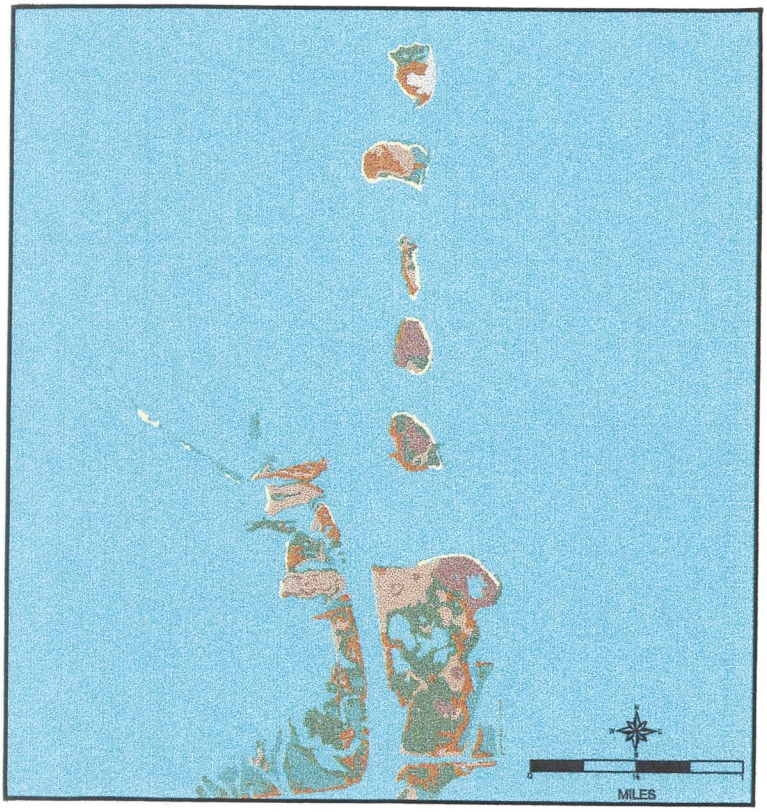
U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1996 ANNUAL REPORT

Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana Baptiste Collette Bayou

Base Year 1975 through Fiscal Year 1996



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INTRODUCTION

The Baptiste Collette Bayou (BCB) navigation channel is located on a Mississippi River distributary northeast of Venice, Louisiana. (Figure 1). The navigation channel runs south to north and extends approximately 3.5 miles from Head of Passes into Breton Sound. The U.S. Army Corps of Engineers - New Orleans District (USACE-NOD) maintains the channel by annual dredging with a cutterhead dredge. Approximately 700,000 to 900,000 cubic yards of sediment is dredged annually and the physical character of the material is estimated to be 30 percent sand and 70 percent silt/clay. The dredged material is used in confined and unconfined beneficial use areas for wetland development.

The Beneficial Use of dredged material Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the USACE-NOD. This site was used as the Pilot Study site for BUMP in 1993 and this report includes revised and updated information from that pilot study, through and including the USACE-NOD Fiscal Year 1996 maintenance event (31 Jul 96 - 16 Sep 96). BUMP results are provided in map series, annual reports, and scientific literature.

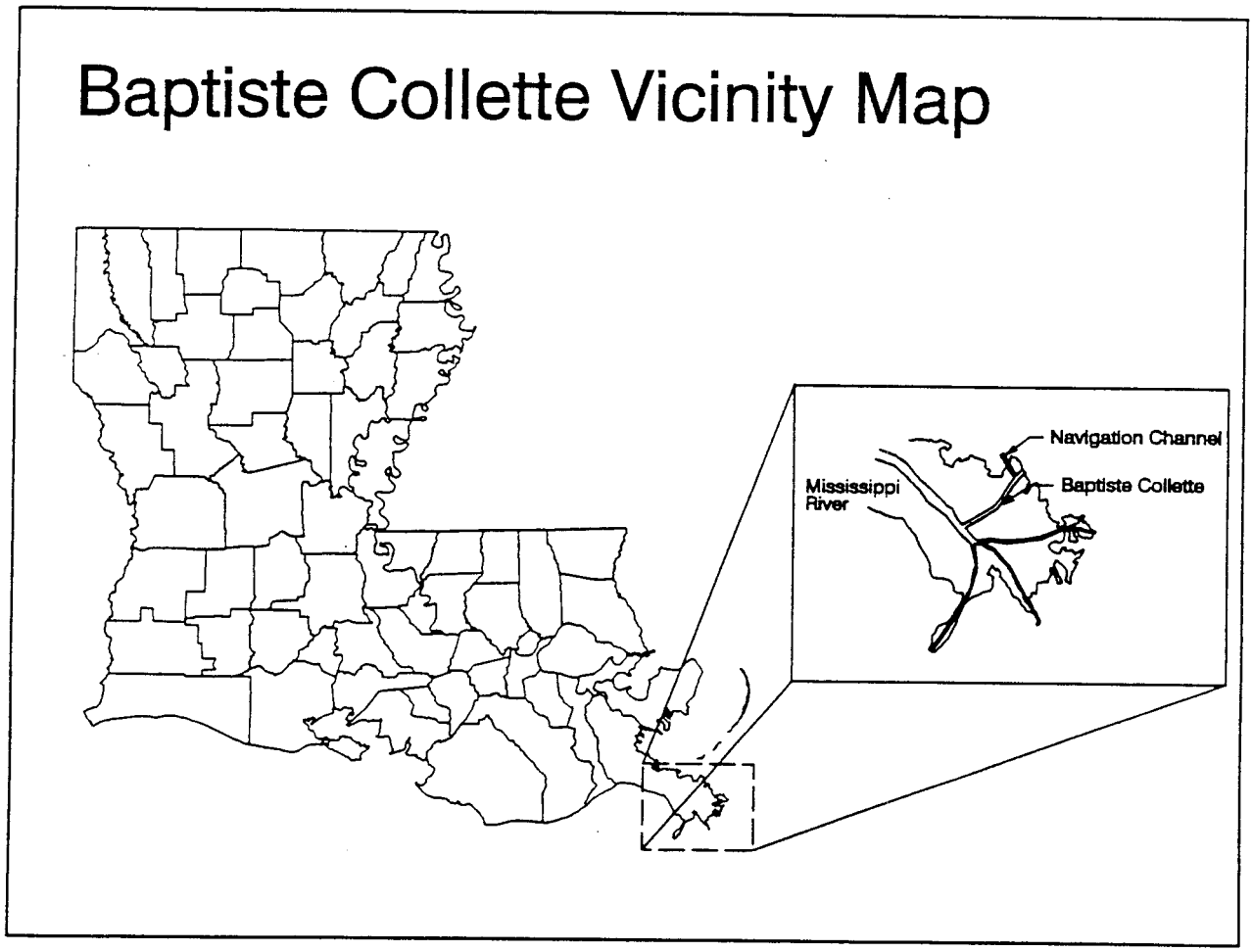


Figure 1. The location of the Baptiste Collette Bayou navigation channel in Louisiana.

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

Part 1: Introduction and Methodology
Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland
Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Using aerial photography, LSU classified the natural and man-made habitats in the study area for October 1975, December 1985, December 1990, February 1993, November 1994, November 1995 and November 1996. Through GIS analysis, the areas of sites selected were calculated and changes documented. Field surveys were conducted in August 1995 on the beneficial use areas created in 1992 and 1994, and in August 1996 on areas created in 1995 and 1996. Habitats were ground truthed and survey transects established to document vegetation species, stacking elevations, and as a base for measuring subsidence. Figure 2 shows the area of minimum aerial photo-mosaic coverage and the limit of the digitized area.

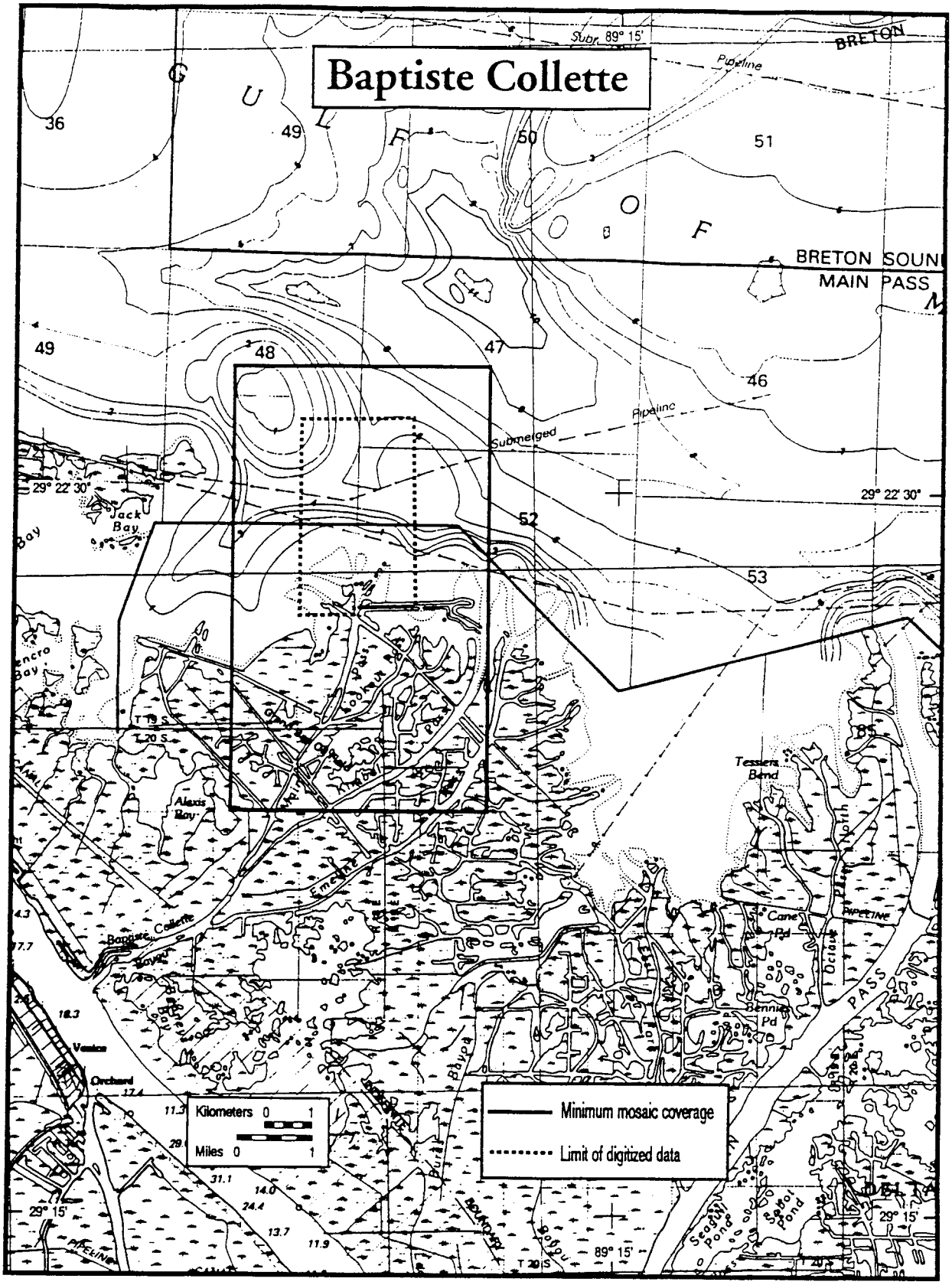


Figure 2. The Baptiste Collette Bayou BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.

DREDGED MATERIAL DISPOSAL HISTORY

Baptiste Collette Bayou existed as a small canal in 1868 that extended between the river and what was then known as Bird Island Sound. In 1874, a crevasse occurred, and by 1893, a small subaerial subdelta had been formed. In 1908, the Corps of Engineers dammed the crevasse to maintain the flow through the navigation channels. In 1915, the dam was breached and growth of the subdelta resumed. The subdelta was nearly 20 square miles in 1959, but considerable subsidence and ponding was evident on the 1959 survey, indicating that the deterioration phase of this subdelta had already begun (Morgan, 1977).

The River and Harbors Act of 1968, approved August 13, 1968, authorized the USACE-NOD to enlarge the existing channel of Baptiste Collette Bayou to -14 feet Mean Low Gulf (MLG) over a bottom width of 150 feet with an entrance/bar channel in open water 16 feet deep over a bottom width of 250 feet. Jetties to the 6 foot depth contour also were authorized. Enlargement of the channel began in November, 1977 and was completed in May, 1978. Jetty construction was completed in May 1979.

Beneficial use of dredged material from maintenance of the Baptiste Collette bar channel began in 1977 with the placement of dredged material in shallow open water on the east side of the channel in a manner conducive to wetland creation and to the creation of islands for colonial nesting seabirds. Wetland creation on the west side of the jettied channel began in 1988. Maintenance dredging takes place annually and all dredged material is used for confined or unconfined wetland creation and the creation of islands suitable for avian habitat. Figure 3 illustrates the dredged material disposal history for the study areas since 1975.

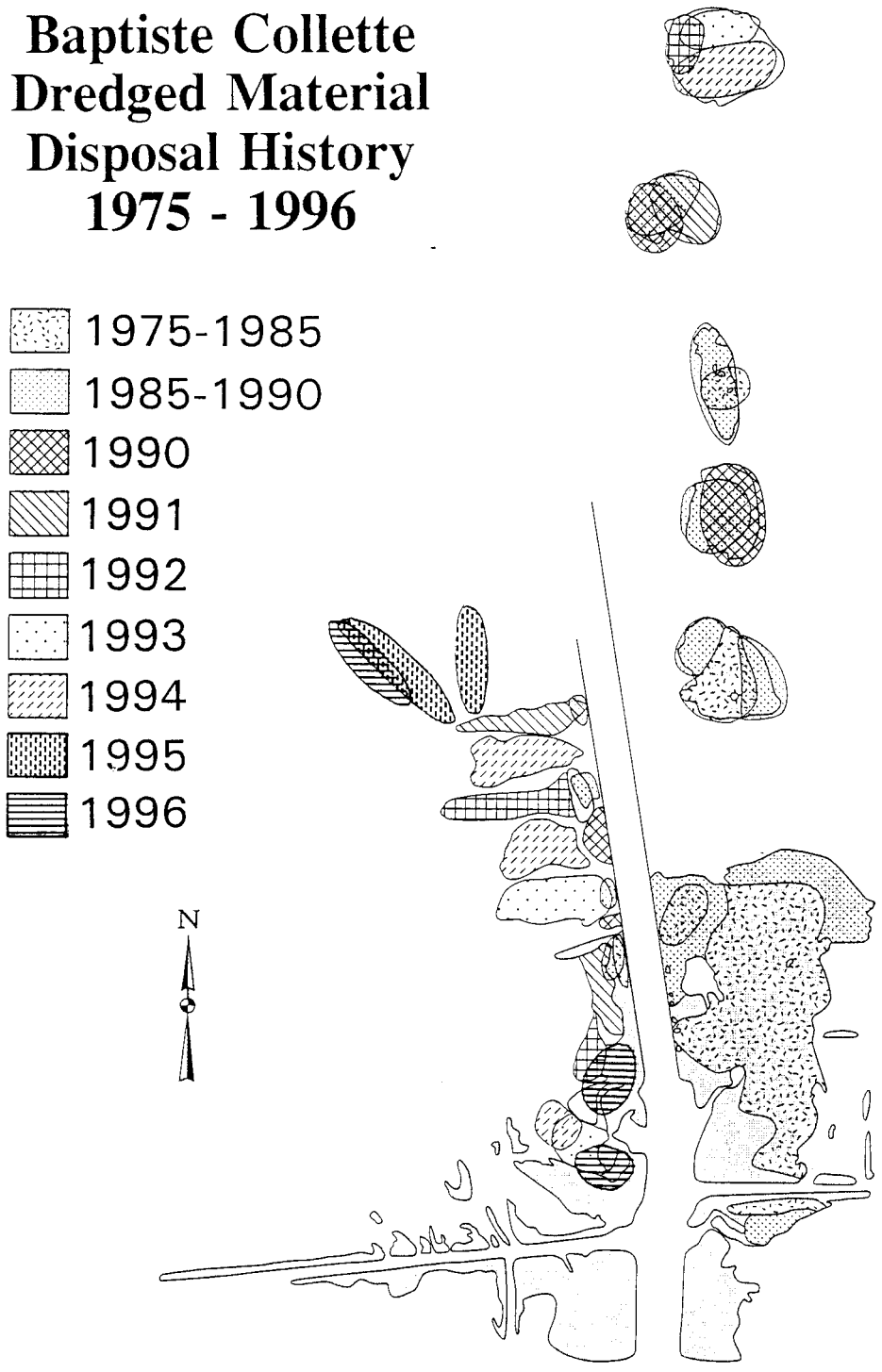


Figure 3. The dredged material disposal history for the Baptiste Collette Bayou study area, 1975 to 1996.

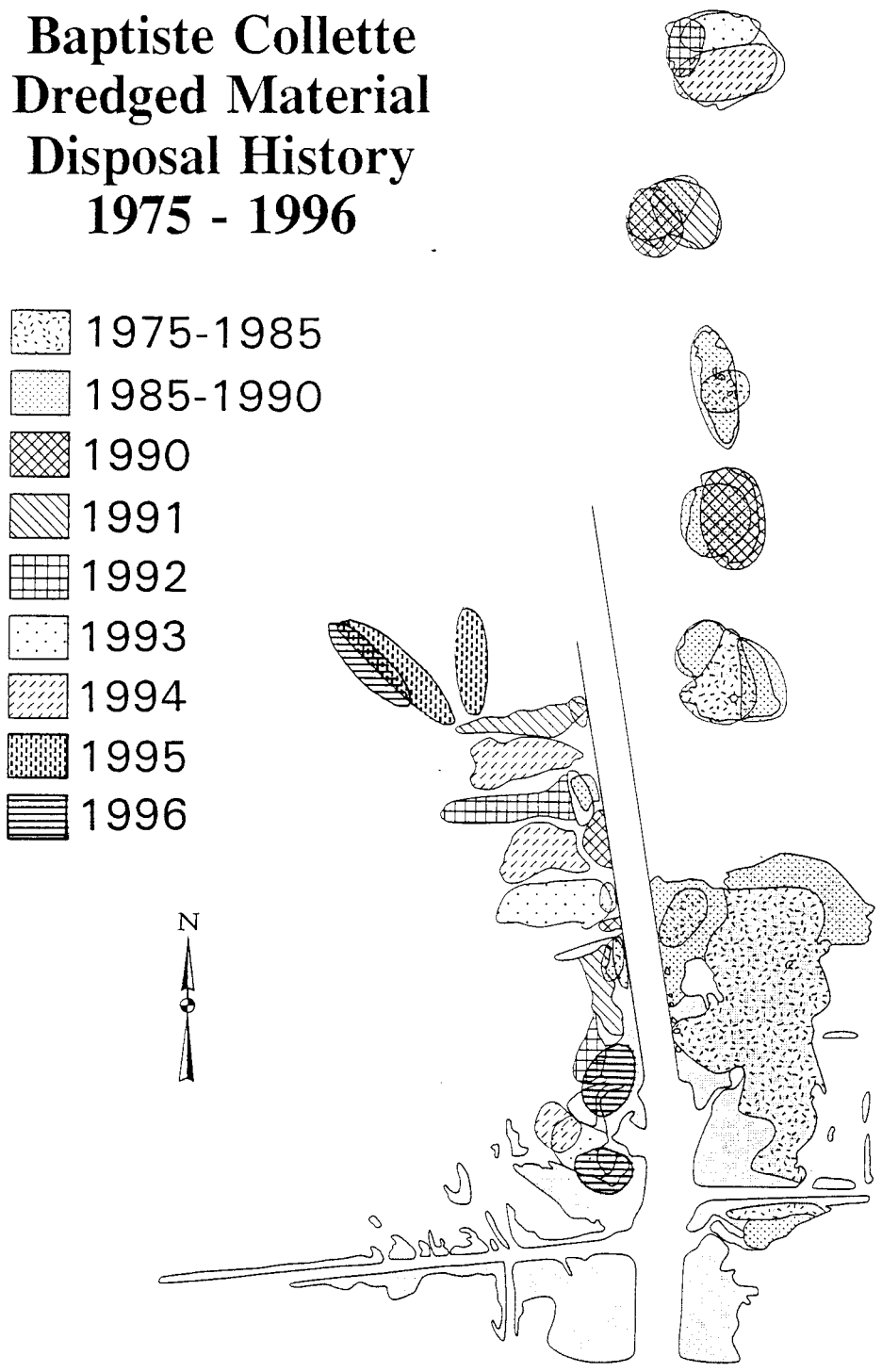


Figure 3. The dredged material disposal history for the Baptiste Collette Bayou study area, 1975 to 1996.

FIELD SURVEY RESULTS

Methodology

Elevation Profile Surveys

The BUMP study area is located where the Baptiste Collette Bayou navigation channel leaves the Mississippi River delta marshes and enters Breton Sound (Figure 1). The collection of elevation profile surveys was conducted in two phases. Phase-I involved assessing the characteristics of various beneficial use disposal areas to determine the most applicable sites to establish a long-term monitoring program to document the beneficial use of dredged materials and habitat development. This was accomplished by reviewing the BCB pilot study, using vertical aerial photography, reviewing dredging schedules and history, ground-truthing the study area, and by defining vegetative composition and island morphology. Based on these factors, three areas were selected: one *bird island* (Shea Island) on the east side of the channel and two spits (Seal and South Chris islands) on the west side of the channel (Figure 4). Transect lines were positioned on each site along both the longitudinal and lateral axes. Two stakes were placed to define the orientation of each longitudinal transect line, recording secondary features such as towers or navigation markers to assist in locating the transects when the vegetation becomes taller or thicker. Permanent 1-inch diameter by 6-foot galvanized stakes were driven approximately 3.5 feet into the ground and secured with concrete. The stakes were positioned at congruent distances and their position was defined spatially using a Global Positioning System (GPS). The dip transects were established at approximately 90° to one of the stakes. 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.

Phase-II involved the actual collection of profile datum. In August 1995, profile surveys were conducted along the transects defined by the stakes during phase-I. Subsequent profiles were collected in August 1996. One longitudinal *strike* (island crest) profiles and one lateral *dip* (perpendicular to island crest) transect profile was collected from each site (Figure 10). Survey datum and profiles were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25 ft ± 0.0125 ft., with a vertical accuracy of 0.45 ft ± 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. 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. The transect datum collected were processed, referenced to the benchmark at the Southern Natural Gas platform and the permanent tide staff in the channel, and entered into a graphic software program to produce topographic profiles.

The topographic profiles for the study area were constructed in reference to the U. S. Army Corps of Engineers benchmark #SNG, at the Southern Natural Gas platform located on the east side of the channel (Figure 4). The mean diurnal tidal range for the Baptiste Collette Bayou area is published as 1.1 ft. Profiles ranged in length from 1185 to 1300 feet. Maximum relief along the profiles was 6.55 feet at Shea Island.

