

Ecological Restoration & Resiliency Plan

FOR THE HOUSTON ARBORETUM & NATURE CENTER



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HOUSTON
ARBORETUM &
NATURE CENTER

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INTRODUCTION

The Houston Arboretum & Nature Center (Arboretum) is a 155-acre non-profit urban nature sanctuary located on the western edge of Memorial Park, approximately three miles from Downtown Houston (Fig 1). Established in 1967 as a Section 501(c)(3) organization, the Arboretum was among the first nature education facilities for children in Texas and continues to serve more than 10,000 students annually while welcoming over 600,000 visitors each year.

The mission of the Arboretum is twofold: *to provide education about the natural environment to people of all ages and to protect and enhance the Arboretum as a haven and as a sanctuary for native plants and animals.* The Arboretum occupies a unique ecological position at the convergence of three Texas ecoregions: the Piney Woods, Post Oak Savanna, and Gulf Prairie (Gould et al. 1960). Through the conservation and restoration efforts, the Arboretum supports wildlife, improves local ecological function, preserves increasingly rare native ecosystems, and provides an unparalleled educational landscape within the urban core of Houston.

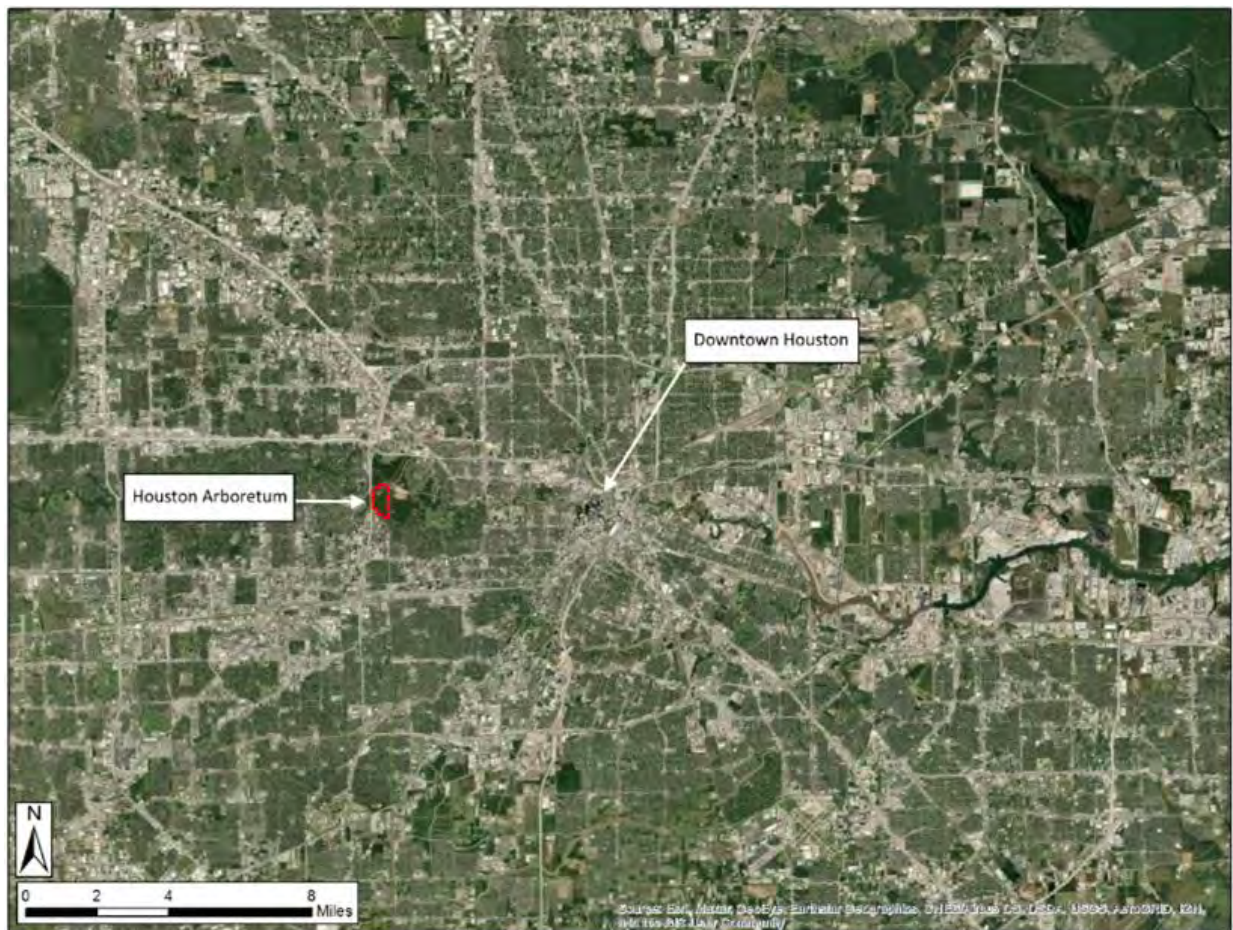


FIGURE 1 Location of the Arboretum within Houston and surrounding urban development.

In 2008 and 2011, Hurricane Ike and an extreme drought, respectively, resulted in the loss of approximately 50% of the Arboretum's tree canopy. These disturbances exposed long-standing ecological degradation caused by decades of minimal natural resource management but also created an opportunity to re-envision urban ecological stewardship. In response, a comprehensive Master Plan was initiated in 2012 and finalized in 2021. The plan incorporated expert consultation,

historic aerial imagery, archival records, and analyses of site geology, hydrology, and vegetation communities to conduct a forensic ecological assessment and identify the causes underpinning widespread canopy decline.

For much of its history, active land stewardship at the Arboretum was limited. Historic disturbances such as fire and grazing were excluded due to surrounding urban development, and pre-settlement savanna, prairie, and open woodland systems transitioned to closed-canopy forests with dense understories (Fig 2). This trajectory was reinforced by a widely accepted “hands-off” conservation philosophy and limited institutional resources. While well-intentioned, this approach proved insufficient to sustain biodiversity or ecological resilience.

The Master Plan established a framework for restoring historic ecosystem structure and function through active, ongoing stewardship. Passive land stewardship alone would allow rapid reversion to degraded conditions and increase vulnerability to increasingly frequent and severe climatic disturbances. Effective stewardship therefore requires intentional intervention informed by monitoring, adaptive management, and the best available ecological science.

This Ecological Restoration & Resiliency Plan builds upon post-Master Plan conditions and provides guidance for the long-term conservation of the Arboretum’s ecosystems. The plan is adaptive by design: management techniques, timing, and intensity may vary annually in response to monitoring data, observed site conditions, and anticipated environmental change. The plan prioritizes conservation actions necessary to sustain biodiversity, resilience, and ecological function while balancing operational capacity and available resources.



FIGURE 2 Aerial photos of the Houston Arboretum & Nature Center in 1944, 1979 and 2023 showing the transition to closed canopy woodland and current conditions.

HYDROLOGY & SOILS

Hydrology at the Arboretum is strongly influenced by soils and can be approximated by the 18-meter contour line that divides the site into two distinct hydrologic zones (Fig. 3):

- Above 18m contour: Generally level terrain with shallow depressions and low sandy mounds. Surface water frequently accumulates during heavy rainfall and persists for several days, creating a fine-scale mosaic of vegetation.
- Below 18m contour: Slopes descend gradually to steeply toward Buffalo Bayou and its tributaries.

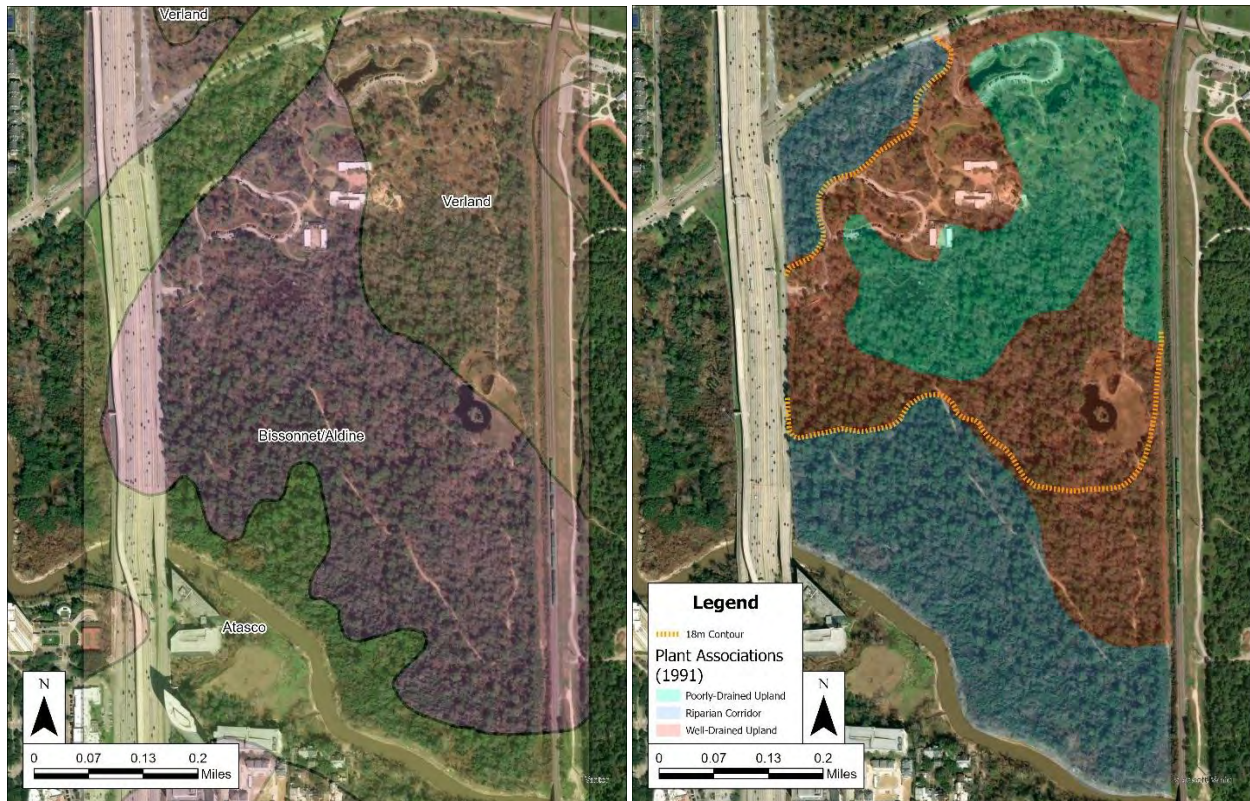


FIGURE 3 USDA soil survey map, and map showing the 18m elevation contour and plant associations based on Williams 1991 Vegetation Survey.

The Arboretum can be categorized into three main associations based on hydrology and soil characteristics that influence vegetation communities (Williams 1991; Fig. 2). Although originally delineated prior to implementation of the Master Plan, these associations remain generally applicable. No major soil disturbance has occurred within the Arboretum, and the intact soil profile and associated microtopography constitute a critical natural resource that strongly influences ecosystem function, and its preservation must remain a priority.

ASSOCIATIONS

1. Well-Drained Upland: This association is largely flat with relatively good drainage and supports woodland to open-woodland habitat. A diversity of woody species includes Loblolly Pine (*Pinus taeda*), Oaks (*Quercus* spp.), Elms (*Ulmus* spp.), Farkleberry (*Vaccinium arboreum*), and Hawthorns (*Crataegus* spp.). The understory is dense and dominated by Yaupon (*Ilex vomitoria*),

Chinese Privet (*Ligustrum sinense*), and American Beautyberry (*Callicarpa americana*), with sparse herbaceous cover and diversity. Soils are typically mapped as Bissonnet or Aldine series, which are moderately coarse relative to adjacent poorly drained areas.

2. Poorly-Drained Upland: These areas are flat with randomly scattered shallow mounds and depressions. Mounds support vegetation similar to well-drained uplands, while surrounding soils exhibit poor drainage. Willow Oak (*Quercus phellos*) are the indicative woody species of these areas. Understory density is high but generally less so than in well-drained uplands and is dominated by yaupon and Chinese Privet, with scattered Southern Arrowwood (*Viburnum scabrellum*). Soils align with the Verland series, which historically supported prairie but are prone to woody encroachment due to fine-textured, clay-rich substrates.
3. Riparian Corridor: Riparian areas along Buffalo Bayou and its tributaries exhibit variable slopes and well-drained alluvial soils. Indicator species include Cherry Laurel (*Prunus caroliniana*), Elderberry (*Sambucus nigra*), Box Elder (*Acer negundo*), and scattered hickories (*Carya* spp.). Soils are typically loamy and mapped as Atasco series.

ECOSYSTEMS

Prior to European settlement, the Houston region was dominated by a savanna–prairie complex with woodlands largely confined to riparian corridors. These ecosystems were historically maintained by large herbivores and frequent fire every 2-3 years on average (Frost 1998). Urban development eliminated these disturbances, allowing woody encroachment, initially by pines, followed by hardwoods, resulting in widespread closed-canopy forests.

Decades of limited management at the Arboretum further simplified plant communities. Historical records indicate substantial shifts in species composition and structure. For example, Cherry Laurel, once described as “scattered” almost 90 years ago (Fitzgerald 1938), now dominates riparian midstory vegetation (Benigno 2024). Similarly, Yaupon dominates understories throughout the Arboretum and species such as Devil’s Walking Stick (*Aralia spinosa*) are nearly nonexistent, while both were described as “abundant” in 1938. Inventory data also show a transition from pine–oak dominance toward elm-dominated canopies and reduced canopy diversity due to excessive understory density (Fig. 4) (Benigno 2024; Benigno unpublished).

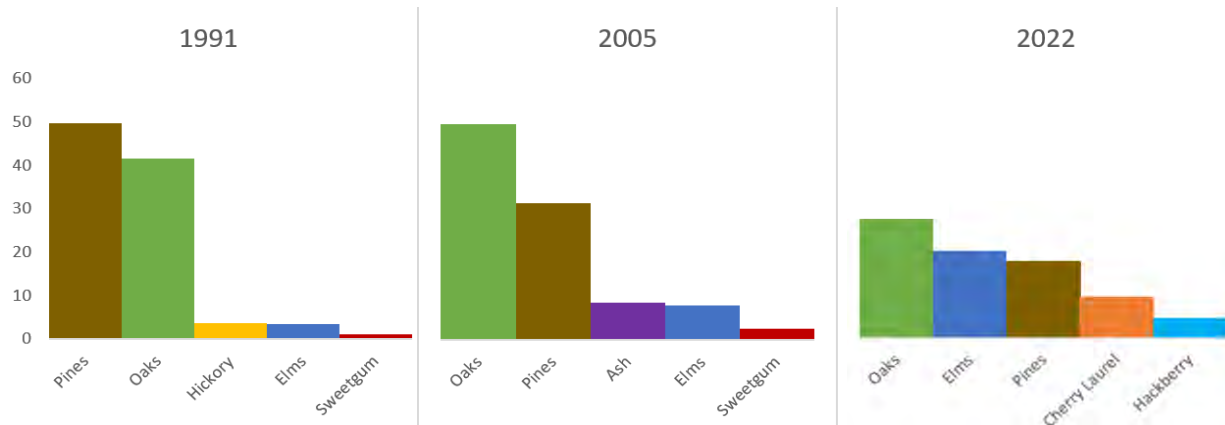


FIGURE 4 Overstory tree composition and trajectory (adapted from Watson 2013) over the past 35 years.

Following implementation of the Master Plan, Arboretum ecosystems more closely reflect historic structure and are better aligned with site hydrology, soils, and management capacity. Given the surrounding urban matrix, true reference ecosystems are limited, and ecological restoration in its

strictest definition may not be attainable. Management therefore emphasizes restoration of structure, function, and the even distribution of native biodiversity to enhance ecological resilience rather than exact replication of pre-settlement conditions.

