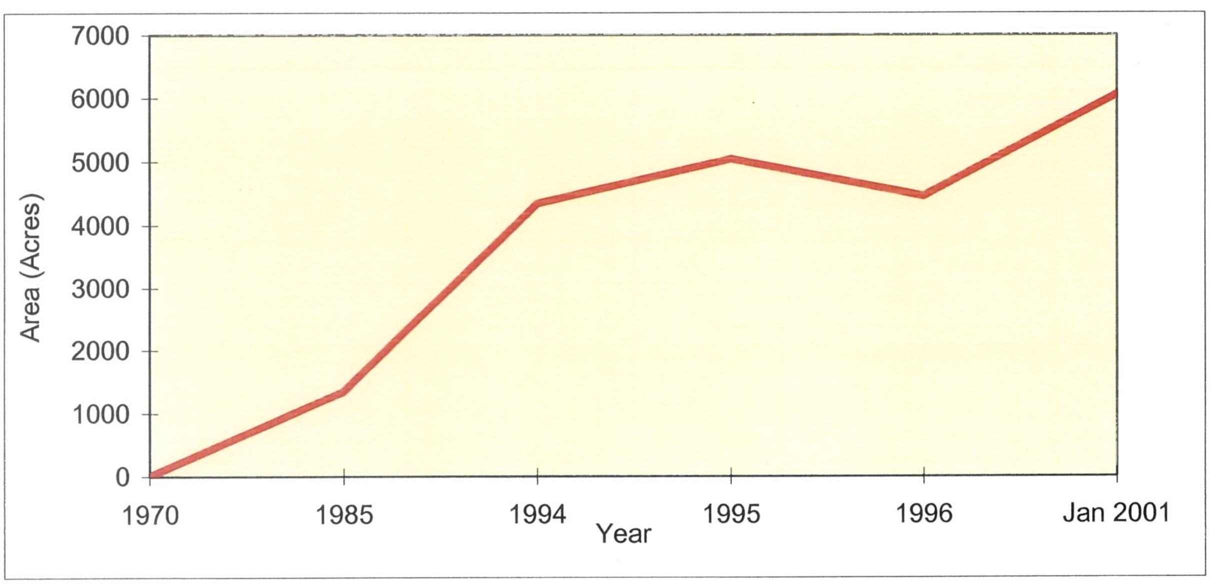


Figure 55. Graph of the area of the Atchafalaya delta over time.

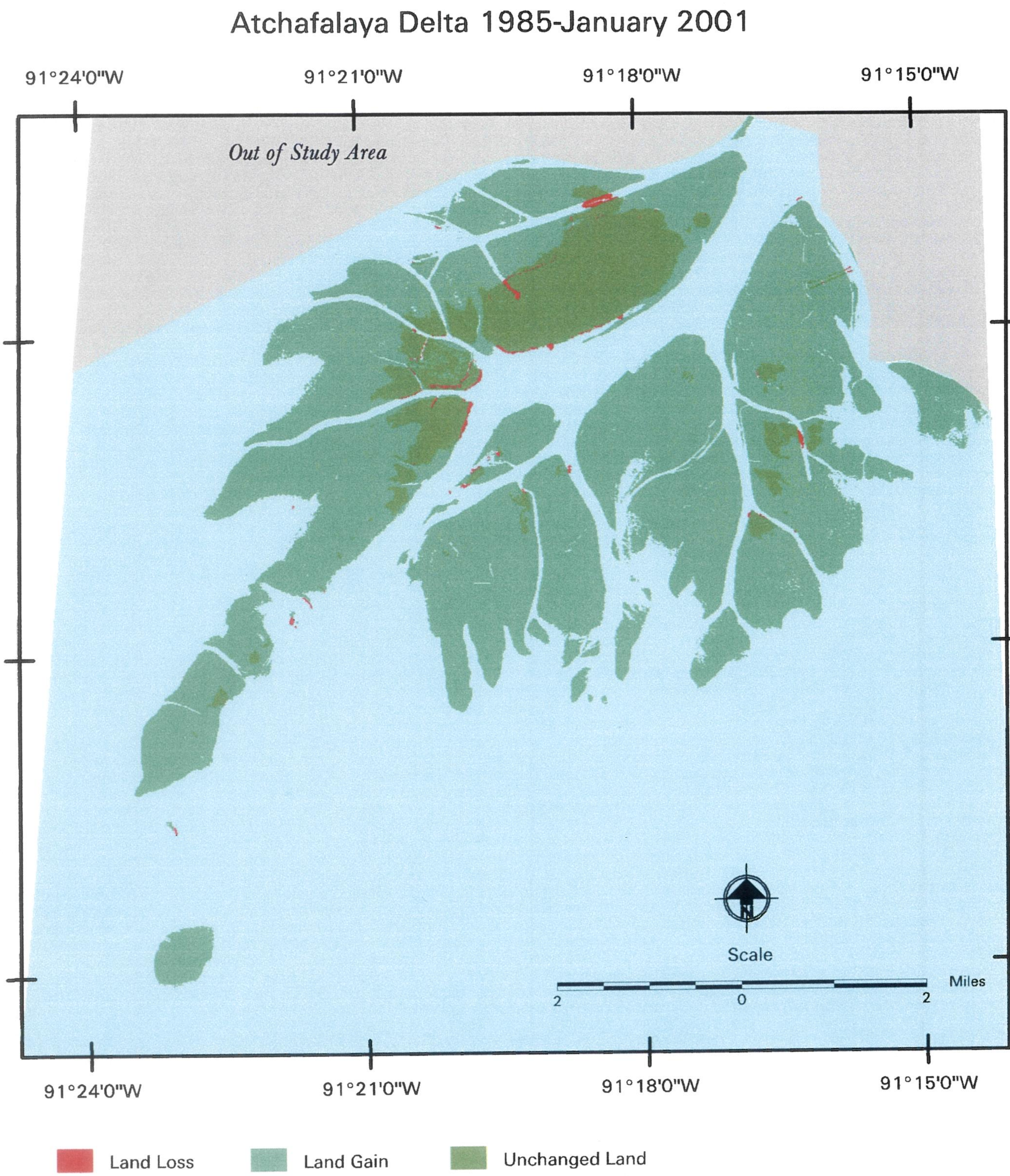


Figure 56 Land loss/Land gain map of the Atchafalaya River delta between December 1985 and January 2001.

