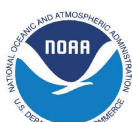




Challenger Seven Memorial Park Habitat Restoration Project

Final Report

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Bayou Preservation Association
Submitted to Texas General Land Office 2022



Fight Flooding PAC

This report was funded in part by a Texas Coastal Management Program grant approved by the Texas Land Commissioner, providing financial assistance under the Coastal Zone Management Act of 1972, as amended, awarded by the National Oceanic and Atmospheric Administration (NOAA), Office for Coastal Management, pursuant to NOAA Award No. NA20NOS4190184. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA, the U.S. Department of Commerce, or any of their subagencies.

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Executive Summary

The Challenger Seven Memorial Park habitat restoration project focused on the restoration of forested riparian habitat along Clear Creek in Harris County Texas. Throughout the project timeline, our work crews were able to treat 55.4 acres of riparian habitat in Challenger Seven Memorial Park. These areas consisted of a first clearing to remove the large bulk of invasives followed by a second clearing to remove any invasives that were missed, had not fully died from treatment, or had emerged since the first clearing. This was done to ensure that treated areas achieved a target of at least 90% reduction in invasive species cover. Over the course of this project, we have had great success with our restoration efforts. Almost all our treated area reached our goal of 90% reduction, with most of it achieving even better results. While originally a stumbling block, project delays have allowed work crews to visit these areas over a longer period, allowing mop-up activities to take place in different seasons and after longer growing periods. This has allowed us to catch more emerging invasives than would be possible in a shorter project timeframe. This has allowed us to ensure that we are treating new invasives that were thriving after the initial removal of the invasive canopy, as well as the emergence of invasives from the seed bank. Work was completed through the use of contract labor in conjunction with several young adult conservation crews. Although COVID-19 put a strain on many of the community engagement and outreach activities planned at the outset of this project, we were able to successfully host two hybrid workshops to inform interested parties about the work happening in the park as well as about watersheds and habitat restoration as a whole. Overall, this project has achieved its goal of restoring 16.5 acres of coastal wetland forest and has been able to add additional acreage by leveraging additional funding.

Introduction

Much of the Houston-Galveston Region was historically part of the Gulf Coast Prairie ecosystem. The prairie was intersected by riparian forest lands adjacent to the region's many bayous and streams. These areas are sources of high biodiversity, providing food and shelter for a wide variety of plant and animal life. Challenger Seven Memorial Park still retains vestiges of the historic prairie ecosystem and also hosts ample amounts of riparian forest lands along Clear Creek.

Prior to the restoration work, most of the riparian habitat was densely populated by invasive species such as Chinese Tallow (*Triadica sebifera*), Ligustrum, and Privet (*Ligustrum sp.*). These species had grown to outcompete much of the native plants, resulting in exclusion zones, loss of diversity, and lack of native food sources for wildlife. Because these habitats no longer have the same natural biodiversity prior to the invasion, the function of these systems is altered. Along with reduced habitat they often exhibit reduced capacity to improve water quality, increased erosion, and alteration of soil chemistry. Bayou Preservation's work at Challenger Seven seeks to remedy some of the problems posed by invasive species and restore the natural functions and resilience of these riparian habitats.

When engaging in the removal of large invasive trees and the use of herbicides, it is important to educate and engage the public about the nature and purpose of the work. This helps to not only educate the public about the importance of habitat restoration, but often gains support from neighbors and park users for actions that to some may be construed as simply cutting down the trees they enjoy. To this, we hosted two workshops to educate the public and park stewards about the work we were doing in the park as well as concepts including watersheds, habitat restoration, and invasive species.

Project Significance and Background

The Challenger Seven restoration project was important to restoring riparian habitat on the shores of Clear Creek. While densely populated with invasive species, the area was less degraded than many riparian areas in the region, and the presence of many native plants indicated that recruitment of native species should be possible after the removal of competing invasives.