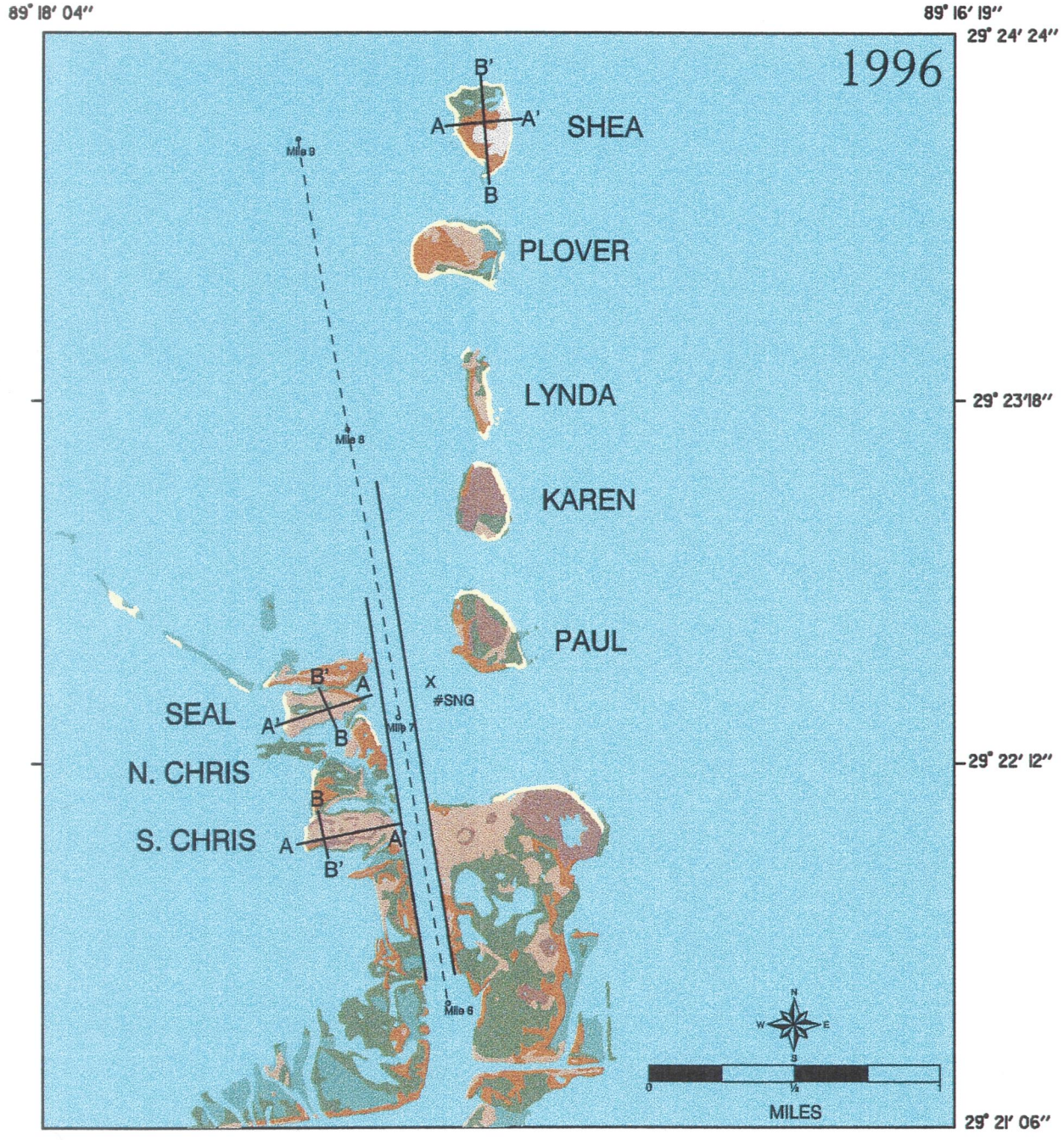


Figure 4. Location of the Baptiste Collette Bayou BUMP study area profile transects and the benchmark (#SNG) that was used to reference the elevation data.

Vegetation Surveys

Initial ground truthing for vegetative species composition and habitat verification was done in August 1995, and the species list has been augmented by subsequent field visits. Species composition was determined within a 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 author. 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 5A 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.

Profiles

For the pilot study completed in 1993, elevation and vegetation data were obtained, but profiles were not permanently established. Therefore, we could not reoccupy them for comparison purposes with any degree of scientific accuracy. The 1995 profiles were established with metal poles (stakes) set in concrete and extending 2-3 feet from the sediment surface. Two stakes were placed at each site to define a permanent *strike* profile. A *dip* profile was taken near-perpendicular to the *strike* from one of the stakes. The 10-foot, white PVC poles were still in place at the time of the 1996 field effort, making re-location much less difficult.

Shea Island

Shea Island is the most seaward *bird island* located along the northeast side of Baptiste Collette Bayou near the mouth of the outlet to Breton Sound (Figure 4). The construction of Shea Island was initiated during the USACE-NOD FY1993 maintenance event. The island was enlarged during the FY1994 maintenance event. No disposal took place on this island in FY1995 or FY1996.

The *strike* transect was delineated by 2 stakes (1-0 and 1-1) set east northeast (85°) along the axis of newest deposit, and the *dip* transect was positioned to cross both the new deposit and old island at the western-most stake (1-0). The visual line is between a red navigation marker to the west and a large platform to the east. The disposal material was a silty fine sand and was constantly reworked into small aeolian dunes around areas of sparse vegetation. Vegetation had not increased significantly since the 1995 field effort.

Figure 5 shows the comparison between the August 1995 and August 1996 elevation profiles. This comparison shows that the margins of Shea Island eroded over 100 feet on each side and that the surface elevation decreased as much as one foot.

The 1996 profiles here ranged in length from 1185 to 1300 ft . The maximum relief along the longitudinal axis (A-A') is 6.55 ft, with an average relief of 4.56 ft. Maximum relief along the lateral axis (C-C') is 5.62 ft, with an average relief of 3.94 ft. Profile A-A' is defined by stakes 1-0 and 1-1, and by stake 1-1 for profile C-C' (Figure 6).

In contrast, the 1995 profiles here ranged in length from 1460 to 1650 ft. The maximum relief along the longitudinal axis (A-A') was 7.70 ft, with an average relief of 4.64 ft. Maximum relief along the lateral axis (B-B') was 4.68 ft, with an average relief of 3.40 ft. The elevation at the top of these stakes was 6.83 ft at stake 1-0, and 8.32 ft at stake 1-1 (Figure 7).

These profiles indicate that the island is typically characterized as a sand flat with patches of young amorphous dunes which produce an undulating topography. Random patterns of dune formation and scattered pockets of developed vegetated clumps amid the overall low, flat profile of this area suggests vegetative colonization and dune building will produce a dune terrace.

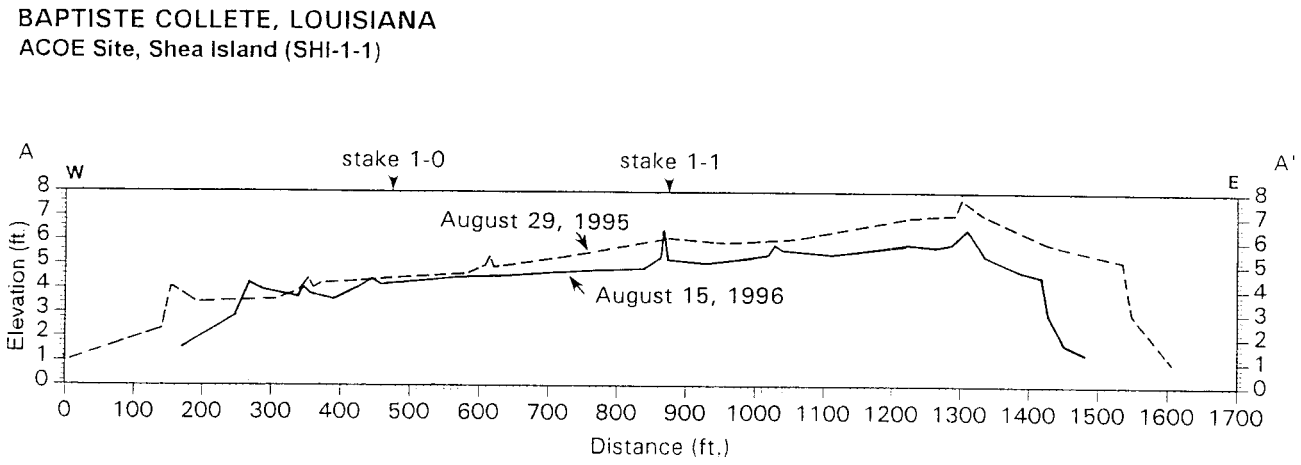


Figure 5. The *Strike* profile SHI-1-1 at Shea Island comparing elevation data obtained on August 30, 1995 and August 15, 1996.

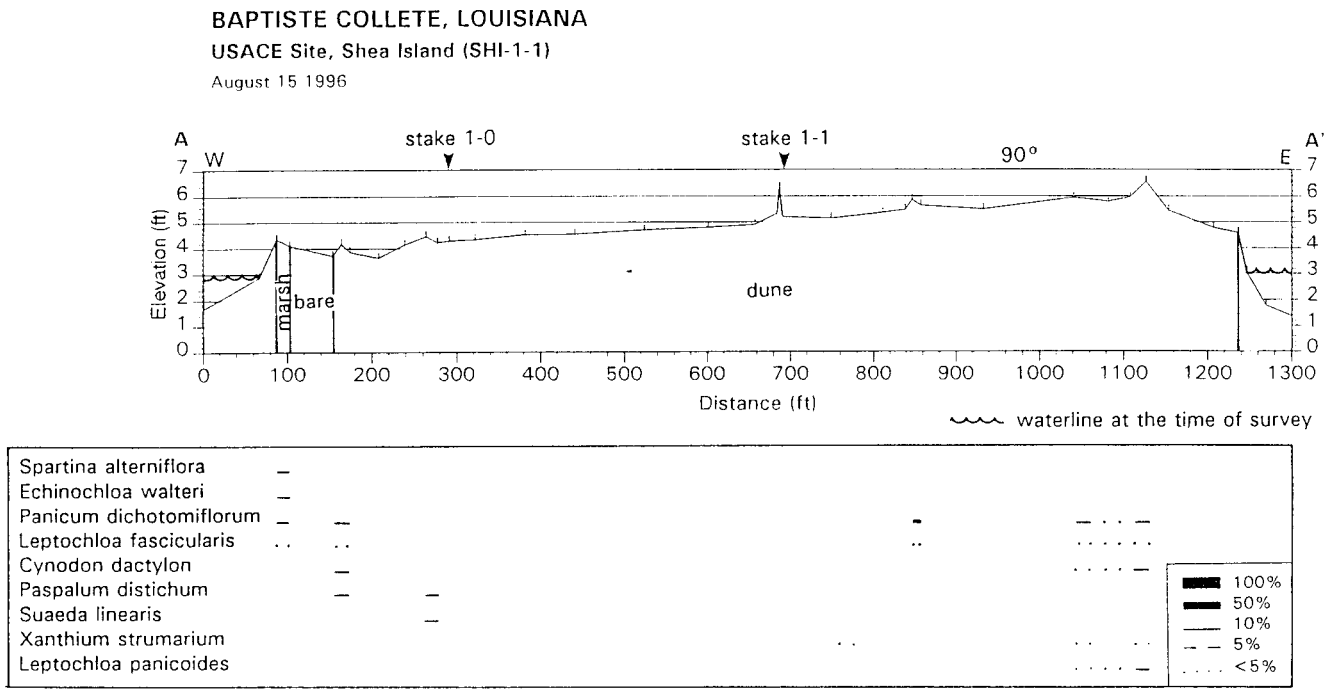


Figure 6. August 1996 *Strike* profile SHI-1-1 at Shea Island with vegetation data illustrated.

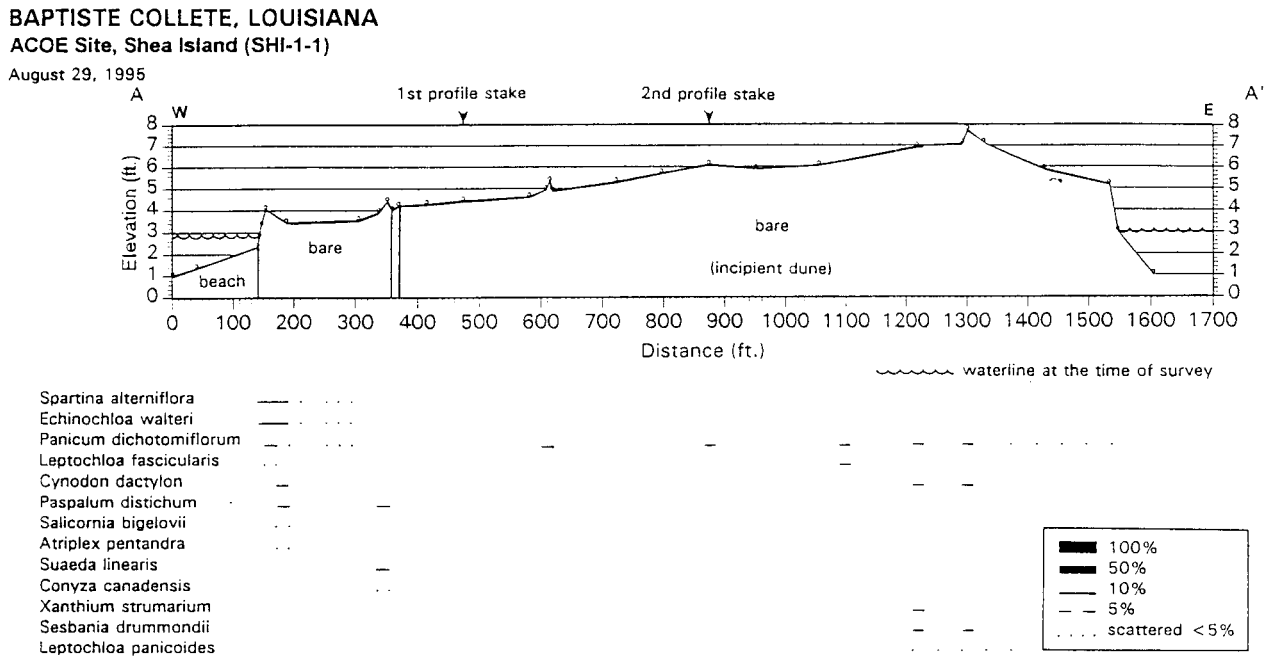


Figure 7. August 1995 *Strike* profile SHI-1-1 at Shea Island with vegetation data illustrated.

South Chris Island

South Chris Island is located along the northwest side of Baptiste Collette Bayou near the mouth of the outlet to Breton Sound (Figure 4). South Chris Island was constructed during the 1993 maintenance event. In 1995, an effort was made to establish the profile as close as possible to the profile taken during the 1993 BUMP Pilot Study. The *strike* profile (A-A') was defined by 2 stakes (1-0 and 1-1) just to the south of the axis of island, in line with navigation marker *14* at the jetty, and the *dip* profile(B-B') was near-perpendicular to the strike at the west stake (1-0). The *strike* profile was set just south of the island crest because a line of tall shrubs occupied the highest ridge, making it difficult to survey. In 1996, the transect was repeated.

Figure 8 shows the comparison between the August 1995 and August 1996 elevation profiles. This comparison shows that the margins of Chris Island eroded up to 40 feet and the elevation along the eastern margin decreased up to one foot.

In 1995, the profiles here ranged in length from 500 to 1800 ft. The maximum relief along the longitudinal axis (A-A') was 3.74 ft, with an average relief of 2.74 ft. Maximum relief along the lateral axis (B-B') was 3.45 ft, with an average relief of 2.58 ft (Figure 9).

In 1996, the profiles here ranged in length from 550 to 1825 ft (Figure 10). The maximum relief along the longitudinal axis (A-A') was 3.55 ft, with an average relief of 2.76 ft. Maximum relief along the lateral axis (B-B') was 3.59 ft, with an average relief of 2.31ft. The profiles indicate that the island is typically characterized as a low relief sand flat with a longitudinal sand crest and well-developed vegetation along the perimeter of the island. The crest of the island exhibits patches of young amorphous dunes producing an undulating dune terrace morphology (Figure 10).

BAPTISTE COLLETE, LOUISIANA
ACOE Site, South Chris Island (SCI-1-1)

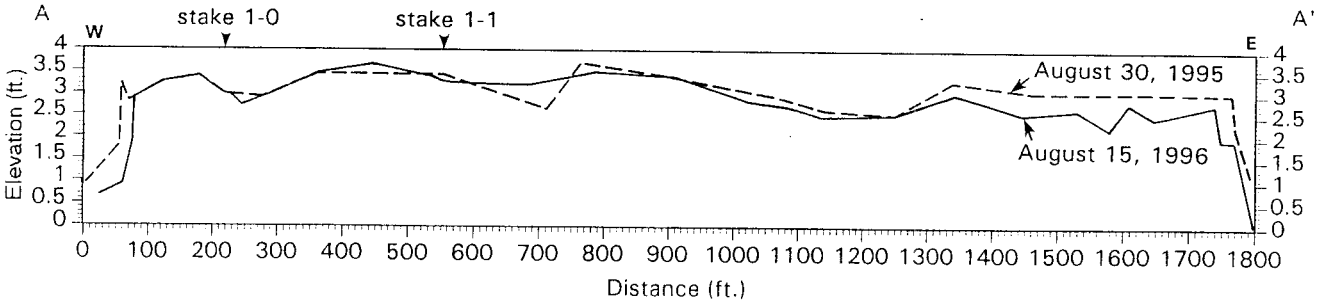


Figure 8. A comparison of the elevation data along the *strike* profile SCI-1-1 at South Chris Island obtained on August 30, 1995 and August 15, 1996.

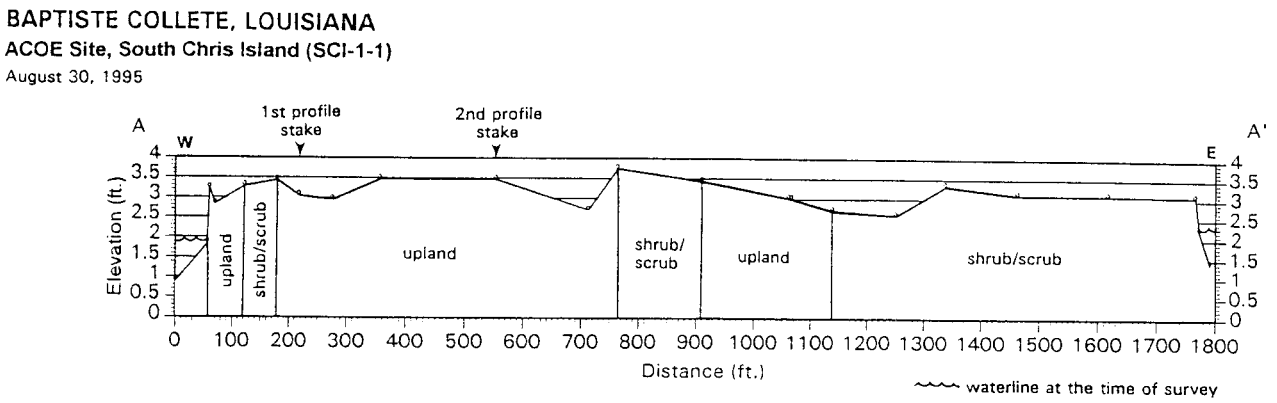


Figure 9. *1995 Strike* profile SCI-1-1 at South Chris Island with habitat data illustrated.

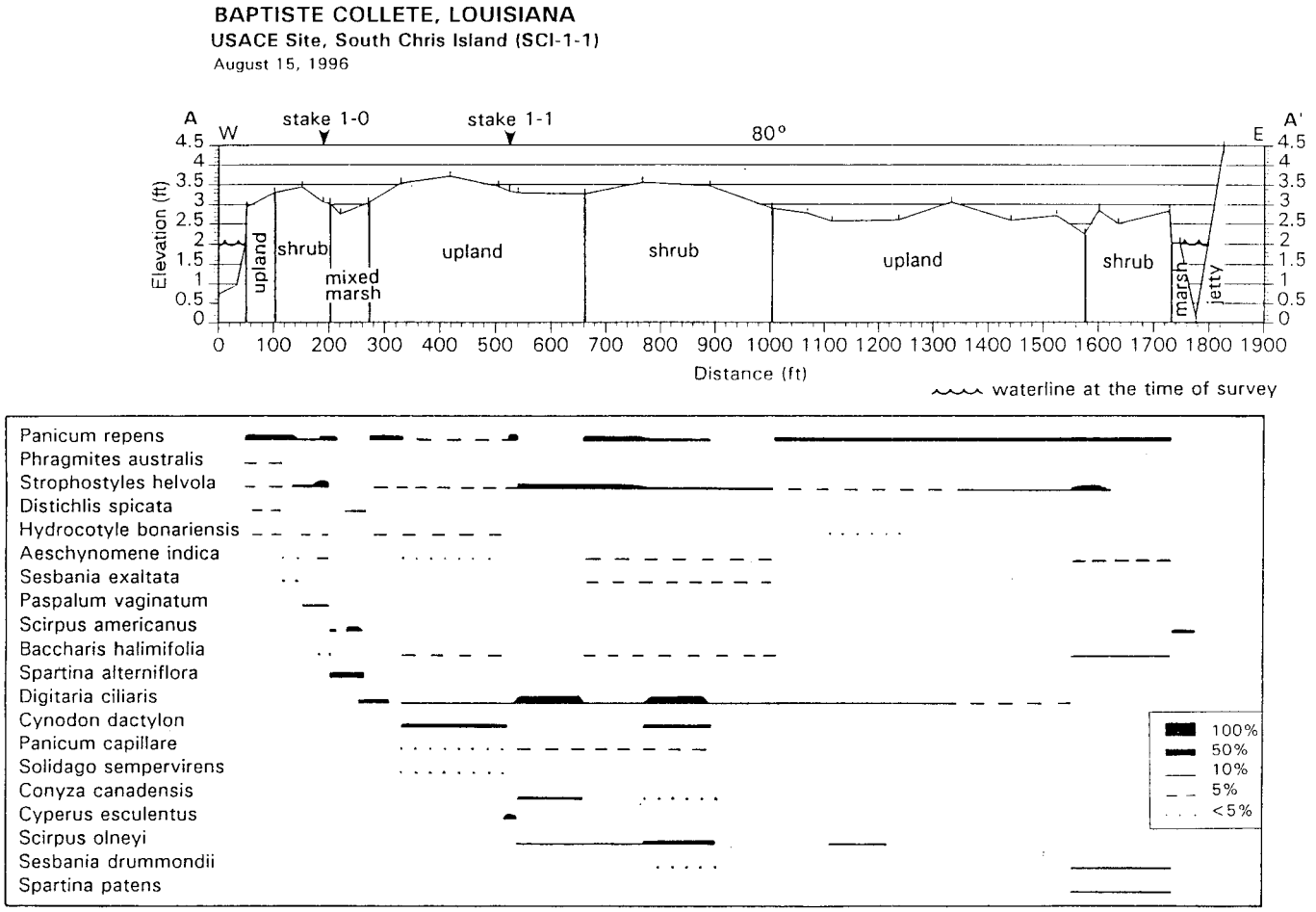


Figure 10. 1996 *Strike* profile SCI-1-1 at South Chris Island with vegetation data illustrated.

