MONITORING PLAN

PROJECT NO. TE-18 TIMBALIER PLANTINGS

ORIGINAL DATE: May 1, 1995
REVISED DATE: July 23, 1998

Preface

Pursuant to a CWPPRA Task Force decision on April 14, 1998, the original monitoring plan was reduced in scope due to budgetary constraints. Specifically, the goal to decrease the rate of shoreline erosion, and the monitoring of the shoreline were dropped.

Project Description

Timbalier Island is considered part of the Bayou Lafourche barrier system and lies about 75 km west of the mouth of the Mississippi River and about 80 km south of New Orleans. The island originated from the westward progradation of the Caminada-Moreau headland. When the spit subsequently breached during storms, the island was detached from the headland. Sand erosion from the Caminada-Moreau headland remains the primary source of coarse-grained sediment to Timbalier Island. In 1988 the average width of Timbalier Island was 1360 ft (415 m; more than 3000 ft less than in 1887) and the length of the island was 8 to 9 mi (13 to 14 km).

The erosional forces acting on Timbalier create an environment of updrift erosion and downdrift accretion, resulting in a southeast-to-northwest migration of the island (Hester and Mendelssohn 1992; LGS 1992; McBride et al. 1991). The eastern half of the island has averaged a loss of 18.6 m/yr over the past 100 yr and is frequently overwashed. The western half of the island has averaged a 17.6 m/yr gain (Penland and Boyd 1981), and has higher elevations and substantially fewer overwash areas. This differential movement of sediment has resulted in the island's migration from southeast to northwest. Between 1887 and 1988, the average gulfside rate of change was -7.9 ft/yr (-2.4 m/yr), whereas the bayside shoreline was retreating at the rate of -16.4 ft/yr (-5.0 m/yr; McBride et al. 1991). The island has decreased in size by 58% over the last century, and an additional 20% was lost between 1978 and 1985 (Hester and Mendelssohn 1992). Marsh loss, as well as shoreline erosion, have significantly contributed to the decrease in land area.

The dunes of Timbalier Island are not well-developed, and are less than 6.5 ft (2 m) above mean sea level, and composed of primarily fine-grained sands. The island has a semi-tropical climate: water temperatures range from 18^{o}C in February to 29^{o}C in August (U.S. Army Corps of Engineers 1979) and air temperatures range from 14^{o}C in January to 28^{o}C in July and August (U.S. Army Corps of Engineers 1979). Wind direction, which controls wave direction and aeolian transport, is primarily from the south and southeast during the summer and from the north and northeast during the winter (U.S. Fish and Wildlife Service 1981). Precipitation is generally heavy: the average annual rainfall is 5.25 ft (160 cm), and monthly averages range from 0.3 ft (9 cm) in October to 0.62 ft (19 cm) in July (U.S. Army Corps of Engineers 1979).

Tropical storms are particularly damaging to barrier islands in Louisiana. These storm events may raise water levels 6.5 to 23 ft (2 to 7 m) above mean sea level (Ritchie and Penland 1988). Hurricanes generally occur between June and October and can create a surge of 8 to 10 ft (2.5 to 3 m) that inundates low coastal lands. Winter cold fronts may elevate water levels up to 3 ft (90 cm), with waves often 6.5 to 10 ft (2 to 3 m) high, compared to average wave heights of 2.0 ft (60 cm; Ritchie and Penland 1988).

Numerous studies and experiments have been conducted in recent years in an attempt to understand barrier island processes and to attempt to protect and restore certain islands (Hester and Mendelssohn 1992; Dougherty et al. 1990; Mendelssohn et al. 1991; Monteferrante et al. 1982, and others). Texaco sponsored a project very similar to this one (including vegetative plantings and sand-trapping fences) and concluded that the study successfully demonstrated sand fencing and vegetative planting can be used effectively to stabilize sand dunes on Louisiana's barrier islands and reduce the likelihood of island breaching in the restored areas (Mendelssohn and Hester 1988; Mendelssohn et al. 1991). However, Mendelssohn et al. (1991) concluded that the only way to maintain a healthy, well-vegetated dune on Louisiana's transgressive barriers appears to be through beach nourishment in conjunction with dune building and vegetative stabilization techniques.

