Restoration of Isles Dernieres, Louisiana: Some Reflections on Morphodynamic Approaches in the Northern Gulf of Mexico to Conserve Coastal/Marine Systems

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ABSTRACT


The Isles Dernieres barrier island chain, located along the southern Louisiana coast, USA, displays some of the highest rates of erosion for any coastal region in the world. Between 1887 and 1988, the average annual rate of land loss was 28.2 ha yr⁻¹ whereas the average rate of Gulf shoreline retreat was 11.1 m yr⁻¹ (McBride et al., 1991). This condition contributed to landward migration (barrier island rollover) and rapid disintegration of the Isles Dernieres sedimentary system. Failure of the barrier decreased the natural protective capacity of the island to maintain the adjacent mainland marshes and wetlands from the effects of storm surge, saltwater intrusion, increased tidal prism, and energetic storm waves (McBride and Byrnes, 1997). The modern islands are transgressive products of hundreds of years of persistent inundation and shoreline retreat, which has led to the formation of five separate barriers that include: Wine Island, East Island, Trinity Island, Whiskey Island, and Raccoon Island. Modern morphodynamic evolution of these islands is related to high rates of land loss, synergistic effects of relative sea-level rise, land subsidence, tropical and extra-tropical storm activity, inadequate sediment supply, and anthropogenic disturbances (Boyd and Penland, 1981; List et al., 1997; Penland and Ramsey, 1990; Roberts et al., 1987). In response to accelerated land loss along the fringing mainland marshes, due to continued deterioration of barrier island ecosystems, the State of Louisiana developed a near-term strategy in 1993 for large-scale restoration through dedicated dredging of sand. The primary objective of the project was to attempt quasi-stabilization of the landward retreating and disappearing Isles Dernieres by adding sediment to the barrier system and by facilitating vegetative growth on dunes and in marshes to protect the lower Terrebonne Basin estuarine system. The specific goals of the project were to (1) increase the height and width of the islands using dredged sediments; and (2) reduce the loss of dredged sediments through sand fencing and subsequent planting to establish a protective cover on the artificial fill surface. Quantitative evaluation of these goals indicated how well the project objectives were met. Near-vertical aerial photography of the project area and LIDAR surveys facilitated the assessment of project performance. Conclusions are based on the analysis of topographic data collected pre- and post-construction, efficacy of sand fencing, and growth of vegetation on Whiskey, East and Trinity islands. The results of the restoration effort with respect to volumetric changes indicate that the goals were achieved with plausible increase in the longevity of the islands. It was observed that the total habitat area increased, predominantly the bare-land, some times at the expense of other habitats. The survival of the vegetative plantings on the three islands varied due to drought. Initial assessments of the planted vegetation indicate that the planted species dominated in the planted areas but they did not extend significantly to the unplanted areas depicting a lack of spread.

ADDITIONAL INDEX WORDS: Coastal land loss, beach erosion, dune stabilization, sand fencing, barrier island, restoration, habitat mapping.

INTRODUCTION

Wine Island, East Island, Trinity Island, Whiskey Island, and Raccoon Island located along the southern Louisiana coast, USA (Figure 1) constitute the Isles Dernieres barrier island chain. Hundreds of years of persistent inundation and shoreline retreat have led to the formation of these five separate barriers islands. Modern morphodynamic evolution of these islands is related to high rates of land loss, synergistic effects of relative sea-level rise, land subsidence, tropical and extra-tropical storm activity, inadequate sediment supply, and anthropogenic disturbances (Boyd and Penland, 1981; List et al., 1997; Penland and Ramsey, 1990; Roberts et al., 1987). These modern barrier islands of Isles Dernieres display some of the highest rates of erosion of any coastal region in the world. Between 1887 and 1988, the average annual rate of land loss was 28.2 ha yr⁻¹ whereas the average rate of Gulf shoreline retreat was 11.1 m yr⁻¹ (McBride et al., 1991).