Seal Island

Seal Island is located along the northwest side of Baptiste Collette Bayou near the mouth of the outlet to Breton Sound just north of South Chris Island (Figure 4). Seal Island was constructed during the 1994 maintenance event. The *strike* profile (A-A') was defined by 2 stakes (1-0 and 1-1) set east northeast along the axis of the south lobe of this new island, and the *dip* profile (B-B') is across the entire island from the east stake (1-0). The west stake can be found 267° in line with a set of tanks to the west. The east stake is in line with the west stake and north leg of Southern Natural Gas platform across the jetty. The new deposited dredged material is fine sand and was being well-colonized by vegetation.

Figure 11 shows a comparison between the 1995 and 1996 elevation profile data. This comparison shows a similar pattern observed for Shea Island and Chris Island at Seal Island. The margins of the island eroded up to 100 feet and the elevation decreased up to one foot.

In 1995, the profiles here ranged in length from 540 to 1795 ft. The maximum relief along the longitudinal axis (A-A') is 4.35 ft, with an average relief of 3.07 ft. Maximum relief along the lateral axis (B-B') was 3.34 ft, with an average relief of 2.58 ft (Figure 12).

In 1996, the profiles here ranged in length from 430 to 1865 ft. The maximum relief along the longitudinal axis (A-A') is 4.38 ft, with an average relief of 2.94 ft. Maximum relief along the lateral axis (B-B') was 3.19 ft, with an average relief of 2.67 ft. The profiles indicate that the island is typically characterized as a sand flat with patches of young amorphous dunes producing an undulating dune and sparse vine terrace morphology. Patterns of dune formation and sparse pockets of developed vegetated clumps throughout the flat profile of this area indicates revegetation and dune building is occurring (Figure 13).

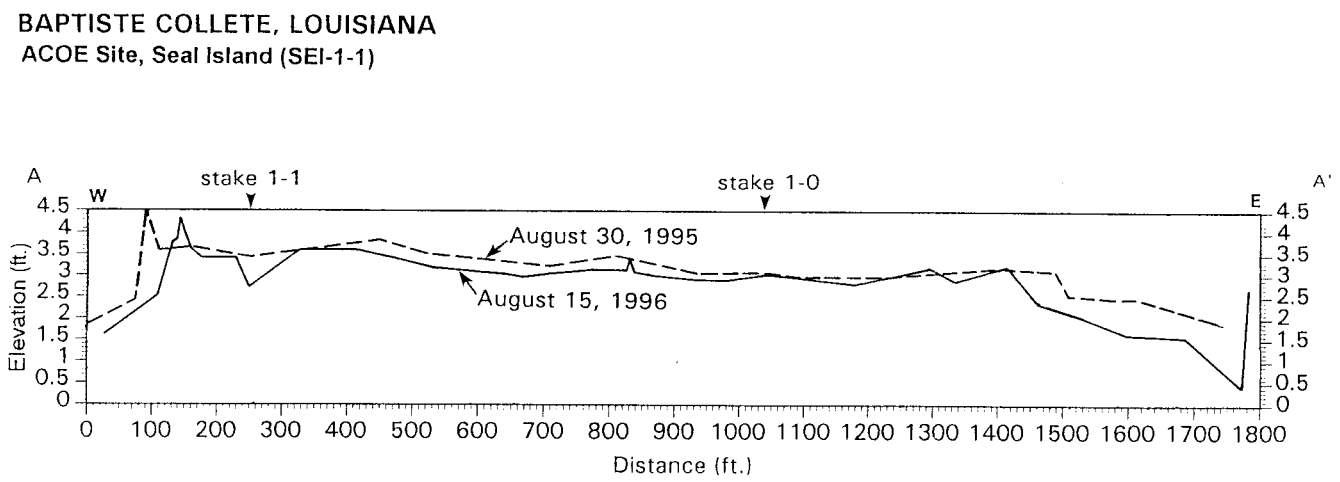


Figure 11. The *Strike* profile SEI-1-1 at Seal Island comparing elevation data obtained on August 30, 1955 and August 15, 1996.

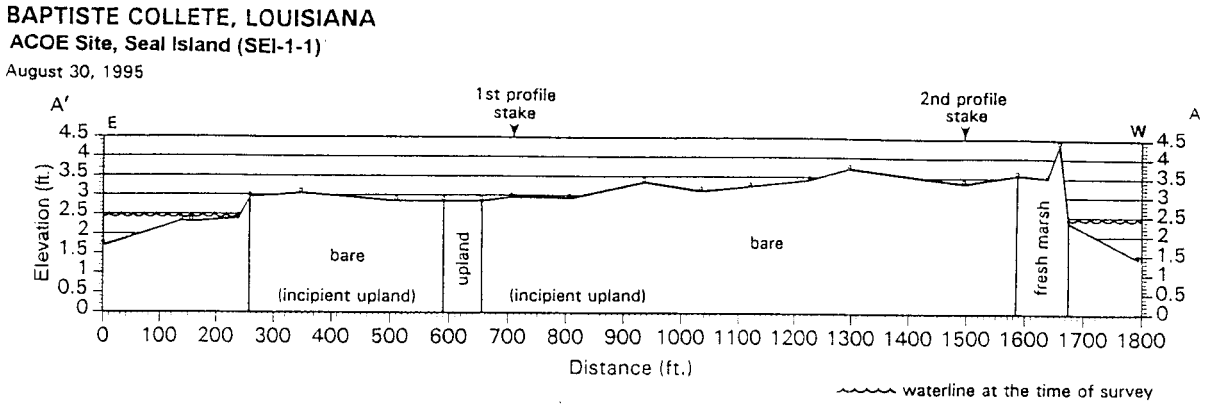


Figure 12. 1995 *Strike* profile SEI-1-1 at Seal Island with habitat data illustrated. This profile was plotted in reverse in relation to the 1996 data.

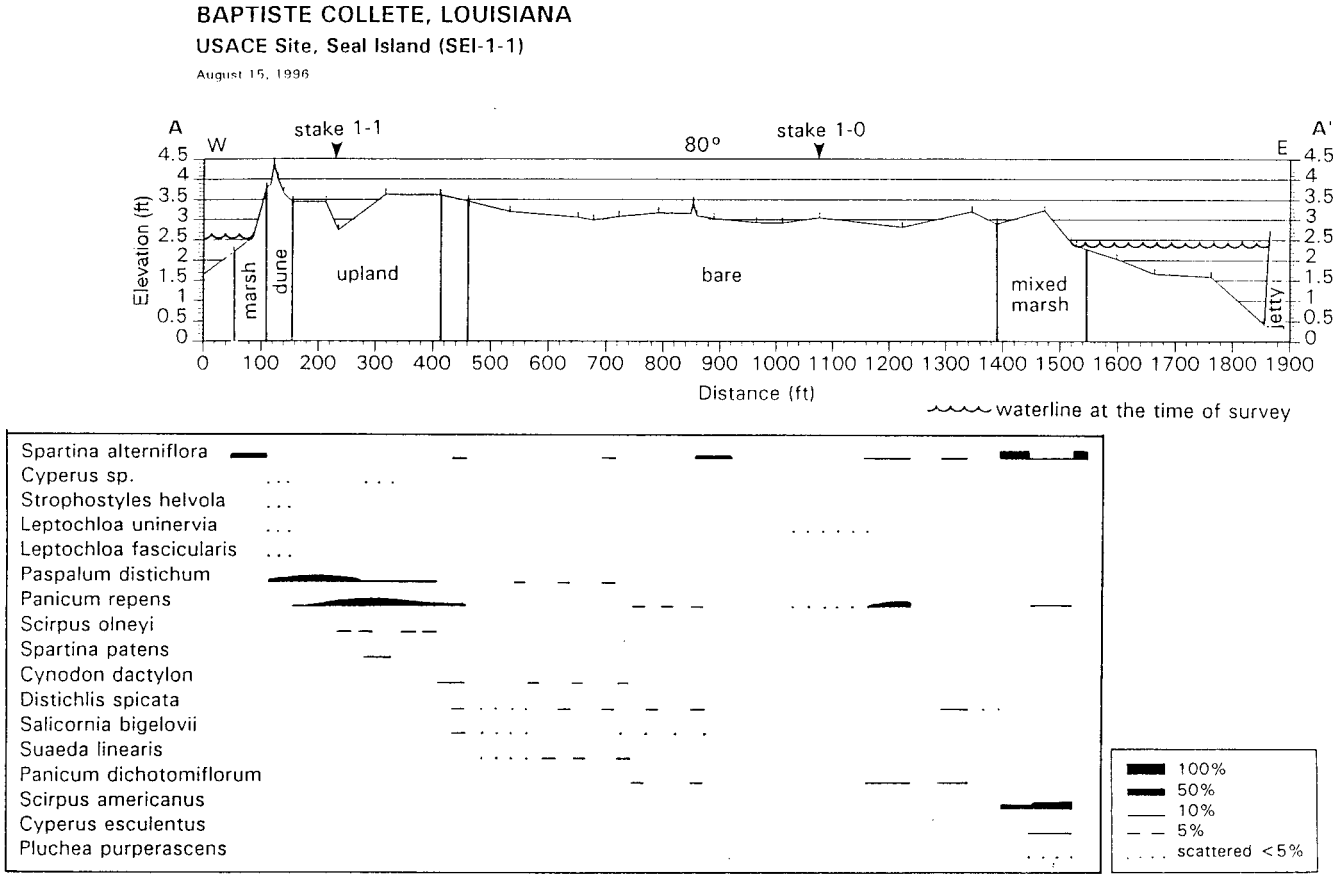


Figure 13. 1996 *Strike* profile SEI-1-1 at Seal Island with vegetation data illustrated.

Vegetative Character

General Description

The overall marsh type for this area is classified as intermediate marsh. The marsh exposed to the daily tides (low marsh) exhibited a mixed marsh community in response to the frequently changing salinity regime that exists at the mouth of a Mississippi River distributary. During the time of the field survey, Oyster grass (*Spartina alterniflora*), a typical salt marsh species, was growing next to or mixed with fresh marsh species of duck potato *(Sagittaria latifolia*) and softstem bulrush (*Scirpus validus*), with water hyacinth *(Eichhornia crassipes*) thickly rafted against these. The salinity regime of this area changes periodically due to changes in freshwater flow from the Mississippi River, which at times favors salt marsh development at low-flow/high salt levels, or fresh marsh development at high-flow/low salinity levels. Salt marsh species, in general, establish quickly in saline conditions and grow well under freshwater conditions, but they can be out-competed by other non-saline tolerant species. Most freshwater species that establish during fresh conditions cannot tolerate saline water for long and die. Intermediate marsh species tolerate a little of both and are therefore the most prevalent.

The navigation channel is dredged frequently and new areas are created annually. The islands on the east side of the channel are maintained at a higher elevation than those to the west to provide habitat for the many bird species that nest and roost in the area. The islands to the west of the jetties were created at a lower elevation to encourage marsh development.

Vegetative community types

The low marsh in the study area is inundated by daily tides and consist of a mixture of *Spartina alterniflora* (salt marsh), *Scirpus americanus* (fresh to intermediate marsh) and *Echinochloa walteri* (also fresh to intermediate marsh) in solid or intermixed stands. The outer edges of the marsh also included *Scirpus validus*, *Polygonum lapathifolium*, *Eichhornia crassipes*, *Leptochloa panicoides*, *Cyperus odorata*, *Sagittaria latifolia*, and *Panicum repens*. Various *Cyperus* species, and *Leptochloa fascicularis* occurred along the margins between low and high marsh areas.

High marsh areas in the study area are inundated periodically by high tides and were heavily represented by grasses and intermediate marsh species, mainly *Spartina patens*, *Echinochloa walteri*, and *Distichlis spicata*, with scattered *Phragmites australis*, *Pluchea odorata*, *Ammania coccinea*, *Xanthium strumarium*, *Heliotropium curassavicum*, *Aster subulatus*, and *Aster tenufoilus*. There were small stands of *Phragmites* surrounded by *Paspalum vaginatum*, and some *Panicum repens* and *Salicornia bigelovii*. Low wet areas within the high marsh, included *Distichlis spicata*, *Panicum repens*, *Bacopa monnieri*, *Alternanthera philoxeroides*, *Leptochloa panicoides*, *Panicum dichotomiflorum*, *Polygonum lapathifolium*, and *Ammania coccinea* and showy species such as *Ludwigia decurrens*, *Ludwigia octovalvis*, *Bidens frondosa*, *Aster tenuifolius*, and *Aster subulatus*. There were extensive flats of *Salicornia bigelovii* and *Distichlis spicata* which sometimes included *Paspalum distichum*, *Panicum repens*, *Sesuvium portulacastrum*, *Cyperus* spp., or *Heliotropium curassavicum*.

The beach above the high waterline was colonized in bands paralleling the waterline predominantly by *Echinochloa walteri*, *Polygonum lapathifolium*, *Paspalum distichum*, *Cyperus* spp., and *Spartina patens*. *Echinochloa*, *Polygonum*, *Cyperus*, *Spartina alterniflora*, and *Leptochloa fascicularis* occur at the interface of the beach with interior marsh or lagoons. *Cynodon dactylon*, *Aeschynomene indica*, *Vigna luteola*, *Strophostyles helvola*, *Leptochloa fascicularis*, and *Panicum dichotomiflorum* occur at the interface of the upper beach with upland areas.

Upland areas were represented by grasslands or terraces, including areas supporting small scattered shrubs. Grasses establish quickly on well-drained, freshly deposited dredged materials and form grasslands that help to quickly stabilize the new material. *Distichlis spicata*, *Panicum repens*, *Digitaria ciliaris*, *Leptochloa fascicularis*, *Spartina patens*, and *Panicum vaginatum* tend to be the most common grass species, with *Cyperus* sp., *Conyza canadensis*, *Pluchea odorata* as common herbaceous plants. The vines *Vigna luteola* and *Strophostyles helvola* were present in some high marsh areas and most upland areas entwining everything in reach into a tangled mat. Older terraces develop with additional species of *Panicum dichotomiflorum*, *Cynodon Dactylon*, and small stands of *Phragmites australis* or small *Sesbania drummondii* shrubs.

Shrub/scrub communities consist of woody plants to small trees under 20 feet tall. Some areas that would otherwise be classed as high marsh but support shrubs or small trees such as *Iva frutescens*, *Baccharis halimifolia*, or *Salix nigra* are classified as shrub/scrub. Older elevated areas develop shrub communities of *Baccharis halimifolia*, *Iva frutescens*, or *Sesbania drummondii* with an understory of grasses *Spartina patens*, *Distichlis spicata*, *Panicum repens*, *Paspalum vaginatum*, and *Echinochloa walteri*, with *Pluchea odorata*, and *Hydrocotyle bonariensis*. Advanced shrub communities also may contain an occasional *Salix nigra* and *Hibiscus moscheutos*.

Elevation and the Distribution of Vegetative Community Types

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 community composition delineate boundaries between habitats. Older deposits with more time for plants to establish, generally exhibit greater density and diversity than younger deposits. Also, with more settling of the sediment having taken place and more time for competition to effect vegetative species, older deposits exhibit a greater degree of zonation and distinct habitat formation.

The maximum elevation along the transects of the dredged material at Baptiste Collette Bayou navigation channel was 6.55 feet, on the *bird island* named Shea Island (Figure 9). The maximum elevation along the transects of the western islands was 4.38 feet on Seal Island (Figure 13).

The intermediate marsh was documented along the transects generally below 3.0 feet MSL. Upland habitat dominated by grasses and shrub/scrub habitats occurred above 3.0 feet .

GIS ANALYSIS RESULTS

Shoreline Changes: 1976-1994

Figure 14 graphs the spatial history of the Baptiste Collette Bayou (BCB) study area between 1975 and 1996 depicted in Table 1 and illustrated in Figure 15. In October 1975, the BCB study area was measured at 125.71 acres. The study area in November 1996 was measured at 588.85 acres. This is a cumulative area increase of +463.14 acres or an increase in area of +368.42 percent for the 21 year period at an overall rate of change of +22.05 acres per year. There was an overall loss of -51.83 acres of natural habitats, offset by the creation of +514.94 acres due to the beneficial use of dredged materials. Without the contribution of new habitats due to the placement of dredged material, the total coastal land loss in the study area would have exceeded -18 acres at a rate of -1.0 acres per year, which is equivalent to a one percent loss of the area per year.

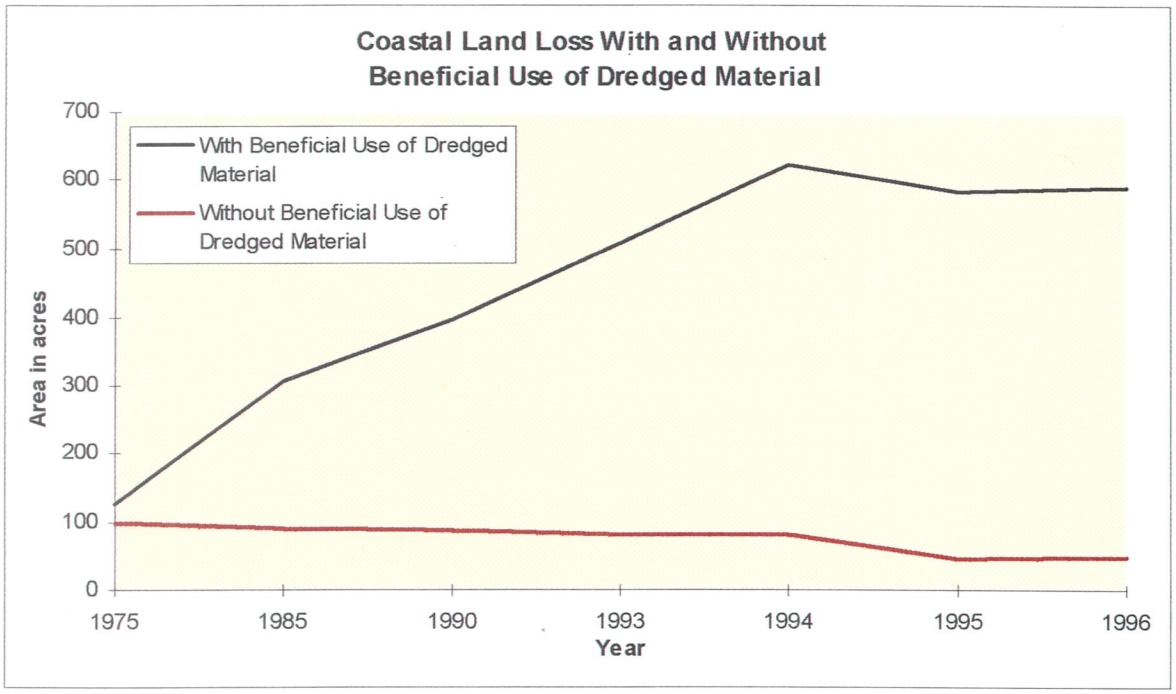


Figure 14. Graph of the area of the Baptiste Collette Bayou BUMP study area over time showing the contribution of beneficial use of dredged material. The red line graphs the total natural area excluding areas created by beneficial use of dredged materials.

TABLE 1
Baptiste Collette Bayou Area: 1975-1996

Area in Acres	Oct 1975	Dec 1985	Dec 1990	Feb 1993	Nov 1994	Nov 1995	Nov 1996
Natural Areas	99.37	89.08	88.29	82.41	81.14	44.42	47.57
BUMP-made Areas	26.34	216.72	307.76	426.24	542.04	537.21	541.29
Total	125.71	305.80	396.05	508.65	623.18	581.63	588.86

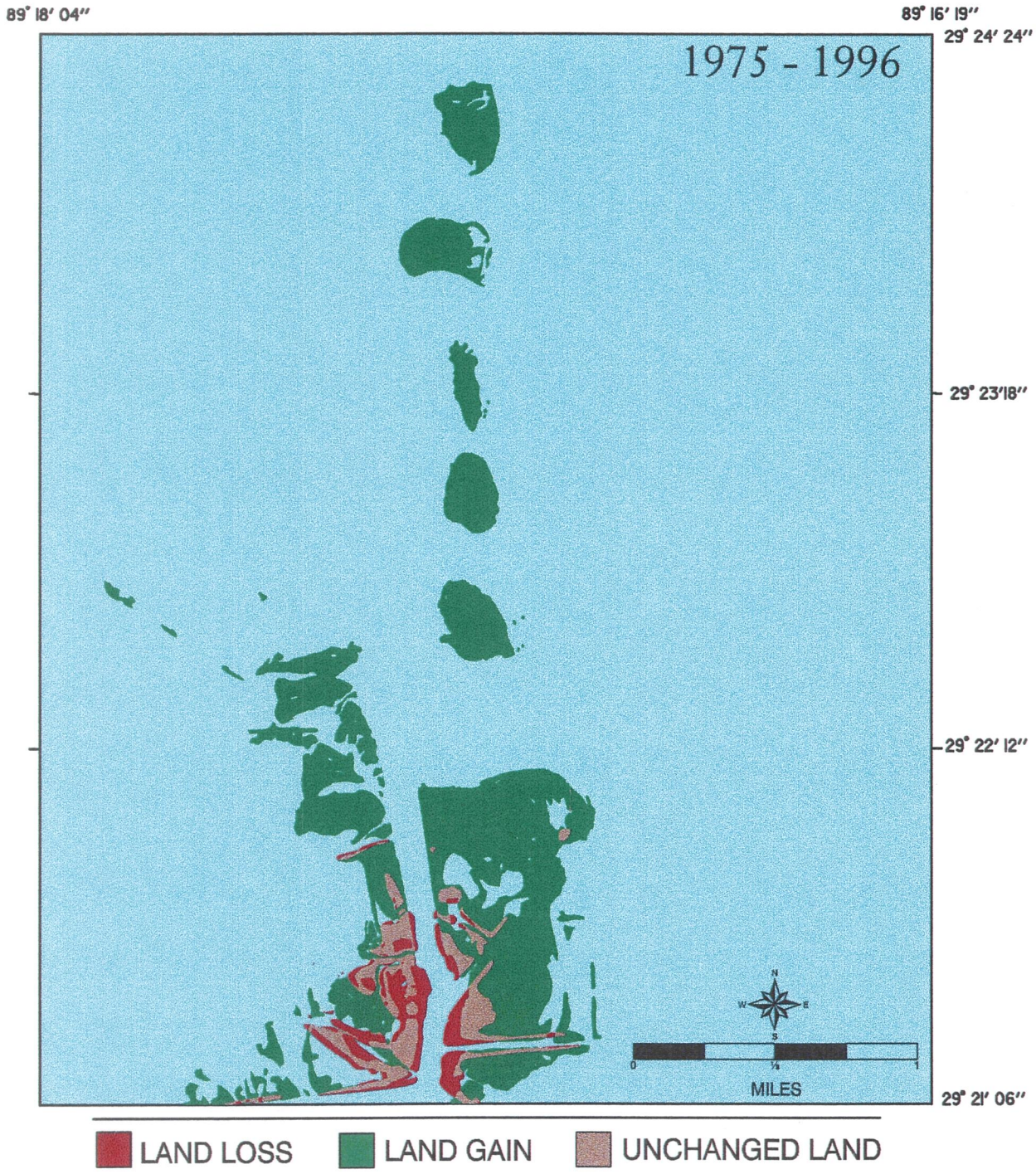


Figure 15. Shoreline change history for the Baptiste Collette Bayou BUMP study area between October 1975 and November 1996.