This project was specifically designed to stabilize existing portions of bare beach and washover areas on Timbalier Island through the use of sediment-trapping fences and vegetation similar to the experiments done by Mendelssohn and Hester (1988). It should be noted, however, that Mendelssohn and Hester (1988) documented herbivore damage (rabbits and nutria) to planted vegetation on the island. Although this plan does not specify a direct measurement of herbivory, it will be noted if damage is evident.

The project features include:

1. The construction of approximately 7,390 linear ft (2,252 m) of fencing parallel to the shoreline with perpendicular spurs, which extend 25 ft (7.6 m) from the fence towards the bay at 50-ft (15.2 m) intervals along the fence. The fencing will be constructed in seven individual sections of varying lengths (sections A-E, I-1, and I-2, figure 1). Fencing will be installed parallel to the existing Gulf of Mexico shoreline. These fences are designed to trap and accumulate sediments at the nine locations along the length of the island.

2. Planting vegetation (17,250 *Spartina patens* [marshhay cordgrass], and 17,250 *Panicum amarum* var. *amarulum* [Atlantic panicgrass]) on the bayward side of the fences (along approximately 5,750 ft [1,753 m] of fence) to accelerate sediment accumulation and to stabilize existing sediments. Planting areas will belocated in all designated sections with the exception of fences D and E and portions of I1 and I2. These fence segments are planned for sections of beach where some natural vegetation exists. The plants will be established immediately behind the dune fencing, on the bayward side of the parent fence, between the side spurs. The two

Figure 1. Timbalier Island Plantings (TE-18) project elements. Letters (A-I) represent fence segments.

species of vegetation will be planted in a row-column configuration, with row-column intercepts on 24 in. (0.6 m) centers. Vegetation will be planted at each line intercept, alternating species across each row and column.

Project Objective

1. Provide a catalyst to hasten the development of dunes by constructing fences and planting vegetation to trap and stabilize aeolian and *in situ* (overwash) sediments.

Specific Goals

The following goals will contribute to the evaluation of the above objective:

1. Increase % cover of emergent vegetation behind fences.

2. Increase elevation adjacent to sediment-trapping fences.

Monitoring Elements

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

1. Aerial Photography — To document vegetated and non-vegetated areas, and long-term island morphological changes, color-infrared aerial photography (1:12,000 scale, with ground controls) will be obtained. The photography will be georectified by the Nation Wetland Research Center (NWRC) using their standard operating procedures, but detailed photointerpretation, mapping, and GIS analysis are not currently planned. The photography will be obtained in 1993 (pre-construction), and in 2001 (post-construction). Additional photography may be obtained in response to storm events, if funds are available.

2. Vegetation — Vegetation will be monitored by collecting data from each vegetative fence (A-E, I1, and I2). Each 50-ft x 25-ft (15.2 m x 7.6 m)segment will be split into 2 evenly divided sections (50 ft x 12.5 ft): front and back. The general condition of the plants will be documented using a generally accepted methodology similar to Mendelssohn and Hester (1988), Coastal Vegetation Project: Timbalier Island. Percent survival and species composition will be measured for a minimum of

5% of the vegetation by establishing and sampling a permanent 2 m x 2 m square (containing 16 plants) within each subunit. Percent cover will be monitored in 1.0 m^2 plots which correspond with the SE corner of the larger plots (figure 2). These criteria will be documented at 1 month and 1 year after planting to document the establishment of the vegetation and in 1999 and 2001, or until the original plants are indistinguishable. If the individual plants are indistinguishable, only percent cover and species composition will be documented (from the smaller 1 m^2 plots). Vegetative data will also be collected from the areas between the fences and on either end of project the area (as reference areas) at 1 month after vegetative planting and in 1997, 1999, and 2001 (to correspond with elevational surveys). The possibility of herbivore damage is recognized and will be recorded if observed.

3. Bathymetry/ topography

To document vertical change adjacent to sediment-trapping fences, elevational transect lines will be established relative to fence position. Data will be collected from a randomly selected 50-ft x 50-ft (15.2 m x 15.2 m) section of fence (between two spurs) from each fence (A-E, I1, and I2) and will be assumed to be representative of that particular fence. Elevations will be recorded at 10-ft (3 m) intervals from points along 5 transect lines (perpendicular to the parent fence), spaced 10 ft apart. Data will also be collected at any significant change in elevation within any 10-ft interval. Additional elevational data will be collected along transects extending 50 ft gulfward of the parent fence. These transects will extend from the eastern- and western-most transect lines on the bay side of each fence (figure 3). Elevational These transects will extend from the eastern- and western-most data will also be collected from the areas between the fences and on either end of project the area (as reference areas) immediately after fence construction. These transect lines will be re-surveyed at 1 month after vegetative planting and in 1997, 1999, and 2001 (to correspond with vegetative sampling). Additional surveys may be conducted following significant storm events that alter the morphology of the islands.

