

# **Supplemental Environmental Project (SEP) Using Mitigation Funds for Mussel Inventories in the Big Thicket National Preserve**

**(Prepared by the Big Thicket Association, Mary C Johnston, July 2011- 2012; 2013-2014, Final- Jan. 2015)**

## Abstract:

The Big Thicket Association's first Supplemental Environmental Project became an actuality through litigation funding acquired by the Sierra Club. As a result, mollusk inventory work was conducted to further wetland species and ecosystem analysis in the Big Thicket National Preserve. Mollusks are of value as a biological indicator species and can provide information on pollution and climate changes. This research focused on newly acquired Preserve lands in Orange County. With the acquisition of additional funds through a Park Partnership and Texas Commission on Environmental Quality mitigation fines, research expanded to other wetland communities in the Preserve. Data is input into a National Park Service database through the Thicket of Diversity All Taxa Biodiversity Inventory and is used as an aid in natural resource decision making.

## Introduction:

Litigation and mitigation funds have enabled the Big Thicket Association to coordinate and finance environmental research. On Dec. 29, 2010 the Lone Star Chapter of the Sierra Club negotiated a settlement with XXX company for a total of \$110,000. Funds were to be paid out over a 4 year period for violations of effluent limitations and conditions under National Pollutant Discharge Elimination System permit issued by the Texas Commission on Environmental Quality (TCEQ). The Big Thicket Association (BTA) received \$3682 for year one. Legal fees were paid up front at an estimated \$23,818. For years two, three and four the BTA received \$27,500. In return, the BTA was to implement a Supplemental Environmental Project (SEP). The organization chose for its SEP to contribute data on wetland species through a mussel inventory in the Big Thicket National Preserve.

It was recognized that the mussel research conducted through the Thicket of Diversity All Taxa Biodiversity Inventory would help in ecosystem analysis. The acquisition of baseline data conducted through comprehensive biological inventories in Big Thicket National Preserve wetlands provides a qualitative tool to assess current and future status of living species, water quality and the integrity of its floodplains. Research of known biological indicator species is of benefit and absolutely essential for resource managers.

Ecosystem health is influenced by different factors. Pollution in and along waterways can contribute to dead zones and excessive aquatic growth. Invading alien species in the US cause major environmental damages and losses adding up to almost \$120 billion per year. About 42% of the species on the "threatened" or "endangered" species lists are at risk primarily because of alien-invasive species. (Pimentel et al 2004). Protected areas such as the Big Thicket National Preserve were created to conserve wild biodiversity. These areas have now been impacted by invasive species such as the Chinese tallow that are gradually changing the natural biodiversity to the detriment of some species of plants, some plant assemblages and some animals that depend upon them for shelter and food. (Emerton and Howard 2003). Inventories are essential

and aid in the analysis of harmful non-native species spreads, pollution and the impacts of climate change.

The Thicket of Diversity utilizes research of Taxonomic Working Inventory Groups (TWIGs) and Citizen Scientist volunteers. Information is collected and catalogued into a database as part of the National Park Service Biodiversity Discovery Initiative. Inventory data is input according to scientific standards including GPS records and is available for review by resource managers.

It is known that *Biological Indicator Species* have a known behavior when exposed to a single or known combination of pollutant. Using this method to discover a polluted water body is a cheaper and easier approach when compared to performing expensive and time consuming water quality tests. The four groups most commonly sampled are Invertebrates, Periphyton, Fish, and Macrophytes. This study focused on invertebrates, mussels. Invertebrates such as freshwater mussels make very good indicators since they are easily collectable, limited in mobility, and can determine pollution levels. In addition, mussels can live longer than most other invertebrate species.

Study Area:

This SEP focused research in Big Thicket National Preserve (BTNP) lands in Orange County, Texas. The US Park Service is an ideal location for this inventory as the Preserve meanders through 250 miles of waterways across seven East Texas counties: Hardin, Jefferson, Orange, Jasper, Liberty, Polk, and Tyler. The Neches River is the Preserve’s eastern boundary. Currently, there are approximately 6,000 acres in the BTNP’s Beaumont Unit.

With assistance of The Conservation Fund new wetland properties in Orange and Jefferson counties were donated to BTNP. These lands have never been inventoried by the Park Service and data is needed for resource management. According to the U.S. Census Bureau, Orange County has a total area of 380 square miles of which 356 square miles is land and 23 square miles (6.10%) is water. Orange County is bordered on its east by the Sabine River- the border with Louisiana, and on its southeast by the Gulf of Mexico. On its northwestern border is the Neches River.