Figure 16 depicts the coastal land loss history for BCB between October 1975 and December 1985. The total area of BCB increased by +180.09 acres at a rate of +20.0 acres per year for this nine year period. The primary areas of progradation took place along the eastern margin of the BCB navigation channel. Land loss was associated with BCB channel widening and erosion along the western margin of the navigation channel.

Figure 17 depicts the coastal land loss history for the BCB area between December 1985 and December 1990. The area of BCB study area for this five year time period increased by +90.75 acres at a rate of +18.05 acres per year. Land gain occurred primarily along the eastern margin of the navigation channel. Land loss was concentrated on the *bird islands* and occurred sporadically in the southern portion of the study area as edge erosion.

Figure 18 depicts the coastal land loss history for the BCB study between December 1990 and February 1993. The BCB study area increased by +112.60 acres over 2.17 years at a rate of +51.89 acres per year. Land gain occurred primarily in the *bird islands* and the western side of the navigation area. Land loss took the form of edge erosion on the bird islands and along the channel margins.

Figure 19 depicts the coastal land loss history for BCB study area between February 1993 and November 1994. The BCB study area increased by +114.53 acres for the 1.75 year time period at a rate of +65.45 acres per year. The primary areas of land gain occurred in the *bird islands* and west of the navigation channel. Land loss was concentrated along the north/northeast facing shorelines of the *bird islands* and the area east of the channel.

Figure 20 depicts the coastal land loss history for BCB study area between November 1994 and November 1995. The BCB study area decreased by -50.56 acres for the 1.0 year time period. Land loss was concentrated along the north/northeast facing shorelines of the *bird islands* and the areas to the east and west of the channel at mile marker #6.

Figure 21 depicts the coastal land loss history for BCB study area between November 1995 and November 1996. The BCB study area increased by +7.23 acres for the 1.0 year time period. The primary areas of land gain occurred in the bird islands and the areas west of the channel. Land loss was concentrated along the north/northeast facing shorelines of the *bird islands* and the area east of the channel.

In addition to the creation of new habitats, the effect of the beneficial use of dredged materials has been to accelerate the progradation of the BCB distributary channel. The sediments that accumulate in the BCB navigation channel are primarily distributary mouth bar sands and silts. Prior to the beneficial use of dredged materials at the BCB navigation channel, this distributary was prograding at a rate of ±100 meters per year. Since 1985, the rate of distributary progradation at the BCB has accelerated to rates greater than +400 meters per year on the east side of the channel and to rates greater than +200 meters per year on the west side of the channel.

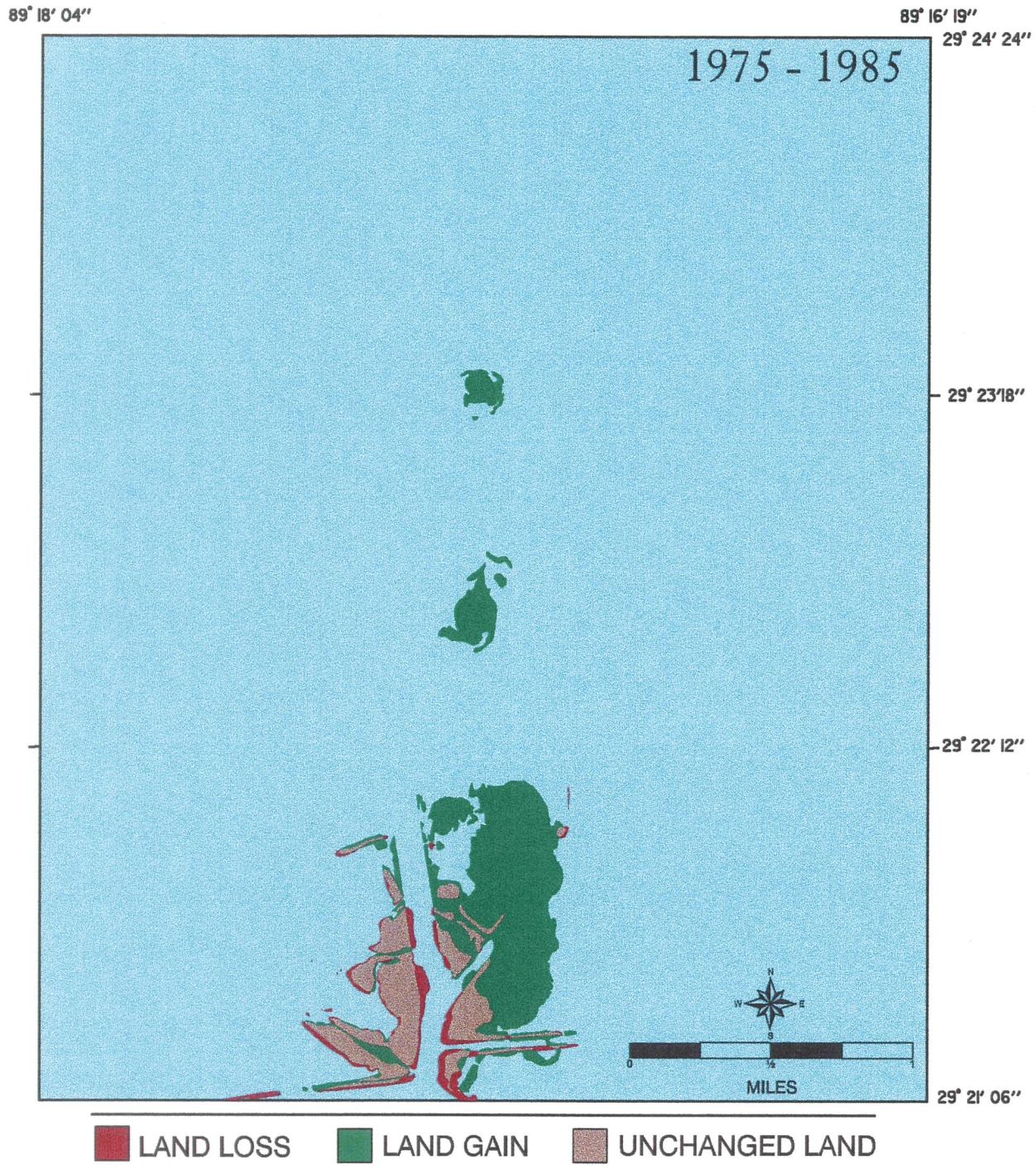


Figure 16. Shoreline change history for the Baptiste Collette Bayou BUMP study area between October 1975 and December 1985.

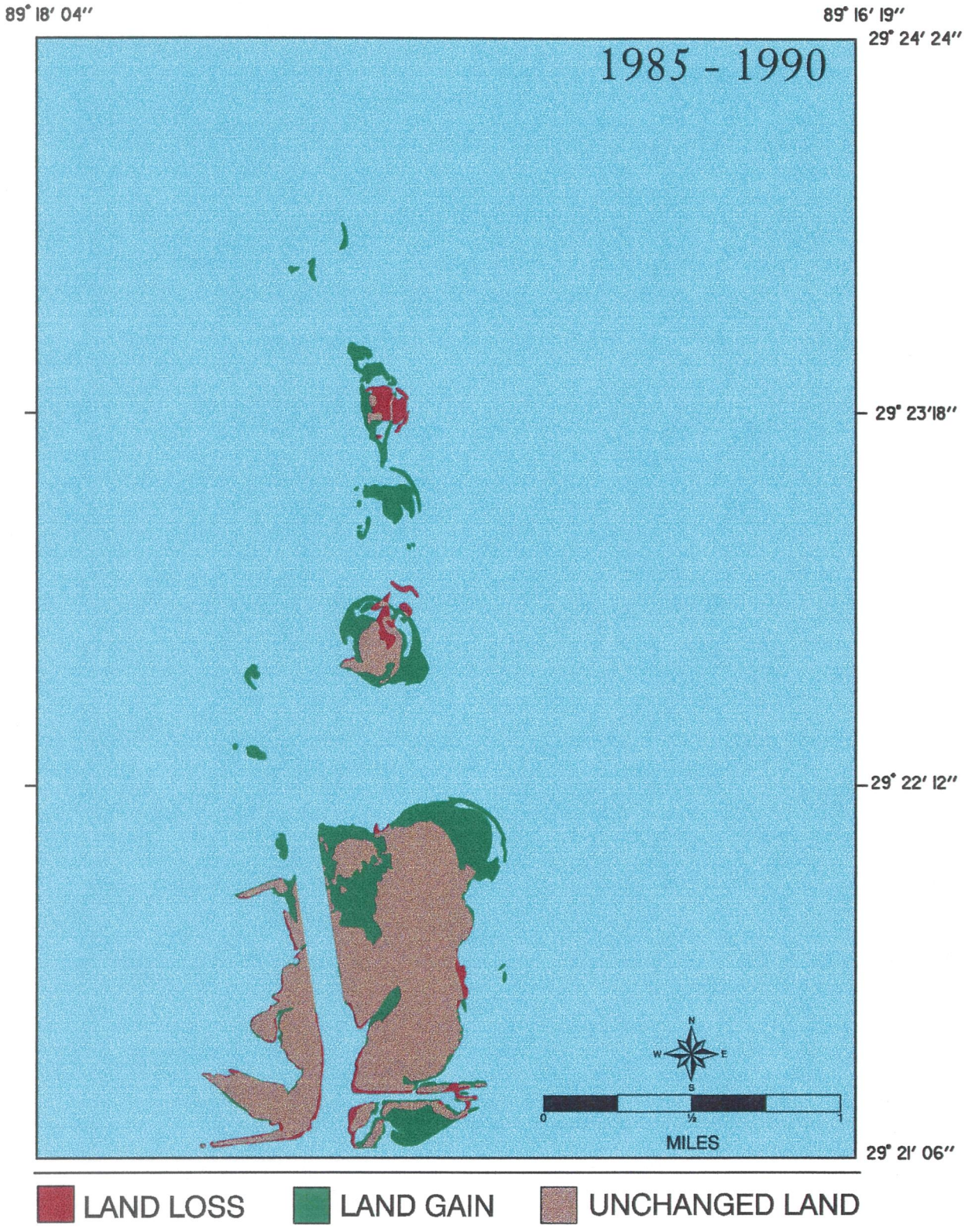


Figure 17. Shoreline change history for the Baptiste Collette Bayou BUMP study area between December 1985 and December 1990.

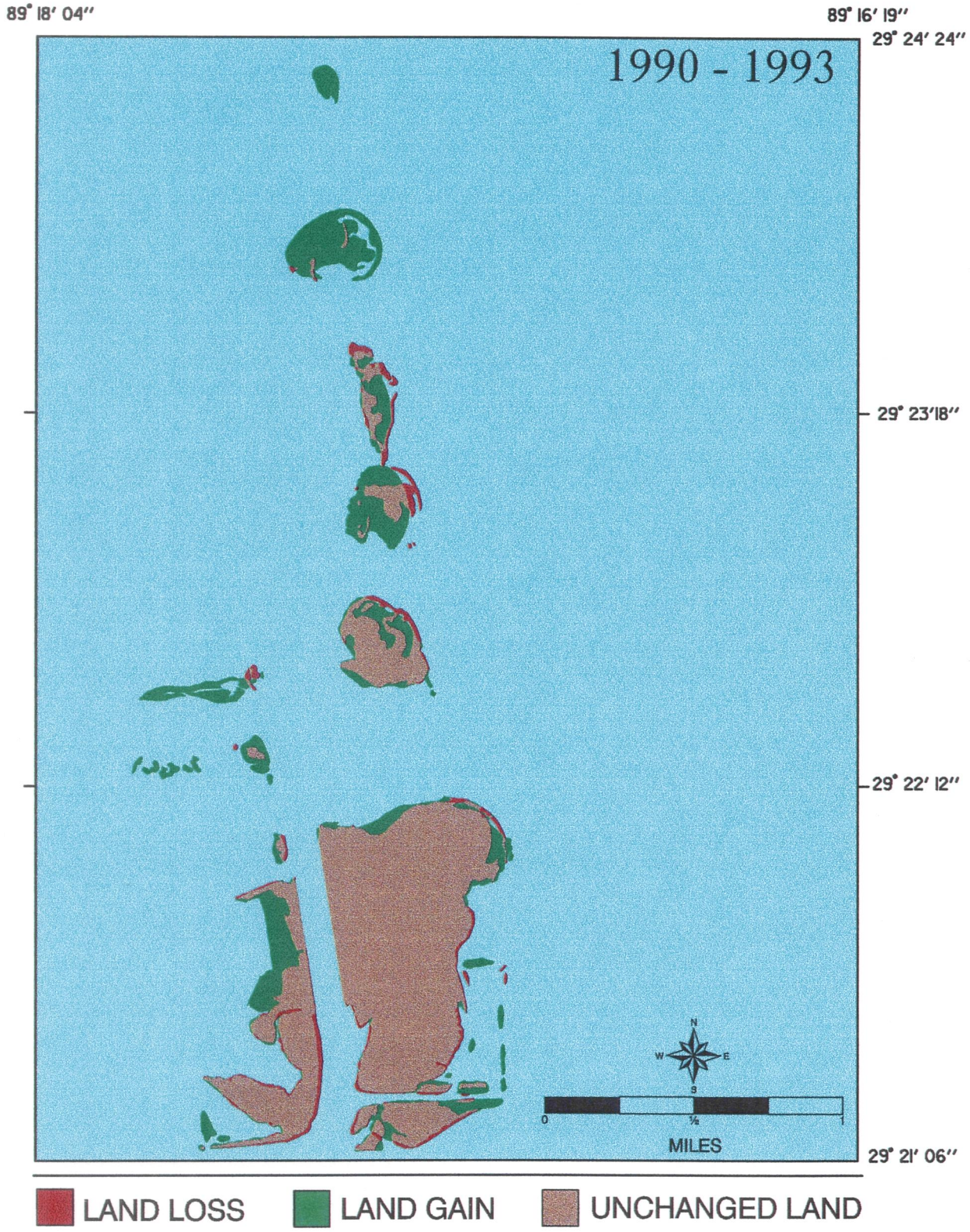


Figure 18. Shoreline change history for the Baptiste Collette Bayou BUMP study area between December 1990 and February 1993.

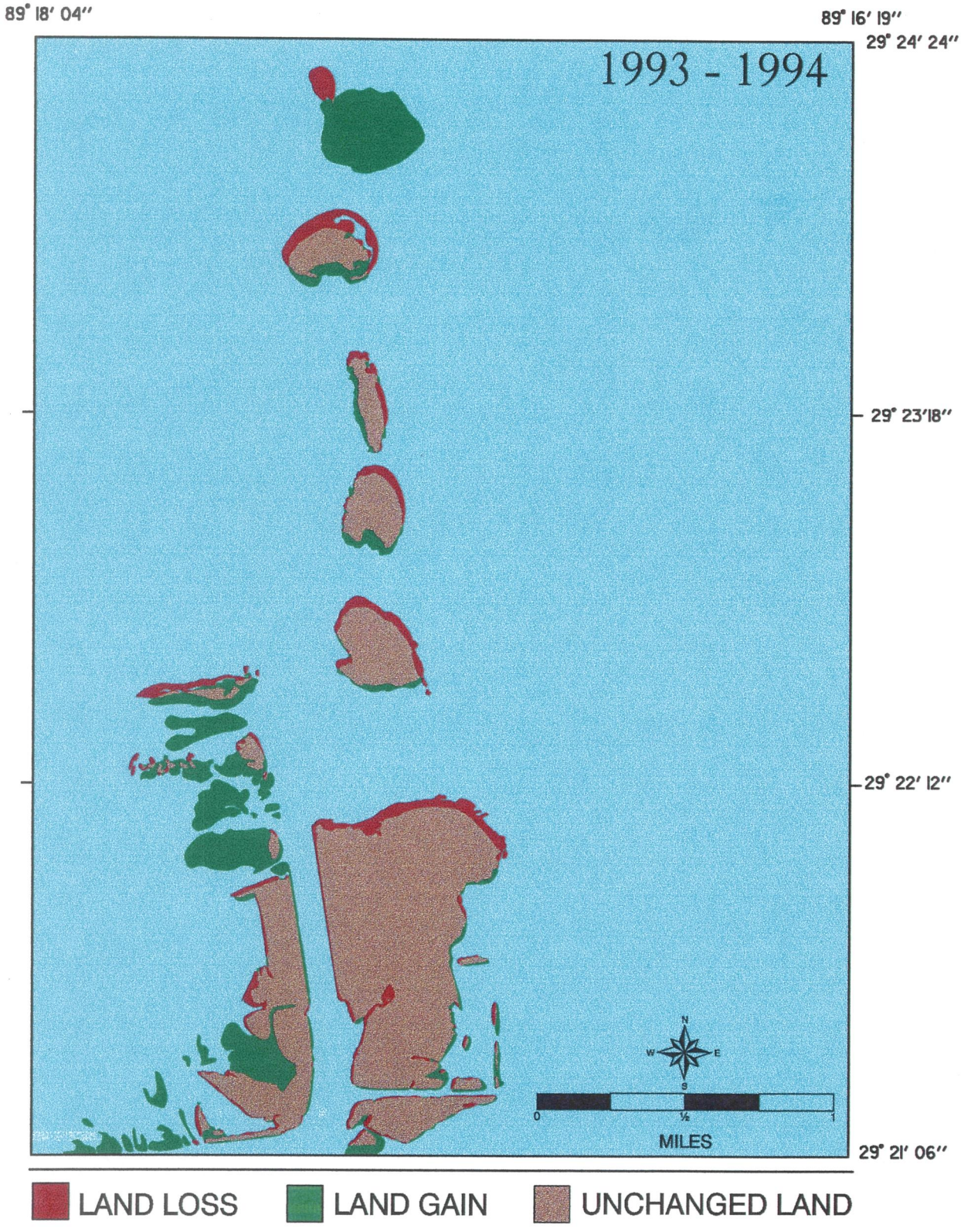


Figure 19. Shoreline change history for the Baptiste Collette Bayou BUMP study area between February 1993 and November 1994.

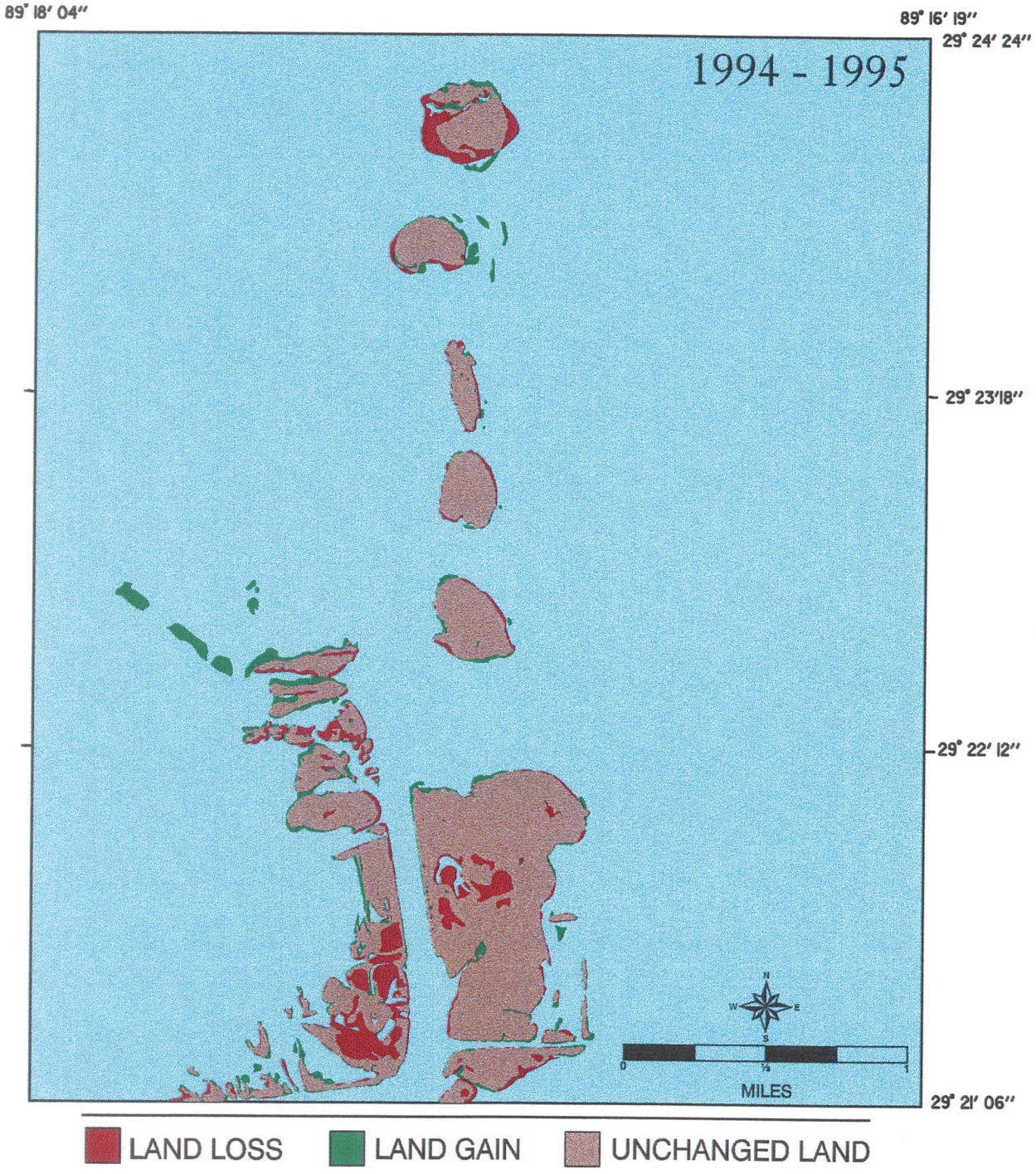


Figure 20. Shoreline change history for the Baptiste Collette Bayou BUMP study area between November 1994 and November 1995.