Failure of the barrier decreased the natural protective capacity of the island to maintain the adjacent mainland marshes and wetlands from the effects of storm surge, saltwater intrusion, increased tidal prism, and energetic storm waves (McBride and Byrnes, 1997). This condition contributed to landward migration (barrier island rollover) and rapid disintegration of the Isles Dernieres sedimentary system. In...
response to accelerated land loss along the fringing mainland marshes due to continued deterioration of barrier island ecosystems, the State of Louisiana along with several federal agencies developed a near-term strategy in 1993 for large-scale restoration primarily through emplacement of dredged sand/sediment.

Goals, Objectives, and Scope

The primary objective of creating dune and marsh via "soft" option was to attempt quasi-stabilization of the landward retreating and disappearing Isles Dernieres by adding sediment to the barrier system and by facilitating vegetative growth over the newly emplaced sediment to protect the lower Terrebonne Basin estuarine system.

The specific goals of the projects were to increase the height and width of the islands using dredged sediment (sand) and then to reduce the loss of dredged sediment through sand fencing and subsequent planting to establish a protective cover on the artificial fill surface. Both of these objectives entailed formation of new landforms on Whiskey, Trinity, and East Islands, which were constructed almost concurrently during 1998-99 and are discussed herein.

This paper discusses pre- and post-construction topographic data as well as vegetation data collected approximately three growing seasons after vegetation were planted. It also evaluates quantitatively the results of the emplacement of sand/sediment with respect to volumetric changes, habitat restoration and assesses the initial responses of the planted vegetation. Topographic survey by LIDAR and habitat mapping by near-vertical aerial photography of the project area are presented to facilitate the assessment of project performance.

Project Features

The Whiskey Island Restoration project included the creation of approximately 177 ha of supratidal (beach, dune, barrier flat) and intertidal (beach, marsh) habitats using approximately 2.2 million m³ sediments dredged from Whiskey Pass (Figure 2). Most of the dredged material was placed landward of the existing Gulfside beach to restore the back barrier portion of the island. Target elevations ranged from +0.3m to +1.2 m North American Vertical Datum of 1988 (NAVD 88). Aerial seeding of Cynodon dactylon (Bermudagrass) immediately employed after construction to stabilize the newly placed material. In total, 14,200 Spartina alterniflora (smooth cordgrass), 9,333 Spartina patens (marshhay cordgrass), 9,333 Panicum amarum (bitter panicum), and 1,625 Avicennia germinans (black mangrove) were planted along the newly restored dune terrace and back-barrier shoreline to establish a protective cover that would facilitate fill stabilization

An area of approximately 143 ha was filled for creating dunes and wetland including supratidal and intertidal habitats by using approximately 3.7 million m³ sediment dredged from two borrow areas in Lake Pelto in Trinity Island Restoration project (Figure 3). The sediment was placed on the existing gulf shoreline and marsh to create dune/marsh platform that extended the entire length of the island approximately 7000 m. The Trinity Island design template consisted of a +2.4 m NAVD dune crest measuring 91.5 m in width. The Gulfside of the dune had a 1:10 slope to +1.8 m NAVD with a varying slope to the backshore of the natural shoreline. The elevation of natural shoreline was 0.6-0.9 m NAVD. The bayside of the +2.4 m NAVD dune had a 1:10 slope to +1.2 m NAVD and a variable slope to Lake Pelto. This final construction template was achieved by cutting, grading, and shaping.

Aerial seeding of Cynodon dactylon (Bermudagrass) was immediately employed after construction to stabilize the newly placed material. Vegetation planting of 10,579 Spartina patens (marshhay cordgrass), 8,348 Spartina alterniflora (smooth cordgrass), and Panicum amarum (bitter panicum) was carried out to stabilize the emplaced sediment on the newly created dune area, in the back-bay area, and on spurs from the dune area across the island to the back-bay area. Approximately 6860 m of sand fencing was erected almost shore-parallel to capture wind blown sediments and to reduce losses from eolian activities. Vegetation was planted along fencing and throughout the project to aid in sediment stability.