From Orange County Tax Records)

<u>Big Thicket National Preserve</u>	<u>Acreeage</u>	<u>The Conservation Fund</u>	<u>Acreeage</u>
Property R21956	218.974	Property R10289	166.49
Property R11614	0.457	Property R28061	30.1
Property R19188	136.798	Property R15712	500
<b>Total BTNP ACREAGE:</b>	<b>356.229</b>	Property R10843	177.627
		<b>Total TCF ACREAGE:</b>	<b>874.217</b>

The geography of Orange County varies relatively little, with an elevation that reaches 33 feet above sea level at very few points within the county. Orange County is very flat, and its soil is quite sandy, as expected in a county along the Gulf of Mexico. There are saltwater marshes in much of the southeastern part of Orange County that borders the Sabine River and piney woods in the northern part of the county. In addition to the two rivers- the Sabine and the Neches, the

physical features of Orange County include 2 bays, 3 bends, 2 cliffs, 3 guts, 13 islands, 6 lakes, 1 rapids, 3 ridges, 21 streams, 2 swamps and 3 valleys.

There are numerous waterways along the Neches River near Big Thicket National Preserve including:

- Adams Bayou: (30.0482,-93.7298) This very small stream connects the Neches River from the South to a large wetland area to the north and is located roughly 5 miles east of Neches River mouth.
- Bird Island Bayou: (29.9947,-93.925) This third order stream branches off of the Neches River into a wetland area and is located roughly 6.5 miles east of Neches River mouth.
- McFadden Bend Cutoff: (30.0259, -94.0302) is located on the Neches River south of Industrial Plants.
- North Bayou: (29.9874, -93.9043) This small first order stream connects the Lower Neches with a large wetland area to the north.

The region has been impacted by natural disturbances which emphasize the need for the expansion of inventory projects. Inventory is important because one is unable to measure losses without an accurate accounting of natural assets. Two hurricanes occurred in the past decade, Hurricane Rita (2005) and Hurricane Ike (2008). Rainfall levels typically range at 58.7 inches per year compared to 36.5 for the US. In 2011 the region experienced a record drought with an estimated 38 inches of rain. In June 2011 the US Department of Agriculture designated Orange County and 212 other counties in Texas as *Primary Natural Disaster Areas* after one of the worst droughts in more than a century. Hurricanes, droughts and wildfires are all natural disturbances associated with this ecoregion. Both excessive rainfall and drought effect living species and contribute to successional changes. Resource managers can benefit from inventory data to assess changes.

Orange County experiences environmental challenges due to the industry and development in the region. The area experienced rapid growth in the late 19th century due to 17 sawmills within the city limits, making Orange the center of the Texas lumber industry.<sup>3</sup> Orange became a key industrial city by offering a port for cotton carriers sailing in the Sabine River. The harbor leading into the Port of Orange was dredged in 1914 to accommodate large ships. Ship building during World War I contributed to the growth in population and economy. The Great Depression affected the city negatively, and it was not until World War II that the local economy was boosted again. A U.S. Naval Station was installed, and the population increased to just over 60,000 residents.

After the war, the peace-time population decreased to about 25,000. At this time, the Navy Department announced it selected Orange as one of eight locations where it would store reserve vessels. The area of the shipyards provided a favorable location, as the Sabine River furnished an abundant supply of fresh water to prevent saltwater corrosion. Also during this period the local petro-chemical plants expanded which boosted the economy.

TxDOT expedited approval plans for a 423 mile inland canal which resulted in a quick, safe reliable transfer of goods. With the Sabine Pass Ship Channel, the Sabine-Neches Waterway forms a Y-shaped set of interlocking river channels and canals extending from the Gulf of

Mexico to Port Arthur, Beaumont, and Orange. A series of jetties, canals, rivers, and turning basins now compose the waterway. According to historian W.T. Block, “In 1979 well over 75,000,000 tons passed through the Sabine Pass jetties, making the Sabine-Neches shipping district the second largest in the state, behind that of Galveston-Houston-Texas City. Petroleum and petroleum-related products shipped in and out of the waterway's four ports, as well as assorted cargoes associated with the Intracoastal Canal, dominate the busy channels.”

The chemical industry continues today as a leading source of revenue in the area. On occasion, violations occur as a result of the heavy industry resulting in environmental infractions and pollution. Mitigation is providing the funding for this particular project and can serve as a model for other SEP's.

### Methods:

The Thicket of Diversity, a program managed by the Big Thicket Association, a 501 (c)3 nonprofit, operates with an Executive Council. It is the role of the Council to approve the researcher, the species they wish to inventory and their funding, and to oversee the details of the project. The researcher becomes a Taxonomic Working Inventory Group (TWiG) leader. The leader may use Citizen Scientists- students, BTA members, community volunteers and/or Park Service employees for the collection of inventory specimens. Team members work often for days in the field. The leader and students then spend additional hours in the lab analyzing, identifying species and preparing reports.