Anticipated Statistical Tests and Hypotheses

The following hypotheses correspond with the monitoring elements above and will be used to evaluate the accomplishment of the project goals.

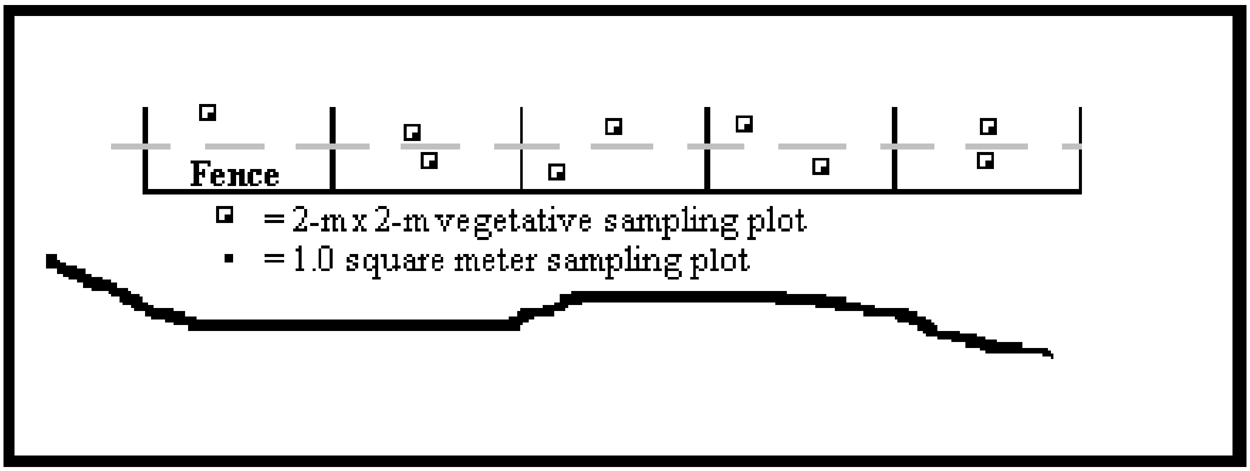

Figure 2. Example of randomized vegetative sampling scheme on Timbalier Island

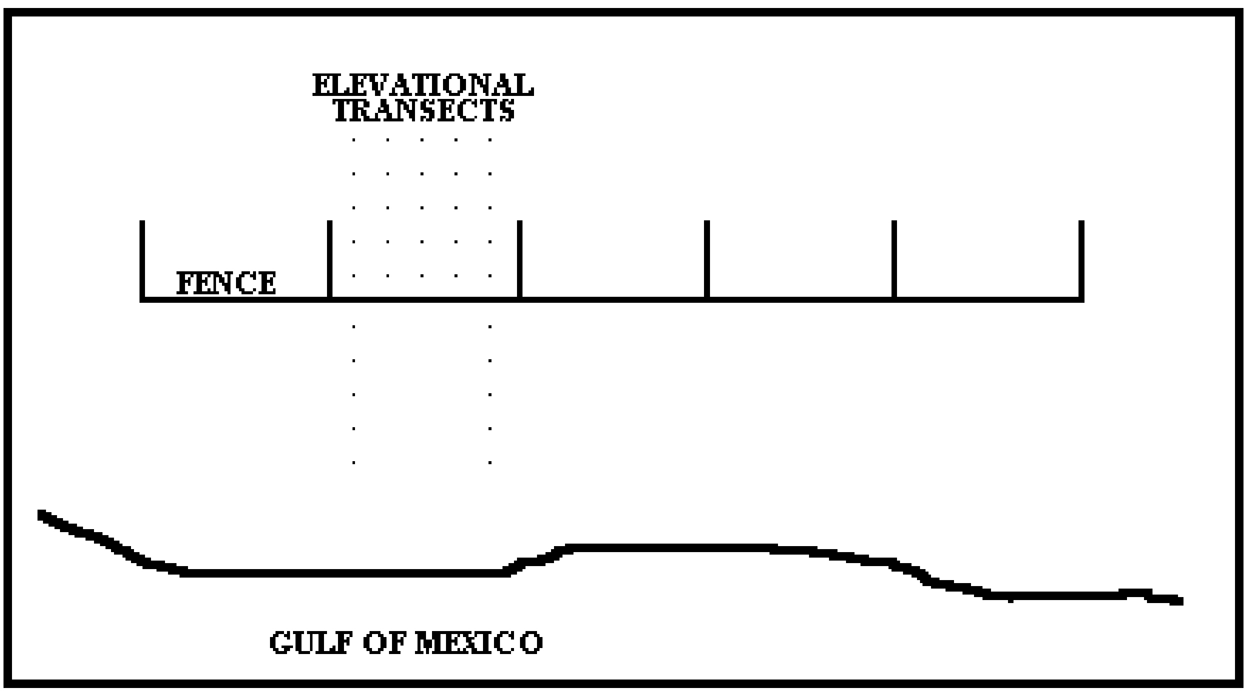

Figure 3. Example of orientation of elevational transects on Timbalier Island.

1, 2. Paired t-tests, Analysis of Variance (ANOVAs), descriptive, and summary statistics will be used to evaluate vegetative planting success (first-year analyses will concentrate on descriptive and summary statistics). Analyses will include percent survival and percent cover. Additional analyses are dependent upon data availability and sampling frequency. The ANOVA approach may include terms in the model to adjust for station locations, elevation, and seasonal fluctuations. If we fail to reject the null hypothesis, we will investigate for negative effects. This ANOVA will allow for the analysis and long-term documentation of vegetative changes on Timbalier Island (goal 1). Ancillary data (*i.e.*, herbivory, historical) will be used when available. This additional information may be evaluated through analyses such as correlation, trend, multiple comparison, and interval estimation. Data will be obtained from aerial photography and vegetative sampling. At current loss rates, McBride et al. (1991) estimate that Timbalier Island will disappear by the year 2000.

Goal: Increase % cover of emergent vegetation behind fences.

Hypothesis:

H_0: Occurrence of vegetation at year j will not be significantly greater than occurrence of vegetation at year i.

H_a: Occurrence of vegetation at year j will be significantly greater than occurrence of vegetation at year i.

3. Data will be evaluated through paired t-tests or ANOVAs. Additional analyses may be conducted dependent upon data availability and sampling frequency. These tests will allow for the analysis and long-term documentation of elevational changes adjacent to sediment-trapping fences (goal 2). Analyses will include a spatial component and will examine