The riparian habitat has a direct effect on the water quality of Clear Creek. Functional riparian zones will slow the progress of water from the surrounding uplands into the creek and may help mitigate flooding. The reestablishment of the native understory will also help in soil retention and reduce erosion, as well as capture sediments and debris from runoff before it enters the channel. These healthy plant communities also can improve water quality through the utilization of nutrients, removing some from the water in order to facilitate plant growth. Our continued work in the Clear Creek Watershed, and our focus on all the waterways of the Houston Region, have led us to become involved in the Clear Creek Watershed Partnership, a planning effort to reduce the levels of bacteria in the watershed. While the Challenger Seven project does not directly address this issue, properly functioning riparian areas are a crucial piece of natural infrastructure that brings with it many benefits to water quality. Bayou Preservation Association will continue to pursue these parallel goals to ensure that Houston's many bayous and waterways will be properly managed and can be enjoyed by all residents and visitors to our region now and into the future. The Challenger Seven project also aligns with goals from the following approved state and regional plans:

- ▶ **Texas Coastal Resiliency Master Plan:** goal of enhancing the habitat and infrastructure in our coastal communities
- ▶ **RESTORE Comprehensive Plan DRAFT 2022 Update:** Objective to restore, enhance, and protect habitat
- ▶ **Galveston Bay Plan 2nd Edition:** HC-2, Habitat Restoration; HC-3, Habitat Enhancement; SC-2, Invasive Species Management

The methods utilized here at Challenger Seven have been developed and honed over many years of experience, and we will continue to utilize these methods on future restoration projects. While a small part of the larger riparian network of the region, restoring this habitat at Challenger Seven helps to improve riparian habitat and connectivity and adds to the resilience of the valuable riparian habitat. This project also provides recreational benefits to park users by improving the visibility of Clear Creek, uncovering overgrown paths, and increasing wildlife diversity.



Methods & Results

Habitat Restoration

Bayou Preservation Association secured contract labor through longtime partner, EBR Enterprises. EBR comes with decades of knowledge pertaining to plant identification and removal in Texas.

Bayou Preservation also hired Student Conservation Association and Texas Conservation Corps work crews to assist EBR in removal and treatment of invasives. EBR and Bayou Preservation Association provided work crews with training and on the ground supervision to educate crews on invasive species identification and removal techniques. Together, our work crews were able to improve 55.4 acres (Appendix 1) of riparian habitat.

Removals were done through the use of hand tools such as chainsaws, hand saws, pole saws, and loppers. Cut plants were then followed up with herbicide treatment with appropriate, water-safe herbicides. Temporary, movable signs were placed in areas where work crews were actively working or had recently applied herbicide, alerting the public to the work as well as who to contact with questions or concerns.

Removals (Appendix 2) followed the below methodology

- ▶ Invasive plants were marked with paint by experienced practitioners to make identification of plants easy for those less experienced in plant identification
- ▶ Marked plants were then cut, making sure that some of the stump, as well as the paint markings, were still visible for those following up with herbicide treatment
- ▶ Leaf litter and cut debris were then removed from the base of the plant and the plant was cut to expose as much of the cambium layer as possible
- ▶ Herbicide was then sprayed carefully and directly onto the freshly exposed cambium layer
- ▶ Mop-ups of previously treated areas were performed regularly to check for missed plants, plants that were not fully killed, and newly emerging seedlings

A small supplemental planting of 35 native wetland plants was conducted on March 02, 2022, in a visible drainage cleared of invasives. We hoped to improve species diversity and water quality while also improving aesthetics by choosing species with showy blooms. Species planted include: 30 American Crinum Lily (*Crinum americanum*), 3 Blue Flag Iris (*Iris virginica*), and 2 Purple Pickerel Weed (*Ponterderia cordata*).





Education and Outreach

The ongoing COVID-19 pandemic made many of our originally planned outreach activities difficult. Volunteer work days and other community events were cancelled due to health concerns. Bayou Preservation was fortunate enough to host two educational workshops (November 2021 and May 2022) to inform interested parties about the work being done at Challenger Seven as well as educating about the topics of watersheds, riparian corridors, habitat restoration, and invasive species. Our workshops were conducted using a hybrid model with an online, educational presentation followed the next day by an in-person visit of the worksite. Through our workshops, we reached at least 48 unique individuals from a wide variety of government, non-profit, and community groups (Appendix 3). Our second workshop was recorded and added to the Bayou Preservation Association's YouTube channel to allow for continued access to the information to interested parties who were unable to attend (Appendix 4). Bayou Preservation Association commissioned artist Sarah Welch to aid in the design of three interpretive signs. These signs provide environmental interpretation covering the topics of native species, invasive species, and the anatomy of a watershed. Bayou Preservation Association then solicited feedback on the signs from Harris County Precinct two, General Land Office, and internal committees to arrive at the final design and wording. The signs have been installed at the park in frames designated by Harris County Precinct 2. (Appendix 5, 6 and 7).