MIXED PINE-HARDWOOD FOREST

Mixed pine-hardwood forest comprises most of the Arboretum and reflects affinities with both the Pineywoods and Post Oak Savanna ecoregions, blending upland pine with both bottomland and mesic hardwood communities, shaped by a warm, humid climate and periodic disturbances such as hurricanes and fire. Species composition varies with subtle changes in elevation, drainage, and soil texture. Pines dominate well-drained uplands, while hardwoods increase in flatter, lower areas.

The canopy is moderately closed, with loblolly pine emergent above oaks (primarily *Q. phellos*) and shade-tolerant hardwoods such as elm and Green Ash (*Fraxinus pennsylvanica*). The midstory and understory are dominated by Yaupon, American Beautyberry, and nonnative privets (*L. sinense*, *Ligustrum japonicum*), with scattered Southern Arrowwood, Eastern Red Cedar (*Juniperus virginiana*), Red Mulberry (*Morus rubra*), hawthorns, and Farkleberry. Historically, the understory supported diverse grasses, sedges, and forbs (Fig 5) (Fitzgerald 1938), but these have largely been excluded by woody encroachment and overgrowth of Yaupon and Chinese Privet (Fig 6).

Fire and herbivory historically maintained open structure and age-class diversity. Their absence has resulted in dense understories that favor generalist species, suppress regeneration, and reduce overall biodiversity (Benigno unpublished).



FIGURE 5 Photograph of woodland area from Fitzgerald 1938 showing patches of sunlight reaching the herbaceous understory and open space between woody vegetation. Caption: “Photograph of Oak with French Mulberry Undergrowth.” French Mulberry is the antiquated name for American Beautyberry.



FIGURE 6 Dense understory of yaupon with little to no herbaceous ground cover, indicative of current woodland conditions, and yaupon and Chinese privet colonizing a canopy gap left by a dead tree.

COASTAL TALLGRASS PRAIRIE

Coastal tallgrass prairie once dominated the Houston region but has been largely displaced by development and woody encroachment. At the Arboretum, the lack of vegetation management allowed woody species to encroach on prairie over time at the Arboretum, but prairie persists primarily in the Meadow and portions of the Wildflower Trail loop. These areas occur on nearly level, fine-textured soils and are characterized by full sun and minimal woody cover.

In its true form, prairie is a highly productive, grass-dominated ecosystem found in nearly level to gently undulating deep, fertile, clay to clay-loam soils that are often seasonally saturated but dry and crack during summer droughts. Vegetation is dominated by tall, warm-season grasses interspersed with highly diverse forbs, providing continuous flowering and critical pollinator habitat. Prairie species are adapted to frequent disturbance, including fire, grazing, and periodic flooding. In the urban context of the Arboretum, annual mowing substitutes for grazing, and prescribed fire should be applied when feasible.



FIGURE 7 Photograph of savanna and grassland from Fitzgerald 1938 showing what appears to be mainly pine as the dominant mature species, with minimal shade and a continuous herbaceous understory. Caption: “Grassland.”

PINE-OAK SAVANNA

Pine–oak savannas are open, fire-maintained systems transitional between forest and grassland. Canopy cover typically ranges from 20–50%, dominated by loblolly pine with fire-tolerant oaks such as Post Oak (*Q. stellata*) and Southern Red Oak (*Q. falcata*).

At the Arboretum, savanna occurs primarily in the northeast corner atop Verland soils, with subtle mound–depression microtopography. Trees were observed to exhibit higher survival on sandier mounds during drought conditions. The herbaceous layer is rich and prairie-like but an overabundance of the non-native Deep-Rooted Sedge (*Cyperus entrerianus*) and native Sawtooth Blackberry (*Rubus argutus*) currently reduce overall herbaceous diversity.

Frequent low-intensity fire is essential to maintain savanna structure. Without disturbance, these areas rapidly succeed to closed-canopy forest dominated by Yaupon, Chinese Privet and mesic hard and softwoods. Mowing may serve as a partial substitute when and where prescribed fire is not feasible.

RIPARIAN

Riparian corridors include Buffalo Bayou and a small ephemeral tributary known colloquially as the Ravine. These areas support bottomland hardwood forests adapted to periodic flooding and

nutrient-rich alluvial soils of the Atasco series. Overstory species include Loblolly Pine, American Sycamore (*Plantanus occidentalis*), Box Elder, Hackberry (*Celtis laevigata*), and Eastern Cottonwood (*Populus deltoides*). Cherry Laurel dominates the midstory, with Yaupon, non-native Privets, and American Beautyberry present. Steep slopes limit mechanical management in riparian habitats. Approaches such as prescribed fire or targeted herbivory may be appropriate to control overabundance of understory woody species on a larger scale.

MANAGEMENT PHASES

Informed and ongoing ecosystem management is critical to achieving site goals. The three phases below were defined to assist tracking the progress of specific areas within the Arboretum. Phases do not need to occur simultaneously across the Arboretum and must align with available resources. For example, Phase I should only be implemented where Phase II can immediately follow. Phases II and III may occur in the same area if opportunities align. Quantitative and qualitative monitoring should inform management decisions and guide phase transitions.

PHASE I: PREPARATION

The Preparation Phase is the most resource-intensive due to legacy conditions resulting from historic land use, fragmentation, and prolonged invasive species establishment. Decades of unmanaged conditions have resulted in excessive dominance by invasive species or aggressively establishing native species. The quantity of these species and others may need to be managed prior to any major attempts toward ecosystem enhancement. Management may include mechanical removal, herbicide application, prescribed fire, targeted herbivory, or a combination of these strategies depending on site conditions. Fortunately, the intact soil profile and recent riparian enhancements negate the need to amend most soils or hydrological conditions.

Transition from Phase I to Phase II should be contingent upon notable reductions in invasive or aggressive native species cover and demonstrated feasibility of follow-up maintenance.

PHASE II: STABILIZATION

The Stabilization Phase focuses on reinforcing ecological feedbacks that promote long-term system stability and reduce reliance on intensive intervention. Immediate follow-up management after Phase I is required to prevent reestablishment of undesirable species. Over time, management intensity and frequency should decrease, provided annual monitoring and treatments continue. Large-scale management strategies such as prescribed fire may be critical to efficiently maintain ecosystem health given limited resources and additional staff duties.

Transition from Phase II to Phase III will be contingent upon sustained control of desirable conditions through monitoring over multiple growing seasons.

PHASE III: REHABILITATION

The Rehabilitation Phase is intended to accelerate recovery or increase functional diversity where natural regeneration alone is insufficient, rather than to recreate a fixed historical condition. The type of enhancement will depend on the location, specific habitat, and long-term management objectives, with decisions guided by ongoing monitoring to identify emerging issues before they escalate. Rehabilitation efforts to improve biodiversity, such as planting or seeding, should occur only after Phases I and II have demonstrated sustained, long-term control of undesirable species. In some cases, passive recovery from existing seedbanks may provide sufficient rehabilitation. Spot

treatment of isolated invasive species or selective thinning of aggressive native species may also be required during this phase to maintain desired ecological conditions.

Phase III represents the long-term management condition for restored areas and is expected to continue in perpetuity unless monitoring indicates ecological degradation or threshold crossings that warrant a return to earlier management phases.

ECOLOGICAL RESTORATION & RESILIENCY GOALS

Ecological restoration is defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed while ecological resilience is the ability of a restored ecosystem to withstand disturbance and environmental change, recover essential functions, and avoid transition to an undesirable alternative state. Achieving the goal of true ecological restoration of the Arboretum may not be possible given limited regional reference sites, lack of historical data and extensive surrounding urbanization. Additionally, inadequate resources constrained management efforts for decades, resulting in impaired ecological resiliency and current degraded conditions. However, recent increases in funding and public engagement now allow for more active management, and it is the responsibility of the Arboretum to leverage those assets for ecosystem enhancement.

The mission of the Arboretum states a broad objective to deliver environmental education to the public and to protect and enhance its ecosystems, with no defined or measurable success criteria. The overarching goal should therefore be to promote and strive for an even distribution of high native biodiversity that maximizes ecological resilience while preserving public interaction with nature. Measurable success may be determined through quantifiable monitoring and comparisons to baseline conditions. High standards, professional knowledge, and involvement in the broader ecological community will allow staff to achieve these goals.

PLAN INTENTION AND USE

This plan is intended to guide long-term ecological restoration and resilience at the Arboretum through adaptive, site-specific decision-making aimed at improving the even distribution of native biodiversity. Annual variation in climate, staffing, resources, and programming precludes rigid management schedules, and actions should therefore reflect the natural temporal and spatial variability that historically structured these ecosystems.

The sections below provide a background and outline priorities for specific areas of the Arboretum, arranged into individual **Management Units** and **Subunits**. They do not intentionally define when, or in many cases how, to achieve goals. Implementation should be informed by current site conditions, available resources, monitoring data, and long-term objectives. Actions should be guided by professional judgment and adaptive management principles.

These sections also refer to **Conservation Actions** (CA) (Appendix A) that are methods for restoring and managing ecosystems at the Arboretum. They were developed to standardize and describe tasks that can be implemented across the Arboretum to improve consistency and clarity for staff. CAs are presented in the context of each individual Management Unit in the **Management Tables** below, and a more detailed **Management Focus** is provided for each Subunit.

This plan was developed and intended to be adapted as Management Phases progress and ecosystems evolve. Revisions to any part of this plan should be recorded in the Plan Revisions Table beginning on Page 3 of this document.

MANAGEMENT UNITS & SUBUNITS

The landscape of the Arboretum contains four main ecosystems: coastal tallgrass prairie, mixed pine-hardwood forest, pine-oak savanna, and riparian. These ecosystems have been divided further into Management Units and Subunits (Fig. 7) based upon trail placement, geographic barriers, and objectives to provide the framework for planning, tracking, and prioritizing Management Phases and implementing CAs effectively. This plan focuses on Management Units 3-9, while separate plans have been developed for Unit 1 Turf Lawns and Unit 2 Gardens.

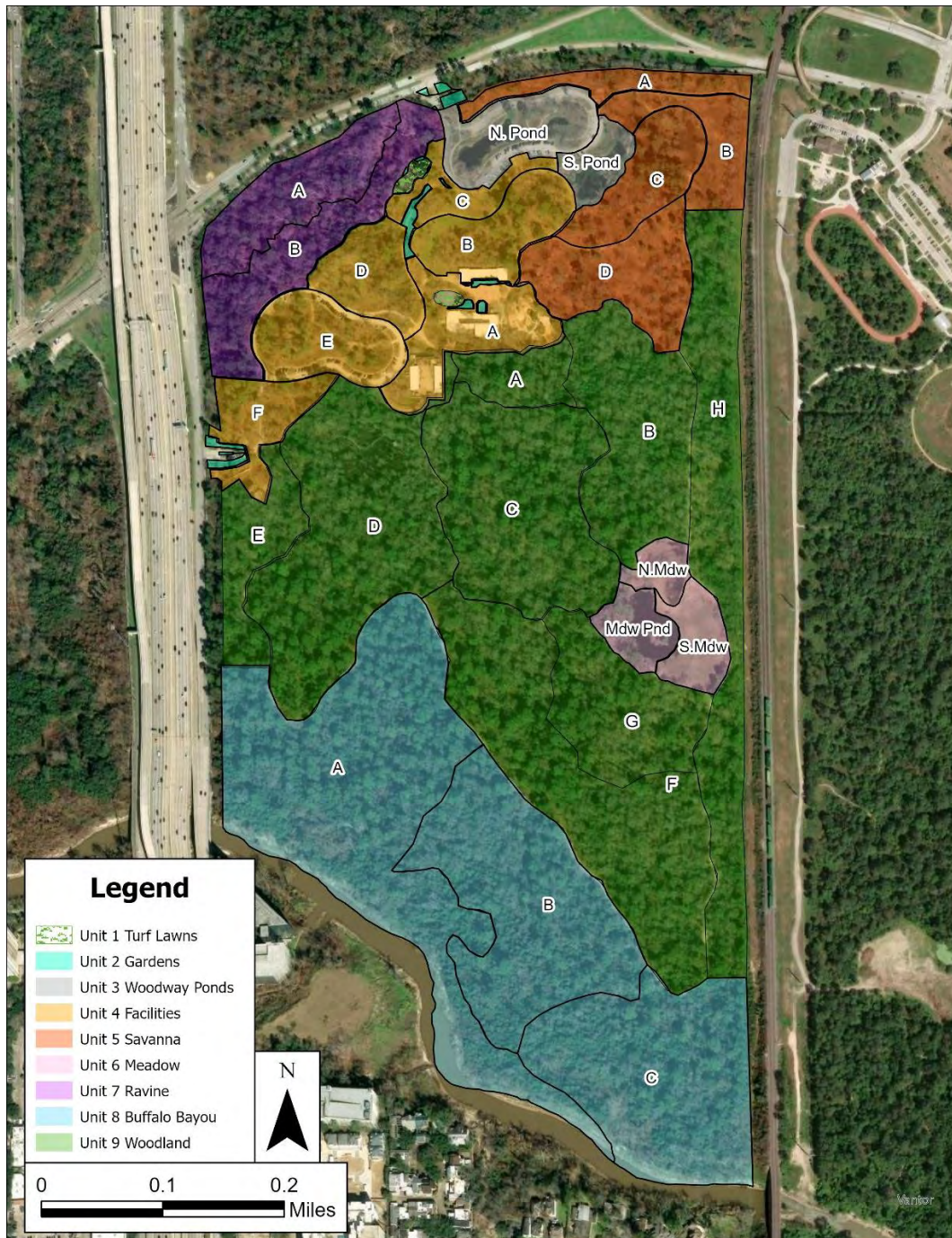


FIGURE 7 Management Unit and Subunit locations

MANAGEMENT UNIT 3 WOODWAY PONDS

Management Unit 3 (4.7ac) includes the North & South Woodway Ponds and the Woodway Parking Loop. These areas are highly viewed and interacted with by guests and therefore require a specific management approach that balances conservation, public interaction and park aesthetics. Given the need to maintain a more park-like setting, management of Unit 3 is currently assigned to an individual staff member to monitor closely throughout the year, then prescribe and conduct CAs individually or as a team if needed.

The ponds are a source of non-potable reclaimed water used for irrigation of Unit 1 Turf Lawns, Unit 2 Gardens, and natural areas of the Courtyard and Nature Playscape in Unit 4 Facilities. Rainfall and runoff from Units 1, 2, 3 and 4 are conveyed through underground drainage infrastructure into both ponds. A pump is located at the bottom of the South Woodway Pond that delivers water to the appropriate areas using a programmed irrigation system. Maintenance of the pump and irrigation system are not included in this plan. The ponds do not share continual surface water flow but are connected by belowground infrastructure that maintains a consistent water level between them. Maximum water level is determined by a double overflow drain box located in the northwest corner of the North Woodway Pond and drains into Unit 7 Ravine via an underground culvert. Pond water level can be manipulated by turning on a city water valve or blocking the lower overflow drain.

Invasive species removal has been seemingly continuous within the ponds since their construction. Aquatic invasive species have been shown to monopolize the entire water surface and column, and can disrupt or damage the irrigation water pump. Waterhyme (*Hydrilla verticillata*) was the initial invader, colonizing the entire water column of both ponds. It was treated by a water-specific herbicide, Aquathol-K, multiple times before it was eradicated completely. Afterwards, Common Salvinia (*Salvinia minima*) and Alligatorweed (*Alternanthera philoxeroides*) became established in both ponds, and were treated by the herbicides Clipper and ProcellaCOR, respectively. They currently only exist in the South Woodway Pond and still require treatment for full eradication. Manual removal of these species has been ineffective. Native aquatic species such as Mosquito Fern (*Azolla caroliniana*) or Duckweed (*Lemna minor*) have become prolific in the Woodway Ponds, and other ponds of the Arboretum, but are not persistent and do not require intervention.