Habitat Inventory

The aerial photographic interpretation combined with field surveys identified six major habitat types in the Atchafalaya delta. These habitats are further classified as natural, BUMP man-made and non-BUMP man-made. The natural class identifies habitats created by natural deltaic processes. The BUMP man-made class (BUMP-made) identifies the habitats created by placement of dredged material. The Non-BUMP man-made class (other-made) separates areas created that were not part of the BUMP effort, such as areas created in association with the oil industry access and pipeline canals. Areas created indirectly by the beneficial use of dredged materials being re-worked by natural processes are included as natural. 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 1 lists the areas of the four habitat types found in the Atchafalaya River delta in December 1985. The location and arrangement of these habitats are presented in figure 57. The total area of the Atchafalaya delta was 1,339.3 acres. Of this total, 231.9 acres were natural, 1,064.5 acres were BUMP-related, and 4.29 acres were other man-made. In terms of habitat totals, shrub/scrub (613.8 acres) and fresh marsh (549.7 acres) dominated the landscape. Under natural conditions, the normal deltaic processes create a greater percentage of fresh marsh than shrub/scrub. In contrast, under man-made conditions the dredged material disposal process created more shrub/scrub than fresh marsh.

Table 1. December 1985 Habitat Inventory of the Atchafalaya Delta

HABITAT	TOTAL	NATURAL	BUMP MAN-MADE	OTHER MAN-MADE
Marsh	549.7	174.9	363.8	11.0
Shrub/Scrub	613.8	56.7	535.8	21.3
Bare Land	150.8	--	140.2	10.6
Beach	25.0	0.3	24.7	--
Habitat Total	1,339.3	231.9	1,064.5	42.9

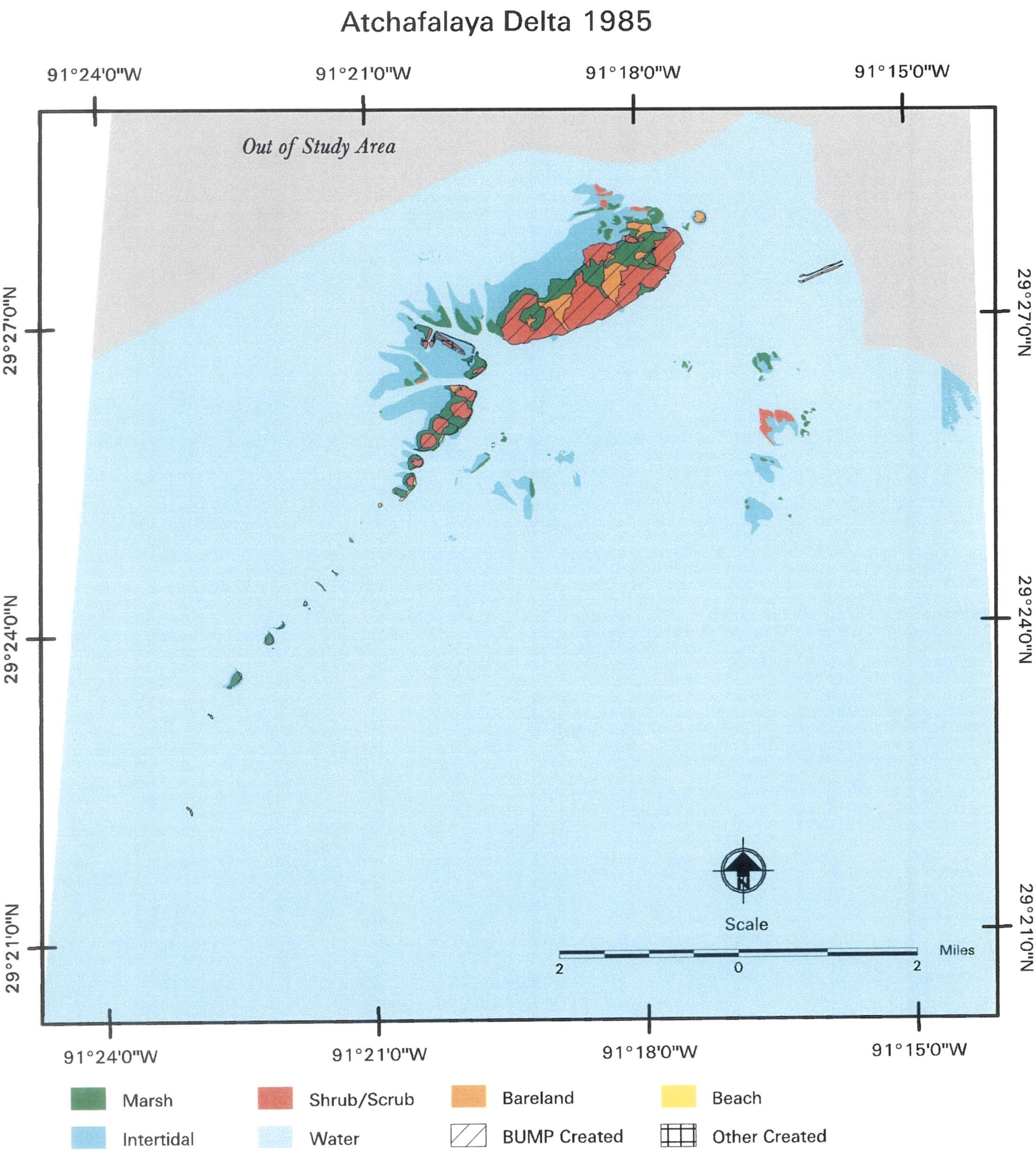


Figure 57 Habitat inventory map of the Atchafalaya River delta in December 1985.