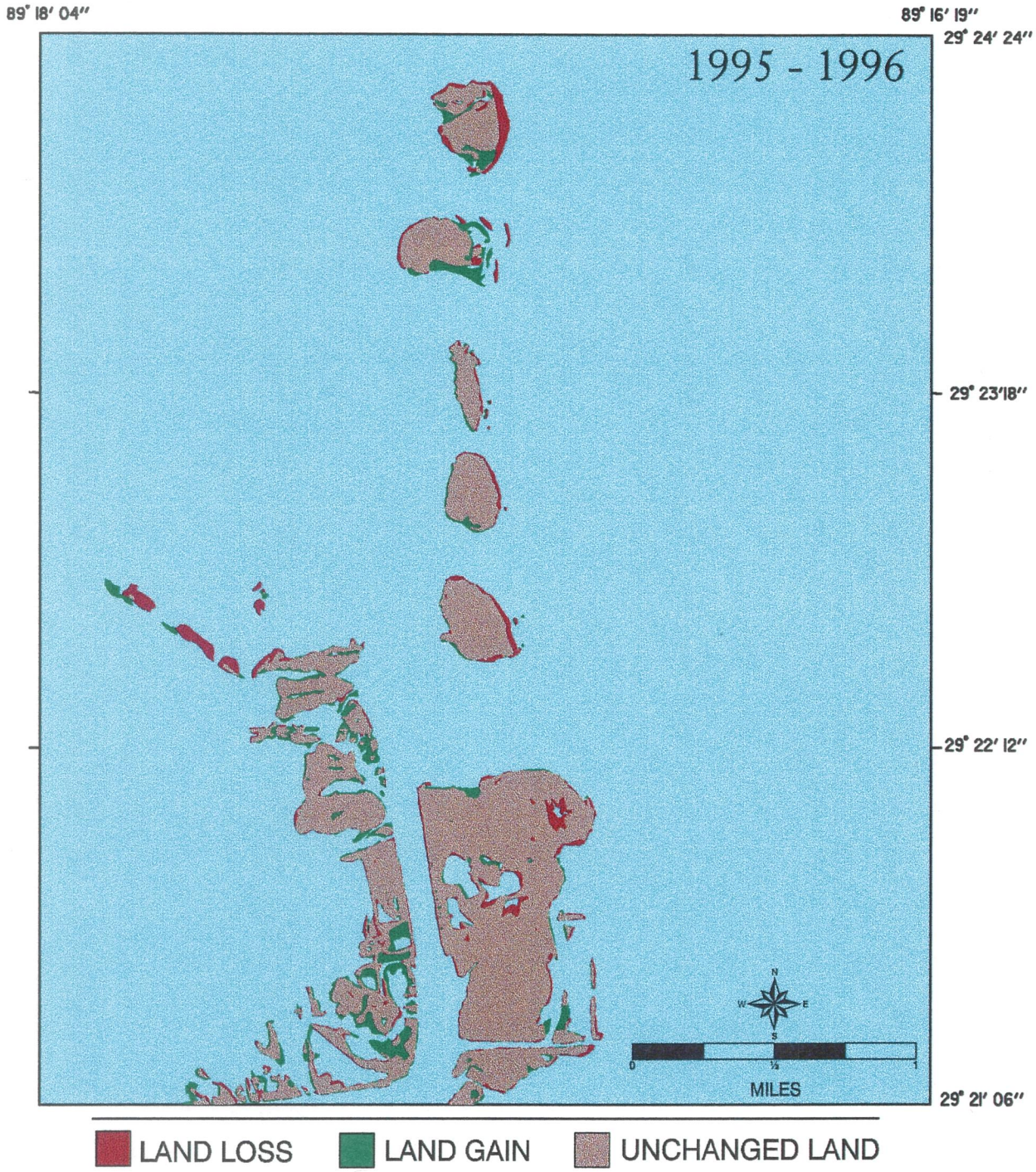


Figure 21. Shoreline change history for the Baptiste Collette Bayou BUMP study area between November 1995 and November 1996.

Habitat Inventory

The aerial photographic interpretation combined with field surveys identified six major habitat types in the Baptiste Collette Bayou BUMP study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The man-made class identifies the habitats created by the beneficial use of dredged material. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Table 2 lists the areas of the three habitat types found in the study area in October 1975. The location and arrangement of these habitats is presented in figure 20. The total area of the Baptiste Collette Bayou BUMP study area was 125.71 acres. Of this total, 99.37 acres were natural and 26.34 acres were man-made, or 79.0 percent were natural and 21.0 percent were man-made. In order of decreasing size and importance, the largest habitat found was natural marsh (99.37 acres) followed by man-made marsh (18.16 acres), man-made shrub/scrub (5.01 acres), and man-made bare land (3.17 acres).

In terms of habitat totals, marsh (117.53 acres or 93.5%) dominated the landscape.

TABLE 2
October 1975 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	117.53	99.37	18.16
Shrub/Scrub	5.01	0.00	5.01
Bare Land	3.17	0.00	3.17
Habitat Total	125.71	99.37	26.34

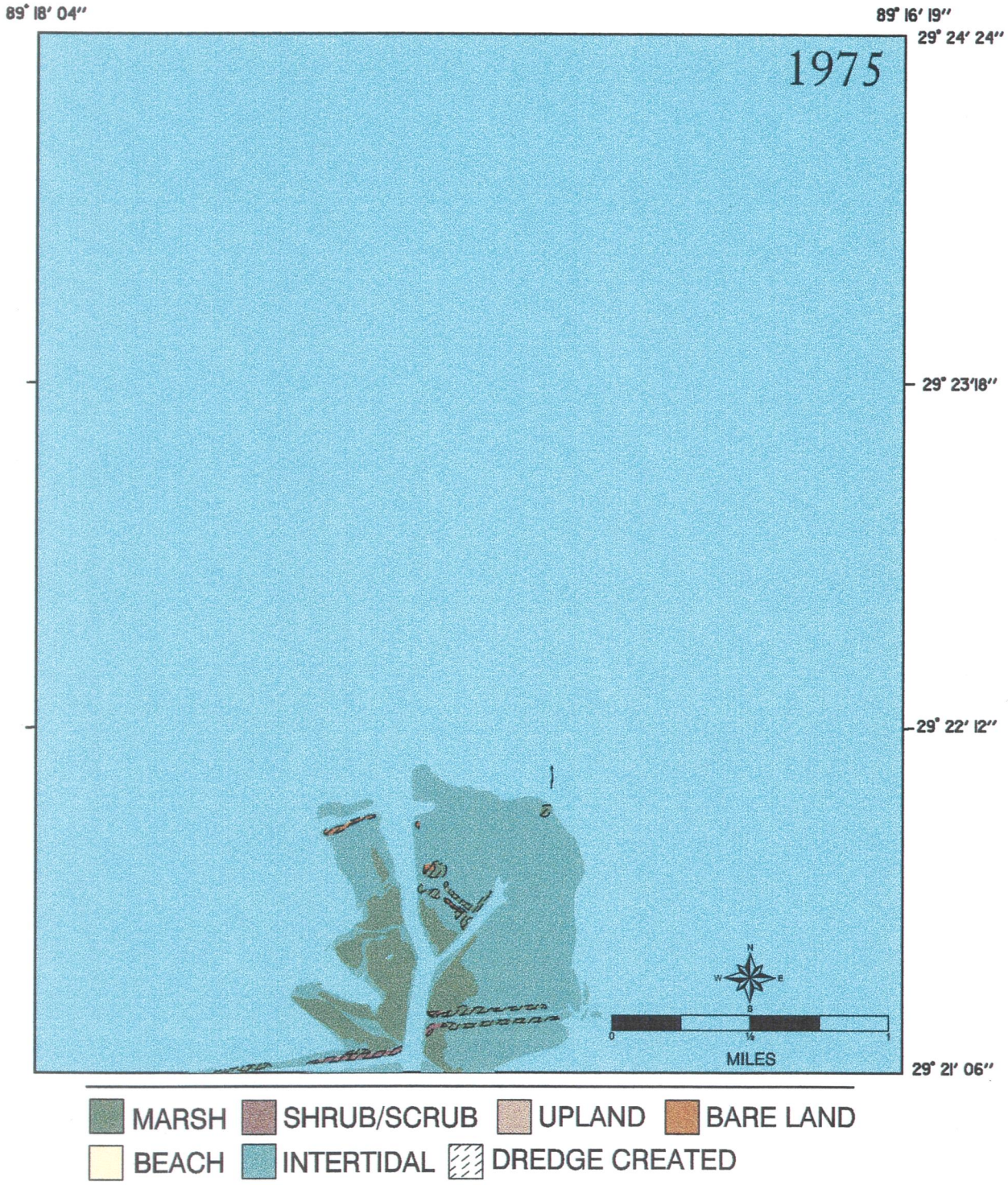


Figure 20. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in October 1975.

Table 3 lists the areas of the five habitat types found in the Baptiste Collette Bayou BUMP study area in December 1985. The location and arrangement of these habitats is presented in Figure 21. The total area of the Baptiste Collette Bayou study site was measured at 305.80 acres. Of this total, 89.08 acres were natural and 216.72 acres were man-made or 29.1 percent were natural and 70.9 percent were man-made. In order of decreasing size and importance, the largest habitat found was man-made marsh (136.53 acres) followed by natural marsh (82.17 acres), man-made bare land (45.60 acres), man-made upland (25.42 acres), natural bare land (6.91 acres), man-made beach (5.76 acres), and man-made shrub/scrub (3.41 acres).

In terms of habitat totals, marsh (218.70 acres or 71.5%) dominated the landscape.

TABLE 3
December 1985 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	218.70	82.17	136.53
Upland	25.42	0.00	25.42
Shrub/Scrub	3.41	0.00	3.41
Bare Land	52.51	6.91	45.60
Beach	5.76	0.00	5.76
Habitat Total	305.80	89.08	216.72

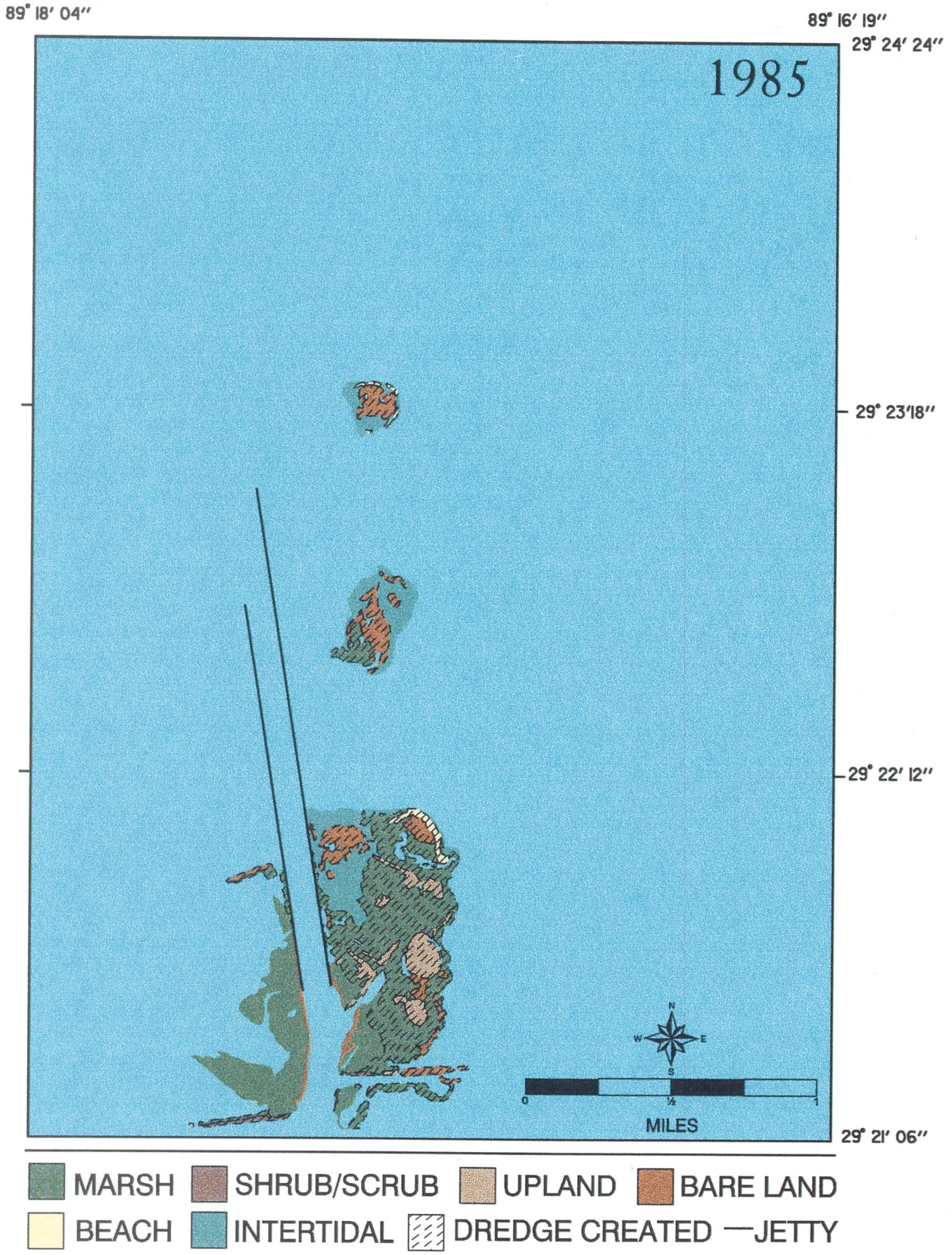


Figure 21. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in December 1985.

Table 4 lists the areas of the five habitat types found in the Baptiste Collette Bayou BUMP study area in December 1990. The location and arrangement of these habitats are presented in figure 22. The total area of the Baptiste Collette Bayou study site in December 1990 was 396.05 acres. Of this total, 88.29 acres were natural and 307.76 acres were man-made or 22.3 percent were natural and 77.7 percent were man-made. In order of decreasing size and importance, the largest habitat found was man-made marsh (182.04 acres) followed by natural marsh (71.00 acres), man-made bare land (55.95 acres), man-made shrub/scrub (36.50 acres), man-made upland (17.41 acres), natural bare land (16.46 acres), man-made beach (15.86 acres), and natural upland (0.83 acres).

In terms of habitat totals, marsh (253.04 acres or 63.9%) dominated the landscape.

TABLE 4
December 1990 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	253.04	71.00	182.04
Upland	18.24	0.83	17.41
Shrub/Scrub	36.50	0.00	36.50
Bare Land	72.41	16.46	55.95
Beach	15.86	0.00	15.86
Habitat Total	396.05	88.29	307.76

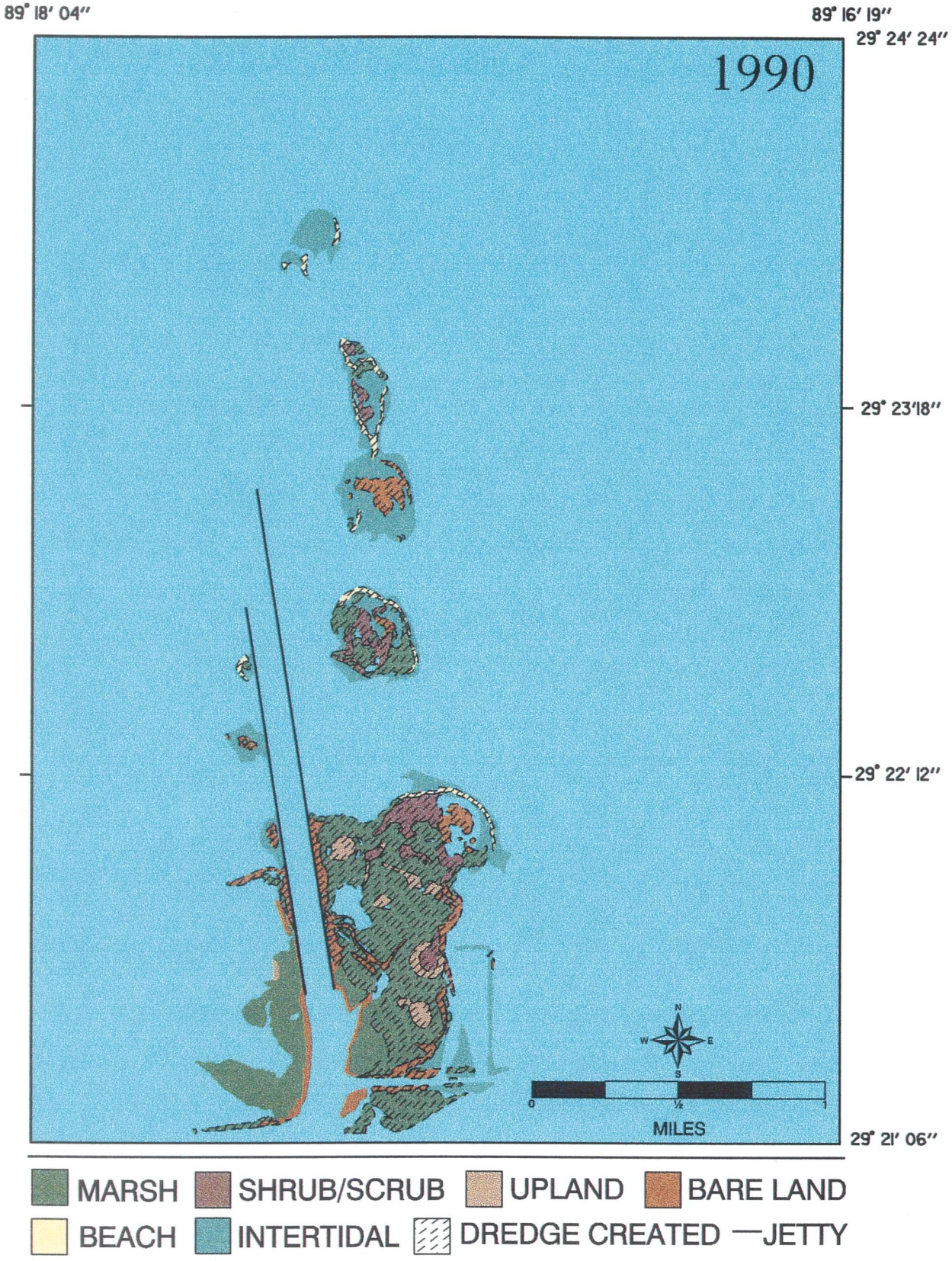


Figure 22. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in December 1990.

Table 5 lists the areas of the five habitat types found in the Baptiste Collette Bayou BUMP study area in February 1993. The location and arrangement of these habitats is presented in figure 23. The total area of the Baptiste Collette Bayou study site in February 1993 was 508.65 acres. Of this total, 82.41 acres were natural and 426.24 acres were man-made or 16.2 percent were natural and 83.8 percent were man-made. In order of decreasing size and importance, the largest habitat found was man-made marsh (200.85 acres) followed by man-made bare land (68.25 acres), natural marsh (69.35 acres), man-made upland (64.10 acres), man-made shrub/scrub (53.52 acres), man-made beach (39.52 acres), natural bare land (11.61 acres), and natural upland (1.45 acres).

In terms of habitat totals, marsh (270.20 acres or 53.1%) dominated the landscape.

TABLE 5
February 1993 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	270.20	69.35	200.85
Upland	65.55	1.45	64.10
Shrub/Scrub	53.52	0.00	53.52
Bare Land	79.86	11.61	68.25
Beach	39.52	0.00	39.52
Habitat Total	508.65	82.41	426.24

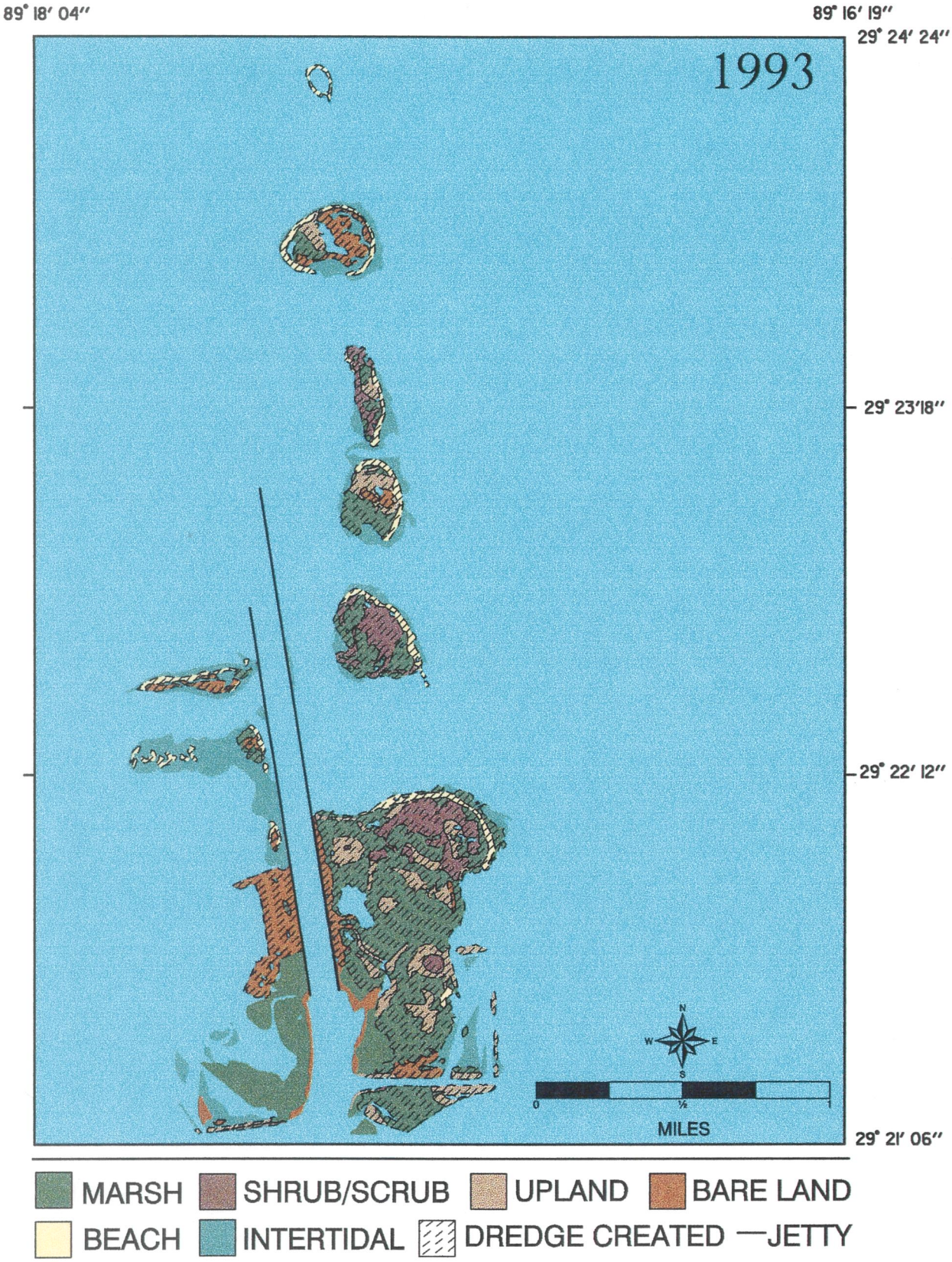


Figure 23. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in February 1993.