Aquatic Milkweed (*Asclepia perennis*) appearing after invasive clearing

Results and Observations

The restoration project at Challenger Seven Memorial Park has been a success. Our work crews have been able to significantly decrease the number and density of invasive plants in the work area to below 10%, opening up space for the large native trees already in place and increasing light availability for native understory plants and seeds. The youth conservation crews greatly assisted EBR in removal of large woody invasives, increasing the speed and efficiency with which we could combat many of these heavily infested areas. The attendees of the workshops remain interested and engaged with the information, and return to see the work that has been completed at the park.

The Challenger Seven riparian restoration project resulted in the improvement of 55.4 acres of habitat, as well as the planting of 35 native wetland plants. We have begun to see the re-emergence of native species by natural recruitment and are optimistic about the return of native biodiversity with continued maintenance of the site. Native plants that we have observed re-emerging during this project include: Aquatic Milkweed (*Asclepia perennis*), Ironweed (*Vernonia sp.*), Yellow Passionflower (*Passiflora lutea*), and Downy Lobelia (*Lobelia puberula*)

Lessons Learned and Post-Treatment Assessment

Due to the removal of dense, invasive overstory, the increase light availability provides excellent growing conditions for both native and invasives to grow. This can become a problem when many invasive seed sources are present both in the seed bank and in adjacent properties. We worked to reduce this threat by cutting and bagging the seeds off felled Ligustrum trees when removals were occurring during their fruiting season. This should help with maintaining the progress this work has made by reducing the number of invasive seeds in the work area. The importance of strong plant identification skills and frequent mop-ups were also highlighted during this project by the late identification of exotic trees Chinese Sweet Plum (*Sageretia thea*) and Chinese Elm (*Ulmus parvifolia*). This required working back through already treated areas to remove these often-large trees that were missed previously due to them being unidentified.

One area of concern remains within the treated area, in the southwest portion, closer to the creek and W Nasa Rd. In this area of roughly 10 acres, Cat's Claw Vine (*Dolichandra unguis-cati*) has emerged as the primary invasive after removing the canopy of *Ligustrum* and Chinese Tallow. This species has proven difficult to contain due to a two-step process needed to treat it. The first step involves treating the vines that have crawled up the trunks of nearby trees with a weak solution. This allows us to knock back these plants, and prevent them from flowering and seeding, without harming the native tree species. We then must apply a follow up treatment of the basal portions of the plant, and runners along the forest floor with a stronger herbicide mix in order to achieve the desired level of treatment for these plants. This species is rather resilient to many environmental factors that have slowed the growth of many other invasives in the park. This, coupled with its quick growth, has made it difficult to knock back and that has been a slower process than anticipated. Luckily, we have made slow and steady progress in reducing its spread, and it seems contained to the wet lowlands of the park and not readily spreading to other areas.

Even with these challenges, the areas containing the Cat's Claw Vine have still achieved an overall reduction of invasives of 80%. Overall, this project has achieved its goal of restoring 16.5 acres of coastal wetland forest and has been able to add additional acreage through leveraging additional funding. In order to maintain the work, we have accomplished during this project, Bayou Preservation Association and EBR have created a post-project maintenance document (Appendix 8) that has been shared with county staff that outlines proper treatment techniques as well as identification of the most common invasives in the park.

Appendix 1. Final Map of Area Treated



Figure 1. Map of Challenger Seven Habitat Restoration Work Site

Appendix 2. Photos of Invasive Removal



Figure 2. Treated large, multi-trunked Chinese Tallow Tree



Figure 3. Large number of treated stumps



Figure 4. Large felled Ligustrum trees and treated stumps



Figure 5. TxCC Crew Members



Figure 6. Native wetland plants planted in a restored tributary of Clear Creek



Figure 7. Native wetland plants after planting



Figure 8. Treated Cat's Claw Vine



Figure 9. Treated Stumps



Figure 10. Treated Japanese Climbing Fern



Figure 11. Large Cut and Treated Ligustrum

Appendix 3. List of Community Groups Engaged

1. Harris County Precinct 1
2. Harris County Precinct 2
3. American YouthWorks (Texas Conservation Corps)
4. Student Conservation Association
5. Harris County Flood Control District
6. Houston Parks Board
7. Houston Arboretum
8. Woolpert
9. Ecosystem Planning & Restoration
10. Clear Creek Watershed Partnership
11. Interested Individuals