Table 2 lists the areas of the seven habitats found in the Atchafalaya River delta in November 1996. The location and arrangement of these habitats is presented in figure 58. In 1996, the total area of the Atchafalaya delta was calculated at 4,445.0 acres. Of this total, 1,222.9 acres were natural, 3,035.7 acres were BUMP-made, and 186.4 acres were other man-made. In terms of total area, fresh marsh (1,864.4 acres), forested wetland (1,230.2 acres), shrub/scrub (711.9 acres), and bare land (247.5 acres) dominated the landscape of the Atchafalaya delta. These areas were designed not to directly create marsh, but to direct sediment-laden water through existing natural channels to augment the natural delta-building process. Under natural conditions, the normal deltaic processes tend to create a greater percentage of fresh marsh than shrub/scrub.

Table 2. November 1996 Habitat Inventory of the Atchafalaya Delta

HABITAT	TOTAL	NATURAL	BUMP MAN-MADE	OTHER MAN-MADE
Marsh	1,864.4	1,120.0	671.8	72.6
Upland	330.8	--	317.8	13.0
Shrub/Scrub	711.9	18.0	689.5	4.4
Wetland Forest	1,230.2	81.4	1,052.7	96.1
Bare Land	247.5	3.5	243.7	0.3
Dune	39.5	--	39.5	--
Beach	20.7	--	20.7	--
Habitat Total	4,445.0	1,222.9	3,035.7	186.4

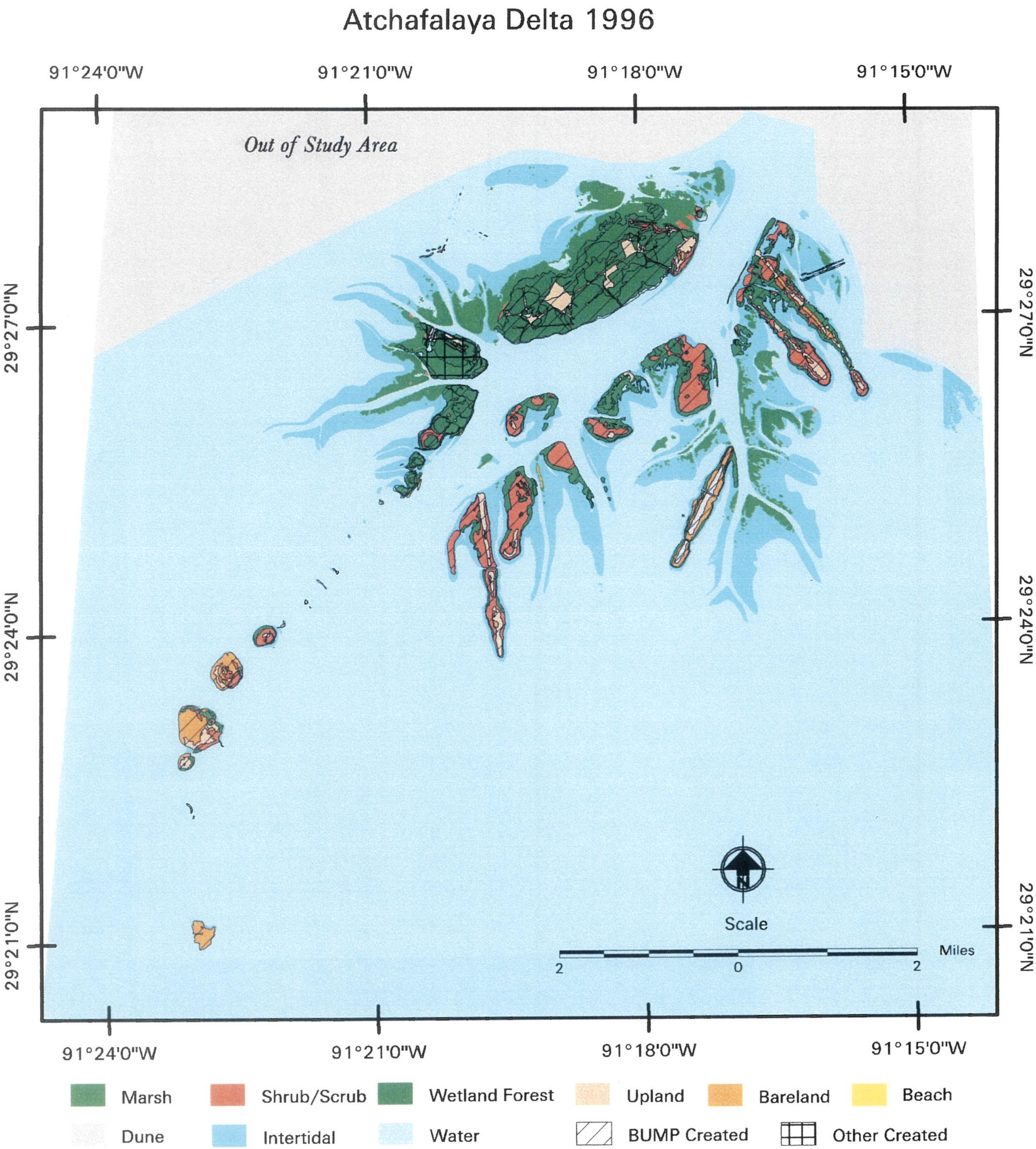


Figure 58 Habitat inventory map of the Atchafalaya River delta in November 1996.

Table 3 lists the areas of the six habitats found in the Atchafalaya River delta in January 2001. The location and arrangement of these habitats is presented in figure 59. In 2001, the total area of the Atchafalaya delta was calculated at 6,043.2 acres. Of this total, 1,995.2 acres were natural, 3,860.5 acres were BUMP-made, and 187.5 acres were other man-made. In terms of total area, fresh marsh (2,813.1 acres) and forested wetland (2,065.0 acres), shrub/scrub (632.1 acres), and bare land (395.5 acres) dominated the landscape of the Atchafalaya delta. These areas were designed not to directly create marsh, but to direct sediment-laden water through existing natural channels to augment the natural delta-building process. Under natural conditions, the normal deltaic processes tend to create a greater percentage of fresh marsh than shrub/scrub.