The CAs below provide a general guideline for Unit 3. Timing and frequency should be adapted based upon visual monitoring throughout the year and dependent on current conditions such as climate, site conditions or resources available. This plan focuses on CAs and not facilities tasks (pruning, edging or mowing herbaceous vegetation along trail edges, irrigation pump or system maintenance). For any mowing requirements to aid CAs (using the tractor, billy goat mower, etc.), consult and schedule with the Facilities staff.



Management Table - Unit 3 Woodway Ponds			
Conservation Action	Description	Details	
Monitoring	Visual monitoring	One walkthrough per Subunit per month	Prescribe and follow up with CAs as needed
		Maintain necessary pond water level	Water level can be raised or lowered for irrigation requirements or vegetation management
			Open or close the city water valve located in Unit 5A, north-northwest of Unit 3 boundary
Individual Tree Care	Prune established trees	Limbs that encroach on trails, roads and parking spots	Create a clearance height of 7' minimum
		Remove lower limbs of all mature trees to height of 4-5', with exceptions based upon location and tree form	Maintain dense underbrush to deter visitors from crossing trails where necessary
			Retain an existing proportionally large tree limb
			Species with a clumping, spreading, bushy or smaller form may not require pruning
		Structurally prune young trees	Subordinate trees with double leader, remove splits, broken branches, etc.
			Do not prune saplings or recently planted trees (within 3 years)
			Consult with Forestry staff if necessary
	Identify and cultivate desirable native trees and shrubs (Appendix C)	Stake and flag individual seedling/sapling, and map location if necessary	Map and markers should be used to identify for supplemental care
		Maintain individuals until they are mature enough to no longer require supplemental care	Remove encroaching vegetation and vines from desirable saplings and smaller trees & shrubs
			Apply water during drought
			Apply mulch if able
Dead or Hazardous Tree Removal	Identify dead or hazardous trees that may impact targets	Communicate location to Forestry staff to determine method for removal	Trees leaning toward a target or overhanging branches may require action
			Trees that do not impact a target do not require action

Management Table - Unit 3 Woodway Ponds			
Conservation Action	Description	Details	
Invasive Vegetation Removal	Remove woody and herbaceous invasive species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or basal bark, or mechanical removal by mowing, cutting, hand-pull or weed wrench
			If herbicide is necessary within ponds, a specific written plan must be developed that considers impacts to native wetland vegetation, wildlife, and irrigated areas immediately following application
High-Density Native Species Removal	Remove or thin out high-density native woody and herbaceous species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or basal bark, or mechanical removal by mowing, cutting, hand-pull or weed wrench
		Not necessary to removal every individual and is dependent on circumstance	Large clusters of the same species
			Proximity to more desirable species
			Woody species adjacent to facilities such as light poles or parking spots
		For high-density woody species that are of an age/size/location that may allow for their retention, prune appropriately to maximize beneficial shape/form	Subordinate trees with double leader, remove splits, broken branches, etc.
Seeding	Broadcast seed when and where appropriate	May not be necessary or effective every year or in every Subunit	Appropriate times may follow habitat mow or prescribed fire
		Source seed appropriately	Ex. region-specific, light and soil requirements for applied areas

Management Table - Unit 3 Woodway Ponds			
Conservation Action	Description	Details	
Plant Installation	Install plants when and where appropriate	Install species that enhance diversity and maintain character of the area	Do not plant large shade tree into a prairie area or block view of desirable feature or facility
		Schedule during dormant season	May require supplemental care following installation depending on weather conditions or other factors
Habitat Mow	Mow using the tractor or billy goat mower	For areas with dense woody understory and/or herbaceous ground cover	Maintain line of sight and/or prevent brush encroachment
		Consult and schedule with the Facilities staff	Communicate and/or flag location of desirable native trees and shrubs to avoid
		Schedule as needed or when conditions allow	Ex. dormant season, to prevent seed production, weather/ground moisture conditions, event programming
Targeted Herbivory	Rent goats to simulate herbivory in the landscape	Applicable in areas where understory brush is too dense and overgrown for a habitat mow	Protect trunks of desirable native trees and shrubs prior to goat arrival by wrapping in wire and securing
Prescribed Fire	Prescribe fire may be inappropriate due to features and facilities	-	-

SUBUNIT NORTH WOODWAY POND (3.4 ac) is encountered by visitors entering the Arboretum from the Woodway Entrance. It encompasses the North Woodway Pond, Woodway Parking Loop, Pond Overlook and the donor medallion bridge. It includes coastal prairie vegetation along the pond slope, open woodland, wetland, forested pond margin and pond habitats, with recently planted and established native desirable woody species throughout the subunit. The North Woodway Pond contains wetland shelves along its banks that support emergent vegetation, open water west of the donor medallion bridge, and a narrow band of emergent wetland vegetation east of the donor medallion bridge. Access to the pond margin can occur using pond steps located on the north side of the pond. Subunit North Woodway Pond is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species if necessary
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Maintain a sparse and open understory within woodlands and suppress woody overgrowth within coastal prairie areas
 - Schedule mowing once per year
 - Mow up to pond margin but avoid placing equipment on wet soil
 - Communicate location of desirable woody species to mowing operator
 - Maintain pond visibility from the parking loop
 - Remove or cut back shrubs and lower limbs of trees
3. Suppress undesirable terrestrial species (Appendix B)
 - Invasive species
 - Non-native privets (*Ligustrum spp.*), Yellow Bluestem (*Bothriochloa ischaemum*), Beggarticks (*Bidens pilosa*), Deep Rooted Sedge (*Cyperus entrerianus*), Brazilian Vervain (*Verbena brasiliensis*)
 - High-density native herbaceous and woody species
 - Black Willow (*Salix nigra*), Cottonwood (*Populus deltoides*), Elms (*Ulmus alata*, *U. crassifolia*), Eastern Baccharis (*Baccharis halimifolia*), Jamaican Sawgrass (*Cladium mariscus* ssp. *jamaicense*), Sawtooth Blackberry (*Rubus argutus*)
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, existing desirable trees, fallen logs, etc.
4. Pond Management
 - Suppress wetland invasive and undesirable native species within the pond and its margin (Appendix B)
 - Torpedograss (*Panicum repens*), Alligatorweed (*Alternanthera philoxeroides*), Salvinia (*Salvinia minima*), Waterhyme (*Hydrilla verticillata*)
 - Monitor pond water levels
 - Open or close city water valve when needed
5. Maintain circle overlook, donor medallion bridge and pond steps
 - Remove weedy species growing within circle overlook
 - Remove vines from plaques on donor medallion bridge
 - Maintain access down the pond steps

SUBUNIT SOUTH WOODWAY POND (1.3 ac) is located southeast of the North Woodway Pond and contains the South Woodway Pond and Donor Boardwalk. It is a mix of coastal prairie on the pond slopes, wetland, forested pond margin and pond habitats, with recently planted native desirable woody species throughout the subunit. The South Woodway Pond contains open water in the middle of the pond, and wetland shelves along its banks and around the Donor Boardwalk that support emergent vegetation. Subunit South Woodway Pond is in **Management Phase I**.

Management Focus

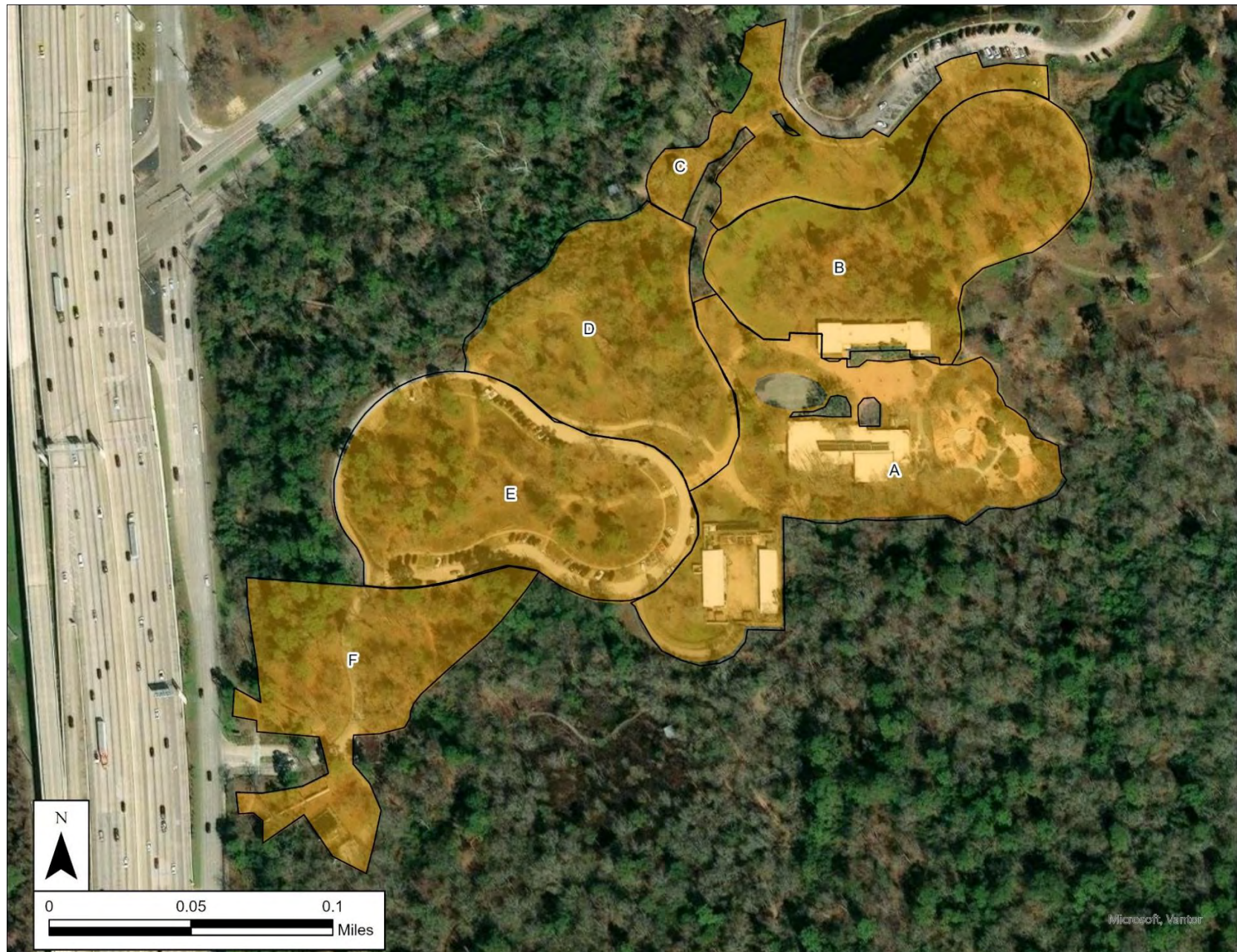
1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species if necessary
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Suppress woody overgrowth
 - Schedule mowing once per year
 - Mow up to pond margin but avoid placing equipment on wet soil
 - Communicate location of desirable woody species to mowing operator
 - Maintain pond visibility from the parking loop
 - Remove or cut back shrubs and lower limbs of trees
3. Suppress undesirable terrestrial species (Appendix B)
 - Invasive species
 - Non-native privets (*Ligustrum spp.*), Yellow Bluestem (*Bothriochloa ischaemum*), Beggarticks (*Bidens pilosa*), Deep Rooted Sedge (*Cyperus entrerianus*), Brazillian Vervain (*Verbena brasiliensis*)
 - High-density native herbaceous and woody species
 - Black Willow (*Salix nigra*), Cottonwood (*Populus deltoides*), Elms (*Ulmus alata*, *U. crassifolia*), Eastern Baccharis (*Baccharis halimifolia*), Jamaican Sawgrass (*Cladium mariscus ssp. jamaicense*), Sawtooth Blackberry (*Rubus argutus*)
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, existing desirable trees, fallen logs, etc.
4. Pond Management
 - Suppress wetland invasive and undesirable native species within the pond and along its edge (Appendix B)
 - Torpedograss (*Panicum repens*), Alligatorweed (*Alternanthera philoxeroides*), Salvinia (*Salvinia minima*), Waterhyme (*Hydrilla verticillata*)
 - Monitor pond water levels
 - Open or close city water valve when needed

MANAGEMENT UNIT 4 FACILITIES

Management Unit 4 (17.6ac) includes natural landscapes of open woodland and savanna matrix, as well as wildflower dominated coastal prairies that surround buildings, parking loops and other facilities. These areas are highly viewed and interacted with by guests and therefore require a specific management approach that balances conservation, public interaction and park aesthetics. This unit was altered significantly during the Master Plan, with belowground irrigation for Unit 1 Turf Lawns and Unit 2 Gardens, and drainage infrastructure that drains into Unit 3 Woodway Ponds.

Given the need to maintain a more park-like setting, subunits are currently assigned to an individual staff member to monitor closely throughout the year, then prescribe and conduct CAs individually or as a team if needed. Ecological monitoring may be conducted by the assigned staff member or by appropriate experienced personnel.

The CAs below provide a general guideline for Unit 4. Timing and frequency should be adapted based upon visual monitoring throughout the year and dependent on current environmental conditions such as climate, site conditions or resources available. This plan focuses on CAs and not facilities tasks (pruning, edging or mowing herbaceous vegetation along trail edges) or turf lawn or gardening tasks performed Unit 1 or Unit 2.



Management Table - Unit 4 Facilities			
Conservation Action	Description	Details	
Monitoring	Visual monitoring	One walkthrough per Subunit per month	Prescribe and follow up with CAs as needed
	Ecological monitoring	Herbaceous Transect Survey in Subunit B	Twice a year, April & October
			Combine with herbaceous transects in Savanna & Meadow
		Vegetation Survey Analysis Plots (65, 80)	Every 5-10 years
			Combine with larger data set
Individual Tree Care	Prune established trees	Limbs that encroach on trails, roads and parking spots	Create a clearance height of 7' minimum
		Lower limbs of all mature trees up to height of 4-5', with exceptions based upon location and tree form	Maintain dense underbrush to deter visitors from crossing trails where necessary
			Retain an existing proportionally large tree limb
			Species with a clumping, spreading, bushy or smaller form may not require pruning
		Structurally prune young trees	Subordinate trees with double leader, remove splits, broken branches, etc.
			Do not prune saplings or recently planted trees (within 3 years)
			Consult with Forestry staff if necessary
	Identify and cultivate desirable native trees and shrubs (Appendix C)	Stake and flag individual seedling/sapling, and map location if necessary	Map and flagging should be used to identify for supplemental care
			Remove encroaching vegetation and vines from desirable saplings, shrubs & smaller trees
		Maintain individuals until they are mature enough to no longer require supplemental care	Apply water during drought
			Apply mulch if able
Dead or Hazardous Tree Removal	Identify dead or hazardous trees that may impact targets	Communicate location to Forestry staff to determine method for removal	Trees leaning toward a target or overhanging branches may require action
			Trees that do not impact a target do not require action
Invasive Vegetation Removal	Remove woody and herbaceous invasive species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide by foliar, cut stump, or basal bark, or mechanical removal by mowing, cutting, hand-pull or weed wrench

Management Table - Unit 4 Facilities			
Conservation Action	Description	Details	
High-Density Native Species Removal	Remove or thin out high-density native woody and herbaceous species (Appendix C)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide by foliar, cut stump, or basal bark, or mechanical removal by mowing, cutting, hand-pull or weed wrench
		Not necessary to removal every individual and is dependent on circumstance	Large clusters of the same species
			Proximity to more desirable species
			Woody species adjacent to facilities such as light poles, parking spots or drainage infrastructure
Seeding	Broadcast seed when and where appropriate	For individuals that are of a size / location that may allow their retention, prune appropriately to maximize beneficial shape/form	Subordinate trees with double leader, remove splits, broken branches, etc.
		May not be necessary or effective every year or in every Subunit	Appropriate times may follow habitat mow or prescribed fire
Plant Installation	Install plants when and where appropriate	Source seed appropriately	Ex. region-specific, light and soil requirements for applied areas
		Install species that enhance diversity and maintain character of the area	Do not plant large shade tree into a prairie area or block view of desirable feature or facility
Habitat Mow	Mow using the tractor or billy goat mower	Schedule during dormant season	May require supplemental care following installation depending on weather conditions or other factors
		For areas with dense woody understory and/or herbaceous ground cover	Maintain line of sight and/or prevent brush encroachment
		Consult and schedule with the Facilities staff	Communicate and/or flag location of desirable native trees and shrubs to avoid
Targeted Herbivory	Rent goats to simulate herbivory in the landscape	Schedule as needed or when conditions allow	Ex. dormant season, to prevent seed production, weather/ ground moisture conditions, event programming
		Applicable in areas where understory brush is too dense and overgrown for a habitat mow	Protect trunks of desirable trees & shrubs prior to goat arrival by wrapping in wire and securing
Prescribed Fire	Prescribe fire when and where appropriate	Dependent on staff and support availability, events & program schedule, etc.	Specific communication & preparations are required

SUBUNIT 4A (4.0ac) includes buildings, the Courtyard & Courtyard Lawn, Playscape, Sensory and Pollinator Gardens. This subunit hosts events and classes, and features established mature trees, open and closed canopy woodlands, wetlands, and coastal prairies with recently planted native desirable woody species throughout the subunit. No action is required in the Pollinator or Sensory Gardens, or Courtyard Lawn. Subunit 4A is in **Management Phase II & III**.

