Progress Report for Grant "Planting and Monitoring of the Caernarvon Delta in Big Mar": January through June, 2012

Andy Baker, Theryn Henkel and John Lopez
Lake Pontchartrain Basin Foundation

A Project of the Lake Pontchartrain Basin Foundation and the Coalition to Restore Coastal Louisiana

July 7, 2012

Introduction

In an ongoing partnership with the Coalition to Restore Coastal Louisiana (CRCL), the Lake Pontchartrain Basin Foundation (LPBF) has been documenting the development of a delta and conducting bald cypress (Taxodium distichum) plantings in the receiving basin (Big Mar) of the Caernarvon Diversion outfall canal since October of 2010. To read about the monitoring and restoration efforts conducted in Big Mar from October 2010 to December 2011 visit http://www.saveourlake.org/ and view the report entitled "Geomorphology and Bald Cypress Restoration of the Caernarvon Delta near the Caernarvon Diversion, Southeast Louisiana."

This report will serve as a supplement to the aforementioned report and summarize work done in Big Mar from January 2012 through June 2012. During these six months, the LBPF conducted one bald cypress planting, one monitoring trip and one overhead flight (to document delta evolution). Four other trips to Big Mar were conducted to deliver trees for planting and to check on unplanted trees because planting was delayed three times due to inclement weather and high water.

Bald Cypress Planting

On March 8th, 2012, 225 bald cypress trees were transported to Big Mar and along with 45 trees that had overwintered in the marsh unplanted, were moved three miles out into the marsh, near planting sites, in preparation for planting scheduled the next day. Severe storms in the area delayed this planting and the trees were left out in the marsh and planting was rescheduled for March 23rd. A site visit was conducted on March 20th to check on the unplanted trees. This trip revealed that most of the trees had survived without nutria protectors and protectors were placed on the most exposed trees (those on the outside of groups). Planting had to again be delayed due to severe weather. The next planting was scheduled for April 2nd. This planting was delayed because the Caernarvon diversion was opened at high flow for a 2-week experiment from March 31st to April 13th. During this time the
diversion was operated at a discharge of approximately 7,500 cfs, elevating water levels to over 2 feet in the marsh, inundating planting sites. A site visit on April 5th revealed that many of the trees were under one to two feet of water but all were alive. During this visit, 100 trees were moved to higher ground to prevent them from washing away in the high water.

The next planting date was set for May 1st. A site visit was conducted on April 30th to prepare for planting the next day. The water was low and trees and supplies were distributed to planting sites. Also, it was found that nineteen trees out of the 270 had died over the course of the two months that they sat in the marsh unplanted. It seemed that most of the mortality was due to rabbit grazing and inundation or physical trauma.

On May 1st all remaining 251 trees were planted by CRCL and LPBF staff and volunteers. Trees were planted in the southwest corner of Big Mar where a pro-delta has been forming (Figure 1), a process that began with the introduction of marsh balls during Hurricane Katrina (see aforementioned report). In this planting, five foot bamboo stakes were used to support nutria protectors instead of the 3 foot lengths that were used in previous plantings. Previously, under windy conditions, the nutria protectors would be blown over causing the entire tree to also be blown over, especially in softer soils. The longer stakes would theoretically provide more stability because they could be driven further into the ground, preventing tree blow over.

**Monitoring**

One comprehensive monitoring trip was conducted, on June 5th. Due to low water, several sites could not be reached. Also, marsh vegetation was high and dense and therefore some trees most likely were still alive but could not be located.

After one month in the ground, 94% of the trees planted on May 1st survived (Figure 1), despite dry conditions and some damage from abundant webworms that had defoliated many surrounding willow trees. The use of five foot bamboo stakes did indeed provide more stability to the nutria protectors and trees than the three foot ones used in previous plantings.
The spring monitoring also revealed that many of the trees planted in 2011 survived the winter and spring and seem to be thriving. Trees planted in March 2011 have at least doubled in height and diameter and survival of the remaining 38 trees is thought to be high although not all the trees could be located. Growth rates on trees planted in November 2011 did not seem to be as high (trees appeared to be a similar size to when they were planted) but these trees have not yet experienced much of the growing season and are expected to demonstrate more growth by the end of the 2012 growing season.