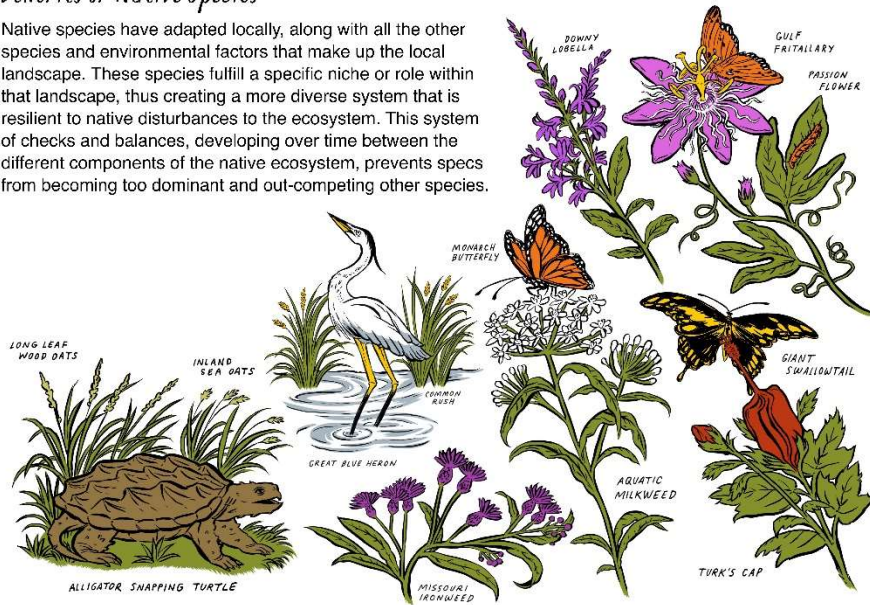
Appendix 4. Educational Workshop Presentation

<https://www.youtube.com/watch?v=2OkHAqInrvw>

Appendix 5. Benefits of Native Species

Benefits of Native Species:

Native species have adapted locally, along with all the other species and environmental factors that make up the local landscape. These species fulfill a specific niche or role within that landscape, thus creating a more diverse system that is resilient to native disturbances to the ecosystem. This system of checks and balances, developing over time between the different components of the native ecosystem, prevents species from becoming too dominant and out-competing other species.



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Appendix 6. What Is So Bad About Invasive Species?

What Is So Bad About Invasive Species?

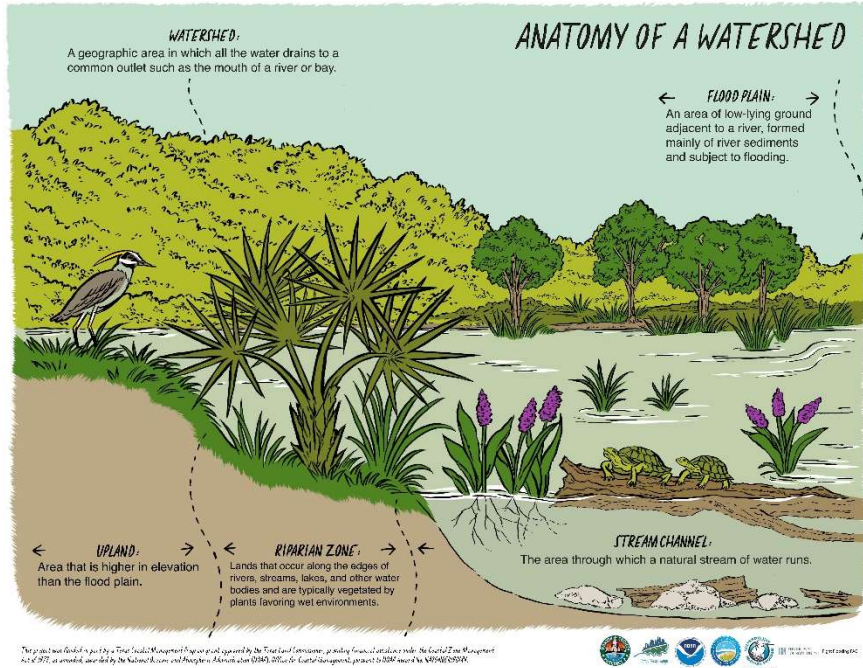
Since they adapted elsewhere, invasive species don't have native predators and diseases in their new homes. This often allows them to reproduce more rapidly than native species, which are usually controlled by these factors. This can lead invasive species to outcompete native species for space and resources, resulting in far less diversity as the invasive species take over. They also tend to provide less food and shelter for native wildlife and can sometimes be toxic and harmful to native wildlife that may eat them.