Table 3. January 2001 Habitat Inventory of the Atchafalaya Delta

HABITAT	TOTAL	NATURAL	BUMP MAN-MADE	OTHER MAN-MADE
Marsh	2,813.1	1,423.9	1,319.3	69.9
Upland	124.3	1.9	119.6	2.8
Shrub/Scrub	632.1	14.9	617.2	0.0
Wetland Forest	2,065.0	422.2	1,528.6	114.2
Bare Land	395.5	131.5	263.4	0.6
Beach	13.3	0.8	12.4	0.0
Habitat Total	6,043.2	1,995.2	3,860.5	187.5

Habitat Change

Figure 60 shows the creation of new habitat, both natural and man-made, in the Atchafalaya delta by comparing December 1985 and January 2001. The total area increased by +4,703.9 acres which represents a 351 percent increase in area between 1985 and 2001. Of this increase in area, 1,763.3 acres were natural and 2,796.0 acres were BUMP-made by the placement of dredged material. Table 4 lists the major habitat changes. The major habitat-increase by natural processes was the increase in natural marsh (+1,423.9 acres). Large increases occurring in the BUMP-made habitats include forested wetland (+1,528.6 acres), marsh (+955.5 acres), upland (+119.6 acres), and shrub/scrub (+81.4 acres). Figure 61 shows a time series of habitat changes in the Atchafalaya delta. In terms of dredged material placement, the greatest areas of new habitat creation include BUMP-made forested wetland (+1,528.6 acres), and BUMP-made marsh (+955.5 acres). Figure 61A graphs the natural habitat changes over time. Natural marsh development dominates the natural habitat class. Figure 61B graphs the BUMP-made habitat changes over time. Forested wetland and fresh marsh dominate the man-made class.