Overall, the November 2011 plantings have 67.1% survival after seven months, for areas that were accessible (Figure 2). The sites along the outfall canal demonstrated the highest survival, with 84% of the trees still alive. These trees are on relatively high, firm, moist ground, under moderate shade. In this area, the trees are not exposed to high water levels when the diversion is operating at a high discharge and are somewhat protected from storms (winds and heavy rain) by surrounding trees such as black willow (*Salix nigra*), hackberry (*Celtis laevigata*) and Chinese tallow (*Triadica sebifera*). However, these trees do not contribute to new land formation as they are planted on existing and stable spoil.
banks, so their restoration value may be diminished. However, those that survive and reach reproductive maturity can act as a seed source for the rest of the marsh.

The trees planted on the delta had 57.4% survival. Much of the mortality occurred in one area at the southeastern end of the delta, where 82 out of 100 trees died in seven months (Figure 2). Judging from heavy plant debris deposited on that site, we speculate that fast-moving water from high discharge from the diversion created a high energy environment and therefore unstable conditions for the trees. Excluding this high-mortality area, the delta plantings had a 76.6% survival rate. Actual mortality may not be this high in the remainder of the delta, as some trees may be surviving in the dense vegetation and could not be found (dominant vegetation was giant cutgrass (Zizaniopsis miliacea) which is hard to move through).

During the June 5th monitoring trip, the northern "triangle" island was inaccessible due to low water (Figure 2). The northern end of Big Mar has historically been shallow and continues to fill in from sediments deposited by the diversion along with the emerging delta. Survivorship was found to be 83% during the December 2011 monitoring trip, even though many trees had fallen over due to short stakes and soft sediment (in December trees than had fallen over were put upright).

![Figure 2](image)

Figure 2: Location and survival of trees planted in November of 2011. Note that the island at the northern end of the delta could not be reached and low survivorship at the southern end, perhaps due to fast moving water when discharge from the Caernarvon diversion was 7,500 cfs.
Overall, with all plantings included, survival of bald cypress in Big Mar is 54% (Table 1). This includes the first planting where no trees survived. If this planting is excluded then survival is 63%. We believe that this survival rate is good considering the dynamic environment into which we are planting. Also, lessons learned over time (such as trees need nutria protectors, trees must be planted on vegetated ground etc.) have improved planting success overtime with the most recent plantings (November 2011 and May 2012) having high survival rates. In this most recent planting, in 2012, the use of longer stakes to hold nutria protectors in the ground and upright was another improvement that will help increase survival by preventing trees from blowing over.

Table 1: Activities in Big Mar from March 2010 through June 2012 as well as planting dates and estimated bald cypress survival to date.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
<th>Discharge (cfs)</th>
<th># trees planted</th>
<th>Estimated Survival</th>
<th>% Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconnaissance</td>
<td>March 24, 2010</td>
<td>1,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconnaissance</td>
<td>August 27, 2010</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td>October 15, 2010</td>
<td>600</td>
<td>200</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Planting</td>
<td>March 11, 2011</td>
<td>2,000</td>
<td>175</td>
<td>38</td>
<td>22%</td>
</tr>
<tr>
<td>Monitoring &amp; nutria protection</td>
<td>April 1, 2011</td>
<td>1,200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutria protection</td>
<td>April 4, 2011</td>
<td>1,200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>June 8, 2011</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>August 24, 2011</td>
<td>3,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flight over delta</td>
<td>August 29, 2011</td>
<td>2,800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground mapping of delta &amp; veg ID</td>
<td>September 16, 2011</td>
<td>1,100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td>November 1-3, 2011</td>
<td>1,500</td>
<td>678</td>
<td>424</td>
<td>63%</td>
</tr>
<tr>
<td>Monitoring &amp; planting</td>
<td>November 8, 2011</td>
<td>2,200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>December 12, 2011</td>
<td>3,300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees delivered to planting site</td>
<td>March 8, 2012</td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Checked on unplanted trees</td>
<td>March 20, 2012</td>
<td>3,300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Checked on unplanted trees</td>
<td>April 5, 2012</td>
<td>7,500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Checked on unplanted trees</td>
<td>April 30, 2012</td>
<td>250</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td>May 1, 2012</td>
<td>200</td>
<td>251</td>
<td>236</td>
<td>94%</td>
</tr>
<tr>
<td>Monitoring</td>
<td>June 5, 2012</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1304</td>
<td>698</td>
<td>54%</td>
<td></td>
</tr>
</tbody>
</table>