Table 6 lists the areas of the five habitats found in the Baptiste Collette Bayou BUMP study area in November 1994. The location and arrangement of these habitats is presented in figure 24. In 1994, the total area of the site was calculated at 623.18 acres. Of this total, 81.14 acres were natural and 542.04 acres were man-made, or 13.0 percent was natural and 87.0 percent was man-made. In order of decreasing size and importance, the largest habitat found is man-made marsh (291.88 acres) followed by man-made bare land (102.98 acres), man-made shrub/scrub (68.54 acres), man-made upland (65.88 acres), natural marsh (64.64 acres), natural upland (16.50 acres), and man-made beach (12.76 acres).

In terms of total area, marsh (356.52 acres or 57.2%) dominated the landscape of the study area.

TABLE 6
November 1994 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	356.52	64.64	291.88
Upland	82.38	16.50	65.88
Shrub/Scrub	68.54	0.00	68.54
Bare Land	102.98	0.00	102.98
Beach	12.76	0.00	12.76
Habitat Total	623.18	81.14	542.04

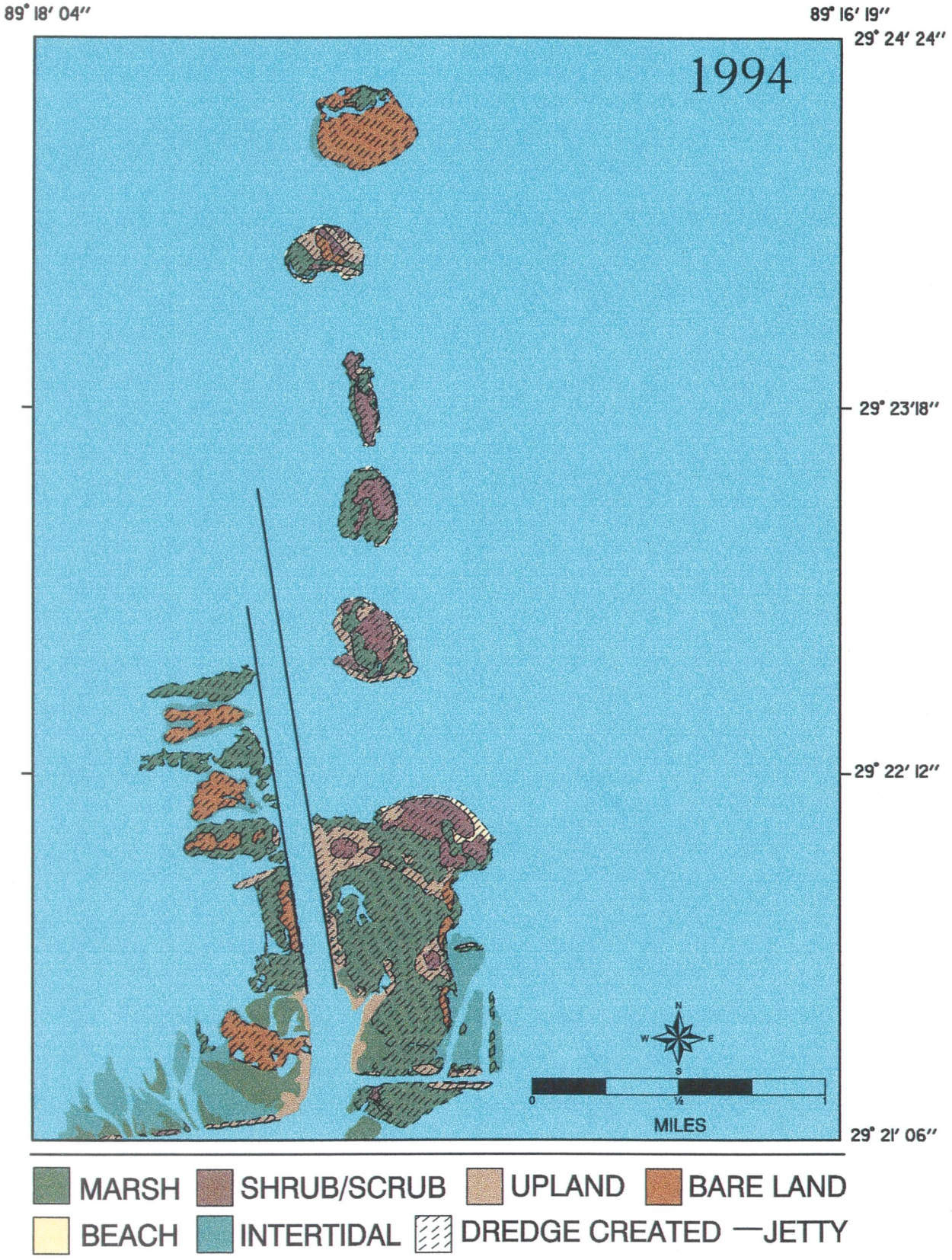


Figure 24. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1994.

Table 7 lists the areas of the five habitats found in the Baptiste Collette Bayou BUMP study area in November 1995. The location and arrangement of these habitats is presented in figure 25. In 1995, the total area of the site was calculated at 581.63 acres. Of this total, 44.42 acres were natural and 537.21 acres were man-made, or 7.6 percent was natural and 92.4 percent was man-made. In order of decreasing size and importance, the largest habitat found is man-made marsh (255.37 acres) followed by man-made upland (114.39 acres), man-made shrub/scrub (68.88 acres), man-made beach (45.46 acres), man-made bare land (38.16 acres), natural marsh (36.93 acres), man-made dune (14.95 acres), natural upland (6.22 acres), and natural bare land (1.27 acres).

In terms of total area, marsh (292.30 acres or 50.3%) dominated the landscape of the study area.

TABLE 7
November 1995 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	292.30	36.93	255.37
Upland	120.61	6.22	114.39
Shrub/Scrub	68.88	0.00	68.88
Bare Land	39.43	1.27	38.16
Dune	14.95	0.00	14.95
Beach	45.46	0.00	45.46
Habitat Total	581.63	44.42	537.21

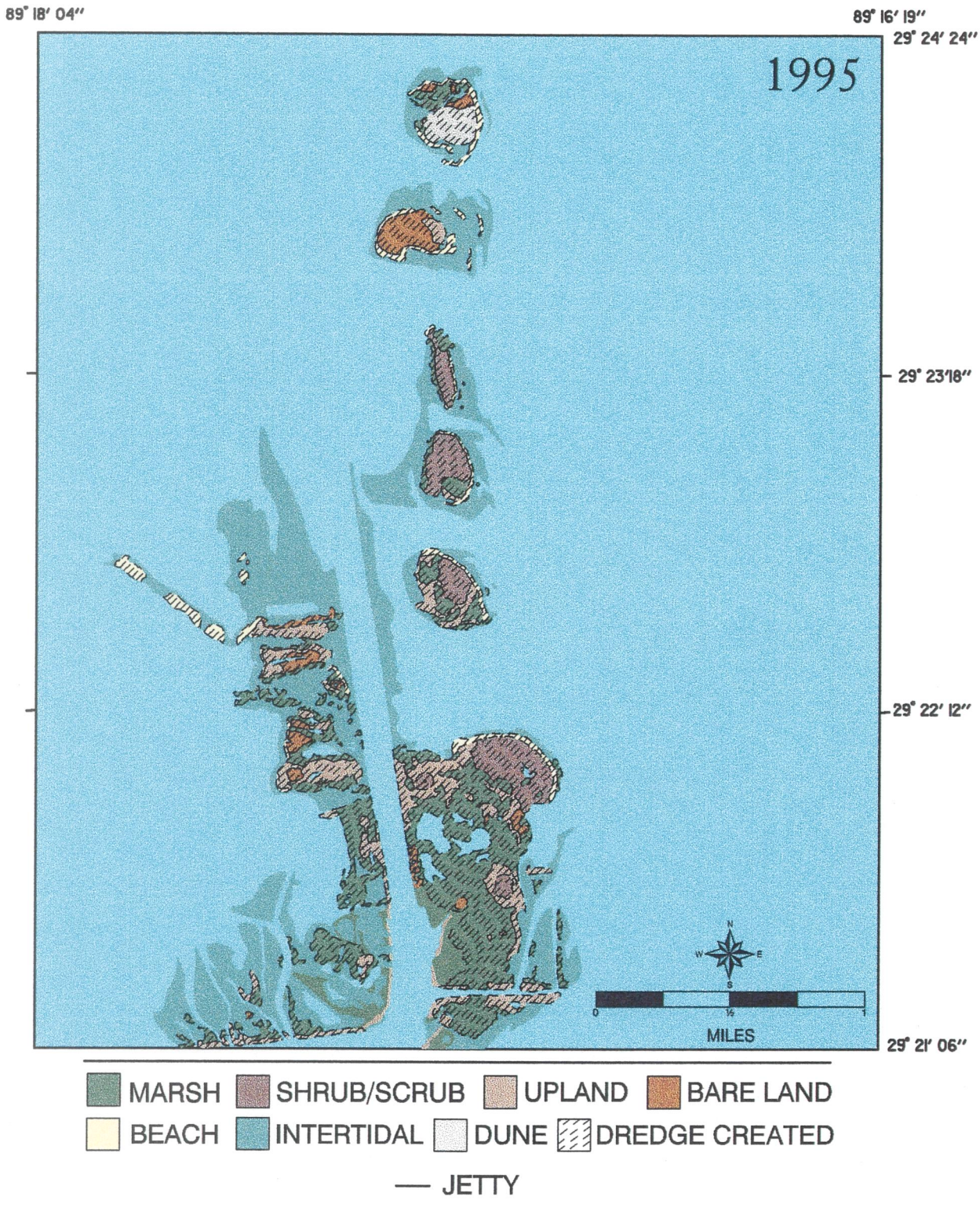


Figure 25. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1995.

Table 8 lists the areas of the five habitats found in the Baptiste Collette Bayou BUMP study area in November 1996. The location and arrangement of these habitats is presented in figure 26. In 1996, the total area of the site was calculated at 588.86 acres. Of this total, 47.57 acres were natural and 541.29 acres were man-made, or 8 percent was natural and 92 percent was man-made. In order of decreasing size and importance, the largest habitat found is man-made marsh (212.5 acres) followed by man-made upland (120.07 acres), man-made bare land (107.68 acres), man-made shrub/scrub (59.84 acres), natural marsh (36.05 acres), man-made beach (33.78 acres), natural bare land (10.04 acres), man-made dune (7.42 acres), and natural upland (1.48 acres).

In terms of total area, marsh (248.55 acres or 42.2%) dominated the landscape of the study area.

TABLE 8
November 1996 Habitat Inventory of the Baptiste Collette Bayou BUMP Study Area

HABITAT	TOTAL	NATURAL	MAN-MADE
Marsh	248.55	36.05	212.50
Upland	121.55	1.48	120.07
Shrub/Scrub	59.84	0.00	59.84
Bare Land	117.72	10.04	107.68
Dune	7.42	0.00	7.42
Beach	33.78	0.00	33.78
Habitat Total	588.86	47.57	541.29

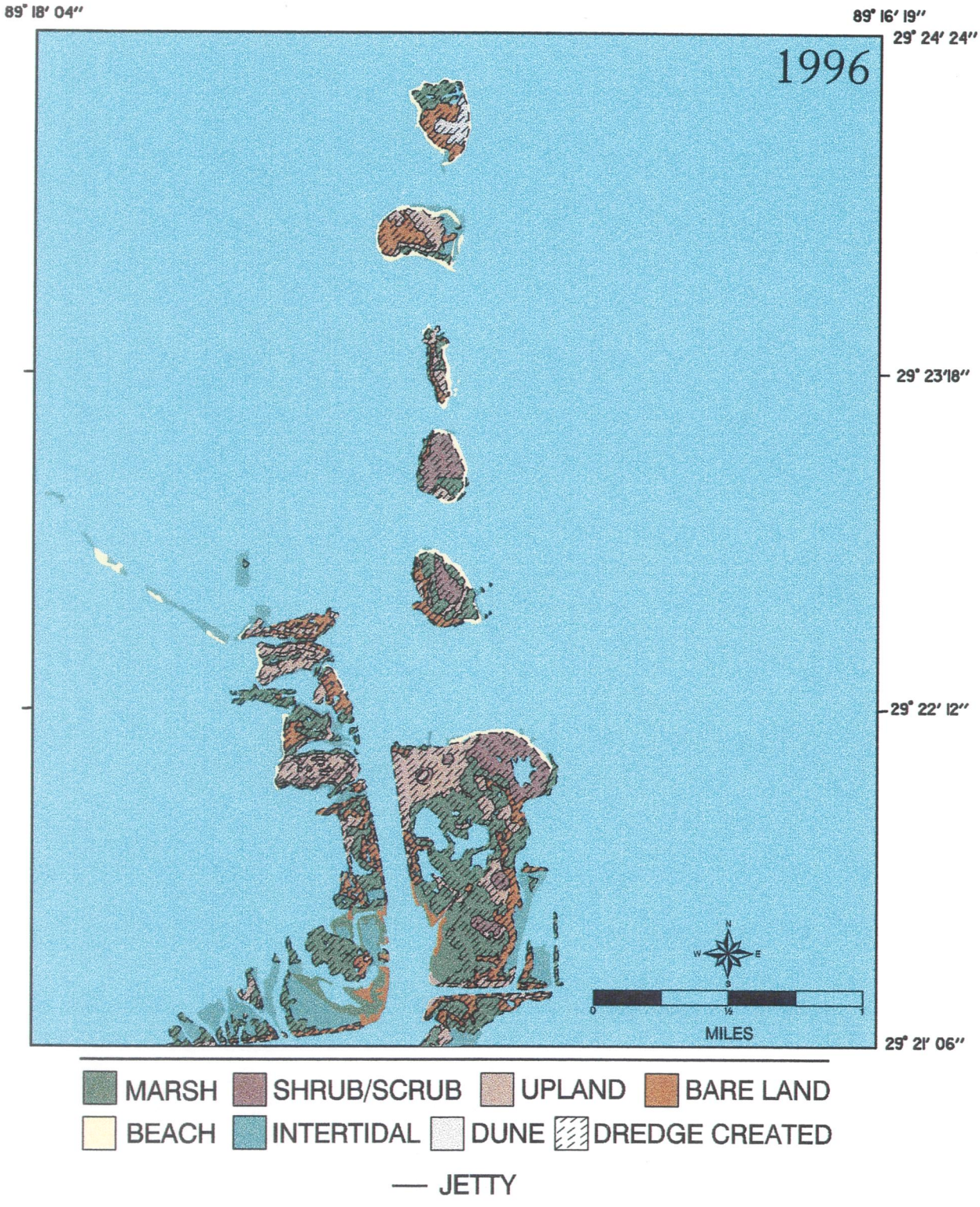


Figure 26. Habitat inventory map of the Baptiste Collette Bayou BUMP study area in November 1996.

Habitat Change

Figure 27 shows the creation of new habitat, natural and man-made, along the study area by comparing October 1975 and November 1996. Land gain due to beneficial use of dredged materials dominates the processes of this area. The total area increased by +463.15 acres between 1975 and 1996 which represents a +368 percent increase in area. There was an overall -51.8 acres of decrease of the natural habitats, offset by an overall +514.95 acres of increase in man-made habitats. Table 9 lists the major habitat changes.

The greatest cumulative habitat change between 1975 and 1996 was the increase of man-made upland due to beneficial use of dredged materials. For the natural areas, there was a loss of -63.32 acres of marsh and a slight increase in bare land (+3.13 acres). The natural upland class increased by +1.48 acres. The total natural habitat changes accounted for -51.8 acres of loss. For the man-made habitats, in decreasing order, there was a gain of +120.07 acres of upland, +104.51 acres of bare land, +54.83 acres of shrub/scrub, and +33.78 acres of beach, and +7.42 acres of dune, for a total gain of +514.95. The overall change in natural and man-made habitats was an increase of +463.15 acres.

Figure 28 shows a time series of habitat changes along the Baptiste Collette Bayou navigation channel. Figure 28A graphs the natural habitat changes over time. Natural marsh degradation and erosion dominates the processes affecting the natural habitat class. Figure 28B graphs the man-made marsh, man-made shrub/scrub and man-made bare land that dominate the man-made class. In terms of the beneficial use process, the greatest areas of new habitat creation include man-made upland (+94.76 acres), and man-made marsh (+75.99 acres) as indicated by the most recent inventory in November 1996 (Table 8).

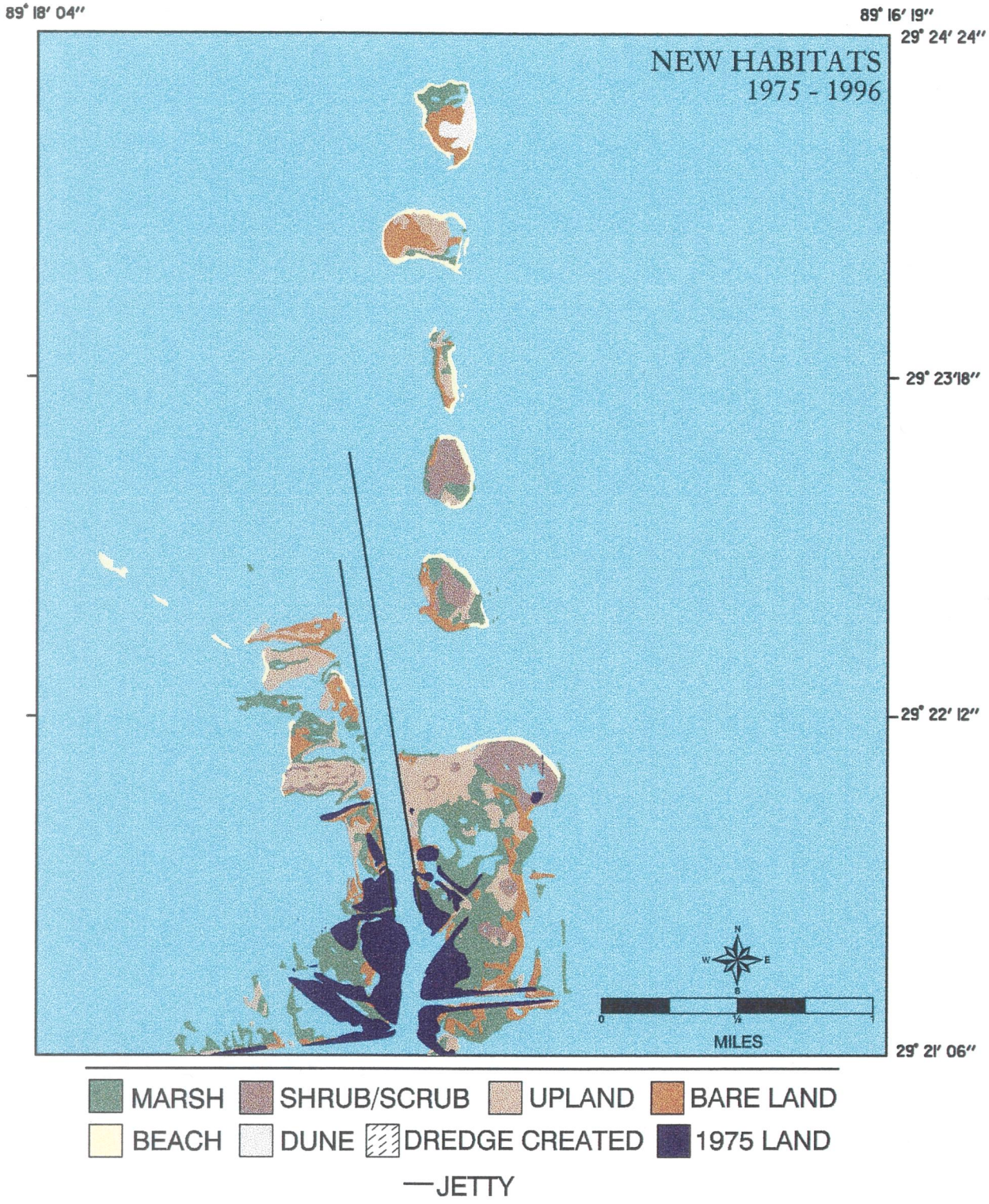
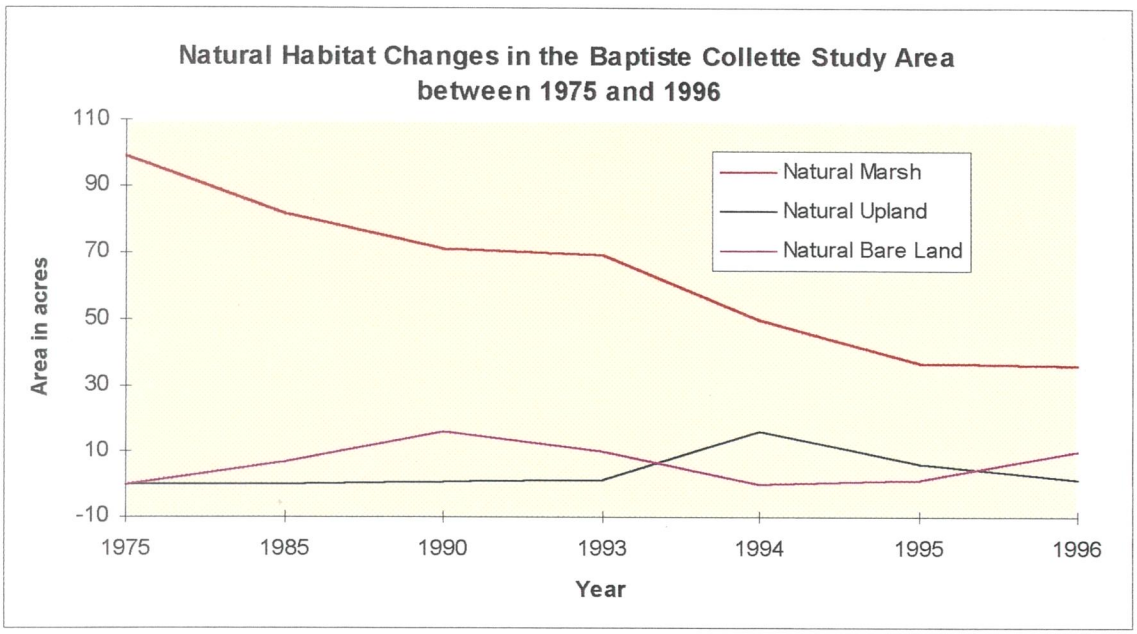


Figure 27. New habitats created by beneficial use of dredged materials in the Baptiste Collette Bayou BUMP study area comparing October 1975 and November 1996.