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Appendix 7. Anatomy Of A Watershed



Appendix 8. Post-Project Maintenance Document

Generally speaking, “mop up” activities are necessary to keep a restored area intact. It is recommended to return to work areas every 6-12 months to remove any unnoticed, new, or re-sprouting invasive, exotic plant species. This commonly takes less than 10% of the original labor and effort as the first completed passes. This post-treatment management is the most time and cost-efficient method of preventing future infestations of invasives in restored habitats.

Native plants tend to successfully recolonize an area after the invasive, exotic plants have been removed, but it may also be a good idea to replant some local native plants to speed up the recovery process. As long as at least one person on a team can identify the target plants, it will be possible to paint mark the individual plants to be removed. This allows plants to be marked ahead of those doing the physical removal and results in successful removal by less experienced work crews. In addition, the paint marking will make it easier for crews and applicators to find the plants and/or stumps to be treated.

Challenger 7 Memorial Park – Red – Work Areas with Completed First Passes of Removals, as of 12/13/22



Invasive, Exotic Species Removed:

(Plants Species in Bold Were the Most Commonly Encountered)

Trees:

Camphor Tree – *Cinnamomum camphora*

Chinaberry – *Melia azedarach*

Chinese Elm – *Ulmus parvifolia*

Chinese Tallow – *Triadica sebifera*

Tree Ligustrum – *Ligustrum lucidum*

Shrubs:

Banana – *Musa sp.*

Chinese Privet – *Ligustrum sinense*

Chinese Sweet Plum – *Sageretia thea*

Eleagnus – *Eleagnus sp.*

Flowering Senna – *Senna corymbosa*

Macartney Rose – *Rosa bracteata*

Nandina – *Nandina domestica*

Pittosporum – *Pittosporum tobira*

Trifoliolate Orange – *Poncirus trifoliata*

Wax Leaf Ligustrum – *Ligustrum japonicum*

Annuals and Perennials:

Brazilian Vervain – *Verbena brasilensis*

Moss Verbena – *Verbena tenuisecta*

Wedelia – *Wedelia trilobata*

Grasses:

Johnson Grass

Vasey Grass - *Panicum*

Vines:

Asian Jasmine - *Trachelospermum asiaticum*

Cat's Claw Vine – *Macfadyena unguis-cati*

Japanese Climbing Fern – *Lygodium japonicum*

Japanese Honeysuckle – *Lonicera japonica*

Wetland – Aquatic:

Elephant Ear – *Colocasia esculenta*

Water Hyacinth – *Pontederia crassipes*

Chemical Use and Application Plan - 2022

The herbicide mixes will be applied with 1 - 2 gallon handheld, pump sprayers. The Vastlan and Aquastar herbicides are mixed together.

Vastlan, EPA Reg. No. 62719-687 – Triclopyr choline based. 5 oz per gallon – **Tree mix**, 2 oz per gallon – **Sensitive mix**.

Aquastar, EPA Reg. No. 42750-59 – Glyphosate based. 5 oz per gallon – **tree mix**, 2 oz per gallon – **Sensitive mix**. This can also be used by itself at 5 oz per gallon (secondary aquatic mix) to treat things like Water Hyacinth.

The **Tree mix** and the **Sensitive mix** can be used in upland or wetland areas!

Clearcast, EPA Reg. No. 241-437-67690 – Ammonium Salt of Imazamox 2. 6 oz per gallon – **Aquatic mix**.