location (west vs. east) on the island. If we fail to reject the null hypothesis, we will investigate for negative effects. Data will be obtained from elevational surveys adjacent to selected fences and at reference areas. Comparisons will also be done on fenced vs. non-fenced areas. At current loss rates, McBride et al. (1991) estimate that Timbalier Island will disappear by the year 2000.

Goal: Increase elevation adjacent to sediment-trapping fences.

Hypothesis:

H_0: Elevation adjacent to fences after project implementation at year i, will not be significantly higher than elevation before project implementation.

H_a: Elevation adjacent to fences after project implementation at year i, will be significantly higher than elevation before project implementation.

NOTE: Available ecological data, both descriptive and quantitative, will be evaluated in concert with all of the above data and with statistical analyses to aid in determination of the overall project success.

Notes

1.	Implementation:	Start fence construction:	March 8, 1995
		End fence construction:	May 10, 1995
		Start plantings:	March 15, 1996
		End plantings:	July 15, 1996
2.	NRCS Point of Contact:	Cindy Steyer	(504) 389-0334
3.	DNR Project Manager:	Kenneth Bahlinger	(504) 342-7362
	DNR Monitoring Manager:	Mary Anne Townson	(504) 447-5072
	DNR DAS Assistant:	Chris Cretini	(504) 342-0277

4. The five year monitoring plan development and implementation budget for this project is $69,673. Progress reports will be available in August 1995, June 1996, December 1996, June 1997, July 1998 and July 2000, and a comprehensive report will be available in July 2002. These reports will describe the status and effectiveness of the project.

5. Near-vertical, color-infrared 9-in. x 9-in. aerial photography was flown for LDNR/CRD at 1:12,000 scale in November 21, 1993 (pre-construction).

6. Aerial photography will be flown in conjunction with the other barrier island projects.

7. The responsibility of collecting elevational/bathymetric data and vegetative data will be assumed by NRCS with DNR assistance.

8. References:

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