The East Island Restoration project filled an area of approximately 96.7 ha to create dunes and wetlands including supratidal and intertidal habitats using approximately 3.0 million m³ (3.93 million cubic yards) sediments dredged from backbarrier borrow sites (Figure 4). The East Island design template consisted of a +2.4 m NAVD dune crest measuring 91.5-150 m in width. The Gulfside of this dune had a crest elevation of +2.4 m NAVD with a 1:10 slope to the +1.8 m NAVD elevation and then with variable slope to the back side of natural beach. The Bayside of the +2.4 m NAVD dune had a slope of 1:10 to +1.2 m NAVD elevation and then slope would vary to the Lake Pelto shoreline. Aerial seeding of Cynodon dactylon (Bermudagrass) was immediately employed after construction to stabilize the newly placed material. In total, 12,075 Spartina alterniflora (smooth cordgrass), 5,431 Spartina patens (marshhay cordgrass), and 5,431 Panicum amarum (bitter panicum) were planted on the newly created...
randomly chosen plants for the percent survival sampling. Established within the seeded and planted treatments using the Blanquet method (M and E 1974) percent cover of vegetation were determined using the Braun- and spur, as well as seeded areas, species composition and percent survival plots contained 16 plants.

Plots varied both within and among treatment types. However, treatments, such as varying numbers of plant rows from 1 to 6, bay, and spur. Due to inconsistencies in planting design within established in the 3 seeded and planted treatment types of dune, measure percent survival of hand planted vegetation were carried out and sampled during August 1999 as well as during 2002. These photos were georectified and mosaicked using 1998 Digital Ortho Quarter Quad photos.

**METHODOLOGY**

**Near-Vertical Aerial Photography**

During December 1996 and again in April 2002, color-infrared (CIR) aerial photographs for the Whiskey Island along with Trinity and East Islands were acquired for analysis. The spatial sub-meter accuracy of these photographs was achieved by employing a differentially corrected global positioning system during data acquisition at a scale of 1:24,000. These photos were georectified and mosaicked using 1998 Digital Ortho Quarter Quad photos.

**Topographic Surveys**

**Conventional Topographic Surveys**

During 1997 pre-construction topographic and bathymetric surveys were conducted along several transects on Whiskey, East, and Trinity Islands in the proposed restoration areas. Elevations were referenced to both NGVD29 and NAVD 88, depending on the project. During 1998, as-built surveys were conducted along the same transects. Since all survey points after emplacement of sand were on land, no bathymetric data was collected. Horizontal and vertical controls were established using a static Global Positioning System (GPS) technique. Survey data for both the surveys were referenced to the Louisiana Coordinate System (South Zone), NAD 83 and NAVD 88.

**LIDAR Surveys**

In the year 2000, an airborne LIDAR (Light Detection And Ranging) topographic survey of the Isles Dernieres barrier island chains was conducted to acquire subaerial elevation data along all the three islands. The LIDAR topo-surveys are much faster and cost-effective. Partially overlapping passes were flown to fully cover the region of interest, to eliminate gaps in the data, and to increase data density. The footprint, and subsequent horizontal resolution, of laser is approximately 1 m in diameter and an individual laser shot was collected every 2 m².

**Vegetation Plantings**

Between May and June, 1999 vegetation planting was carried out and sampled during August 1999 as well as during September 2001 to determine percent survival, species composition, and percent cover. Randomly established plots to measure percent survival of hand planted vegetation were established in the 3 seeded and planted treatment types of dune, bay, and spur. Due to inconsistencies in planting design within treatments, such as varying numbers of plant rows from 1 to 6, plots varied both within and among treatment types. However, all percent survival plots contained 16 plants.

Within the three seeded and planted treatments of dune, bay, and spur, as well as seeded areas, species composition and percent cover of vegetation were determined using the Braun-Blanquet method (Müller-Dombois and Ellenberg, 1974) as described by Steyer et al. (1995). Cover plots were established within the seeded and planted treatments using the randomly chosen plants for the percent survival sampling.