Management Focus

1. Aesthetics and health of current woody vegetation
 - Complement buildings & facilities
 - Safety of guests
 - Mitigate risks to buildings
2. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
3. Enhancement of herbaceous landscapes
 - Schedule habitat mowing once per year minimum within appropriate areas
 - Communicate location of desirable woody species to mowing operator
 - Additional mowing in front of Nature Center and within Playscape may be necessary to maintain sight lines
 - Optional broadcast of purchased or collected wildflower seed
 - Transplant herbaceous individuals when and where appropriate
4. Suppression of undesirable species (Appendix B)
 - Invasive species
 - High-density native herbaceous and woody species
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, existing desirable trees, fallen logs, etc.
5. Management of Nature Center wetland
 - Maintain constant water level in wetland using nearby irrigation quick coupler
 - Remove vines from Cattail Donor Plaques

SUBUNIT 4B (3.4ac) is located behind the Administration Building and within the Wildflower Trail Loop. It includes coastal prairie, savanna, closed and open canopy woodland habitats. Goats were utilized in May 2023 to browse understory vegetation within woodland habitats. Subunit 4B is in **Management Phase II & III**.

Management Focus

1. Diversity of woody species within current woodland and savanna habitats
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species if appropriate
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Diversity of wildflowers & forbs within current coastal prairie and savanna habitats
 - Broadcast purchased or collected wildflower-only seed each year following mowing

- Separate sun & shade mix must be broadcast in appropriate locations
 - Avoid broadcasting seed in closed canopy woodland areas
- Transplant herbaceous species when and where appropriate
- 3. Maintaining a sparse and open understory within woodland & savanna habitats and suppressing woody species within coastal prairie habitat
 - Schedule habitat mowing once per year
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire and/or targeted herbivory when appropriate
- 4. Suppression of undesirable species (Appendix B)
 - Invasive species
 - High-density native herbaceous and woody species
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, existing desirable trees, fallen logs, etc.

SUBUNIT 4C (1.8ac) is located between the Wildflower Trail, Woodway Parking Loop, and Event Lawn, and straddles the Display Walk. It is a mix of savanna, open and closed canopy woodland habitats, and includes the Cypress Pond. No action is required in the Display Walk Gardens. Subunit 4C is in **Management Phase I**.

Management Focus

1. Diversity of woody species within current woodland and savanna habitat
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species if appropriate
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Diversity of wildflowers & forbs within current savanna habitat
 - Optional broadcast of purchased or collected wildflower-only seed following mowing
 - Separate sun & shade mix must be broadcast in appropriate locations
 - Avoid broadcasting seed in closed canopy woodland areas
 - Transplanting individuals when and where appropriate
3. Maintaining a sparse and open understory within savanna habitat east of Display Walk
 - Schedule habitat mowing once per year
 - Communicate location of desirable woody species to mowing operator
 - Open understory may not be appropriate along sides of the Display Walk to discourage visitors from cutting across trails
4. Cypress Pond management
 - Suppress invasive and undesirable native species within and along the edge (Appendix B)
 - Removal of fallen tree limbs and large debris from pond
 - Communicate low pond water level to Conservation Team
5. Suppression of undesirable species (Appendix B)
 - Invasive species
 - High-density native herbaceous and woody species
 - Removal of woody species in undesirable locations

- Adjacent to facilities, existing desirable trees, fallen logs, etc.
- Prescribed fire and/or targeted herbivory when appropriate

SUBUNIT 4D (2.7ac) is located between the Display Walk, Ravine Trail, and 610 Parking Loop. It encompasses the Laydown Yard, a construction staging area used during the Master Plan. Poor soils of the Laydown Yard support invasive and undesirable native species but woody species should still be suppressed for future needs or access to stored materials. Outside of the Laydown Yard, this subunit is mostly closed canopy woodland habitat. Goats were utilized in May 2025 to browse understory vegetation within woodland habitats. Subunit 4D is in **Management Phase II & III**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Maintaining a sparse and open understory within woodland areas
 - Schedule habitat mowing once per year minimum
 - Laydown Yard area may require multiple annual mows
 - Communicate location of desirable woody species to operator
 - Open understory may not be appropriate along boundary of the Ravine Trail and the 610 Parking Loop to discourage visitors from cutting across trails
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - High-density native herbaceous and woody species
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, existing desirable trees, fallen logs, etc.
 - Prescribed fire and/or targeted herbivory when appropriate

SUBUNIT 4E (3.6ac) is located within and around the 610 Parking Loop. It is a mix of savanna, and open and closed canopy woodland habitat, with recently planted native desirable woody species throughout the subunit. Low-lying swales carry runoff from the parking loop into underground drainage infrastructure. Goats were utilized in May 2022 to browse understory vegetation. Subunit 4E is in **Management Phase II & III**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Diversity of herbaceous species within current open woodland habitat
 - Optional broadcast of purchased or collected shade-tolerant seed following mowing
 - Avoid broadcasting seed in closed canopy woodland areas
 - Transplant herbaceous species when and where appropriate

3. Maintaining a sparse and open understory within woodland habitat
 - Schedule habitat mowing once per year minimum
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire and/or targeted herbivory when appropriate
4. Suppression of undesirable species (Appendix B)
 - Invasive species
 - High-density native herbaceous and woody species
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, existing desirable trees, fallen logs, etc.
 - Growing within drainage swales or adjacent to culverts that would otherwise impede water flow or impact infrastructure

SUBUNIT 4F (2.5ac) is encountered by guests entering the Arboretum from the 610 Entrance. It encompasses the sections of woodlands leading to the 610 Parking Loop, around the Plant Sale Area, and in the uncultivated areas behind the 610 Gardens. It is a mix of open and closed canopy woodland habitat. Subunit 4F is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Maintaining a sparse and open understory
 - Schedule habitat mowing once per year minimum
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - High-density native herbaceous and woody species
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, existing desirable trees, fallen logs, etc.

MANAGEMENT UNIT 5 SAVANNA

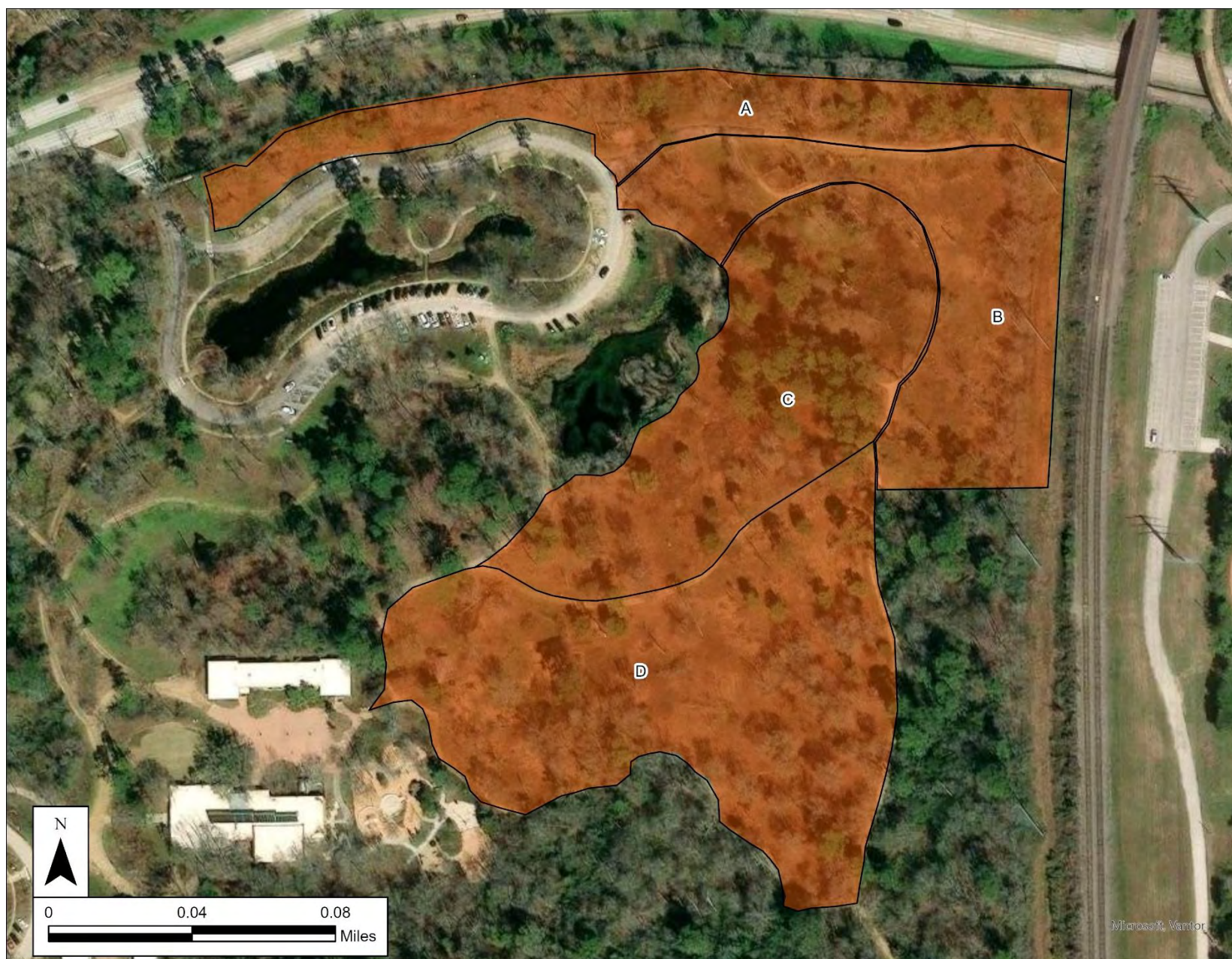
Management Unit 5 (12.5ac) consists of the recently restored Savanna ecosystem. The area was previously a closed canopy woodland prior to Hurricane Ike in 2008 and the severe drought of 2011. High mortality of woody vegetation following these extreme climatic events necessitated the reevaluation and eventual restoration to align more closely with historic ecological conditions. As part of the Master Plan, many of the remaining woody species were removed using a hydro-axe and the area was seeded with herbaceous species. The landscape is now managed as a post oak-pine savanna ecosystem and has a diversity of sparsely separated trees with an understory of native grasses and wildflowers. Standing dead trees (snags) and fallen logs provide wildlife value and add character.

The Savanna is situated atop the Verland soil type that primarily supports prairie vegetation but is prone to tree encroachment. It contains shallow clays and occasional shallow depressions that retain pools of water during heavy rainfall and low mounds that appear to have a higher sand content and anecdotally support a different vegetation assemblage and higher survival of woody species.

The biggest impediment to this ecosystem is the regrowth of woody species and conversion back into a closed canopy forest. A minimum annual habitat mow is required in all Subunits to maintain the Savanna, with a prescribed fire every three years maximum if allowable. If these methods are not employed, resprouting trees may become too large to remove with a habitat mow by tractor, and more disruptive and expensive methods may be required. Two successful prescribed fires were conducted in the Savanna in late winter 2021 (Subunits C, D) and 2024 (Subunits B, C, D).

Following restoration, bare ground was colonized extensively by Deep-Rooted Sedge that still persists in dense quantities throughout the Savanna (Morales 2024). This is the most prevalent invasive species and must be managed. Aside from Deep-Rooted Sedge and woody resprouts, another undesirable species is Sawtooth Blackberry that while native, appear to reduce biodiversity at high densities. The Savanna may be expanded in the future to the south, as the Verland soil type extends all the way to Unit 6 Meadow. Prior to expansion, Deep-Rooted Sedge must be controlled to prevent it from migrating into the Meadow.

Unit 5 is adjacent to the Arboretum's facilities but does not contain buildings, parking loops or other significant structures. The management approach should focus more on conservation, biodiversity and ecosystem enhancement, while still considering public interaction and safety. Unit 5 is not currently assigned to an individual staff member but should be monitored closely throughout the year by all Conservation staff, with CAs applied as a team with guidance from the Conservation Director. The conservation actions below provide a general guideline for activities to be performed in Unit 5. Actions should be scheduled and adapted based upon current environmental conditions such as climate, site conditions or available resources. This plan focuses on conservation actions and not facilities tasks (trail mulching, boardwalk repair, pruning, edging or mowing herbaceous vegetation along trail edges).