Aquaking – Surfactant. 1 oz per gallon. Used for all mixes.

Turf Mark Blue, Blue Dye Indicator. 1 oz per gallon. Used for all mixes.

Invasive, exotic trees and shrubs are cut down with chainsaws, loppers, handsaws, and machetes. They are always cut a little higher instead of flush with the ground to give more area to apply the **Tree mix** herbicide. The remaining stumps, root flares, root runners, etc. are scraped with machetes, axes, or other tools to expose as much of the cambium layer as possible. The sprayer is set close to a steady stream and the **Tree mix** herbicide is applied to all or most of the stumps, depending on the amount of exposed cambium layer.

Invasive, exotic vines, grasses, and herbaceous plants are treated using the **Sensitive mix**. This mix is the tree mix at half strength to reduce the amount of non-target plant damage. Small seedlings can also be treated with this mix. Japanese Honeysuckle Vine can be foliar sprayed with this mix. When the vine can be traced to the ground, they can be cut and scraped like a shrub, and the stump treated with the sensitive mix or the tree mix.

Elephant Ears are now being treated with the herbicide, Clearcast. This is our primary **Aquatic mix**. Historically, we have used glyphosate products, but the need for many repeated applications was very challenging. In 2021 we started using this herbicide and it has definitely been a huge improvement. The sprayers are set close to steady stream, and the individual stems are treated. The upper leaves are not treated, as they are more resistant to liquids and cause extra run off. That made it harder to preserve native species in between the Elephant Ears. It can take up to 3 - 4 weeks for the effects to be seen in the form of yellowing and droopiness. The herbicide Aquastar can be used as a secondary aquatic mix for other species.

Riparian Restoration: 8 Best Steps for Removing Invasive, Exotic Plants

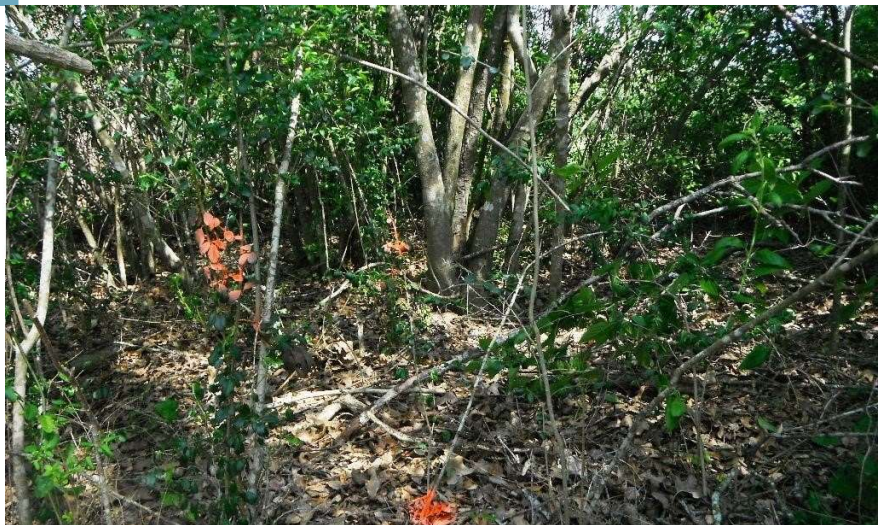


BAYOU PRESERVATION
ASSOCIATION

celebrate. protect. restore.