Cover plots in seeded areas were established between the spurs, using a randomly chosen distance from the dune plots. Differential Global Positioning System (DGPS) coordinates were also collected at each stake to facilitate re-establishment of stations in the future.

**Data Processing and Analyses**

**Aerial Photographs**

Habitat Analysis was done on the basis of photo-mosaics prepared from 1996 and 2002 CIR aerial photographs. Six classes of habitat viz. marsh, beach, bareland, shrub/scrub, intertidal and water were identified.

**Topographic Data**

Analysis of the topographic survey data was accomplished using ArcView® Geographic Information System software (GIS). ArcView’s Spatial Analyst® extension was used to generate digital elevation models from the pre-construction, post-construction, and 1.5 year post-construction survey data in order to quantify aerial changes achieved during the dredging phase of construction, as well as evolution of the fill surface after construction. Terrain models developed were classified by elevation into three discrete classes that represent subtidal, intertidal, and supratidal habitats. A dune habitat was also classified as a subset of the supratidal class.

The subtidal class comprises that portion of the project area that lies below mean lower low water (MLLW). Normally this habitat is subaqueous during all stages of the tide. The intertidal class comprises that portion of the project area that lies between

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### Table 1. Barrier island habitat area in hectares.

<table>
<thead>
<tr>
<th>Project</th>
<th>Beach</th>
<th>Bare Land</th>
<th>Marsh</th>
<th>Barrier Vegetation</th>
<th>Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiskey Island</td>
<td>66.8</td>
<td>41.4</td>
<td>1.01</td>
<td>79.6</td>
<td>123.2</td>
</tr>
<tr>
<td>Trinity Island</td>
<td>76.3</td>
<td>36.4</td>
<td>5.8</td>
<td>110.2</td>
<td>156.4</td>
</tr>
<tr>
<td>East Island</td>
<td>55.3</td>
<td>45.0</td>
<td>0.2</td>
<td>86.4</td>
<td>16.0</td>
</tr>
</tbody>
</table>

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Figure 5. Elevation habitat classes at Whiskey Island Restoration Project during (A) pre-construction, (B) as-built, and (C) 19 months post-construction.
MLLW and mean higher high water (MHHW). This habitat is normally subaerial at low water when the tide is in ebb, but submerged at high water when the tide is in flood. The supratidal class comprises that portion of the project area that lies above MHHW. This habitat is subaerial during all stages of the tide and is only inundated during intense extra-tropical storms and tropical cyclones (RITCHIE and PENLAND 1988).

Elevations associated with each of these habitat classes was derived from the Wetland Value Assessment (WVA) barrier island model used to plan and evaluate CWPPRA projects (ENVIROMETAL WORK GROUP, 2002). The subtidal class comprises the area below 0 m NAVD 88. The intertidal class comprises the area between 0 - 0.61 m NAVD 88. The supratidal class comprises the area between 0.61-1.5 m. The dune includes the portion of the project area that lies above 1.52 m NAVD 88.

**Vegetation Data**

Sampling data of August 1999 and September 2001 were analyzed to show planting survival one growing season post-planting, as well as percent cover approximately one and three growing seasons post-planting. Analysis was conducted of percent survival of planted species as a total of the plot. Percent survival of each species planted could not be tracked, due to the variability of the plantings.

Comparisons are made within the data set using an unbalanced block design. The assumptions of parametric analysis were tested using Statistical Analysis System (SAS) univariate procedure (SAS INSTITUTE INC. 1996). When the univariate procedure indicated that data were not normally distributed, square-root transformation (\(y^{1/2}\)) of the data resulted in a near-normal distribution. Analysis of Variance (ANOVA) least significant difference (LSD) tests at the 95% confidence level were used to determine differences among treatments (SAS INSTITUTE INC., 1996). Data were de-transformed for presentation.

**RESULTS**

**Aerial Photographs**

The analysis of color-infrared (CIR) aerial photographs acquired for Whiskey, Trinity and East Islands during December 1996 and April 2002 indicates the major changes in beach, bare-land and marsh habitats. It was observed that the total area of beach and marsh decreased whereas bare-land increased significantly in April 2002 (Table 1).