Management Table - Unit 5 Savanna			
Conservation Action	Description	Details	
Monitoring	Visual monitoring	One walkthrough per Subunit quarterly	Prescribe and follow up with CAs as needed
	Ecological monitoring	Herbaceous transect monitoring in Subunit C & D	Twice a year, April & October
			Combine with herbaceous transects in Wildflower Trail & Meadow
		Vegetation Survey Analysis Plots (69, 76, 80, 83, 86, & 87)	Every 5-10 years
			Combine with larger data set
Individual Tree Care	Prune established trees	Limbs that encroach on trails and parking spots	Create a clearance height of 7' minimum
		Remove lower limbs of all mature trees to height of 4-5', with exceptions based upon location and tree form	Maintain dense underbrush to deter guests from crossing trails where necessary
			Retain an existing proportionally large tree limb
			Species with a clumping, spreading, bushy or smaller form may not require pruning
		Structurally prune young trees	Subordinate trees with double leader, remove splits, broken branches, etc.
			Do not prune saplings or recently planted trees (within 3 years)
			Consult with Forestry staff if necessary
	Identify and cultivate desirable native trees and shrubs (emphasis on <i>Pinus</i> spp. and <i>Q. stellata</i> , Appendix C)	Stake and flag individual seedling/sapling, and map location if necessary	Map and markers should be used to identify for supplemental care
		Maintain individuals until they are mature enough to no longer require supplemental care	Remove encroaching vegetation and vines from desirable saplings and smaller trees & shrubs
			Apply supplement water during drought
			Apply mulch if able
Dead or Hazardous Tree Removal	Identify dead or hazardous trees that may impact targets	Communicate location to Forestry staff to determine method for removal	Trees leaning toward a target or overhanging branches may require action
			Trees that do not impact a target do not require action

Management Table - Unit 5 Savanna

Conservation Action	Description	Details	
Invasive Vegetation Removal	Remove woody and herbaceous invasive species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench
High-Density Native Species Removal	Remove or thin out high-density native woody and herbaceous species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench
		Not necessary to removal every individual and is dependent on circumstance	Large clusters of the same species
			Proximity to more desirable species
			Woody species adjacent to facilities such as light poles or parking spots
Seeding	Broadcast seed when and where appropriate	May not be necessary or effective every year or in every Subunit	Appropriate times may follow habitat mow or prescribed fire
		Source seed appropriately	Ex. region-specific, light and soil requirements for applied areas
Plant Installation	Install plants when and where appropriate	Install species that enhance diversity and maintain character of the area	Sparse woody canopy species (emphasis on pines and post oak) with an herbaceous understory
		Consider species preferences, location and hydrologic regime	Anecdotal evidence suggests that woody species survival increases when established on mounds
		Schedule during the dormant season	May require supplemental care following installation depending on weather conditions or other factors
Habitat Mow	Mow using the tractor or billy goat mower	For areas with dense woody understory and/or herbaceous ground cover	Maintain line of sight and/or prevent brush encroachment
		Consult and schedule with the Facilities staff	Communicate and/or flag location of desirable native trees and shrubs to avoid
		Schedule as needed or when conditions allow	Ex. dormant season, to prevent seed production, weather/ground moisture conditions, event programming
Targeted Herbivory	May not be as effective in Unit 5 versus other Unit	Goats may not prefer grass-dominant vegetation	Open character of the Savanna makes habitat mowing a more effective option
Prescribed Fire	Prescribe fire when and where appropriate	Dependent on staff and support availability, events & program schedule, etc.	Specific communication & preparations are required

SUBUNIT 5A (1.9ac) is a narrow strip running along the northeast side of the Arboretum. It is bordered on the north by a fence that separates the Arboretum from Woodway Drive and a pedestrian and bike path, and to the south by the Woodway Parking Loop and Centerpoint Driveway, which is a road used by contractors to access the utility right-of-way (ROW) along the east border of the Arboretum. The area is savanna habitat with a higher density of woody species than other Unit 5 Subunits. It contains the city water valve to fill up the Woodway Ponds, located toward the east side of the subunit. Subunit 5A is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Many post oak seedlings currently exist in this area and should be protected
 - Plant new desirable species
 - Consult LiDAR and/or elevation maps and plant atop mound if possible
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Diversity of herbaceous grasses & forbs
 - Optional broadcast of purchased or collected native herbaceous seed following mowing or other disturbances such as prescribed fire or invasive species removal.
 - Separate sun & shade mix must be broadcast in appropriate locations
 - Avoid broadcasting seed in dense canopy areas
 - Transplant herbaceous species when and where appropriate
3. Maintaining a sparse and open understory
 - Schedule habitat mowing once per year minimum
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire when appropriate
4. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privets (*Ligustrum* spp.), Japanese Honeysuckle (*Lonicera japonica*), Deep-Rooted Sedge (*Cyperus entrerianus*), Slender Vervain (*Verbena rigida*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Dewberry (*Rubus* spp.)
 - Removal of woody species in undesirable locations
 - Adjacent to facilities, parking loop, existing desirable trees, fallen logs, etc.
 - Maintain open access along Centerline road to utility ROW
5. Maintain fence line along Woodway Drive and pedestrian and bike path
 - Remove all woody species within 5ft along both sides
 - Remove vines growing on fence line

SUBUNIT 5B (2.6ac) is savanna habitat located in the northeast corner, with the Centerpoint Driveway and utility ROW fence line as a northern and eastern border, respectively. The Savanna Boardwalk and Woodway parking loop form its western boundary, with a wooded southern boundary. A vehicle turnaround is located in the southern portion as well. The subunit has noticeable mounds and depressions that influence vegetation establishment. Subunit 5B is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Consult LiDAR and/or elevation maps and plant atop mound if possible
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Diversity of herbaceous grasses & forbs
 - Optional broadcast of purchased or collected native herbaceous seed following mowing or other disturbances such as prescribed fire or invasive species removal.
 - Separate sun & shade mix must be broadcast in appropriate locations
 - Avoid broadcasting seed in dense canopy areas
 - Transplant herbaceous species when and where appropriate
3. Maintaining a sparse and open understory
 - Schedule habitat mowing once per year minimum
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire when appropriate
4. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privets (*Ligustrum* spp.), Deep-Rooted Sedge (*Cyperus entrerianus*), Slender Vervain (*Verbena rigida*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Green Ash (*Fraxinus pennsylvanica*), Dewberry (*Rubus* spp.), Willow Oak (*Quercus phellos*)
 - Removal of woody species in undesirable locations
 - Adjacent to existing desirable trees, fallen logs, etc.
 - Woody species removal in and adjacent to vehicle turnaround
5. Maintain fence line along utility ROW fence line
 - Remove all woody species within 5ft along the side within the Arboretum
 - Retain a row woody species to form visual barrier of the utility ROW
 - Remove vines growing on fence line

SUBUNIT 5C (3.2ac) is savanna habitat bordered by the Post Oak Trail, South Woodway Pond, and Savanna Boardwalk. It contains the Savanna Field Station and has topography holding noticeable mounds and depressions that influence vegetation establishment. Subunit 5C is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Consult LiDAR and/or elevation maps and plant atop mound if possible
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Diversity of herbaceous grasses & forbs

- Optional broadcast of purchased or collected native herbaceous seed following mowing or other disturbances such as prescribed fire or invasive species removal.
 - Separate sun & shade mix must be broadcast in appropriate locations
 - Avoid broadcasting seed in dense canopy areas
 - Transplant herbaceous species when and where appropriate
3. Maintaining a sparse and open understory
- Schedule habitat mowing once per year minimum
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire when appropriate
4. Suppression of undesirable species (Appendix B)
- Invasive species
 - Non-native Privets (*Ligustrum* spp.), Deep-Rooted Sedge (*Cyperus entrerianus*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Green Ash (*Fraxinus pennsylvanica*), Buttonbush (*Cephalanthus occidentalis*), Dewberry (*Rubus* spp.), Willow Oak (*Quercus phellos*)
 - Removal of woody species in undesirable locations
 - Adjacent to existing desirable trees, fallen logs, etc.

SUBUNIT 5D (4.7ac) is the area located at the southern end of the management unit, between the Post Oak Trail, Willow Oak, Trail Wildflower Trail and Outer Loop. The southwest portion of the subunit borders the Nature Playscape and also contains the Butterfly Bungalow. The subunit has noticeable mounds and depressions that influence vegetation establishment. Subunit 5D is in **Management Phase I**.

Management Focus

1. Diversity of woody species
- Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Consult LiDAR and/or elevation maps and plant atop mound if possible
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Longleaf Pine (*Pinus palustris*) saplings were planted on mounds in this subunit in 2022 and have been maintained since.
2. Diversity of herbaceous grasses & forbs
- Optional broadcast of purchased or collected native herbaceous seed following mowing or other disturbances such as prescribed fire or invasive species removal.
 - Separate sun & shade mix must be broadcast in appropriate locations
 - Avoid broadcasting seed in dense canopy areas
 - Transplant herbaceous species when and where appropriate
3. Maintaining a sparse and open understory
- Schedule habitat mowing once per year minimum
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire when appropriate
4. Suppression of undesirable species (Appendix B)

- Invasive species
 - Non-native Privets (*Ligustrum* spp.), Deep-Rooted Sedge (*Cyperus entrerianus*)
- High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Green Ash (*Fraxinus pennsylvanica*), Buttonbush (*Cephalanthus occidentalis*), Dewberry (*Rubus* spp.), Willow Oak (*Quercus phellos*)
- Removal of woody species in undesirable locations
 - Adjacent to existing desirable trees, fallen logs, etc.

MANAGEMENT UNIT 6 MEADOW

Management Unit 6 (4.5ac) is referred to by name as the Meadow and contains a coastal prairie ecosystem adjacent to a pond and woodland margin. The unit has a Field Station and three separate wooden decks, the North Meadow Deck, South Meadow Deck, and Meadow Deck that are used for programming or events.

The Meadow was created in 1979 as a result of a Southern Pine Bark Beetle infestation that caused high tree mortality in the woodland habitat that existed at that time. To prevent its spread, three acres of pines and other woody species were cleared. Not long after, the Meadow Pond was dug, and excavated soil from dredging the pond was spread out to create a subtle but mound. Over time, various restoration projects established native wildflowers and grasses in the cleared area, and the landscape has been managed as a coastal prairie ever since. Although relatively small in size, there is a high diversity of unique herbaceous grasses and wildflower species that provide floral blooms throughout the year.

Unit 6 is not adjacent to the Arboretum's facilities and does not contain significant facilities. The management approach should focus on conservation, biodiversity and ecosystem enhancement, while still considering public interaction and safety especially on and around the three decks. Unit 6 is not currently assigned to an individual staff member but should be monitored closely throughout the year by all Conservation staff, with CAs applied as a team with guidance from the Conservation Director. The CAs below provide a general guideline for activities to be performed in Unit 6. Actions should be scheduled and adapted based upon current conditions such as climate, site conditions or available resources. This plan focuses on conservation actions and not facilities tasks (boardwalk repair, pruning, edging or mowing herbaceous vegetation along trail edges).



Management Table - Unit 6 Meadow

Conservation Action	Description	Details	
Monitoring	Visual monitoring	One walkthrough per Subunit quarterly	Prescribe and follow up with CAs as needed
	Ecological monitoring	Herbaceous transect monitoring in Subunits North Meadow & South Meadow	Twice a year, April & October
			Combine with herbaceous transects in Wildflower Trail & Savanna
Individual Tree Care	Prune established trees	Limbs that encroach on trails	Create a clearance height of 7' minimum
		Remove lower limbs of all mature trees to height of 4-5', with exceptions based upon location and tree form	Retain an existing proportionally large tree limb
			Species with a clumping, spreading, bushy or smaller form may not require pruning
			Subordinate trees with double leader, remove splits, broken branches, etc.
			Do not prune saplings or recently planted trees (within 3 years)
			Consult with Forestry staff if necessary
	Identify and cultivate desirable native trees and shrubs	Stake and flag individual seedling/sapling, and map location if necessary	Map and markers should be used to identify for supplemental care
		Maintain individuals until they are mature enough to no longer require supplemental care	Remove encroaching vegetation and vines from desirable saplings and smaller trees & shrubs
			Apply supplement water during drought
Dead or Hazardous Tree Removal	Identify dead or hazardous trees that may impact targets	Communicate location to Forestry staff to determine method for removal	Trees leaning toward a target or overhanging branches may require action
			Trees that do not impact a target do not require action
Invasive Vegetation Removal	Remove woody and herbaceous invasive species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench

Management Table - Unit 6 Meadow

Conservation Action	Description	Details	
High-Density Native Species Removal	Remove or thin out high-density native woody and herbaceous species (Appendix C)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench
		Not necessary to removal every individual and is dependent on circumstance	Large clusters of the same species
			Proximity to more desirable species
			Woody species adjacent to facilities such as Field Station or decks
Seeding	Broadcast seed when and where appropriate	May not be necessary or effective every year or in every Subunit	Appropriate times may follow habitat mow or prescribed fire
		Source seed appropriately	Ex. region-specific, light and soil requirements for applied areas
Plant Installation	Install plants when and where appropriate	Install species that enhance diversity and maintain character of the area	Focus on diversity of coastal prairie herbaceous vegetation
		Schedule during the dormant season	May require individual care following installation depending on weather conditions or other factors
Habitat Mow	Mow using the tractor or billy goat mower	For areas with dense woody understory and/or herbaceous ground cover	Maintain line of sight and/or prevent brush encroachment
		Consult and schedule with the Facilities staff	Communicate and/or flag location of desirable native trees and shrubs to avoid
		Schedule as needed or when conditions allow	Ex. dormant season, to prevent seed production, weather/ground moisture conditions, event programming
Targeted Herbivory	Goat browsing may not be as effective versus other Units	Goats may not prefer grass-dominant vegetation	Open character of the Meadow makes habitat mowing a more effective option
Prescribed Fire	Prescribe fire when and where appropriate	Dependent on staff and support availability, events & program schedule, etc.	Specific communication & preparations are required

SUBUNIT NORTH MEADOW (1.0ac) is bordered on the south by the North Meadow Trail, east by the Outer Loop, west by the Inner Loop, and north by woodland habitat (Unit 9B). It contains the Prairie Field Station. A small motte of woody species grows in the middle of this subunit, including mature oak trees. The North Meadow Trail acts as a berm, and as a result, the area closest to the trail may contain standing water following rainfall events along with obligate wetland vegetation that require consideration during habitat mows. Subunit North Meadow is in **Management Phase II & III**.

Management Focus

1. Diversity of herbaceous grasses & forbs
 - Transplant herbaceous species when and where appropriate
 - Optional broadcast of purchased or collected native herbaceous seed following mowing or other disturbances such as prescribed fire or invasive species removal.
 - Separate sun & shade mix must be broadcast in appropriate locations
 - Avoid broadcasting seed in dense canopy areas
2. Diversity of woody species within the motte
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Farkleberry (*Vaccinium arboreum*), Southern Red Oak (*Quercus falcata*), and Fringetree (*Chionanthus virginicus*) currently exist at various ages
3. Suppressing woody species within coastal prairie habitat
 - Schedule habitat mowing once per year minimum
 - Communicate location of desirable woody species to mowing operator
 - Prescribed fire when appropriate
 - Prevent brush encroachment from the north and west sides of the Subunit
 - Foliar or cut and treat herbicide application if needed
4. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Japanese Honeysuckle (*Lonicera japonica*), West Indian Lantana (*Lantana camara*), Slender Vervain (*Verbena rigida*)
 - High-density native herbaceous species
 - Trumpet Creeper (*Campsis radicans*), Peppervine (*Nekemias arborea*), Dewberry *Rubus* spp.

SUBUNIT SOUTH MEADOW (1.9ac) is the larger section of coastal prairie south of the North Meadow Trail, west of the Outer Loop, east of the Meadow Pond, and north of the South Meadow Trail. This subunit contains the subtle raised mound as a result of the pond excavation, creating a drier ridge and supporting a slightly different species assemblage. The area closest to the Outer Loop is slightly wetter and shadier due to overhanging branches on the outside of the Outer Loop. Some mature trees exist along the pond margin. Subunit South Meadow is in **Management Phase II & III**.

Management Focus

1. Diversity of herbaceous grasses & forbs
 - Transplant herbaceous species when and where appropriate

- Optional broadcast of purchased or collected native herbaceous seed following mowing or other disturbances such as prescribed fire or invasive species removal.
 - Separate sun & shade mix must be broadcast in appropriate locations
2. Suppressing woody species
 - Schedule habitat mowing once per year minimum
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire when appropriate
 3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Japanese Honeysuckle (*Lonicera japonica*), McCartney Rose (*Rosa bracteata*), Slender Vervain (*Verbena rigida*)
 - High-density native herbaceous species
 - Trumpet Creeper (*Campsis radicans*), Peppervine (*Nekemias arborea*), Dewberry (*Rubus* spp.)