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It is important to note that collecting on National Park lands is forbidden unless by permit and NPS permits are awarded only to respected scientists/ researchers. Only data collected under the permit process is acceptable for inclusion. Inventory data is input into a National Park Service Database according to national standards and is overseen by the Director for the Thicket of Diversity, Mona Halvorsen, who is responsible for managing the database. For this endeavor, NPS lands were inventoried.

A two day NPS survey led by Stephanie Burgess (BTNP Oil and Gas Program Manager) was conducted to check for sensitive species with mussel TWIG leader, Bob Boensch, some additional interns and seasonal employees. This information assisted a project for the Neches River in conjunction with U.S. Fish and Wildlife Service and was shared with the Texas Parks and Wildlife Department as part of the statewide Texas Mussel Watch Program.

Results:

According to the NPS, "Currently, there are 12 state-listed species of freshwater mussels in Texas, five of which occur within the Big Thicket. Three of these species (the triangle pigtoe, Louisiana pigtoe, and Texas heelsplitter) are currently under federal review for proposed listing as "threatened" or "endangered." Being a downstream segment of the Neches River, in-stream structure, such as that created by downed trees that originate from upstream, collect and play a critical role in driving the unique ecology of this segment. For example, hydrology is altered because of this in-stream structure. This creates an array of habitats that benefit the mussel community. Therefore, mussel richness is high in this segment and the rare and endangered species found upstream are also present here. The low lying characteristics of this downstream segment creates bog habitat that supports a variety of specialized fern species."

There are several species of mussels as candidates for the "threatened" and "endangered" list. To summarize, two sensitive species were identified: the Texas heelsplitter (*Totamilus amphichaenus*), which is currently a candidate for listing for the "endangered" species list and the Sandbank pocketbook (*Lampsilis satura*), which is "state" listed.



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Mussel Researcher, Bob Boensch

## Mussel Data, Orange County, Texas

Date	Common Name	Number Live	Number Dead
7/11/2011	Yellow Sandshell	1	9
7/11/2011	Fragile Papershell	2	2
	Yellow Sandshell	2	0
	Sandbank Pocketbook	1	0
	Asian Clam	1	0
7/11/2011	Southern Mapleleaf	18	0
	Bankclimber	31	0
	Giant Floater	1	1
	Threeridge	18	0
	Sandbank Pocketbook	2	0
	Washboard	1	0
	Round Pearlshell	17	0
	Threehorn Wartyback	4	0
	Louisiana Fatmucket	2	0
	Fragile Papershell	1	0
	Yellow Sandshell	14	0
7/11/2011	Fragile Papershell	0	1
	Texas Heelsplitter	0	3
7/11/2011	Asian Clam	50	0
	Southern Mapleleaf	1	0
	Round Pearlshell	5	0
	Fragile Papershell	1	0
	Sandbank Pocketbook	1	0
	Texas Heelsplitter	0	1
7/11/2011	<b>TOTAL</b>	<b>174</b>	<b>17</b>
7/12/2012	Fragile Papershell	2	3
	Sandbank Pocketbook	7	1
	Giant Floater	4	2
	Threehorn Wartyback	1	0
	Southern Mapleleaf	7	0
	Gulf Mapleleaf	2	1
	Round Pearlshell	42	0
	Yellow Sandshell	20	3
	Flat Floater	0	0
	Louisiana Fatmucket	1	0
	Bankclimber	7	0
	Lilliput	1	0
	Washboard	1	0
	Asian Clam	100	numerous
7/12/2011	Yellow Sandshell	3	3
	Fragile Papershell	0	0
	Sandbank Pocketbook	0	0
	Asian Clam	10	0
7/12/2011	Round Pearlshell	95	0
	Yellow Sandshell	10	9
	Washboard	2	1
	Bankclimber	11	0
	Southern Mapleleaf	30	0
	Atlantic Rangia	0	excessive
	Gulf Mapleleaf	8	0
	Threehorn Wartyback	1	0
	Lilliput	2	0
	Bleufer	0	1
7/12/2012	<b>TOTAL</b>	<b>367</b>	<b>24</b>



The project continued when additional funds were secured from a Park Partnership grant and mitigation monies from the Texas Commission on Environmental Quality. Mussel research thus expanded beyond Orange County in 2013. Dr. Neil Ford, University of Texas-Tyler was contracted to conduct “Surveys of freshwater Mussels in 3 units of the Big Thicket National Preserve.” The total project was \$6000 and it was paid from matching grant funds between the BTNP and BTA. SEP- Sierra monies for 2013 totaling \$27,500 were used for data management. 33 surveys were conducted along the upper Neches River and along tributaries and oxbows directly off the mainstream. Sites were accessed by boat and were selected after viewing satellite maps to identify areas that were appropriate mussel habitat. All live and dead mussels were collected, identified and counted and then live organisms were returned to the river. Each survey location was matched with GPS coordinates. Data was shared with the ToD for inclusion in the NPS database.