**Topographic Data**

A digital elevation model showing habitat classes along the fill area in Whiskey Island before and after construction is presented in Figure 5. The average elevation of the fill area increased from -0.22 m to 0.99 m, NAVD 88 during the dredging process. The fill width along the western section of the project area ranged between 396 - 640 m and along the eastern section between 244 - 366 m. Prior to construction approximately 67% of the project area was subtidal habitat, 29% was intertidal habitat, and 5% was supratidal habitat. After construction 0% of the project area was subtidal habitat, 1% was intertidal habitat, and 99% was supratidal habitat.

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**Figure 6.** Elevation habitat classes at Trinity Island Restoration Project during (A) pre-construction, (B) as-built, and (C) 19 months post-construction.

**Figure 7.** Elevation habitat classes at East Island project during (A) pre-construction, (B) as-built, and (C) 19 months post-construction.

**Figure 8.** Shore parallel sand fences and dune on Trinity Island (Looking west)
Approximately 119.05 ha of supratidal and dune habitat were restored during the project area during the dredging phase of construction. Subtidal and intertidal habitats were reduced by 95.34 ha and 28.01 ha, respectively. Although dunes were not physically created on the island during construction, the areas restored to >1.52 m NAVD 88 are defined as the dune platform. Only 3 ha of dune platform were created during construction, which is only 2% of the entire fill area.

Digital elevation model showing habitat classes along the fill area in Trinity Island before and after construction indicates that the average elevation of the fill area increased from 0.11 m to 1.93 m, NAVD 88 (Figure 6). Within the survey area, approximately 31% of the project area was subtidal habitat, 63% was intertidal habitat, and 6% was supratidal habitat. After construction <1% of the project area was subtidal habitat, 1% was intertidal habitat, and 98% was supratidal habitat. Approximately, 100.61 ha of supratidal and dune habitat were restored in the project area during the dredging phase of construction. Subtidal and intertidal habitats were reduced by 37.01 ha and 30.81 ha, respectively. Although dunes were not physically created on the island during construction, the areas restored to >1.52 m NAVD 88 are defined as the dune platform. More than 68 ha of dune platform were created during construction, which is more than 64% of the entire fill area.

Sand Fences
Sand fences were erected immediately after construction in Trinity and East Islands. This helped in trapping the sand (which would otherwise have blown away) and formation of dunes. In Trinity Island shore parallel dunes with a relief of about 1.2-1.3 m (Figure 8) formed south of the fence. In East Island the NE-SW trending dunes of higher relief (1.8-2.1 m) were formed due to sand fences installed almost orthogonal to the general shore line direction (Figure 9). Evidences of eolian transport along the fill surface during the first six months following construction could be observed on the Trinity and East Islands. During the same period, similar dune development was not observed at Whiskey Island, where sand fencing was not constructed immediately after dredging.

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Vegetation Data
Survival of planted vegetation on the three Isle Dernieres barrier island restoration projects averaged 63% approximately...
1 growing season post-planting. Whiskey, Trinity, and East island projects averaged 28, 84, and 76%, respectively (Figure 10). One growing season post-planting, Whiskey Island had significantly lower percent survival rates (p=0.001) for all treatment types, than the other 2 projects (Figure 10).

One growing season post-planting the mean percent cover of the fill areas at all 3 restoration sites averaged 15%, and had increased to 26% in September 2001, 3 growing seasons post-planting. There was no significant difference in mean cover by project 1 growing season post-planting (p=0.0658), and cover was still not significantly different, among projects, 3 growing seasons post-planting (p=0.2226).

Additionally, when projects were combined to test for treatment differences, no significant differences were detected among treatments both 1 (p=0.1554) and 3 (p=0.0613) growing seasons post-planting.

**DISCUSSION**

On the basis of analysis of pre- and post-construction topographic data, efficacy of sand fencing, and growth of vegetation on Whiskey, East and Trinity islands the evaluation of the fill area of all the three projects illustrates significant changes in island morphology and habitats. The results of the restoration effort of these islands in terms of volumetric changes indicate that the goals were achieved with plausible increase in the longevity of the islands. It was observed that the total habitat area increased, predominantly the bare-land, mainly at the expense of other habitats.