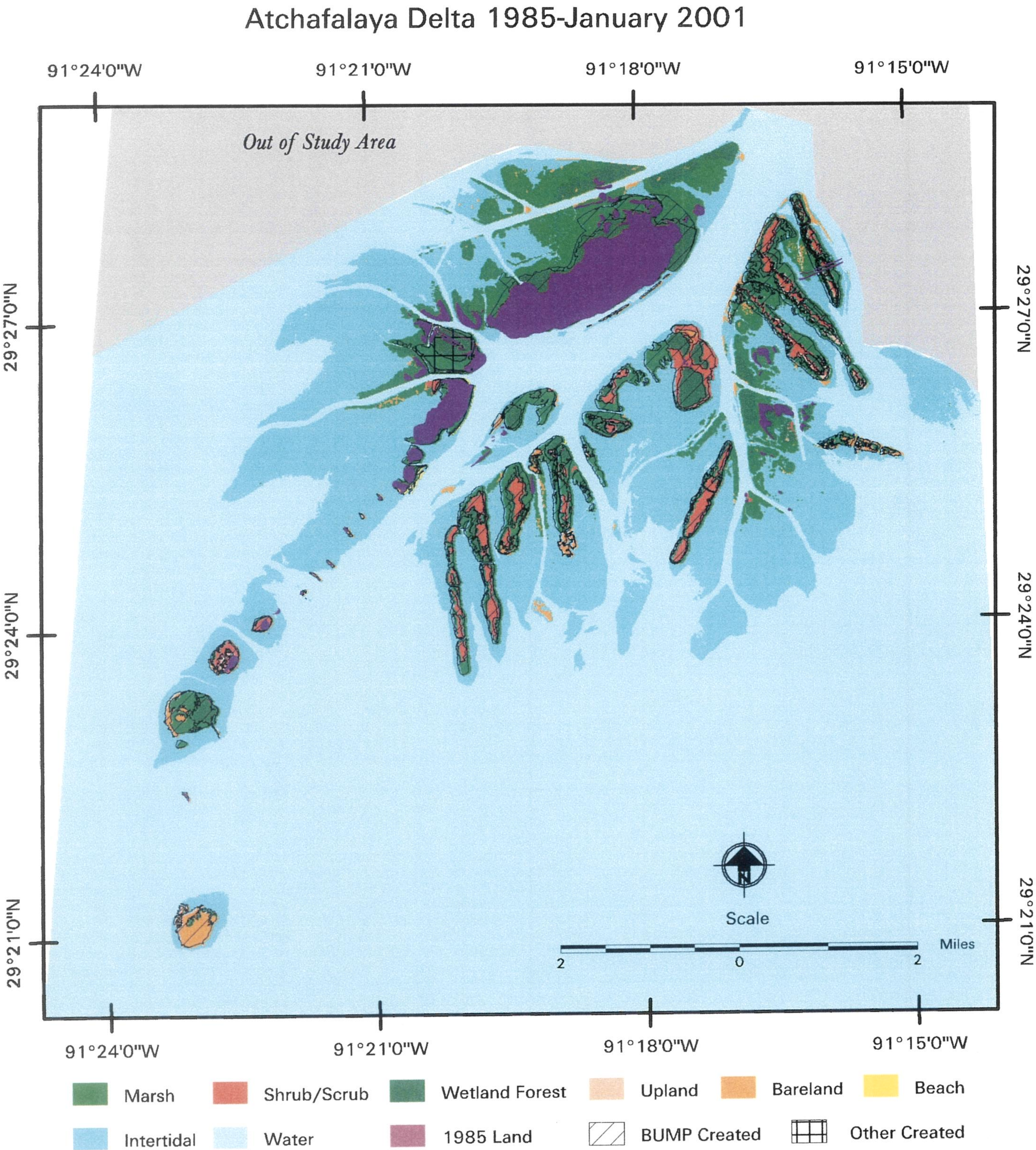


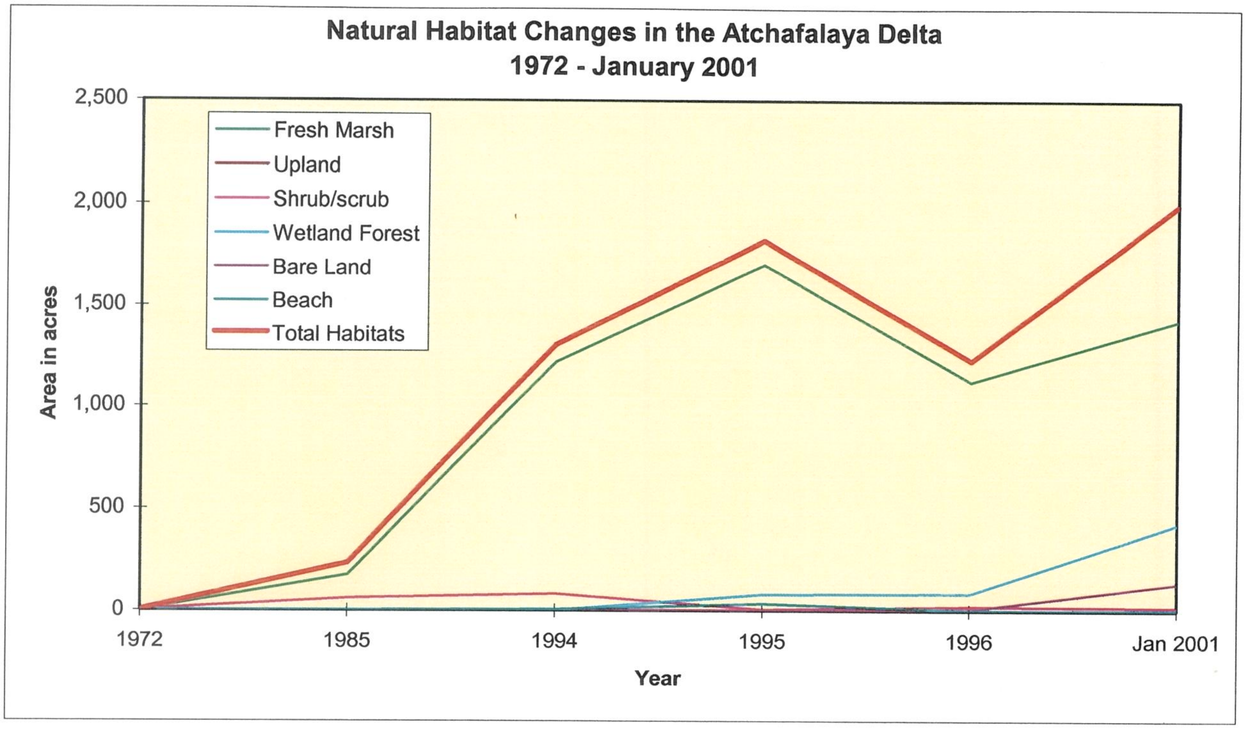
Figure 60 Map of the Atchafalaya River delta showing the new habitats that developed between December 1985 and January 2001.

Table 4 Changes in Total Acres of Each Habitat in the Atchafalaya Delta between December 1985 and January 2001

HABITAT	1985[1]	Jan 2001[1]	AREA CHANGE[1]
Natural Marsh	174.9	1,423.9	1,249.0
Natural Upland	0.0	1.9	1.9
Natural Shrub/Scrub	56.7	14.9	-41.8
Natural Forested Wetland	0.0	422.2	422.2
Natural Bare Land	0.0	131.5	131.5
Natural Beach	0.3	0.8	0.5
Total Natural Habitats	**231.9**	**1,995.2**	**1,763.3**
BUMP-made Marsh	363.8	1,319.3	955.5
BUMP-made Upland	0.0	119.6	119.6
BUMP-made Shrub/Scrub	535.8	617.2	81.4
BUMP-made Forested Wetland	0.0	1,528.6	1,528.6
BUMP-made Bare Land	140.2	263.4	123.2
BUMP-made Beach	24.7	12.4	-12.3
Total BUMP-made Habitats	**1,064.5**	**3,860.5**	**2,796.0**
Other man-made Marsh	11.0	69.9	58.9
Other man-made Upland	0.0	2.8	2.8
Other man-made Shrub/Scrub	21.0	0.0	-21.0
Other man-made Forested Wetland	0.0	114.2	114.2
Other man-made Bare Land	10.6	0.6	-10.0
Other man-made Beach	0.0	0.0	0.0
Total Man-made Habitats	**42.9**	**187.5**	**+144.6**
Habitat Total	**1,339.3**	**6,043.2**	**+4,703.9**

[1]Acres

A



B

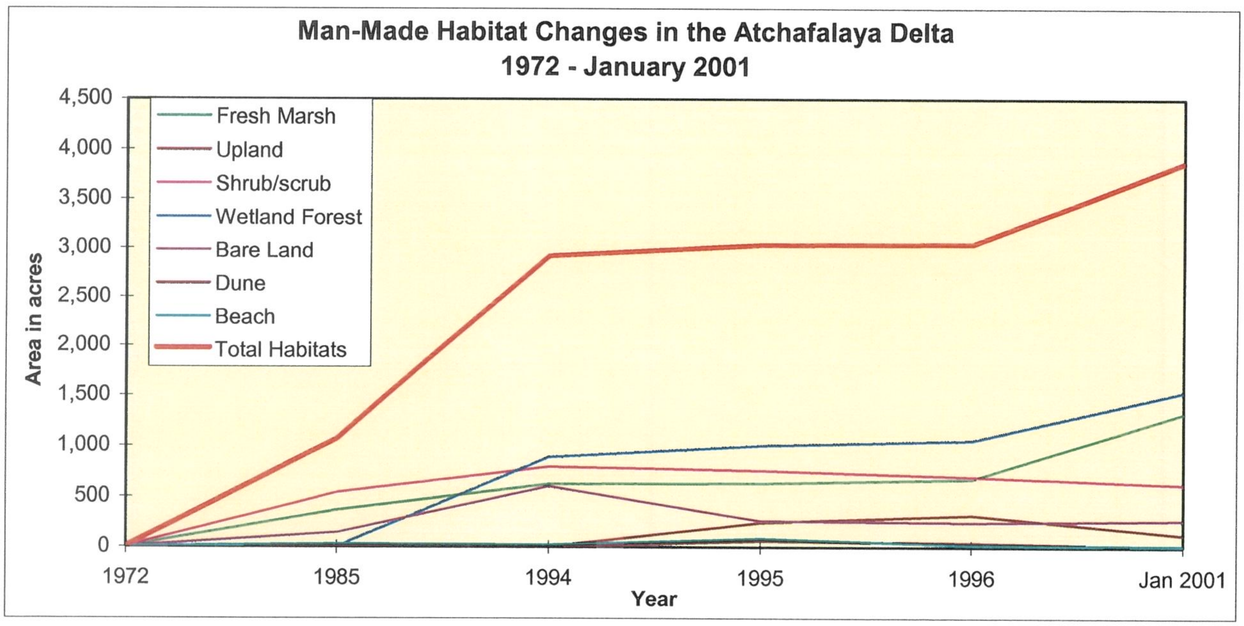


Figure 61. Time series showing the changes in total area of each habitat in the Atchafalaya River delta between 1972 and January 2001. A) natural habitat changes. B) man-made habitat changes.