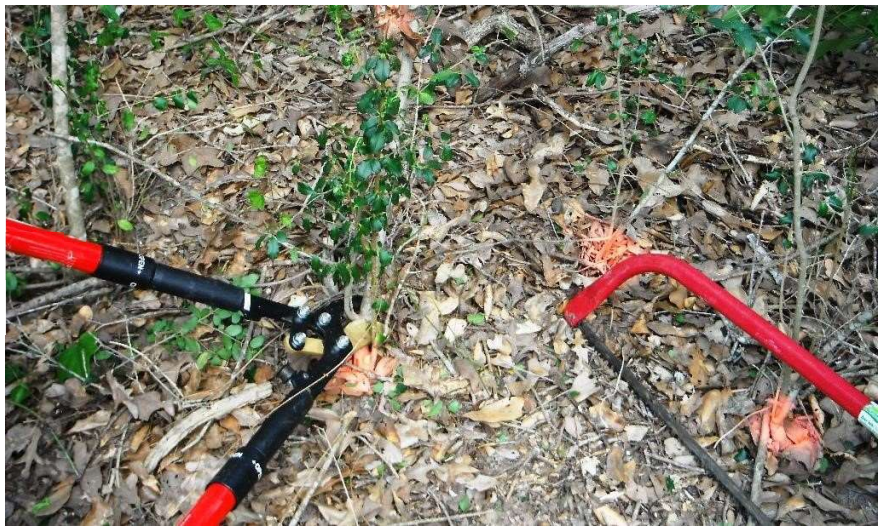
1. Paint Mark Exotic, Invasive Plants

- Mark low, to find after cutting for herbicide application



2. Cut Down Marked Plants

- Use loppers, handsaws, chainsaws, or machetes. Leave a small amount of the paint visible



3. Remove Cut Debris

- Make piles for pickup and disposal by composting



4. Remove Leaf Litter

- Clear litter from around stump of plants



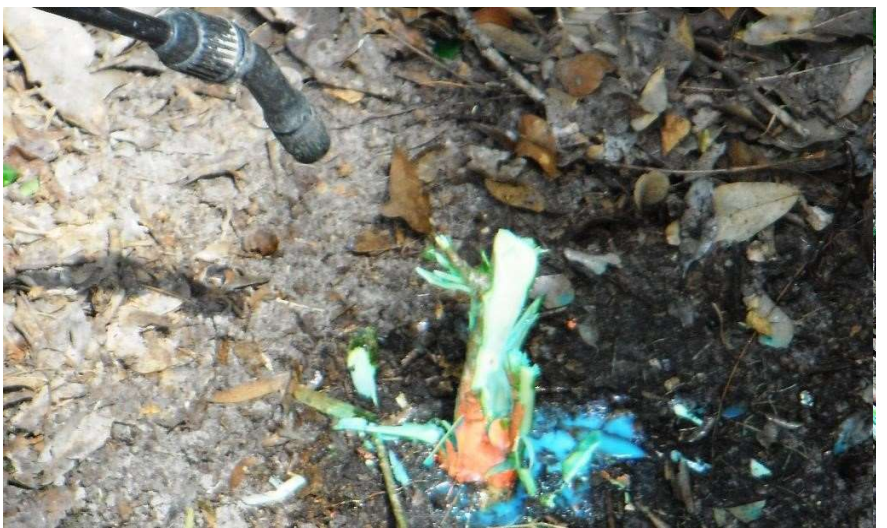
5. Use Machete to Expose Cambium Layer

- Expose layer on remaining stumps and root buttresses, but leave some paint visible



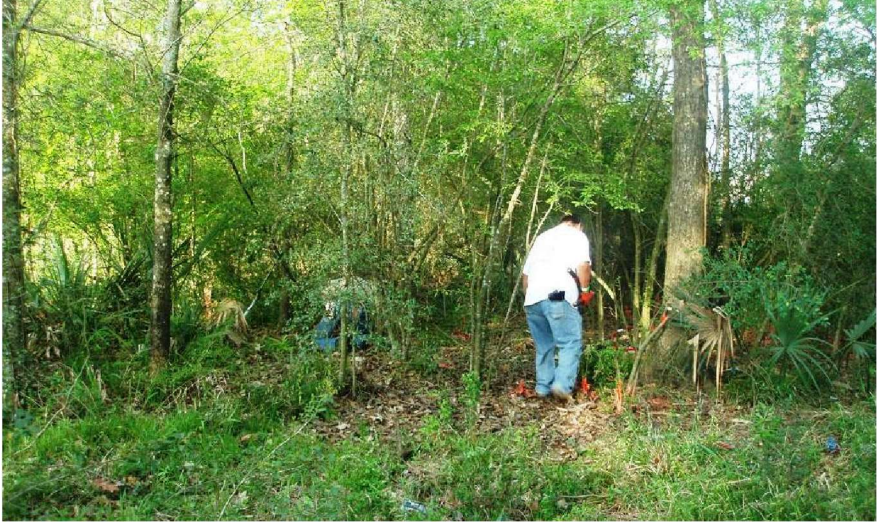
6. Use a Pump-Up Sprayer for Herbicide Application