SUBUNIT MEADOW POND (1.6ac) contains the Meadow Pond, a woodland area in the west part of the subunit, and a wooded pond island. There are three wooden decks in this subunit – the North Meadow Deck, Meadow Deck, and South Meadow Deck. Subunit Meadow Pond is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
2. Maintaining a sparse and open woodland understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Japanese Honeysuckle (*Lonicera japonica*)
 - Alligatorweed (*Alternanthera philoxeroides*) and Crested Floating Heart (*Nymphoides cristata*) in the pond
 - High-density native herbaceous and woody species
 - Common Buttonbush (*Cephalanthus occidentalis*) along pond margin
 - Spatterdock (*Nuphar lutea*) in the pond

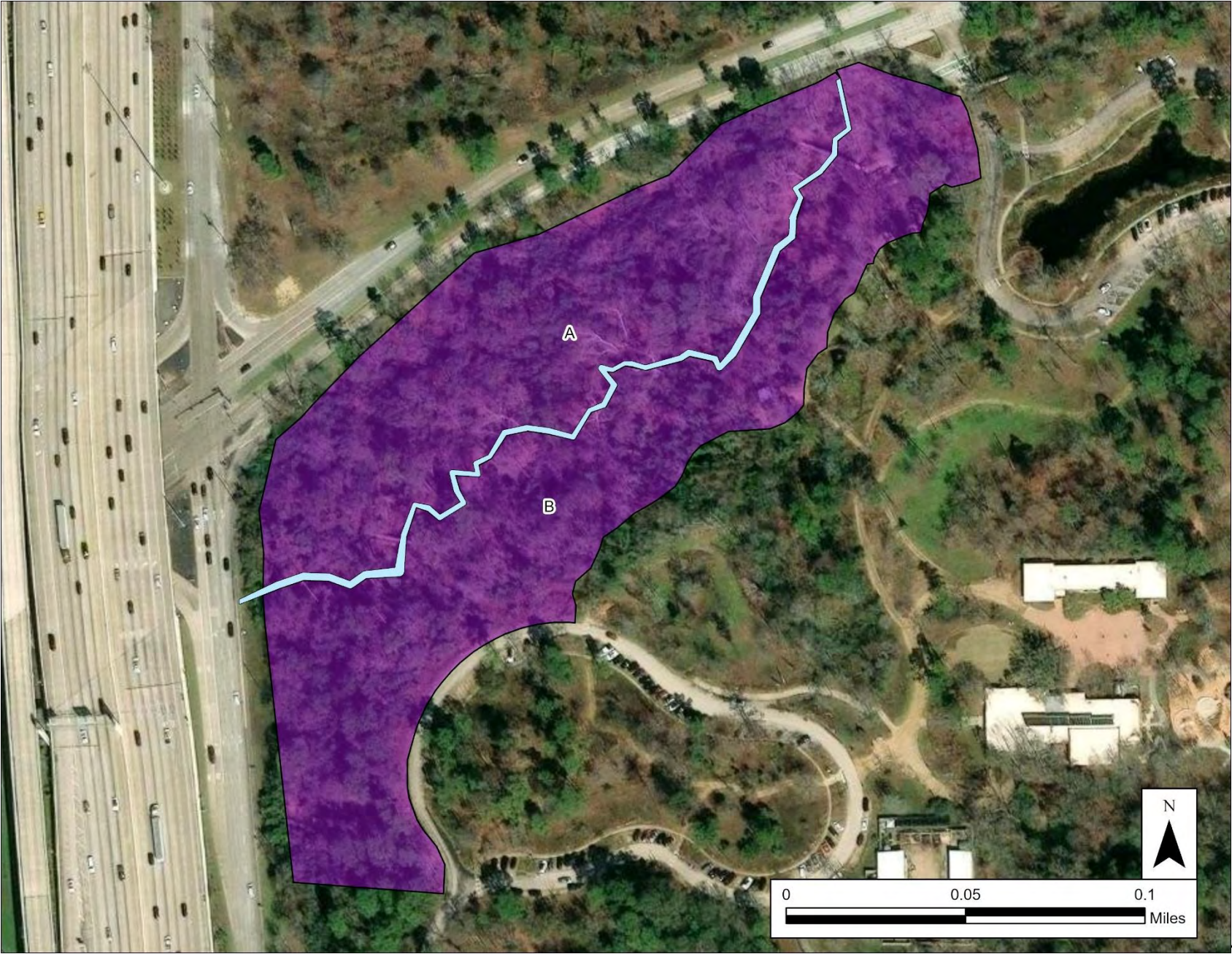
MANAGEMENT UNIT 7 RAVINE

Management Unit 7 (9.1ac) is a tributary of Buffalo Bayou colloquially known as the Ravine and located in the northwest corner of the Arboretum. It begins as a large culvert at its most upstream point within the Arboretum and leaves the Arboretum's boundaries before its confluence with Buffalo Bayou occurs. The culvert is known as the Horse Tunnel, relating to when horse riders used it to access the Arboretum from Memorial Park. Even further upstream, this tributary begins just south of I-10 and flows through Memorial Park before entering the Arboretum. Runoff is contributed from I-10 highway, the Bayou Club, Houston Polo Club and Memorial Drive, and occasionally unnaturally blue water from dye added to algicide flows from these upstream areas. Runoff from infrastructure drainage within the Arboretum may occasionally exceed overflow box culverts in the retention ponds found in Unit 3. When this occurs, this additional runoff flows down a boulder stairstep and into the Ravine near its upstream point. Continuous flow along the entire reach is present following rainfall events, otherwise permanent water exists in small pools between riffles in the tributary bed. These pools may even become completely dry during summer droughts.

Prior to the Master Plan, tributary crossings were earthen bridges with large culverts for water flow that essentially acted like dams during flood events and caused severe erosion. Drainage infrastructure discharged runoff directly onto a tributary slope, further exacerbating erosion. Ravine trails were continuously under repair and had been closed for years. The concept of Natural Channel Design was introduced to understand hydrology and identify natural solutions and locations for channel reinforcement and infrastructure placement. Two bridges were installed at higher elevations to not impede flow during flood events. Trails and decking were constructed using marine-grade grates to withstand flow or kept as mulch for easy repair. Large boulders were strategically placed at the bottom of slopes to support the weight of soil and reduce erosion, or placed at the top of slopes to prevent headcuts from extending. Toewood was buried into the bottom of slopes to help armor the shoreline, and log vanes were used to redirect water flow away from side slopes. Riprap stones were installed to slow water and improve dissolved oxygen. These Natural Channel Design features are intended to allow for the natural dynamic equilibrium of the tributary to occur and provide sufficient time for stabilizing vegetation to establish.

Unit 7 does not contain significant facilities but is adjacent to the Event Lawn and Woodway Entrance. Its two bridges, marine-grade trails and decking, concrete ADA switchback trail, and Natural Channel Design features require closer inspection than typical areas. Ravine slopes should be monitored for changes such as extreme erosion that impacts trails or facilities, or vegetation establishment. The management approach should focus on conservation, biodiversity and streambank stabilization while still considering public interaction and safety. Unit 7 is not currently assigned to an individual staff member but should be monitored closely throughout the year by all Conservation staff, with CAs applied as a team with guidance from the Conservation Director. The conservation actions below provide a general guideline for activities to be performed in Unit 7. Actions should be scheduled and adapted based upon current conditions such as climate, site conditions or available resources. This plan focuses on conservation actions and not facilities tasks (boardwalk repair, pruning, edging or mowing herbaceous vegetation along trail edges).

The Unit 7 Subunits are homogenous and require a similar management approach, therefore only one Management Focus for the entire unit has been developed at this time. Both are in currently **Management Phase I**.



Management Table – Unit 7 Ravine			
Conservation Action	Description	Details	
Monitoring	Visual monitoring	One walkthrough per Subunit quarterly	Prescribe and follow up with CAs as needed
	Ecological monitoring	Vegetation Survey Analysis Plots (64, 78, 79)	Every 5-10 years
			Combine with larger data set
Individual Tree Care	Prune established trees	Limbs that encroach on trails	Create a clearance height of 7' minimum
		Structurally prune young trees	Subordinate trees with double leader, remove splits, broken branches, etc.
			Do not prune saplings or recently planted trees (within 3 years)
			Consult with Forestry staff if necessary
	Identify and cultivate desirable native trees and shrubs (emphasis on riparian species, Appendix C)	Stake and flag individual seedling/sapling, and map location if necessary	Map and markers should be used to identify for supplemental care
		Maintain individuals until they are mature enough to no longer require supplemental care	Remove encroaching vegetation and vines from desirable saplings and smaller trees & shrubs
			Apply supplement water during drought
			Apply mulch if able
Dead or Hazardous Tree Removal	Identify dead or hazardous trees that may impact targets	Communicate location to Forestry staff to determine method for removal	Trees leaning toward a target or overhanging branches may require action
			Trees that do not impact a target do not require action
Invasive Vegetation Removal	Remove woody and herbaceous invasive species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench

Management Table – Unit 7 Ravine			
Conservation Action	Description	Details	
High-Density Native Species Removal	Remove or thin out high-density native woody and herbaceous species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation actions	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench
		Not necessary to removal every individual and is dependent on circumstance	Large clusters of the same species
			Proximity to more desirable species
			Woody species adjacent to facilities such as boardwalks or bridges
Seeding	Broadcast seed when and where appropriate	May not be necessary or effective every year or in every Subunit	Appropriate times may follow targeted herbivory or prescribed fire
		Source seed appropriately	Ex. region-specific, light and soil requirements for applied areas
Plant Installation	Install plants when and where appropriate	Install species that enhance diversity and maintain character of the area	Riparian canopy species with sparse woody understory and an herbaceous understory
		Consider species preferences, location and hydrologic regime	Top of slope, mid-slope, toe-slope and stream margin
		Schedule during the dormant season	May require individual care following installation depending on weather conditions or other factors
Habitat Mow	Mowing may not be feasible given topography.	For areas with dense woody understory and/or herbaceous ground cover	Maintain line of sight and/or prevent brush encroachment
		Billy goat mower may be possible in some locations. Consult and schedule with the Facilities staff	Communicate and/or flag location of desirable native trees and shrubs to avoid
		Schedule as needed or when conditions allow	Ex. dormant season, to prevent seed production, weather/ground moisture conditions, event programming
Targeted Herbivory	Rent goats to simulate herbivory in the landscape	Applicable in areas where understory brush is too dense or topography too difficult for a habitat mow	Protect trunks of desirable native trees and shrubs prior to goat arrival by wrapping in wire and securing
Prescribed Fire	Prescribe fire when and where appropriate	Dependent on staff and support availability, events & program schedule, etc.	Specific communication & preparations are required

SUBUNIT 7A (4.2ac) is located north of the stream bed and bordered on its north side by a fence. It contains steep topography sloping toward the stream bed, with a plant assemblage indicative of riparian areas, and dense understory of mostly Cherry Laurel, Yaupon, and both Chinese and Japanese Privet.

SUBUNIT 7B (4.9ac) is located south of the stream bed and bordered on its south side the Event Lawn, Laydown Yard, and 610 Parking Loop. It contains steep topography sloping toward the stream bed, with a plant assemblage indicative of riparian areas, and dense understory of mostly Cherry Laurel, Yaupon, and both Chinese and Japanese Privet. An ADA switchback trail is located in the northeast corner of the unit, along with the boulder airstair that carries overflow from the Woodway Retention Ponds into the Ravine.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open riparian understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix C)
 - Invasive species
 - Air potato (*Dioscorea bulbifera*), Non-native Privet (*Ligustrum* spp.), Camphor Tree (*Cinnamomum camphora*), Japanese Climbing Fern (*Lygodium japonicum*)
 - High-density native herbaceous and woody species
 - Cherry Laurel (*Prunus caroliniana*), Yaupon (*Ilex vomitoria*)
 - Removal of woody species in undesirable locations
 - Adjacent or between ADA switchback grain
 - Adjacent to bridges or marine grate boardwalks and deck
4. Monitor stream
 - Native vegetation establishment on slopes
 - Slope erosion that may impact trails or infrastructure

MANAGEMENT UNIT 8 BUFFALO BAYOU

Management Unit 8 (44.6ac) is riparian habitat located along the north bank of Buffalo Bayou and south of the Outer Loop Trail. Most of this unit is not accessible by visitors, with only the Couch Birding Trail providing authorized access. The unit is characterized by ridges and gullies that slope toward Buffalo Bayou and carry runoff from upslope. Subunits are delineated by ridgetops that may shift as the bayou experiences flooding and sediment deposition. The water surface elevation of Buffalo Bayou is controlled upstream by the USACE depending on flood risks upstream and downstream of the Arboretum. These shifts can vary the water elevation by up to 9ft annually, creating difficult conditions for vegetation bank establishment or any type of facility installation.

Unit 8 lacks major facilities, though the Couch Birding Trail in 8C runs from the Outer Loop Trail toward Buffalo Bayou and ends at an elevated boardwalk and deck with educational signage serving as a Field Station. An encampment on the east side of 8A near the Hwy 610 underpass at Buffalo Bayou requires caution and should only be accessed by multiple staff. Overall, Unit 8 has seen limited conservation and visitor engagement due to sparse trails, difficult access, and its dynamic riparian topography.

Although mostly out of sight, this unit should not be ignored. Elevation changes and dark loamy and well-draining Atasco soils support a unique plant assemblage and larger canopy trees that are a relic of past conditions along Buffalo Bayou. Initial efforts should focus on phased removal of non-native Privets followed by strategic reduction of Cherry Laurel density. Treatments should be implemented in individual subunits rather than uniformly across the unit to diversify habitat structure while assessing ecological response and methodology effectiveness. Cut-stump or basal bark herbicide applications are preferred methods for woody invasive control and may also be achieved by targeted herbivory given the difficult topography. Less common native species should be documented and protected during operations. Follow-up treatment is required to address resprouting individuals and secondary invasive establishment. Natural regeneration from the existing seedbank should be monitored, and planting of appropriate woodland and riparian species may be implemented if desirable herbaceous or canopy recruitment does not occur.

Prescribed fire may be critical to accomplish long-term structural and compositional objectives of reducing Cherry Laurel and non-native Privets more efficiently than repeated manual removal. Frequency should target an approximate 2-4 year return interval and adapted based on fuel availability, ecological response, staffing capacity, and programmatic or event constraints.

The management approach should focus on conservation, biodiversity and streambank stabilization while still considering public interaction and safety. Unit 8 is not currently assigned to an individual staff member but should be monitored closely throughout the year by all Conservation staff, with CAs applied as a team with guidance from the Conservation Director. The CAs below provide a general guideline for management. Actions should be scheduled and adapted based upon current environmental conditions such as climate, site conditions or available resources. This plan focuses on conservation actions and not facilities tasks (boardwalk repair, pruning, edging or mowing herbaceous vegetation along trail edges).