CONCLUSIONS

1. The total area of the Atchafalaya River delta in December 1985 was 1,339.3 acres. Natural processes accounted for 231.9 acres or 17 percent of the total area. BUMP-made processes related to placement of dredged material accounted for 1,064.5 acres or 79 percent of the total area. Other man-made processes accounted for 42.9 acres or 4 percent of the total areas.

2. The total area of the Atchafalaya River delta in January 2001 was 6,043.2 acres. Natural processes accounted for 1,995.2 acres or 33 percent of the total area. Man-made processes related to the beneficial use of dredged material accounted for 3,860.5 acres or 64 percent of the total area. Other man-made processes accounted for 187.5 acres or 3 percent of the total area.

3. The Atchafalaya River delta increased by +4,703.9 acres between December 1985 and January 2001. Natural processes were responsible for 1,763.3 acres of increase and the beneficial placement of dredged material was responsible for 2,796.0 acres of this increase. Other man-made processes accounted for 144.6 acres of this increase.

4. Natural processes appear to be effective in creating marsh. Beneficial use of dredged material appears to be effective in creating a variety of habitats, including forested wetland, shrub/scrub, bare land, and marsh.

5. The field surveys indicate the current stacking heights are optimal for establishing forested wetland and shrub/scrub habitats and to a lesser extent fringing marshes. The optimal elevation for marsh creation appears to be less than +1.2feet NGVD (+2feet MLG). The average elevation of Andrew Island is +1.9feet NGVD (+2.6feet MLG). The average elevation of eastern Horseshoe Island is +1.5feet NGVD (+2.2feet MLG). The average elevation of Ibis Island is +2.0feet NGVD (+2.8feet MLG). The average elevation of Long Island is +1.8feet NGVD (+2.6feet MLG).

6. The greatest rates of shoreline progradation in the Atchafalaya River delta are associated with the placement of dredged material. This placement of dredged material is effective in creating and assisting in creating a variety of habitats.

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U.S. Army Corps of Engineers, New Orleans District and Louisiana State University, Coastal Institute. 1997. Beneficial Use of Dredged material Monitoring Program: 1996 Annual Report (Base Year through FY 1996). U.S. Army Corps of Engineers, New Orleans District, New Orleans, LA.

Van Heerden, Ivor L., 1994. Natural and dredged material sedimentation in Atchafalaya delta, Louisiana. Contract Report for Environmental Protection Agency. 45 pp.

APPENDIX A

LIST OF VEGETATIVE SPECIES IN THE ATCHAFALAYA DELTA

LIST OF VEGETATIVE SPECIES IN THE ATCHAFALAYA DELTA

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate habitat types as indicated by species observed. The list includes the species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas, The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts, or Louisiana Trees and Shrubs. Common names were from a variety of sources, including the National List of Plant Species that occur in Wetlands Region 2 - Southeast. This list has been compiled from three different field efforts in 1995, 1996 and 2001. The superscript "[01]" indicates those plants identified during the most recent field effort.

[01]**Acacia farnesiana** (L.)Willd. .... sweet acacia

[01]**Acmella oppositifolia** (Lam.) R.K. Jansen var. **repens** .... creeping Spotflower
(Spilanthes americana)
colonial perennial; wet pastures, swamp forests, river banks

[01]**Acnida tamariscina** (Nutt.) Wood. .... water-hemp
(Amaranthus tamariscinus) annual; brackish marshes

Aeschynomene indica L. .... joint-vetch shrub
annual; swamps, marshes, and ditches

[01]**Alternanthera philoxeroides** (Mart.) Griseb. .... alligator-weed
perennial; fresh or intermediate aquatic or very wet habitats

[01]**Ambrosia artemisiifolia** .... annual ragweed
annual; fields, pastures, roadsides and waste places

[01]**Amaranthus cannabinus** (L) JD Sauer .... water-hemp, tidemarsh amaranth
stout, dioecious herb; brackish marshes

[01]**Amaranthus tuberculatus** (Moq) JD Sauer .... rough-fruit amaranth
stout, dioecious herb; margins of swamps and fresh marshes

[01]**Ampelopsis arborea** .... pepper vine
high-climbing vine; low woods and marshes

[01]**Andropogon glomeratus** .... bushy blestem
tufted perennial; fields, roadsides, open woods, savannahs and bogs

[01]**Andropogon virginicus** .... broomsedge
tufted perennial; fields, roadsides, open woods, savannahs and bogs

Asclepsis sp. .... milkweed
perennial herbs

[01]**Aster** (see **Symphyotrichum)**
annual; fresh to brackish marsh

[01]**Baccharis halimifolia** L. .... groundselbush
shrub or small tree; elevated sites in fresh to saline marshes

[01]**Bacopa caroliniana** (Walter) Robinson .... blue water-hyssop
succulent creeping herb; sandy, shallow pond and marsh or moist stream margins

Bacopa monnieri (L.) Pennell .... coastal water-hyssop
succulent creeping herb; sandy margins of fresh or brackish marshes, streams, ponds

Boehmeria cylindrica (L.) Sw. .... False-nettle
perennial; moist or wet soil under shrubs or trees or in open, flats, marshes

[01]**Bulbostylis stenophylla** (Ell.) Clarke .... sandy-field hair sedge
annual; sandy fields

Callibrachoa parviflora (Juss.) D'Arcy .... wild petunia
(Petunia parviflora)
perennial; roadsides and waste places

[01]**Cephalanthus occidentalis** L. .... Button Bush
shrub; low areas, margins of creeks, lakes and marshes