Geomorphology

During the June 5th monitoring trip, large areas of new sediment were observed that were covered with herbaceous vegetation. Plantings that were previously on the shore of islands were 50 to 100 feet inland and had to be walked to. On the ground, it was hard to determine if this was new delta growth or if it was merely exposed mudflat due to the low water conditions. A flight was scheduled for June 23rd to get an aerial perspective.
Leading up to the flight, southerly winds blew consistently, causing water levels to rise. On the day of the flight, the delta did not appear to be expanding and actually appeared smaller in area than in August 2011 (Figure 3). However, the areas that were exposed appeared to have more woody vegetation (black willow) than in 2011, indicating that these areas are becoming solid land that can withstand high discharge rates from the Caernarvon diversion. The delta may be smaller than in 2011 due to the two weeks of high discharge (7,500 cfs) experienced in April when unconsolidated or unvegetated sediments could have been washed away. From previous observation, it seems that sediments that are merely covered with herbaceous vegetation are not stable and can shift easily while mudflats that become vegetated with woody species (black willow, groundsel bush (Baccharis halimifolia)) transition into solid land becoming stable and permanent and may act as nuclei for future delta growth.

Figure 3: Big Mar delta in August 2011 and June 2012. Delta appears smaller in 2012 but water was high during this time making it hard to determine the true extent of the delta.

Future Activities

In the next six months, LPBF will conduct another monitoring trip in the fall. During this trip monitoring of previously inaccessible areas will be focused on and an effort will be made to note some average trees heights and diameters so that growth can be monitored over time (a specific protocol for measuring tree growth will be developed prior to this trip). Also, another planting with the CRCL is planned for late fall (number of trees is yet to be determined and subject to availability from the supplier). LPBF will also do further analysis on the evolution of the Big Mar delta, both in the northeast and southwest quadrants, in order to see if there has been any significant growth or changes.
Lessons Learned

Lessons-Learned:
Previously reported

1. Monitoring did not begin until after the second planting. Monitoring should start immediately after each planting.
2. Planning must consider that soil conditions on the Caernarvon Delta vary dramatically (very soft to firm) in the planting areas and can be difficult or impossible to walk on for planting.
3. Tree planting with volunteers in canoes and with airboat support is adequate for planting.
4. Planting within Big Mar Pond may be hazardous or challenging if the discharge through the Caernarvon Diversion exceeds 3,500 cfs.
5. Requests to reduce the Caernarvon discharge for planting should consider the full possible impacts of altering the discharge.
6. The long-term success of the baldcypress re-forestation and continued land growth is dependent on the continued operation of the Caernarvon Diversion.
7. Nutria protection tubes used in the March 2010 planting are stiffer and may be preferable to those used in November 2011. The tubes used in November required bamboo poles which, in some cases, were still inadequate to keep the tubes in place.
8. Since an expanding delta has inherent geomorphic changes and a dynamic evolution, baldcypress trees should be planted on stable ground indicated by the presence of some emergent vegetation for optimal results.
9. Nutria protection tubes should be used on all baldcypress trees and installed at the time of planting, regardless of local alligator populations or the visible presence of the invasive rodents.
10. Better documentation of tree characteristics (girth & height) should be acquired prior to planting.
11. Future monitoring should include representative sampling of tree height and girth.
12. Accurate location and counting of the planted trees is essential during the work process, preferably using GPS and photography.
13. Monitored trees should be clearly marked with fluorescent tape or flags, because finding a particular plant in the marsh is difficult once the dense native vegetation has grown up around it.
14. Using different colored tags or nutria protection tubes to track trees planted at different times would be useful.

Newly Reported

15. Longer bamboo stakes (5 foot) increased stability of nutria protectors.
16. Over flights should be scheduled during low water to optimize the assessment of the emergent delta.
17. Establishment of black willow appears to stabilize the soil foundation of the Caernarvon delta and pro-delta.
18. Protocols to monitor growth of planted trees should be established.