The topographic data, as expected, shows an almost total reversal in elevation classes of these fill areas from subtidal and intertidal to supratidal habitat after construction (Figure 11). All the three projects changed on an average from about 95% subtidal and intertidal elevations to 96% supratidal elevations. Additionally, 45% of the supratidal habitats were classified into the dune category on an average for all the three islands. However, Whiskey Island was an exception, as it was constructed at +1.21 m NAVD88 elevation and so could create only 3.2 ha, or 2% of project area, within the dune habitat (Figure 11).

![](image1.png)

**Figure 11.** Area of each elevation class by project, during each sample period, in three Isles Dernieres barrier island restoration projects.

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**Table 2.** Mean percent cover by project and treatment for August 1999 (one growing season post-planting) and September 2001 (three growing seasons post-planting) vegetative sampling for the three CWPPRA Isle Dernieres barrier island restoration projects.

<table>
<thead>
<tr>
<th>Project</th>
<th>Treatment</th>
<th>1999 Mean Percent Cover</th>
<th>2001 Mean Percent Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>999 (n=12)</td>
<td>2001 (n=12)</td>
</tr>
<tr>
<td>East Island</td>
<td>Seeded &amp; Planted (Bay)</td>
<td>7 (n=12)</td>
<td>25 (n=3)</td>
</tr>
<tr>
<td></td>
<td>Seeded &amp; Planted (Spur)</td>
<td>12 (n=10)</td>
<td>33 (n=9)</td>
</tr>
<tr>
<td></td>
<td>Seeded</td>
<td>16 (n=6)</td>
<td>23 (n=6)</td>
</tr>
<tr>
<td>Trinity Island</td>
<td>Seeded &amp; Planted (Dune)</td>
<td>30 (n=12)</td>
<td>33 (n=12)</td>
</tr>
<tr>
<td></td>
<td>Seeded &amp; Planted (Bay)</td>
<td>26 (n=12)</td>
<td>30 (n=12)</td>
</tr>
<tr>
<td></td>
<td>Seeded &amp; Planted (Spur)</td>
<td>20 (n=12)</td>
<td>23 (n=12)</td>
</tr>
<tr>
<td></td>
<td>Seeded</td>
<td>3 (n=12)</td>
<td>12 (n=12)</td>
</tr>
<tr>
<td>Whiskey Island</td>
<td>Seeded &amp; Planted (Dune)</td>
<td>11 (n=20)</td>
<td>23 (n=20)</td>
</tr>
<tr>
<td></td>
<td>Seeded &amp; Planted (Bay)</td>
<td>4 (n=12)</td>
<td>12 (n=12)</td>
</tr>
<tr>
<td></td>
<td>Seeded &amp; Planted (Spur)</td>
<td>18 (n=12)</td>
<td>41 (n=13)</td>
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<td></td>
<td>Seeded</td>
<td>17 (n=12)</td>
<td>28 (n=12)</td>
</tr>
<tr>
<td>All Projects</td>
<td>Seeded &amp; Planted (Dune)</td>
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<td>28</td>
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<tr>
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<td>Seeded &amp; Planted (Spur)</td>
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<td>32</td>
</tr>
<tr>
<td></td>
<td>Seeded</td>
<td>11</td>
<td>19</td>
</tr>
</tbody>
</table>

*No Dune treatment plots were sampled at East Island project.*
Nineteen months post-construction 97% of the elevation remained in the supratidal class with a reduction of all elevations in the dune class to only 39% of the total area, as sand may have been removed due to wind and rain. Additionally, intertidal habitats decreased to 3% of the area post-construction. Most probably this decrease in intertidal area may be due more to post-construction area calculation from LIDAR survey, which does not have the capability of measuring subaqueous elevations.