Chamaesyce maculata (L.) Small .... prostrate spurge
erect or prostrate annual; along paths, crevices and sides of sidewalks and roads, waste places

[01]**Chenopodium berlandieri** var. **boscianum** .... pigweed
erect annual; woodlands, roadsides, hedgerows

[01]**Colocasia antiquorum** .... elephantsear
perennial; freshwater marsh, pond and stream margins

[01]**Commelina virginica** L. .... Virginia dayflower
rhizomatous perennial; low woods

Conyza bonariensis (L.) Cronq. .... hairy fleabane
(Erigeron bonariensis)
winter annual; fields and waste places

[01]**Conyza canadensis** (L.) Cronq .... horseweed
annual; fields, roadsides, pastures and waste places

[01]**Cryptontaenia canadensis** (L.) DC. .... Canada honewort
perennial herb; moist woods, woodland margins and stream banks

Cynodon dactylon (L.) Pers. .... Bermuda grass
rhizomatous perennial; fields, roadsides, waste places

[01]**Cyperus aristatus** Rottb. .... awned flatsedge
Annual; sandy fields

[01]**Cyperus brevifolius** (Rottboell) Hasskarl. .... short-leaf flatsedge
(Kyllinga brevifolia)
rhizomatous perennial; low pastures, ditches and roadsides

[01]**Cyperus croceus** .... Baldwin flatsedge

[01]**Cyperus elegans** L. .... sticky flatsedge
fresh to intermediate marsh, sand lake and bayshore

Cyperus esculentus L. .... yellow nutgrass, chufa
perennial; sandy fields, roadsides, and waste places

Cyperus oxylepis Steud. .... sharp-scale flatsedge

[01]**Cyperus polystachyos var. texensis** (Torrey) Fernald .... many spiked flatsedge
annual; low fields, ditches and marshes

[01]**Cyperus rotundus** L. .... purple flatsedge
perennial by rhizomes; gardens, fields and waste places

Cyperus surinamensis Rottb. .... tropical flatsedge
Rhizomatous perennial; disturbed clay-sand beds

?[01]**Cyperus virens** Michaux. .... green flatsedge
rhizomatous perennial; marshes and ditches

Digitaria ciliaris (Retz.) Koel. .... crab grass
annual; sandy fields, roadsides, waste places

Echinochloa crusgalli (L.) Beauv. .... barnyard grass
coarse annual; low fields, marshes and waste places

Echinochloa walteri (Pursh) Heller .... Walter's millet
coarse annual; fresh and intermediate marshes and low waste places

[01] **Echinodorus cordifolius** Richard .... creeping water plantain, bur-head
creeping or prostrate perennial; swamps, stream banks and ditches

Eclipta prostrata (L.) L. (Eclipta alba) .... Yerba de Tajo
annual herb; pond shores, alluvial meadows, marshes, low woods and bogs

Eichhornia crassipes Kunth .... water hyacinth
floating aquatic; freshwater ponds and waterways

Eleocharis parvula (R. & S.) Link .... dwarf spikerush
perennial; brackish marshes, rarely fresh-water marshes

Equisetum hyemale L. var. **affine** (Engelm.) A.A.Eaton .... scouring rush rhizomatous; railroad embankments, roadsides and stream banks

Erigeron philadelphicus L. .... daisy fleabane
perennial herb; old fields, meadows and waste ground

[01]**Eupatorium capillifolium** (Lam.) Small .... thoroughwort, dog fennel
annual; fields, meadows, pastures and disturbed woods

[01]**Eustachys (Chloris) petraea** .... pinewoods finger-grass
tufted perennial; dunes and sandflats

[01]**Eustoma exaltatum** .... seaside gentian, tall prairie gentian
sandy coastal areas, saline to fresh marshes

Galium tinctorium L. .... dye bedstraw
annual; swamps, meadows, marshes and wet ditches

Heliotropium curassavicum L. .... seaside heliotrope
annual succulent; seashores and borders of fresh to saline marsh

Heliotropium procumbens Mill. .... marsh heliotrope
annual succulent

[01]**Hydrocotyle bonariensis** Lam. .... sand pennywort
creeping perennial; among beach dunes, moist open sandy areas

Hydrocotyle ranunculoides L.f. .... pennywort
aquatic or semi-aquatic perennial; seepage areas, pools, stream margins and swamps

Hydrocotyle umbellata L. .... marsh pennywort
creeping perennial; low or moist areas

Hymenocallis crassifolia Herbert .... spider lily
perennial bulb; brackish marshes, low woods and swamp forest borders

Iris giganticaerulea .... giant blue flag
rhizomatous perennial; fresh marshes, swamps, and stream margins

[01]**Isolepis carinata** .... keeled bulrush
(Scirpus koilolepis)
annual; low fields

[01]**Iva annua** L. .... annual sumpweed
Erect annual herb; fields and waste places

Juncus effusus L. .... soft rush
perennial; moist soil, edges of swamps and ponds, low pastures

[01]**Juncus tenuis** Wiild. .... path rush
perennial; dry or moist soil along roadsides and paths

[01]**Kosteletzkya virginica** (L.)Presl. .... seashore mallow
stout perennial herb; brackish marshes

Leptochloa fascicularis (Lam.) Gray .... bearded sprangletop
tufted annual; lakebed, fresh to brackish marsh, best in intermediate marsh subject to drying

Leptochloa uninervia (Presl) Hitchc. & Chase .... Mexican sprangletop
tufted annual; waste places

[01]**?Ligusticum canadense** (L.) Britton .... lovage
stout perennial; rich soil, woodland margins, stream banks and river bottoms

[01]**Ludwigia decurrens** .... primrose willow
erect perennial; marshes and ditches

[01]**Ludwigia octovalvis** .... Mexican seedbox
perennial; marshes and waste places

[01]**Lycopus americanus** Muhl. ex Barton .... American bugleweed
perennial stoloniferous herbs; marshes, wet woods and pond margins

Medicago polymorpha L. .... bur clover
annual; fields, roadsides and waste places

[01]**Mikania scandens** (L.) Willd. .... climbing hempweed
perennial vine; woods, thickets, marshes and bogs, usually very wet habitats