The Subunits are homogenous and require a similar management approach, therefore only one Management Focus for the entire unit has been developed at this time. All Subunits are in currently **Management Phase I.**



Management Table - Unit 8 Buffalo Bayou			
Conservation Action	Description	Details	
Monitoring	Visual monitoring	One walkthrough per Subunit quarterly	Prescribe and follow up with CAs as needed
	Ecological monitoring	Vegetation Survey Analysis Plots (2, 7, 11, 15, 23, 24, 31, 36)	Every 5-10 years
			Combine with larger data set
Individual Tree Care	Prune established trees	Limbs that encroach on trails	Create a clearance height of 7' minimum
		Structurally prune young trees	Subordinate trees with double leader, remove splits, broken branches, etc.
			Do not prune saplings or recently planted trees (within 3 years)
			Consult with Forestry staff if necessary
	Identify and cultivate desirable native trees and shrubs (emphasis on riparian species, Appendix C)	Stake and flag individual seedling/sapling, and map location if necessary	Map and markers should be used to identify for supplemental care
		Maintain individuals until they are mature enough to no longer require supplemental care	Remove encroaching vegetation and vines from desirable saplings and smaller trees & shrubs
			Apply supplement water during drought
			Apply mulch if able
Dead or Hazardous Tree Removal	Identify dead or hazardous trees that may impact targets	Communicate location to Forestry staff to determine method for removal	Trees leaning toward a target or overhanging branches may require action
			Trees that do not impact a target do not require action

Management Table - Unit 8 Buffalo Bayou			
Conservation Action	Description	Details	
Invasive Vegetation Removal	Remove woody and herbaceous invasive species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation management tasks	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench
High-Density Native Species Removal	Remove or thin out high-density native woody and herbaceous species (Appendix C)	Removal method is dependent on species, life stage, density and previous conservation management tasks	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench
		Not necessary to removal every individual and is dependent on circumstance	Large clusters of the same species
			Proximity to more desirable species
			Woody species adjacent to facilities such as boardwalks or bridges
Seeding	Broadcast seed when and where appropriate	May not be necessary or effective every year or in every Subunit	Appropriate times may follow targeted herbivory or prescribed fire
		Source seed appropriately	Ex. region-specific, light and soil requirements for applied areas
Plant Installation	Install plants when and where appropriate	Install species that enhance diversity and maintain character of the area	Riparian canopy species with sparse woody understory and an herbaceous understory
		Consider species preferences, location and hydrologic regime	Top of slope, mid-slope, toe-slope and stream margin
		Schedule during the dormant season	May require individual care following installation depending on weather conditions or other factors

Management Table - Unit 8 Buffalo Bayou			
Conservation Action	Description	Details	
Habitat Mow	Mowing may not be feasible given topography.	For areas with dense woody understory and/or herbaceous ground cover	Maintain line of sight and/or prevent brush encroachment
		Billy goat mower may be possible in some locations . Consult and schedule with the Facilities staff	Communicate and/or flag location of desirable native trees and shrubs to avoid
		Schedule as needed or when conditions allow	Ex. dormant season, to prevent seed production, weather/ground moisture conditions, event programming
Targeted Herbivory	Rent goats to simulate herbivory in the landscape	Applicable in areas where understory brush is too dense and overgrown for a habitat mow	Protect trunks of desirable native trees and shrubs prior to goat arrival by wrapping in wire and securing
Prescribed Fire	Prescribe fire when and where appropriate	Dependent on staff and support availability, events & program schedule, etc.	Specific communication & preparations are required

SUBUNITS 8A (21.0ac), 8B (11.9ac), & 8C (11.7ac)

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open riparian understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Air potato (*Dioscorea bulbifera*), non-native Privets (*Ligustrum* spp.), Camphor Tree (*Cinnamomum camphora*), Japanese Climbing Fern (*Lygodium japonicum*)
 - High-density native herbaceous and woody species
 - Cherry Laurel (*Prunus caroliniana*), Yaupon (*Ilex vomitoria*)
 - Removal of woody species in undesirable locations
 - Adjacent to Couch Birding Trail boardwalk and educational signage
4. Monitor gullies and bank of Buffalo Bayou
 - Slope migration and sediment deposition
 - Erosion along bayou bank and gullies that may impact trails

MANAGEMENT UNIT 9 WOODLAND

Management Unit 9 (67.6ac) is an extensive closed-canopy woodland occurring on moderately well-drained Bissonnet soils characterized by subtle mound-and-depression microtopography. Historically, this unit functioned as a mosaic of open woodland, savanna, and prairie maintained by periodic fire and large herbivores. The absence of these disturbances resulted in canopy closure, dense understory development, and reduced overall biodiversity. The understory is dominated by Yaupon and Chinese Privet with sparse representation of native shrubs and minimal herbaceous cover. Although the overstory currently supports more than twenty tree species, species richness in this canopy layer has declined over the past several decades (Benigno 2024). The dense woody understory was shown to limit regeneration and recruitment of overstory species (Benigno unpub.). Native elms (specifically *U. crassifolia*, *U. alata*) and Willow Oak are increasing in proportional dominance, while Chinese Tallow (*Triadica sebifera*) readily establishes in canopy gaps. Loblolly Pine, though present in the canopy, are unable to successfully regenerate under current low-light conditions.

Initial efforts should focus on phased removal of Chinese Tallow and non-native Privet, followed by strategic reduction of Yaupon density. Treatments should be implemented in individual subunits rather than uniformly across the unit to diversify habitat structure while assessing ecological response and methodology effectiveness. Cut-stump or basal bark herbicide applications are preferred methods for woody invasive control and can be achieved by staff, contractors, volunteers, or scouts. Although large-scale mechanical clearing methods such as hydro-axing are discouraged due to soil disturbance risk, non-target impacts to uncommon native species, and potential negative public perception, targeted herbivory using goats may achieve similar results over a smaller scale. Locally significant or less common native species should be documented and protected during operations. Follow-up treatment is required to address resprouting individuals and secondary invasive establishment. In areas where a native species becomes disproportionately dominant, selective thinning may be warranted to prevent simplified canopy composition and encourage multi-species recruitment. Natural regeneration from the existing seedbank should be monitored, and planting of appropriate woodland species may be implemented if desirable herbaceous or canopy recruitment does not occur.

Long-term sustainability depends on reintroduction of prescribed fire that can accomplish structural and compositional objectives more efficiently than repeated manual treatments by suppressing understory overgrowth of Yaupon and non-native Privet while stimulating herbaceous response and woody regeneration. Burn frequency should target an approximate 2-4 year return interval based on fuel availability, ecological response, staffing capacity, and programmatic and event constraints.

Unit 9 does not contain major facilities or significant structures. The management approach should focus on conservation, biodiversity and ecosystem enhancement, while still considering public interaction and safety. Unit 9 is not currently assigned to an individual staff member but should be monitored closely throughout the year by all Conservation staff, with CAs applied as a team with guidance from the Conservation Director. The CAs below provide a general guideline for management. Actions should be scheduled and adapted based upon current environmental conditions such as climate, site conditions or available resources. This plan focuses on CAs and not facilities tasks (trail mulching, boardwalk repair, pruning, edging or mowing herbaceous vegetation along trail edges).



Management Table - Unit 9 Woodland

Conservation Action	Description	Details	
Monitoring	Visual monitoring	One walkthrough per Subunit quarterly	Prescribe and follow up with CAs as needed
	Ecological monitoring	Vegetation Survey Analysis Plots (27, 28, 34, 37, 39, 45, 46, 52, 54, 55, 58, 63)	Every 5-10 years
			Combine with larger data set
Individual Tree Care	Prune established trees	Limbs that encroach on trails	Create a clearance height of 7' minimum
		Structurally prune young trees	Subordinate trees with double leader, remove splits, broken branches, etc.
			Do not prune saplings or recently planted trees (within 3 years)
			Consult with Forestry staff if necessary
	Identify and cultivate desirable native trees and shrubs (Appendix C)	Stake and flag individual seedling/sapling, and map location if necessary	Map and markers should be used to identify for supplemental care
		Maintain individuals until they are mature enough to no longer require supplemental care	Remove encroaching vegetation and vines from desirable saplings and smaller trees & shrubs
			Apply supplement water during drought
			Apply mulch if able
Dead or Hazardous Tree Removal	Identify dead or hazardous trees that may impact targets	Communicate location to Forestry staff to determine method for removal	Trees leaning toward a target or overhanging branches may require action
			Trees that do not impact a target do not require action
Invasive Vegetation Removal	Remove woody and herbaceous invasive species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation management tasks	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench

Management Table - Unit 9 Woodland

Conservation Action	Description	Details	
High-Density Native Species Removal	Remove or thin out high-density native woody and herbaceous species (Appendix B)	Removal method is dependent on species, life stage, density and previous conservation management tasks	Herbicide application by foliar, cut stump, or cut & treat, or mechanical removal by mowing, cutting, hand-pull or weed wrench
		Not necessary to removal every individual and is dependent on circumstance	Large clusters of the same species
			Proximity to more desirable species
			Woody species adjacent to facilities such as boardwalks or bridges
Seeding	Broadcast seed when and where appropriate	May not be necessary or effective every year or in every Subunit	Appropriate times may follow targeted herbivory or prescribed fire
		Source seed appropriately	Ex. region-specific, light and soil requirements for applied areas
Plant Installation	Install plants when and where appropriate	Install species that enhance diversity and maintain character of the area	Canopy species with sparse woody understory and an herbaceous understory
		Consider species preferences, location and hydrologic regime	Make note of any subtle mounds or depressions that may hold water when planting
		Schedule during the dormant season	May require individual care following installation depending on weather conditions or other factors
Habitat Mow	Mowing may be an alternative if fire or herbivores are unavailable	For areas with dense woody understory and/or herbaceous ground cover	Prevent brush encroachment
		Consult and schedule with the Facilities staff	Communicate and/or flag location of desirable native trees and shrubs to avoid
		Schedule as needed or when conditions allow	Ex. dormant season, to prevent seed production, weather/ground moisture conditions, event programming
Targeted Herbivory	Rent goats to simulate herbivory in the landscape	Applicable in areas where understory brush is too dense and overgrown for a habitat mow	Protect trunks of desirable native trees and shrubs prior to goat arrival by wrapping in wire and securing
Prescribed Fire	Prescribe fire when and where appropriate	Dependent on staff and support availability, events & program schedule, etc.	Specific communication & preparations are required

SUBUNIT 9A (2.0ac) is a relatively smaller subunit just south of the Nature Center, Lily Pond Courtyard and Nature Playscape. It is bordered on its west and south sides by the Inner Loop and east by the Blackberry Trail. The subunit is closed canopy woodland with a dense understory, along with partial shade pond and wetland habitat. It contains the Lily Pond with its boardwalk and adjacent gathering area, which are occasionally used for programs, rentals and events. The Lily Pond can be filled with utility line water by opening the spigot located in the vehicle parking area of the Conservation Center. Subunit 9A is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open woodland understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)
4. Maintain Lily Pond
 - Removal of invasive species within and along margin of the Lily Pond
 - Alligatorweed (*Alternanthera philoxeroides*)
 - Suppression of high-density native species
 - Spatterdock (*Nuphar lutea*), Gulf Swampweed (*Hygrophila lacustris*)
 - Removal of debris and branches within pond
 - Monitor pond water levels
 - Open or close water spigot when needed
 - Removal of woody species encroaching onto Lily Pond boardwalk and gathering area
 - Mitigate hazards from trees over Lily Pond gathering area

SUBUNIT B (7.9ac) is the subunit directly south of Unit 5 Savanna and the Willow Oak Trail. It is located on its west side by the Blackberry Trail and Inner Loop, on its east by the Outer Loop, and south by the North Meadow Subunit. The subunit is closed canopy woodland with a dense understory, along with a full shade ephemeral pond known as the Willow Oak Pond. The pond does not currently have a method to fill it with water and dries out during extended droughts. This subunit was intended to be restored to savanna habitat as part of the Master Plan, based on soil surveys and hydrology, but lack of funding prevented this. This may become a possibility in the future, however,

the prevalence of Deep-Rooted Sedge (*C. enterianus*) in Unit 5 Savanna needs to be controlled, otherwise this invasive species will spread south, establish in this subunit and invade Unit 6 Meadow. Subunit 9B is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open woodland understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)
4. Maintain Willow Oak Pond
 - Removal of undesirable species within and along margin of pond
 - Excessive Buttonbush (*Cephalanthus occidentalis*) encroachment when pond is dry

SUBUNIT C (10.7ac) is the subunit completely encircled by the Inner Loop. The subunit is closed canopy woodland with an incredibly dense understory. Subunit 9C is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open woodland understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)

- High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)

SUBUNIT D (13.5ac) is a closed canopy woodland with an understory that varies from mildly dense to incredibly dense. Its northern border wraps around the 610 Parking Loop and Conservation Center, while being bordered on its east by the Inner Loop. The Outer Loop and Shortcut Trail (small trail between the Inner and Outer Loops) form its southern border. The service driveway forms the majority of its border on the west side. The Buttonbush trail runs west-east in the north section of the subunit, while a portion of the Outer Loop runs north-south in the western section of the subunit. The Woodland Field Station is located in its southwest corner and the Wetland Field Station near the intersection of the Buttonbush Trail and Inner Loop. Subunit D contains the Arrowwood Pond and a distinct large depression, known as “the Swamp”. Both are used for educational programming and can be filled using reclaimed water from the Woodway Ponds and the irrigation system.

As the story goes, the Swamp was inadvertently created due to a broken irrigation pipe. A small section was then deepened, with the spoil used to create a small berm on its northern side. This alteration, and naturally shallow clay soils, influenced hydrology and vegetation community. Prior to Hurricane Ike, the Swamp was a closed canopy wetland but lost many trees during the storm. The new light conditions allowed buttonbush to aggressively colonize the area, obstructing views and forming a near monoculture. In late 2025 / early 2026, the majority of buttonbush, along with the occasional Chinese Tallow, were cleared and the area was replanted with wetland-associated woody and herbaceous vegetation to increase biodiversity and jumpstart the ecological trajectory toward a closed canopy wetland. The majority of Subunit 9D is in **Management Phase I**, while the Swamp is in **Management Phase III**.

Management Focus

1. Diversity of woody species

- Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Provide sufficient care for recently planted saplings in the Swamp
- Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
- Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation

2. Maintain a sparse and open woodland understory

- Manual removal with hand tools
- Foliar or cut and treat herbicide application if needed
- Prescribed fire and/or targeted herbivory when appropriate

3. Suppression of undesirable species (Appendix B)

- Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)
- High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)

- Buttonbush (*Cephalanthus occidentalis*) in the Swamp
- 4. Maintain Arrowwood Pond and the Swamp
 - Removal of debris and branches within Arrowwood Pond
 - Monitor water levels
 - Adjust irrigation programming
 - Maintain sufficient line of sight from Buttonbush Trail boardwalk and Wetland Field Station

SUBUNIT E (3.4ac) is a closed canopy woodland with an incredibly dense understory. It is located between the service driveway and the western fenceline border of the Arboretum. It extends south and ends directly across from the Woodland Field Station, where it transitions to Subunit 8A without a distinct border. It contains desirable mature canopy trees but is otherwise inconspicuous in regard to ecological management or public accessibility. An area off the service driveway is used to stage debris and brush that are removed from other areas of the Arboretum. Subunit 9E is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open woodland understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)
4. Manage debris and brush pile
 - Do not let pile block service driveway
 - Coordinate removal when pile becomes too large

SUBUNIT F (13.6ac) is a woodland with an understory that varies from open to dense. It is located just north of Unit 8 and the southern side of the Outer Loop, and south of the Muscadine Trail and Inner Loop. In 2016 during the Master Plan, eight acres of understory brush (yaupon, privet) in the northwest section of this subunit was thinned by Texas A&M Forest Service using hand tools. Minimal follow-up treatment allowed vigorous resprouting and reestablishment of a dense understory. In 2025, a crew from the Student Conservation Association, along with guidance and follow-up from

staff and a contractor, removed privet species and Chinese tallow from the entire subunit using the cut-stump method of hand tools immediately followed by herbicide. Little to no yaupon was thinned or removed during this work. In late March 2026, a prescribed fire was conducted throughout the entire subunit. It is currently too early to determine post-removal species establishment or resprouting seeds from the seedbank. Subunit 9F is in **Management Phase II**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open woodland understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)

SUBUNIT G (5.8ac) is a woodland with an open understory. It is located south of the South Meadow Trail and Inner Loop, north and east of the Muscadine Trail, and west of the Outer Loop. Targeted herbivory by goats in Spring of 2024 occurred in the east half of the subunit, and again in the remainder of the subunit in Spring 2025. Goats performed successfully in removing dense understory vegetation but did not provide a complete eradication. Staff, volunteers and scouts reentered sequentially to manually cut remaining Yaupon and non-native Privet, then staff returned with a foliar herbicide treatment after the woody species resprouted the following season. In late March 2026, a prescribed fire was conducted throughout the entire subunit. It is currently too early to determine post-removal species establishment or resprouting seeds from the seedbank. Subunit 9G is in **Management Phase II and III**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open woodland understory

- Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
- Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)

SUBUNIT H (10.6ac) is a woodland with an open to extremely dense understory. It is located along the eastern boundary of the Arboretum, and extends from the Savanna toward Buffalo Bayou. While it is important to locate, protect, and cultivate desirable biodiversity in this subunit, it may be beneficial in the short term to allow the dense understory to remain in current locations. The nearby Union Pacific Rail Line right-of-way is a source of invasive species (*Bothriochloa isochasum*, *Paspalum urvillei*, *Sorghastum halepense*) that could be easily dispersed into the Arboretum, and Subunit H may be acting as a physical barrier. A section of this subunit north of the Meadow was cleared of woody understory species using volunteers and scouts, and should be monitored to understand the ecological response and management tasks necessary to maintain it appropriately. Subunit 9H is in **Management Phase I**.