TABLE 9
Cumulative Change in Total Acres of each Habitat
In the Study Area Between 1975, 1985, 1990, 1993, 1994, 1995 and 1996

HABITAT	1975-1985[1]	1985-1990[1]	1990-1993[1]	1993-1994[1]	1994-1995[1]	1995-1996[1]	1975-1996[1]
Natural Marsh	-17.20	-11.17	-1.65	-4.71	-27.71	-0.88	-63.32
Natural Upland	0.00	+0.83	+0.62	+15.05	-10.28	-4.74	+1.48
Natural Bare Land	+6.91	+9.55	-4.85	-11.61	+1.27	+8.77	+10.04
Total Natural Habitats	-10.29	-0.79	-5.88	-1.27	-36.72	+3.15	-51.8
Man-made Marsh	+118.37	+45.51	+18.81	+91.03	-36.51	-255.37	+194.34
Man-made Upland	+25.42	-8.01	+46.69	+1.78	+48.51	+5.68	+120.07
Man-made Shrub/Scrub	-1.60	+33.09	+17.02	+15.02	+0.34	-9.04	+54.83
Man-made Bare Land	+42.43	+10.35	+12.30	+34.73	-64.82	+69.52	+104.51
Man-made Dune	--	--	--	--	+32.70	-11.68	+7.42
Man-made Beach	+5.76	+10.10	+23.66	-26.76	+14.95	-7.53	+33.78
Total Man-made Habitats	+190.38	+91.04	+118.48	+115.86	-4.83	+4.08	+514.95
HABITAT TOTAL	+180.09	+90.25	+112.60	+114.53	-41.55	+7.23	+463.15

[1] in acres



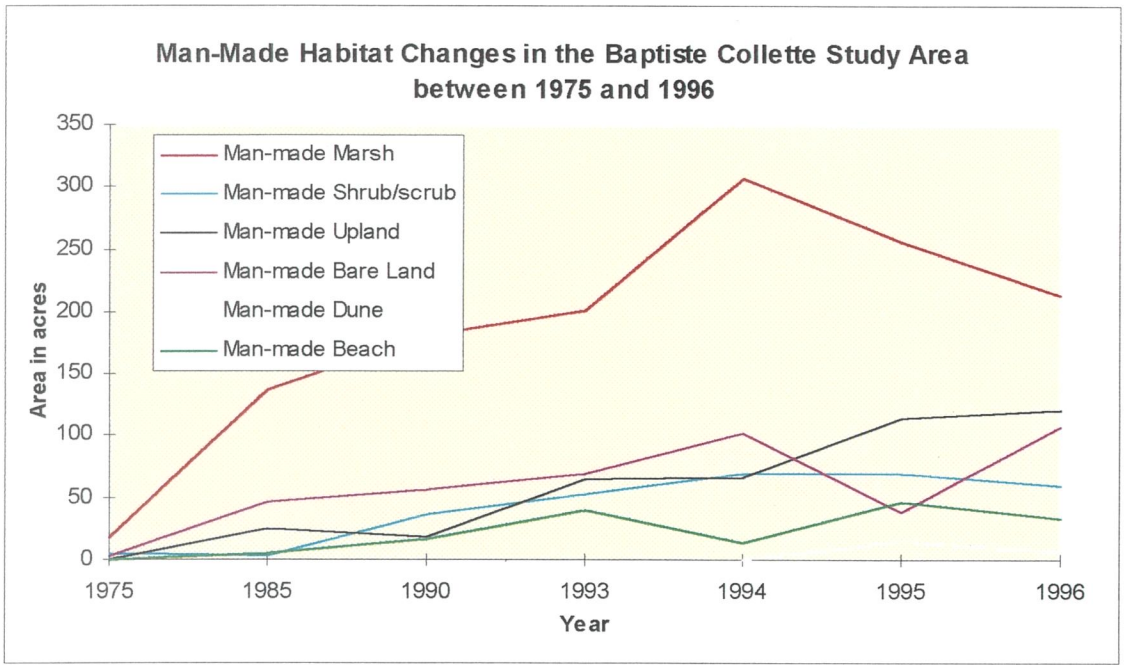


Figure 28. Time series showing the changes in total area of each habitat in the Baptiste Collette Bayou BUMP study area between October 1975 and November 1996. A) natural habitat changes. B) man-made habitat changes.

Figure 29 documents the creation of habitats at the BCB BUMP study area between October 1975 and December 1985. For the natural habitats there was a loss of -17.20 acres of marsh and a gain of +6.91 of bare land for a net change of -10.29 acres. For the man-made habitats, in decreasing order, there was a gain of +118.37 acres of marsh, +42.43 acres of bare land, +25.42 acres of upland, and +5.76 acres of beach. There was a loss of -1.60 acres of man-made shrub/scrub resulting in a total net gain of +190.38 acres. Overall, the total BCB study area increased in size by +180.09 acres for this ten year period.

Figure 30 documents the creation of habitats at the BCB BUMP study area between December 1985 and December 1990. For the natural habitats, there was a loss of -11.17 acres of marsh and a gain of +0.83 acres of upland and +9.55 acres of bare land for a total decrease of -0.79 acres. For the man-made areas, in decreasing order, there was a gain of +45.51 in marsh, +33.09 acres of shrub/scrub, +10.35 acres of bare land, and +10.10 acres of beach. There was a -8.01 acres decrease in man-made upland. The total man-made changes in the BCB study area was a gain of +91.04 acres. Overall, the BCB study area increased in size by +90.25 acres for this five year period.

Figure 31 documents the creation of habitats of the BCB BUMP study area between December 1990 and February 1993. This did not include areas created as a result of the FY93 maintenance event that took place between August and October 1993. For the natural habitats there was a loss of -1.65 acres of marsh and -4.85 acres of bare land. There was a gain of +0.62 acres of natural upland. The total natural changes amounted to a decrease of -5.88 acres. For the man-made habitat, in decreasing order, there were gains of +46.69 acres of upland, +23.66 acres of beach, +18.81 acres of marsh, +17.02 acres of shrub/scrub, and +12.30 acres of bare land. The total man-made changes accounted for a gain of +118.48 acres. The overall BCB study area increased in size by +112.60 acres over this two year period.

Figure 32 documents the creation of habitats in the BCB BUMP study area between February 1993 and November 1994, which includes the results of both FY93 and FY94 maintenance events. For the natural habitats, there was a loss of -4.71 acres of marsh and -11.61 acres of bare land. There was a +15.05 acres increase in the natural upland class. The total change in natural habitats was a decrease of -1.27 acres. For the man-made habitats, in decreasing order, there was a gain of +91.03 acres of marsh, +34.73 acres of bare land, +15.02 acres of shrub/scrub, and +1.78 acres of upland. There was a loss for man-made habitats of -26.76 acres of beach. The total man-made habitat change was a gain of +115.80 acres. The overall study area increased in size by +114.53 acres over this two year period.

Figure 33 documents the creation of habitats in the BCB BUMP study area between November 1994 and November 1995, which includes the results of the FY95 maintenance event. For the natural habitats, there was a loss of -27.71 acres of marsh and a gain of +1.27 acres of bare land. There was a -10.28 acres decrease in the natural upland class. The total change in natural habitats was a decrease of -36.72 acres. For the man-made habitats, there were changes of -36.51 acres of marsh, -64.82 acres of bare land, +0.34 acres of shrub/scrub, and +48.51 acres of upland. There was a gain for man-made habitats of +32.70 acres of beach. The total man-made habitat change was a loss of -4.83 acres. The overall study area decreased in size by -41.55 acres over this one year period.

Figure 34 documents the creation of habitats in the BCB BUMP study area between November 1995 and November 1996, which includes the results of the FY96 maintenance events. For the natural habitats, there was a loss of -0.88 acres of marsh and -4.74 acres of upland. There was a +8.77 acres increase in the natural bare land class. The total change in natural habitats was an increase of +3.15 acres. For the man-made habitats, there were changes of -255.37 acres of marsh, +69.52 acres of bare land, -9.04 acres of shrub/scrub, and +5.68 acres of upland. There was a loss for man-made habitats of -11.68 acres of beach. The total man-made habitat change was a gain of +4.08 acres. The overall study area increased in size by +7.23 acres over this one year period.

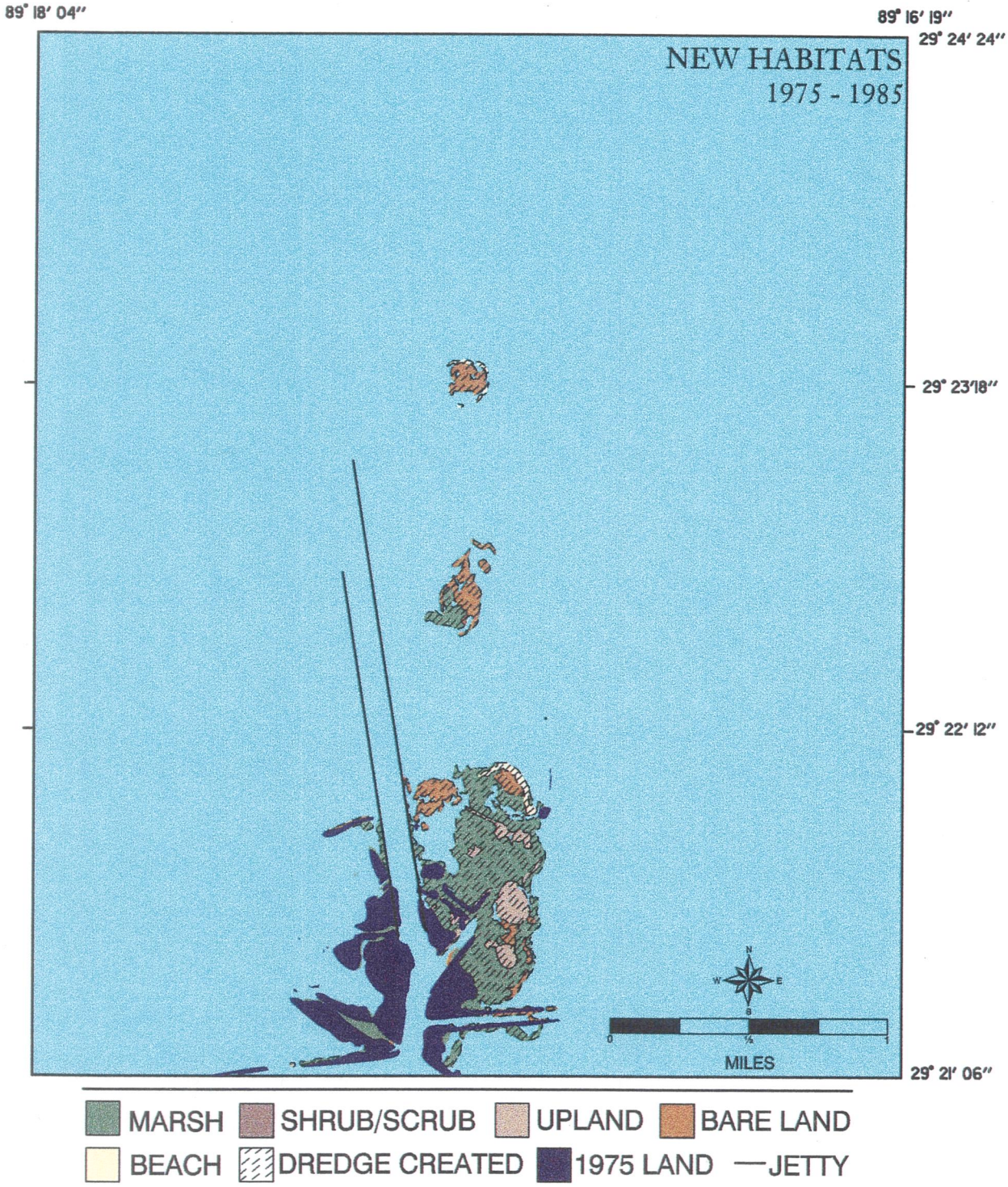


Figure 29. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing October 1975 and December 1985.

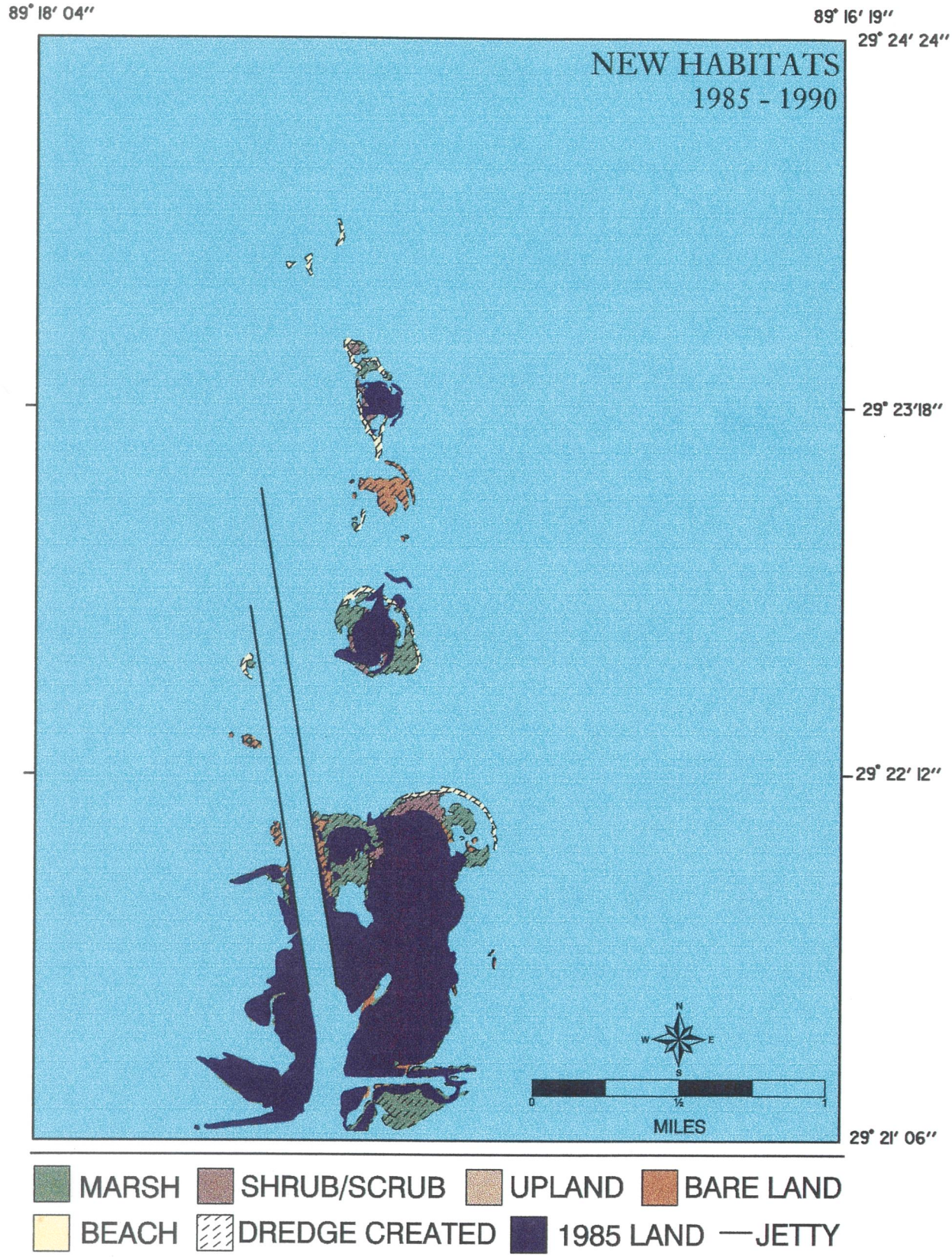


Figure 30. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing December 1985 and December 1990.

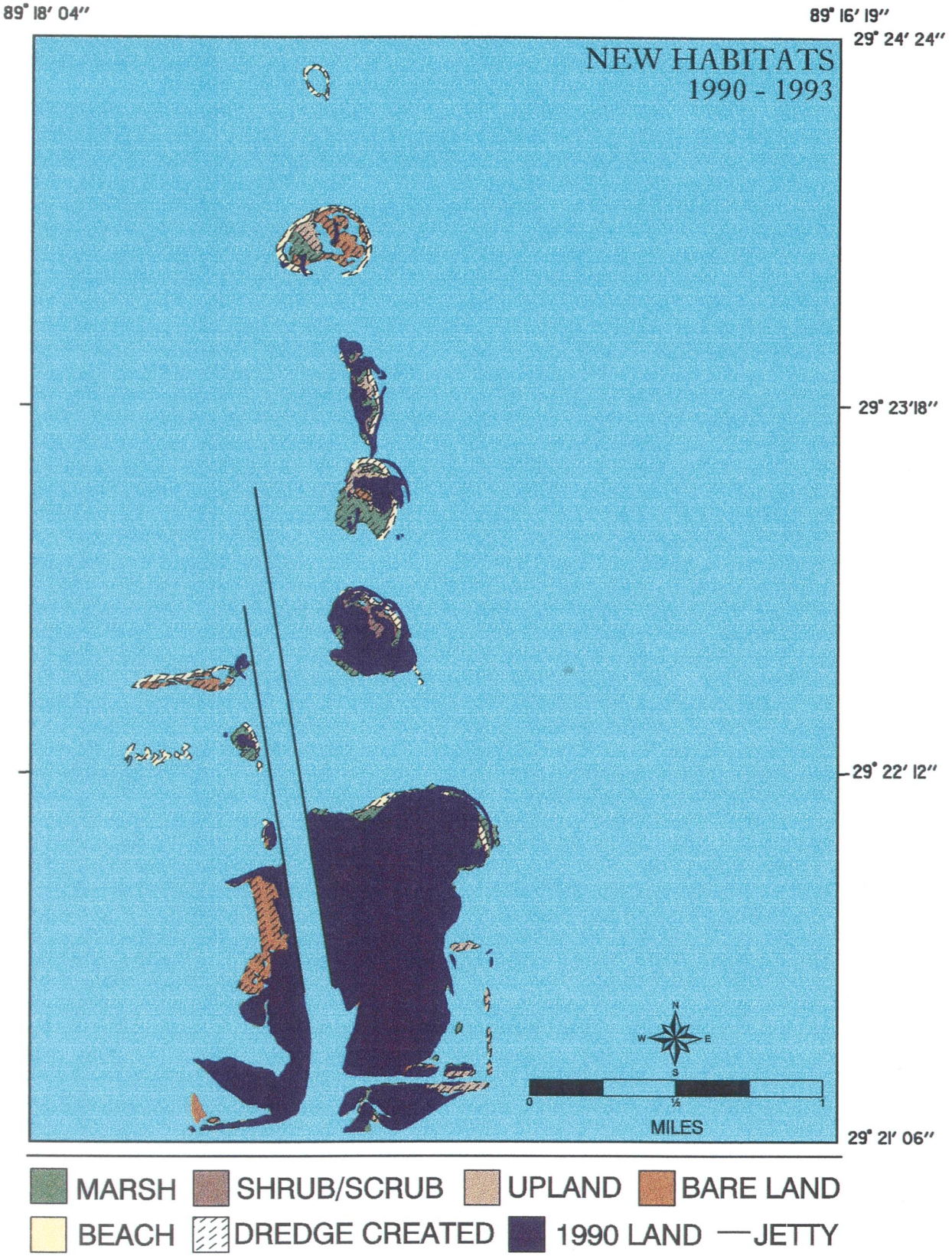


Figure 31. New habitats created as a result of the beneficial use of dredged material in the Baptiste Collette Bayou study area, shown by comparing December 1990 and February 1993.

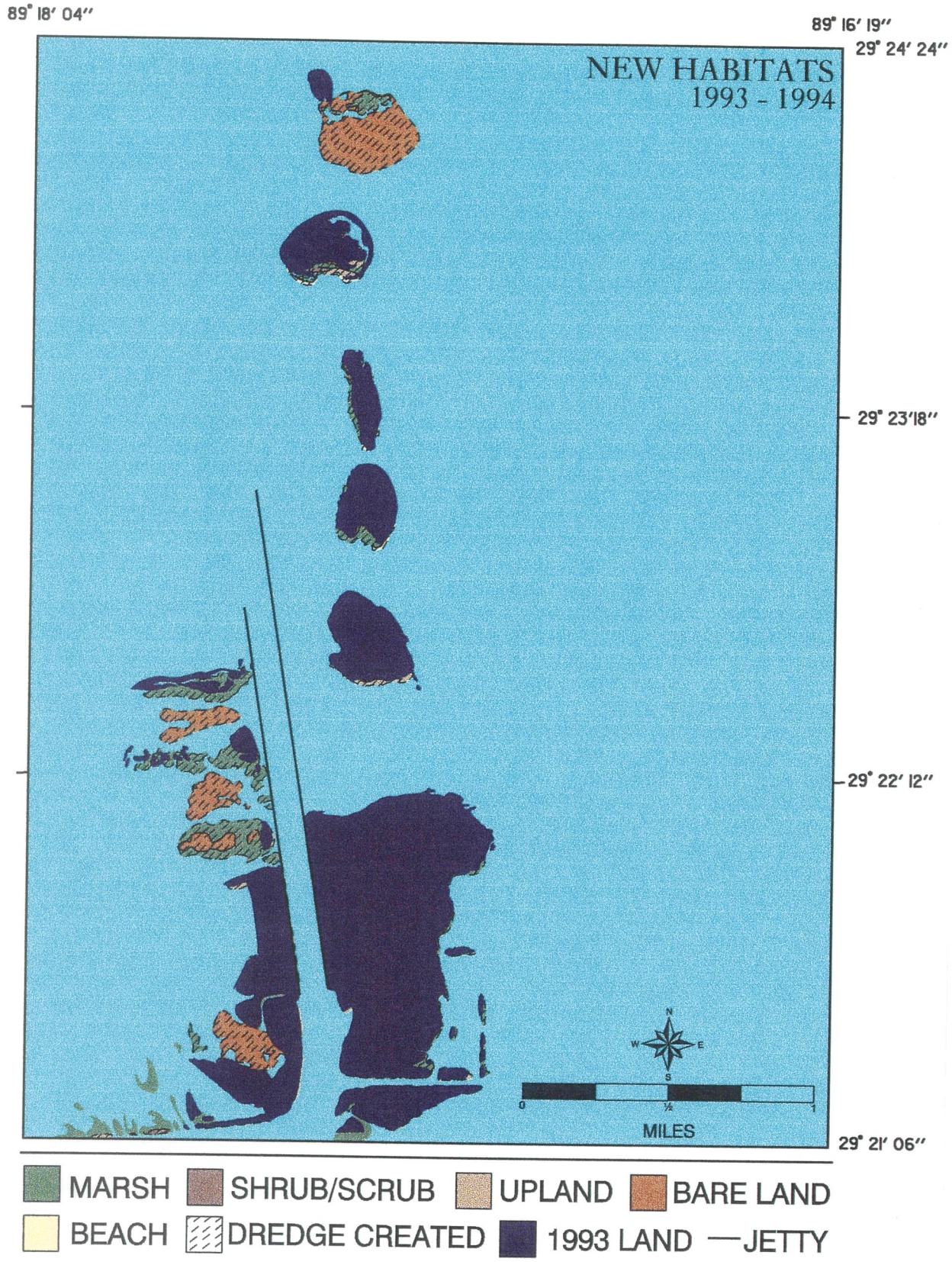


Figure 32. New habitats created as a result of the beneficial use of dredged material FY93 and FY94 maintenance events in the Baptiste Collette Bayou study area, shown by comparing February 1993 and November 1994.