[01]**Mimosa strigillosa** T&G .... herbaceous mimosa, powderpuff
prostrate perennial; sandy soils in thin woods or open grasslands, hammocks roadsides

Modiola caroliniana(L.) G.Don.. Carolina mallow
creeping perennial; lawns, gardens, pastures, roadsides and seepage slopes in woods

[01]**Myrica cerifera**.. wax myrtle
woody shrub; sandflats, pinelands and low woods

Panicum dichotomiflorum Michx.. fall panicum, zig-zag grass
tufted annual; fresh and intermediate marsh, ditches, low woods

[01]**Panicum repens** L. .... dogtooth grass, torpedo grass
perennial grass; fresh and intermediate marsh , slightly elevated sites

[01]**Panicmum virgatum** .... switchgrass
elongate, rhizomatous perennial; savannahs, marshes, and waste places

Paspalum distichum L. .... joint paspalum
mat-forming perennial; brackish and freshwater marshes

[01]**Paspalum fluitans** (Ell.) Kunth .... water paspalum
decumbent or creeping annual; seepage areas in swamp forests

Paspalum urvillei Steud. .... Vasey grass
perennial grass; roadsides, fields and waste places

[01]**Paspalum repens** .... water paspalum
weak, decumbent annual; seepage areas in swamp forests, edges of fresh marsh

[01]**Phragmites communis** .... roseaucane

[01]**Phyla nodiflora** (L.) Greene .... frog-fruits
decumbent perennial; sandy open habitats,usually moist, swales, ditches, pond margins

[01]**Physalis angulata** .... cut-leaf groundcherry
annual; sandy field margins, roadsides and open woodlands

[01]**Pluchea odorata** .... shrubby camphor-weed
aromatic annual; salt and brackish marshes, sloughsand swales, salt flats, rarely in freshwater marshes

[01]**Polygonum lapathifolium** L. .... willow-weed
annual; alluvial fields, river banks, disturbed habitats

[01]**Polygonum punctatum** Ell. .... dotted smartweed
annual or rhizomatous perennial; alluvial woods, swamp forests or marshes

[01]**Polypremum procumbens** L. .... juniper-leaf
perennial with radially ascending branches from a central crown; old fields, thin woodlands, roadsides and waste places

Polypogon monspeliensis (L.) Desf. .... rabbitfoot grass
annual; brackish marshes

[01]**Populus deltoides** Bartr. .... eastern cottonwood
large tree; swamp forests

Ranunculus sceleratus L. .... buttercup
succulent annual; marshes and ditches

[01]**Rhynchospora colorata**.. white-topped sedge, starbrush
(Dichromena colorata)
tufted perennial; andflats, ditches and savannahs

Rorippa palustris (L.) Besser .... yellow cress
biennial or perennial herbs; wet habitats about ponds, lakes, and streams

[01]**Sacciolepis striata** (L.) Nash .... American cupscale
creeping perennial; marshes, swales, sloughs, ditches, pond margins, depressions

[01]**Salix interior Rowlee** .... sandbar willow
tree; temporary sandbars, borrow pits, Mississippi floodplain

[01]**Salix nigra** Marshall.. black willow
tree; streambeds and low moist areas

Samolus valerandii L. subsp. **parviflorus** (Raf.) Hulten.. water pimpernel
annual or perennial; wet habitats, fresh or brackish

[01]**Schoenoplectus americanus**.. American bulrush,
(Scirpus americanus)
freshwater perennial; fresh to intermediate marsh, sandy lake and bayshore

[01]**Schoenoplectus robustus** .... alkali bulrush
(Scirpus robustus)
rhizomatous perennial; brackish marshes and ditches

Scirpus validus Vahl. .... softstem bulrush
creeping perennial; (S. tabernaemontani K.G. Gmel)
marshes and rocky streambeds

Senecio glabellus Poir. .... butterweed
annual; alluvial woods, swamp forests and wet pastures

[01]**Sesbania drummondii** (Rydb) Cory........ yellow rattlebox
(Daubentonia longifolia (Cav.) DC.)
shrub; elevated areas in fresh to saline marsh

[01]**Sesbania exaltata** (Raf.) Rydb.
Annual shrub to 4m; ditches, edge of brackish and fresh marshes, swales, edge of sloughs, fields, alluvial soils

Sibara virginica (L.) Rollins .... winter cress
winter annual; disturbed soils, mostly in low fields

Solanum americanum P. Mill. (or **S. ptychanthum** Dunal)........ nightshade
annual; woodland margins, fields, roadsides and waste places

Solidago sp........ goldenrod
perennial herbs

[01]**Solidago sempervirens** L. .... seaside goldenrod
perennial; brackish marsh or saline sand

Spergularia echinosperma Celak (or **S.marina** (L.) Griseb. .... sand spurrey
tufted annual; salt marshes and tidal flats

[01]**Symphyotrichum divaricatum**........ annual saltmarsh aster
(Aster subulatus)
annual; white to lavender flowers; fresh to brackish marsh

[01]**Symphyotrichum puniceum** .... swamp aster
(Aster puniceus)
perennial; blue to violet, sometimes white flowers; wet meadows, bogs, marshes and low woods

[01]**Symphyotrichum tenuifolium**........ perennial saltmarsh aster
(Aster tenuifolius)
perennial; yellow to red flowers; brackish marshes

[01]**Tamarix gallica** L. .... sea-side cedar, tamarisk
shrub or small tree; escaped to sandy roadsides and waste places

Trifolium dubium Sibthorp .... low hop clover
annual; lawns, fields, roadsides and waste places

Trifolium hybridum L. .... Alsike clover
perennial; lawns, fields, roadsides, swales between stable dunes

[01]**?Typha domingensis** Persoon .... southern cattail
aquatic or paludal, rhizomatous perennial; alkaline brackish marshes and swamps

Urtica chamaedryoides Pursh .... stinging nettle
stinging annual; rich woods over circumneutral soil, rare

[01]**Vigna luteola**........ deer pea
perennial twining vine; waste places, borders of marshes and low fields

[01]**Zizaniopsis miliacea** (Michx.) Doell & Asch. .... southern wild rice,
rhizomatous perennial; brackish and freshwater marshes