Pre-construction habitats when compared with the post-construction change show significant relative increase in the height and width of the project areas. This is important in relating the project’s impacts to island overwash threshold regimes. Pre-construction morphology indicated the majority of the project area was inundated on a regular basis. However, post-construction project profiles show that on an average 97% of the habitat classified as supratidal or higher. The significant increase in height and width provide sufficient subaerial elevations to move the island into a collision to overwash regime (RITCHIE and PENLAND, 1988).

Overwash events are extremely important in sediment transport during the transgressive barrier island arc stage of the abandoned delta evolution. The overall sediment budget deficit during this phase makes conservation of sediment extremely important in longevity of the island. Repeated collision of storm-generated waves erodes the Gulfside shore and sandy sediment are deposited as bars offshore. The bars in turn protect the shore against further erosion. Overwash allows sediment to be deposited and stored on the back-barrier in overwash fans, which may conserve sediment within in the system and allow for it to be reworked by an advancing shoreface. However, overwash does not capture all of the sediments removed from the near and foreshore environments. Additionally the sediment captured in the overwash fan is removed from the current nearshore environment, thereby allowing no immediate return to the shoreline during fair weather wave conditions.

Sand fences accumulated sand created dunes in Trinity and East Islands where these fences were installed immediately after emplacement of sand but were not effective in Whiskey Island where these were erected one and half year post-construction. Ample evidence also exists of significant eolian erosion along the fill areas on Whiskey Island, Trinity Island and East Island restoration projects. The greatest potential for sediment transport exists during the months from and East Island restoration projects. The greatest potential erosion along the fill areas on Whiskey Island, Trinity Island where these were erected one and half year post-construction. Ample evidence also exists of significant eolian erosion along the fill areas on Whiskey Island, Trinity Island and East Island restoration projects. The greatest potential for sediment transport exists during the months from September through May. This period coincides with the months that cold fronts and extra-tropical cyclones are most frequent along the northern Gulf of Mexico. On Trinity and East Islands, where sand fencing was constructed immediately after dredging was completed, dunes of greater than 1 m in height developed in some locations. Because sand fences were not erected on Whiskey Island, no dunes were created and a substantial amount of dredged sand/sediment was probably transported off the island into the Gulf of Mexico and Lake Pelo.

The survival of the vegetative plantings on the three islands varied due to drought. Initial assessments of the planted vegetation indicate that the planted species dominated in the planted areas but they did not extend significantly to the unplanted areas depicting a lack of spread.

CONCLUSIONS

All the three projects appear to achieve the goal of increasing the height and width of the barrier islands after restoration. The pre- and post-construction models indicate increase in width and height of the islands and created supratidal habitats but did not maintain the proportion of intertidal habitats in the ecosystem. However, it is too early to conclude whether the primary project objective of strengthening and stabilizing islands through sediment addition and vegetative growth to maintain the protective barrier between the Gulf of Mexico and the lower Terrebonne Basin estuary system has been achieved.

Template designs still need to be re-assessed to determine the optimal heights, widths, and percentages of habitat classes that should be created. Moreover the present template designs achieved the goals, but at a loss of important intertidal habitats and future projects need to better incorporate those habitats into the designs so that the entire ecosystem is restored.

Significant loss of sediment may occur prior to colonization and maturation of vegetation on the recently placed sediments and sand fences appear to have made significant contributions to maintenance of sediments within other project areas during an important post-construction morphologic adjustment period. It appears that sand fences installed immediately after emplacement of sand can capture significant amount of fill sediment/sand, creating dunes and reducing eolian erosion. The lack of sand fences on Whiskey Island may have been costly from a sand accumulation/project longevity perspective because post-construction adjustment through eolian erosion may reduce the barrier’s elevation and increase the frequency of overwash events.

Continued monitoring efforts must determine if the vegetation plantings have had an impact on sediment stabilization and whether project designs have produced an island long enough of a stability to last the 20-year project life. Moreover, it appears that present configuration of vegetation plantings is not providing enough cover in a sufficient time frame to stabilize sediments. Plantings need to be either increased, or the configuration be changed, or both.

LITERATURE CITED