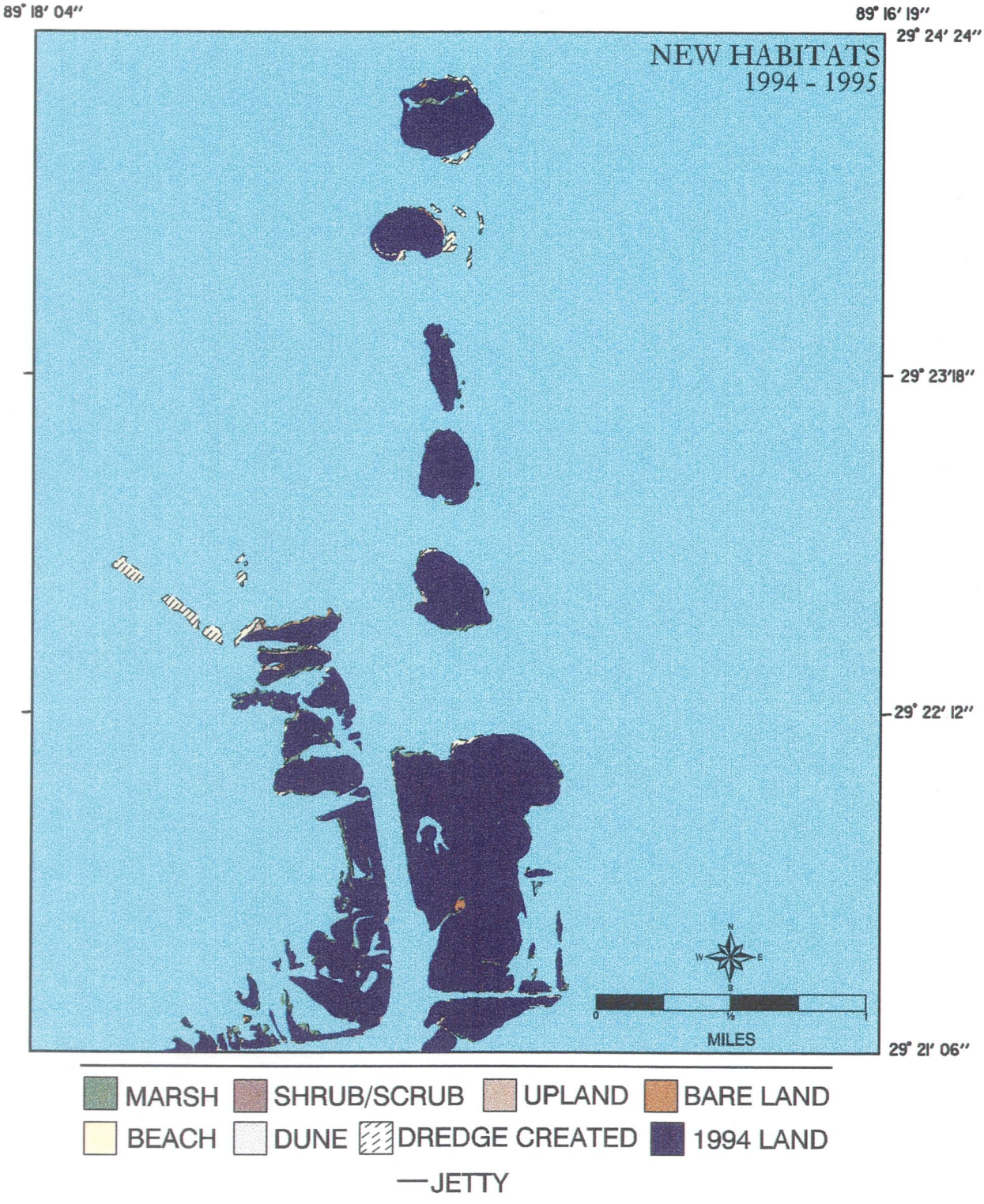


Figure 33. New habitats created as a result of the beneficial use of dredged material FY95 maintenance event in the Baptiste Collette Bayou study area, shown by comparing November 1994 and November 1995.

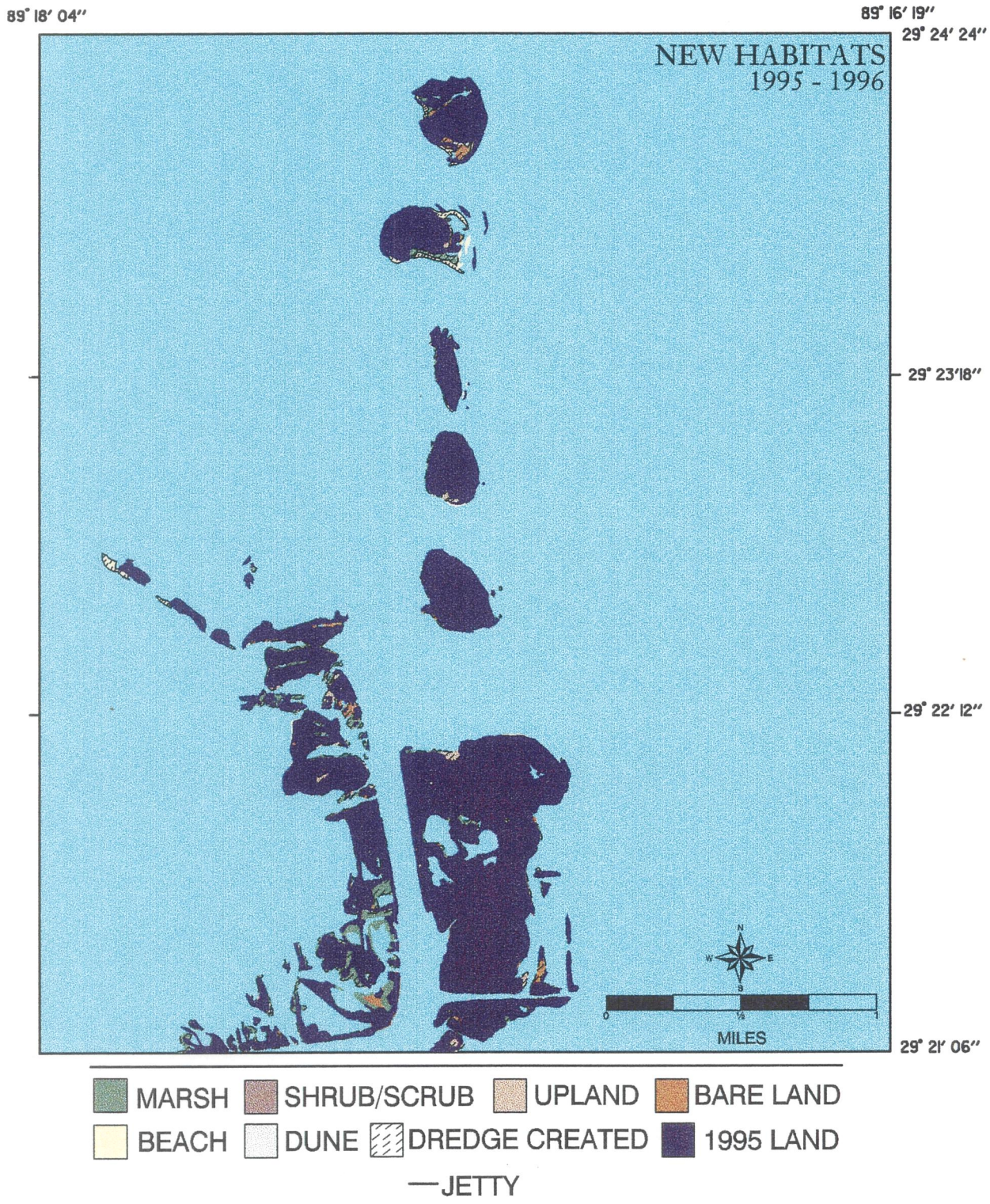


Figure 34. New habitats created as a result of the beneficial use of dredged material FY96 maintenance event in the Baptiste Collette Bayou study area, shown by comparing November 1995 and November 1996.

CONCLUSIONS

1. The beneficial use of dredged material at the BCB navigation channel has been very successful in creating new habitats and has accelerated the growth of this Mississippi River distributary since 1975.

2. The beneficial use of dredged material has created +324.57 acres of man-made habitats between 1975 and 1996. In contrast, the natural habitats in the study area have decreased by -41.51 acres. The resultant total increase in area of the BCB area is +283.06 acres. This increase in area is a result of bird island, wetland, and other habitat creation as a result of the beneficial use of dredged material. Over +75.97 acres of marsh have been created since 1975, which accounts for 23% of the new habitats created. The field surveys also documented that the seaward islands were subject to erosion on their margins, particularly the eastern facing shorelines. These islands were also subject to decreases in elevation due to settlement and overwash processes.

3. The field surveys indicated that the marshes created consist of a mixture of salt marsh through fresh marsh species and should be classed as intermediate marshes. The field surveys also documented that the optimum elevation for marsh development is less than 3 feet msl (3.78 feet Mean Low Gulf).

4. The habitat inventory documented a change from a study area primarily dominated by natural habitats in 1975 to primarily man-made habitats in 1996. In 1975, the study area contained 125.71 acres of which 79% was natural and 21% was man-made. In 1996, the study area contained 588.86 acres of which 9% was natural and 91% was man-made.

5. The habitat change analysis indicated that +75.97 acres of man-made marsh was created through the beneficial use of dredged material. Other significant habitat increases include +62.08 acres of man-made bare land, +94.65 acres of man-made upland, and +56.43 acres of man-made shrub/scrub.

6. The most successful time period for marsh creation occurred between February 1993 and November 1994 when +91.03 acres were created in a little under two years which approximates a rate of +52.02 acres per year. Prior to 1993, the annual rate of marsh creation averaged +11.3 acres per year. This very successful year of marsh creation is a function of beneficially placing the dredged material in unconfined sediment peninsulas to the west of the BCB navigation channel. In contrast, the period 1994 to 1996 saw a tremendous loss in man-made marsh, a decrease of -291.88 acres. This loss is related to the increased storm activity during this time period.

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Morgan, Joel David, 1977. The Mississippi River Delta - Legal-Geomorphic evaluation of historic shoreline changes in *Geoscience and Man*, Vol. 15, School of Geoscience, Louisiana State University, Baton Rouge, Louisiana.

Wayne, L.D., Penland, S., Westphal, K.A., Hiland, M.W., Connor, P., and Zganjar, C., 1995. The development of a coastal monitoring program to document the beneficial use of navigation dredge materials in the U.S. Army Corps of Engineers - New Orleans District: Baptiste Collette Bayou Pilot Study. Final Report, U.S. Army Corps of Engineers, 34 pp.

APPENDIX 5A
LIST OF VEGETATIVE SPECIES
OF THE BAPTISTE COLLETTE BAYOU STUDY AREA

LIST OF VEGETATIVE SPECIES
OF THE BAPTISTE COLLETTE BAYOU STUDY AREA

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the year of observation, 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 or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts.

\- Observed in 1994
• Observed in 1995
\+ Added in 1996

• **Atriplex pentandra** (Jacq.) Standl. . . . . seabeach orach
(Atriplex arenaria)
annual; sand dunes along the coast

\- **Acmella oppositifolia** (Lam.) R.K. Jansen var. **repens** . . . . . creeping spotflower
(Spilanthes americana)
colonial perennial; wet pastures, swamp forests, river banks

• - **Aeschynomene indica** L. . . . . joint-vetch shrub
Annual; swamps, fresh marshes

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

\- **Amaranthus australis** (Gray) Sauer . . . . . Gulfcoast water-hemp, belle dame
(Acnida cuspidata)
annual; brackish or intermediate marsh

\+ **Amaranthus palmeri** Watson . . . . .
Annual; fields and sandhills

• - **Amaranthus tuberculatus** (Moq.) Sauer . . . . . water-hemp
annual;

\- **Ammania coccinea** Rottb. . . . . toothcup, purple ammania
succulent annual; fresh and brackish marshes, margins of ponds

\- **Aster subulatus** Michx. . . . . annual saltmarsh aster
annual; fresh to brackish marsh

• - **Aster tenuifolius** L. . . . . perennial saltmarsh aster
perennial; fresh to brackish marsh

\- **Bacopa monnieri** (L.) Pennell . . . . . coastal water-hyssop
succulent creeping perennial; swales, sloughs, ditches, sand flats, sandy margins of fresh or brackish marshes, streams, ponds

• - **Baccharis halimifolia** L. . . . . groundselbush
shrub; elevated sites in fresh to saline marshes

\- **Bidens frondosa** L. . . . . beggar-ticks
annual; fields, pastures, alluvial woods, fresh marsh and waste places

\- **Bidens laevis** (L.) B.S.P. . . . . bur-marigold, smooth beggar-tick
perennial; fresh marsh and stream banks

• **Cakile constricta** Rodman . . . . . sea rocket
annual; coastal sand dunes

\- **Chamaesyce humistrata** (Engelm. ex Gray) Small . . . . . spurge
prostrate annual;

\- **Chenopodium ambrosioides** L. . . . . Mexican tea
annual; cultivated fields, pastures, waste places

- **Cichorium intybus** L. ..... chicory
  perennial herb; old fields, roadsides, waste places
• **Conyza canadensis** (L.) Cronq. ..... horseweed, hogweed, butterweed
  (Erigeron canadensis)
  annual; fields, roadsides, pastures and waste places
• - **Colocasia antiquorum** ..... elephantsear
  Perennial; fresh marsh, pond and stream margins
• - **Cynodon dactylon** (L.) Pers. ..... Bermuda grass
  rhizomatous perennial; fields, roadsides, waste places
+ **Cyperus articulatus** L. .....
  Perennial; marshes
- **Cyperus difformis** L. ..... variable flatsedge

• **Cyperus elegans** L. ..... nutsedge

• **Cyperus erythrorhizos** Muhl. ..... ivory nutsedge
  annual; marshes and ditches
• **Cyperus esculentus** L. ..... yellow nutgrass
  perennial; sandy fields, roadsides, and waste places
+ **Cyperus iria** L. .....
  annual; marshes, ditches and low waste places
• - **Cyperus odoratus** L. ..... flagrant flatsedge
  perennial; fresh and intermediate marsh, swales, pond margins, ditches
• - **Cyperus oxylepis** Nees es Steud. ..... sharp-scale flatsedge

+ **Cyperus strigosus** L. .....
  coarse perennial; marshes, ditches and low wastw places
+ **Desmanthus illinoensis** (Michx.) Macm. ..... Prairie mimosa
  herbaceous perennial; disturbed fields and roadsides
• **Digitaria ciliaris** (Retz.) Koel. ..... crab grass
  annual; sandy fields, roadsides, waste places
• - **Distichlis spicata** (L.) Greene ..... salt grass
  rhizomatous perennial; brackish marshes and flats
+ **Echinochloa muricata** (Beauv.) Fern. ..... barnyard grass
  low fields, marshes and waste places
• - **Echinochloa walteri** (Pursh) Heller ..... Walter's millet
  coarse annual; fresh and intermediate marshes and low waste places
+ **Eclipta alba** (L.) Hassk. ..... eclipta
  annual; pond shores, alluvial meadows, marshes, low woods and bogs
• - **Eclipta prostrata** (L.) L. (Eclipta alba) ..... Yerba de Tajo
  prostrate annual; pond shores, alluvial meadows, marshes, low woods and bogs
- **Eichhornia crassipes** Kunth ..... water hyacinth
  free-floating, stoloniferous aquatic; freshwater ponds and waterways
+ **Eleocharis montevidensis** Kunth .....
  rhizomatous perennial; wet sands
+ **Equisetum hyemale** L. ..... scouring rush
  rhizomatous perennial; railroad embankments, roadsides and stream banks
+ **Eragrostis minor** Host. .....

+ **Eragrostis reptans** (Michx.) Nees

• **Eupatorium capillifolium** (Lam.) Small ..... dog-fennel, yankee weed
annual; fields, meadows, pastures, and disturbed woods

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

- **Hibiscus lasiocarpus** Cav. ..... marshmallow, woolly rosemallow
perennial; fresh to intermediate marsh on elevated sites

- **Hydrocotyle bonariensis** Lam. ..... sand pennywort
perennials; among beach dunes, moist open sandy areas

• - **Iva frutescens** L. ..... marsh elder
shrub; brackish and saline marshes along elevated sites

- **Juncus roemerianus** Scheele ..... needlerush
perennial; upper portions of salt and brackish marshes, often in solid stands

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

- **Leptochloa panicoides** (presl) Hitchc. ..... Amazon sprangletop

• **Leptochloa scabra** Nees ..... sprangletop

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

+ **Lindernia dubia** (L.) Pennell .....
annul; savannahs, marshes, alluvial woods and wet ditches

- **Lippia nodiflora** (L.) Michaux ..... frogfruit
prostrate perennial herb; sandy open habitats, usually moist

- **Ludwigia decurrens** Walt. ..... primrose willow
short-lived perennial; marshes and ditches

• **Ludwigia leptocarpa** (Jacq.) Raven ..... yellow seedbox
short-lived perennial; marshes and ditches

• - **Ludwigia octovalvis** (Jacq.) Raven ..... Mexican seedbox
short-lived perennial; marshes and waste places

+ **Lythrum lineare** L. ..... loosestrife
herbaceous perennial; brackish marshes

• **Panicum capillare** L. .....
tufted annual; fields, roadsides and waste places

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

• - **Panicum repens** L. ..... dogtooth grass, torpedo grass
creeping perennial; fresh and intermediate marsh, slightly elevated sites

- **Paspalum dissectum** (L.) L. ..... mudbank paspalum
decumbent annual; fresh to intermediate marsh

• **Paspalum distichum** L. .....
mat-froming perennial; brackish and freshwater marshes

• - **Paspalum vaginatum** Sw. ..... seashore paspalum
rhizomatous perennial; fresh to brackish marsh

• - **Phragmites australis** ..... roseau cane
tall, rhizomatous, perennial reed; fresh marsh or elevated sites in other marshes

• - **Pluchea odorata** (L.) Cass. ..... shrubby camphorweed, marsh fleabane
(P. purpurascens)
Aromatic annual; salt and brackish marsh, sloughs, swales, salt flats, rarely fresh marshes

+ **Pluchea purperascens** (Sw.) DC. ..... camphorweed
aromatic annual; brackish marshes

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

• **Portulaca oleracea** L. ..... common purslane
prostrate annual; fields and waste places, upper beaches, drift areas, edge of brackish marshes

\+ **Ptilimnium capillaceum** (Michx.) Raf. ..... mock bishop's weed
Herbaceous annual; open bottom land, marshes, low pastures and wet roadside ditches

- **Rumex obovatus** Danser. ..... dock
perennial;

- **Sagittaria latifolia** Willd. ..... duck potato, Wapato
emersed perennial; fresh marsh, pond edges, swamps,sloughs, ditches

• - **Salicornia bigelovii** Torrey ..... glasswort
succulent annual; saline marsh, salt flats

- **Salix nigra** Marshall ..... black willow
shrub or small tree; streambeds and low moist areas

• - **Scirpus americanus** Pers. ..... American bulrush,
rhizomatous perennial; fresh to intermediate marsh, sandy lake and bayshore freshwater three-square

• **Scirpus olneyi** Gray .....
rhizomatous perennial; brackish marshes and ditches

• - **Scirpus robustus** Pursh (S. maritimus) ..... leafy three-square
perennial; intermediate to saline marsh

\+ **Scirpus tabernaemonantani** K.C. Gmel .....

• - **Scirpus validus** Vahl ..... softstem bulrush
creeping perennial; fresh to brackish marsh

• - **Sesbania drummondii** (Rydb) Cory. ..... yellow rattlebox
(Daubentonia longifolia (Cav.) DC.)
shrub; sandy soils, salt spray community, elevated areas in fresh to saline marsh, scrub pine woods

• **Sesbania exaltata** (Raf.) Cory ..... red rattlebox
annual; ditches, fields and waste places

\+ **Sesuvium maritimum** (Walt.) B.S.P. .....
Annual succulent; sandy beaches

• - **Sesuvium portulacastrum** L. ..... sea purslane
perennial; sandy beaches and flats, drift areas, brackish swales, upper parts of salt marshes

- **Solidago sempervirens** L. ..... seaside goldenrod
perennial; brackish marsh or saline sand

• **Solidago sp.** ..... goldenrod
perennial;

• - **Spartina alterniflora** Lorsel ..... oyster grass
rhizomatous perennial; saline and brackish marsh

• - **Spartina patens** (Aiton) Muhl. ..... marsh hay cordgrass
rhizomatous perennial; brackish marsh, low dunes, sand flats

- **Sphenoclea zeylandica** Gaertn. ..... chicken-spike
perennial; weed in rice fields

• - **Strophostyles helvola** (L.) Ell. ..... trailing wild bean
trailing or twining annual vine; beaches, open woods and clearings

• **Suaeda linearis** (Ell.) Moq. .....
annual; moist sand dunes or brackish marshes

\+ **Tamarix ramosissima** Lebed. .....

- **Typha domingensis** Pers. ..... southern cattail
rhizomatous perennial; alkaline brackish marsh and swamp

+ **Verbena bonariensis** L. . . . . .
Erect perennial; old fields and waste places

• - **Vigna luteola** (Jacq.) Benth. . . . . deer pea
trailing or twining vine; waste places, elevated areas bordering marshes, low fields

• - **Xanthium strumarium** L. . . . . cocklebur
annual; waste places, old fields, pond shores, ditches, stable dune areas, beaches