In 2014 Dr. Neil Ford requested funding for “Surveys of freshwater mussels in 9 units of the Big Thicket National Preserve.” The proposal was approved for \$13,074 and was funded from mitigation monies through the Texas Commission on Environmental Quality. SEP- Sierra funds of \$27,500 were once again used for data management. This closed out the funding of the SEP- Sierra litigation monies.

The diversity of mussels in the northern section of the Preserve was found to have mixed results. Much of the upper Neches River Corridor is now poor habitat for mussels. The dramatic fluctuations in water releases and shifting sands from B.A. Steinhagen Dam and past droughts could have negatively impacted the populations. The oxbows and tributaries did demonstrate a high abundance of mussels as well as the waterway above B.A. Steinhagen Dam. Of concern is that 6 of the 23 species collected were identified as “State Threatened.”

Neil Ford’s 2014 Progress Report stated, “Preliminary genetic analysis has led us to believe we have found iridescent lilliput (*Toxolasma paulus*) as well as a new cryptic *Toxolasma* species in the Village Creek basin. More extensive genetic testing is currently being conducted on a larger sample size and should reveal proper taxonomy. Texas and/or triangle pigtoe, as well as sandbank pocketbook and southern hickorynut have been found live in the preserve. Texas heelsplitter has only been found as shell specimens. Data analysis is not complete at this time.

Data collected from this inventory project was shared in the Taxa Tally posted on the BTA website at [www.thicketofdiversity.org](http://www.thicketofdiversity.org). Further outreach was evidenced at BTA hosted meetings and through Science Cafes featuring the work of Thicket of Diversity researchers. In September 2011 Bob Boensch of The Nature Conservancy presented mussel research at the Log on Café and encouraged public participation in mussel collection as trained Citizen Scientist volunteers. The project was further publicized in the media including a front page article in the Beaumont Enterprise.

Dr. Ford is a Distinguished Professor in the College of Arts and Scientists who specializes in how landscape and geomorphology are related to the abundance and species composition of freshwater mussels in Texas. As a recipient of five Texas Parks and Wildlife grants, Dr. Ford has given many presentations, symposium talks and written published papers on the subject of mussels.

### Discussion:

Newly acquired wetlands in Orange and Jefferson Counties will benefit as inventory data is very limited at this time. Monitoring changes in mussel communities can serve as a sensitive early warning indicator of possible pollution. Thus, future inventories are needed.

Damages after Hurricanes Rita and Ike were difficult to assess as the last comprehensive biological survey was conducted by Corey and Parks in the 1930's. This new research will provide a baseline and eventual comparative data for wetland ecosystems that can assist in climate change analysis.

The new data collected through the Thicket of Diversity will aid resource managers in decision making to protect natural resources locally. Information will also have a national outreach with its inclusion in the NPS database.

In addition to mussel status, observations conducted during inventory work can identify problem areas with invasives such as the Chinese tallow or weeds such as the water hyacinth (*Eichhoria crassipes*) This weed increases evaporative water loss by as much as six times normal evaporation from open water. (Emerton and Howard, 2008). Its identification will mark areas for future removal. This will benefit drinking water plants by lowering their costs for expensive clearance and disposal. The Neches River, a source for drinking water in Beaumont and surrounding areas, forms the Preserve's eastern boundary.

The Environmental Protection Agency conducted a Comparative Risk Report for the Gulf Coast States in Region 6 and recommended, "Databases in each of the programs need to be collected or developed on an ecological basis whether it be by eco-region or community type, for both aquatic and terrestrial communities." (1990) This project supports this recommendation.

The Supreme Court in its ruling over the Clean Water Act and the EPA's Migratory Bird Rule did not dispute the ability of wetlands to positively affect the quality of the Nation's water but stated the importance of using the knowledge of hydrolic cycles, aquatic biology and the causes of water pollution to scientifically document Clean Water Act jurisdiction. (Sipoez, 2003) The Thicket of Diversity with its focus on biology will provide such documentation.

In 2001 the Big Thicket was named a "Globally Important Birding Area." In 2007 the Neches River was named in the top 10 Most Endangered Rivers by the American Rivers Association. Protected areas were created to conserve wild biodiversity. The natural biodiversity in these areas is changing to the detriment of some species. Future SEP projects managed through the Thicket of Diversity can provide benefits by identifying the biodiversity, both native and exotic, in wetland wildlife corridors to assist in stewardship and sustainability.

Successful management by the Big Thicket Association for this SEP and of TCEQ and Park Partnership funds should positively influence consideration of the organization as a recipient of future litigation and mitigation monies to help sustain the very valuable inventory efforts of the Thicket of Diversity.



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