- Use precise application of the herbicide mix within 30 mins to 2 hrs of fresh injury



7. Perform Maintenance "Mop-Ups"

- Mop-ups keep missed plants and seed sources from becoming re-established



8. If Appropriate, Replant With Native Plants

- Re-planting may be conducted after removals and "mop-ups" have been performed



Special Removal Methods

- **Medium to Large Shrubs and Trees:**
 - Kill-in-Place Method – Expose the cambium layer on the lower trunk and root buttress with a machete and treat with herbicide.
- **Very Small Plants:**
 - Carefully spray or hand pull.
- **Aquatic, Exotic, Invasive Plants:**
 - Treat only with an aquatic plant herbicide.

Extremely Long Root Runner! Scraped and Treated.



Elephant Ear Stands Treated with Clearcast - Houston, Texas - 1/2022



Chinaberry – *Melia azedarach*

- Invasive, exotic tree
- Height to 40 ft. or more
- Displacing native plant species all over U.S.
- Produces much fruit and seeds, to spread widely
- Illegal to be sold in Texas
- Native to China



Chinese Tallow – *Triadica sebifera*

- Invasive, exotic tree
- Height to 40 ft.
- Changes soil chemistry, creating exclusion zone
- Very high seed germination
- Heavily displaces native plant species
- Infesting much of U.S. South
- Red Fall Color is Distinctive
- Native to China



Chinese Privet – *Ligustrum sinense*

- Invasive, exotic shrub
- Height to 12 ft.
- Forms exclusion zones, heavily displacing native trees and shrubs
- Epidemic level of infestation
- Berries are Poisonous to Mammals
- Often mistaken for Yaupon
- Sold in nursery and landscape trade in variegated form
- Native to China



Macartney Rose – *Rosa bracteata*

- Invasive, exotic evergreen shrub
- Height is 30 ft.
- White flowers
- Heavy thorns
- Used as living fence before advent of barbed wire
- Native to Asia



Trifoliate Orange – *Poncirus trifoliata*

- Invasive, exotic shrub
- Height to 30 feet
- White flowers
- Forms colonies in woodland and riparian areas
- Used as impenetrable hedge because of thorns
- Also extensively used for orange stocks
- Native to Asia



Wax Leaf Ligustrum, Tree Ligustrum - *Ligustrum japonicum, lucidum*

- Invasive, exotic shrubs to small trees
- Height 6-30 ft.
- Evergreen leaves
- Cream colored flowers
- Bluish purple fruit that is poisonous to mammals
- Sold in nursery and landscape trade
- Epidemic level of infestation
- Very large specimens are often Tree Ligustrum
- Native to Asia



Brazilian Vervain – *Verbena brasiliensis*

- Invasive, exotic perennial
- Height 6-8 ft.
- Tall, weedy growth habit
- Lilac to purple flowers
- Infests prairies and edges & openings in wooded areas
- Native to South America



Cat's Claw Vine – *Macfadyena unguiscati*

- Invasive, exotic vine
- Up to 50 ft. in length
- Yellow trumpet-shaped flowers
- Invades wild areas and smothers trees
- Three-pronged claw-like appendages for grasping
- Native from Mexico and West Indies to Argentina



Japanese Climbing Fern – *Lygodium japonicum*

- Invasive, exotic vine
- Climbing, twining growth habit
- Displaces native vines in wooded areas
- Native to Asia and Australia



Japanese Honeysuckle – *Lonicera japonica*

- Invasive, exotic vine
- Twining and creeping growth habit
- White fragrant flowers
- Chokes out native vegetation and misshapes tree trunks
- Epidemic level of infestation
- Sold in the nursery and landscape trade
- Native to Japan



Elephant Ear – *Colocasia esculenta*

- Invasive, exotic aquatic plant
- Height to 6 ft.
- Large leaf shape similar to elephant's ears
- Infesting wetland and riparian habitats in over 1/3 of U.S.
- Drove to extinction a *Gambusia* fish species, endemic to Texas
- Heavily sold in the nursery and landscape trade
- Native to Asia



Water Hyacinth – *Eichhornia crassipes*

- Invasive, exotic aquatic plant
- Lavender flowers on floating plants
- Clogs waterways and displaces native wetland plants
- Native to South America