Management Focus

1. Diversity of woody species
 - Identify and cultivate seedlings and saplings of desirable species (Appendix C)
 - Plant new desirable species
 - Mark location (flagging and/or ArcGIS Online) and ensure care for two years minimum
 - Identify and document location of mature and less common species
 - Collect seeds or cuttings for propagation
2. Maintain a sparse and open woodland understory
 - Manual removal with hand tools
 - Foliar or cut and treat herbicide application if needed
 - Prescribed fire and/or targeted herbivory when appropriate
3. Suppression of undesirable species (Appendix B)
 - Invasive species
 - Non-native Privet (*Ligustrum* spp.), Chinese Tallow (*Triadica sebifera*), Japanese Climbing Fern (*Lygodium japonicum*), Japanese Honeysuckle (*Lonicera japonica*)
 - High-density native herbaceous and woody species
 - Yaupon (*Ilex vomitoria*), Elms (*Ulmus alata*, *U. crassifolia*), Willow Oak (*Quercus phellos*), Trumpet Creeper (*Campsis radicans*)

APPENDIX A: CONSERVATION ACTIONS

Conservation Actions (CA) are essential practices aimed at restoring, enhancing, and managing natural areas at the Arboretum. These CAs are implemented across all Units except Unit 1 Turf Lawns and Unit 2 Gardens, and are separate from management of facilities such as trails, irrigation or buildings and structures. The type, timing, and frequency of CAs vary based on the specific habitat type within each Unit and are influenced by changing conditions such as weather, plant associations and population numbers, ongoing site work, and visitor interaction.

Adhering to a prescriptive and predetermined management schedule would be too restrictive given that environmental factors differ from year to year, and a defined management plan has intentionally not been developed because of this. Instead, a flexible, adaptive approach is required to effectively manage and enhance these natural areas. Conservation staff must be observant, responsive, and resourceful in implementing this approach. The ten CAs and their descriptions below are intended to identify and standardize practices that Conservation staff may implement and serve as a guide to prioritize CAs based on need and opportunity.

- | | |
|--|-----------------------|
| 1. Monitoring | 6. Seeding |
| 2. Individual Tree Care | 7. Plant Installation |
| 3. Dead or Hazardous Tree Removal | 8. Habitat Mow |
| 4. Invasive Species Removal | 9. Targeted Herbivory |
| 5. High-Density Native Species Removal | 10. Prescribed Fire |

MONITORING

Consistent and diligent monitoring is essential for prescribing CAs and informing adaptive management decisions across all Units year-round. Monitoring may be conducted by visual observation or ecological data collection.

Visual Monitoring

Visual monitoring includes both formal and informal walkthroughs of a specific unit or subunit that may identify the need for a CA. They may be intentional assessments or casual observations that reveal emerging management needs. Formal walkthroughs should include off-trail areas to detect ecological conditions or issues not visible from trails, while informal walkthroughs may occur at any point while traversing the grounds. Visual monitoring should occur throughout the year to capture seasonal changes in plant communities, species behavior, or site conditions. Observations may include the appearance of a new native or invasive species, opportunities to cultivate a desirable woody plant, or the need to thin high-density native vegetation. These walkthroughs are also valuable opportunities to build familiarity with lesser-known species and to observe seasonal ecosystem functions in action.

Ecological Monitoring

Ecological monitoring involves structured data collection and scientific analysis to track plant community dynamics and broader ecosystem trends. The data from these surveys must be analyzed and interpreted to guide ecological decision-making and the implementation of CAs. This approach provides holistic insight into long-term changes at the Arboretum and helps guide strategic decision-making. Currently, two key ecological monitoring programs have been developed:

Vegetation Survey Analysis

This survey inventories plant species across 30 permanent plots and different habitats to assess shifts in native and invasive vegetation populations over time. Conducted every 5–10 years, the results are compared to previous survey periods to identify trends and inform restoration and management priorities.

Herbaceous Transect Survey

Focused on grassland habitats in the Meadow (Unit 6), Savanna (Unit 5), and Wildflower Trail (Subunit 4B), this survey measures herbaceous diversity. Data is collected twice annually (April and October) to capture seasonal variation and long-term species composition changes.

INDIVIDUAL TREE CARE

Targeted management may be required for desirable species of trees and shrubs that are typically uncommon at the Arboretum, or individuals located near focal areas such as the Courtyard, Nature Playscape, lawns, or buildings and facilities. These trees may require supplemental care, including identification and marking for habitat mowing avoidance, structural pruning, watering during droughts, mulching, vine removal, and other targeted interventions. They may have been intentionally planted or naturally established and can be found throughout all Units except Unit 1 Turf Lawns, both near facilities and within natural areas.

Depending on their location and management needs, these individuals may be marked with flagging tape and/or documented in the Individual Tree Care ArcGIS Online map available through the Arboretum Esri portal. Trees planted intentionally or as young saplings require ongoing care until they reach a height and condition where they can thrive independently. For those located near facilities or along trails, regular pruning may be necessary to promote healthy structure, aesthetic form, and ensure safe visitor access.

Trees with high ecological, cultural, or aesthetic value may warrant close monitoring to assess signs of insect infestation, disease, or nutrient deficiency. Soil and foliar analyses may help diagnose underlying issues such as fungal or bacterial infections or nutrient imbalances. If problems are identified, third-party specialists may be needed to implement targeted treatments and improve tree health.

DEAD OR HAZARDOUS TREE REMOVAL

Visitor safety must take priority over ecological or aesthetic considerations, including the retention of dead or declining trees, regardless of their location or perceived ecological value. Trees that pose a hazard near trails, parking areas, buildings, or the Nature Playscape require timely assessment and intervention. This may involve removing a dying limb that overhangs a potential target, complete tree removal, or, when feasible, structural pruning to reduce risk while preserving the tree. Individual tree management actions may reduce the need for removal.

Decisions regarding removal should be made on a case-by-case basis by staff, using in-house resources or third-party contractors as appropriate. Contractors should be engaged when the scope of work exceeds staff expertise or equipment, such as when a limb is too high, a tree is too large, or it is located near a structure or high-traffic area where liability risk is elevated.

A certified arborist may conduct a Level 1 Tree Risk Assessment to proactively identify hazardous trees and determine the level of risk they pose within the Arboretum.

INVASIVE SPECIES REMOVAL

In an ideal scenario, all invasive species would be eliminated from the Arboretum through active management. However, due to its urban setting and the constant flow of visitors and wildlife, both potential vectors for invasive plant material, complete removal is likely unachievable but follow basic principles described below.

All Units contain invasive species requiring some level of intervention. Control strategies depend on species biology, seasonal timing, population density, proximity to infrastructure, and other site-specific conditions. Best practices evolve through experience, experimentation, and expert consultation.

Ongoing vigilance, early detection, and strong plant identification skills are critical to limiting the spread and establishment of invasives. New, unfamiliar invasive species may appear at any time. A comprehensive, though never fully complete, inventory of known invasive species is provided in Appendix B.

Prioritization is essential

Some species pose a greater threat due to their high abundance, aggressive displacement of native species, or ease of spread. Others may have limited ecological impact or occur in isolated areas, making them a lower priority for removal. Pick battles based on ecological impact and available resources.

Early intervention is key

Invasive species at low densities are far easier to eradicate than those already widespread. Like fighting wildfire, small patches of invasive species should be removed first to prevent rapid expansion, followed by larger infestations and primary sources. A single individual that remains may produce sufficient seed to produce 100 individuals the following season.

There is always more

When an invasive species is observed in an area, the actual population is often larger than it appears. Either monitor further to determine the full extent or plan removal operations accordingly, assuming a broader presence.

Leverage species-specific traits

As an example, deep-rooted sedge (*Cyperus entrerianus*) aggressively invades prairies and disturbed areas. With its extended growing season and tiny seeds dispersed by water and gravity, it is best treated with herbicide in late winter or early spring, before native vegetation emerges. Small satellite populations around the Arboretum should be eliminated first, followed by the larger savanna infestation, and lastly, the population near the Woodway Pond slopes, where ongoing upslope seed input limits containment, but reduces risk of broader spread.

They will be back

Initial removal efforts will invariably miss an individual, or the species may reestablish from the seedbank or a buried root node. It is essential to revisit treated areas seasonally, and potentially for several consecutive years, to monitor for regrowth and conduct follow-up removals.

HIGH-DENSITY NATIVE SPECIES REMOVAL

Some native plant species can become overly dominant, forming near-monocultures that outcompete and exclude other native flora. Examples include Yaupon (*Ilex vomitoria*) and Cherry Laurel (*Prunus caroliniana*) in woodland and riparian understories; Buttonbush (*Cephalanthus occidentalis*) in wetland habitats; and Tall Goldenrod (*Solidago altissima*), Common Ragweed (*Ambrosia artemisiifolia*), Trumpet Creeper (*Campsis radicans*), Peppervine (*Nekemias arborea*) and

Dewberry (*Rubus* spp.) in savannas and prairies. Although native, these species can disrupt ecological balance and must be actively managed to promote biodiversity and improve habitat quality.

High-density native species are present in all Units and require targeted intervention. Control methods vary depending on the species, season, population density, proximity to facilities, and other site-specific conditions, and therefore a generic removal plan is not recommended. Best practices evolve through experience, experimentation, and expert consultation. A comprehensive list of high-density native species and recommended management strategies can be found in Appendix B.

SEEDING

Seeding is a simple yet effective way to introduce native species and enhance habitat biodiversity. At the Arboretum, hand broadcasting is the most suitable and likely the only appropriate method, as mechanical seeding equipment may cause unnecessary soil disturbance.

Seed should be sourced locally whenever possible and applied either immediately or within 1–2 years of collection. Purchased seed must come from reputable suppliers who can verify its origin, purity (pure live seed content), and confirm it is free of invasive species. The timing of seeding depends on the species in the mix, which should be tailored to the target ecosystem's light, soil, and hydrologic conditions.

Many commercial wildflower mixes include annuals that bloom in the first year but do not persist. As a result, some areas may require annual reseeding until perennial species are established without needing further intervention.

Successful seeding depends on good seed-to-soil contact. To improve this, areas can be cleared of thatch, leaves, or pine litter before sowing, or sowing should focus on areas with bare soil. A prescribed fire exposes bare soil that will significantly enhance germination and establishment.

PLANT INSTALLATION

Installing native plants is essential for ecological restoration and enhancement. It helps bolster existing populations and reintroduce species that have been lost over time. Plant stock should be grown from locally collected material whenever possible; exceptions may be made only when local sources are no longer available. While many factors influencing plant survival following installation are beyond control, long-term success is more likely if the following considerations are addressed.

Location

Plant species vary in their tolerance to light, soil, and hydrology. The Arboretum's natural topography, including mounds, depressions and riparian gullies, creates diverse microhabitats that affect soil moisture and light availability. Canopy cover further influences light levels. Anecdotal evidence suggests that some species, including trees, may establish more successfully during extreme droughts when growing on mounds versus depressions, or vice versa. Most prairie and savanna forbs and grasses require full sun, though some thrive in dappled shade or poorly-drained soils that retain standing water, while others prefer dry soil. Other forbs and grasses prefer the shade in woodland understories. Similarly, small trees and shrubs vary in their light preferences. For wetland species, even slight differences in water depth—just a few inches—can significantly affect survival. Units are typically categorized by ecosystem type and can serve as a planting guide. Soil and topographic (LiDAR) maps should also be consulted prior to planting.

Time of Year

Avoid planting during late spring, summer, and early fall due to extreme heat, unless working with wetland species where water levels and planting depth can be controlled. When possible, schedule planting just before forecasted rain.

Installation Techniques

Standard planting methods should be used and tailored to the species and plant size. Staff and volunteers must receive clear instructions. For large-scale herbaceous plantings, watering immediately after installation may be sufficient. In contrast, trees and shrubs require at least two years of individual tree management as described above. No more plants should be installed than can be adequately maintained.

Population Viability

To establish self-sustaining populations, plants should be installed in adequate numbers. A single specimen is rarely sufficient unless more are planted later. Annuals often require larger initial plantings for long-term persistence. For dioecious species, both male and female individuals must be included.

Planting native species can also serve as a strategy to suppress invasive plants or high-density native species by occupying open or recently cleared areas.

HABITAT MOW

Habitat mowing is a land management technique that uses a tractor or brush mower to maintain ecological balance by preventing woody plant encroachment. It helps control thicket formation in woodland understories and limits the spread of woody species in prairies and savannas, allowing native herbaceous plants to thrive.

Mowing should be conducted at least once annually in Units 3, 4, 5, and 6. Select areas within Unit 9 may also benefit from mowing, particularly when alternative brush reduction methods, such as prescribed fire or goat browsing, are unavailable. Mowing should be timed for periods when the soil is dry enough to support heavy equipment without causing compaction and should avoid peak flowering seasons. Dormant-season mowing is generally preferred, but timing should vary year to year to prevent favoring a narrow subset of plant species.

Consider leaving approximately 25% of a unit unmown to provide wildlife refuge, unless there is similar adjacent habitat. Resting, or skipping mowing for a season will create a rotational mow schedule. If possible, change mowing depth or height, or spot mow areas to create structural diversity. These considerations prevent favoring a specific species or group of species to improve biodiversity long-term for both vegetation and wildlife.

The primary goal of habitat mowing is to suppress woody vegetation. Skipping annual mowing may allow brush to grow too large for effective removal with standard equipment. Mowing should occur as close as possible around trees, buildings, facilities, fallen logs, and other structures. Follow-up removal by manual, mechanical or chemical means may still be required to prevent undesired woody regrowth.

While reducing woody growth is the focus, the regeneration of native desirable trees must also be considered, except in Unit 6, Subunits North Meadow and South Meadow. Desirable seedlings or saplings should be marked with flagging tape and carefully avoided during mowing operations.

An essential step is cleaning the mower and the underside of the mower deck after completing each area. This should be done using a leaf blower or compressed air to remove seeds and plant material that could otherwise be unintentionally spread to other parts of the Arboretum.

TARGETED HERBIVORY

Herbivory was historically a natural disturbance that helped manage densities of woody vegetation and maintain a more open landscape. Urban development has excluded this influence in the Arboretum. While reintroducing large native herbivores is not feasible, targeted herbivory, and specifically renting a large herd of goats, has offered a practical alternative, though with important considerations.

Vegetation Preference

Goats are browsers, meaning they prefer leaves, soft shoots, and fruit from woody plants, though they will consume nearly any vegetation if accessible. Their browsing behavior mimics that of deer, targeting seedlings, saplings, and the lower branches of woody plants. Over time, this creates a "browse line" that opens the understory, promoting sunlight penetration and understory plant diversity. Goats also strip bark and may rub their horns on young trees or those with thin bark, potentially girdling and killing them. Mature trees with thick secondary bark are generally unaffected.

Site Selection

In previous deployments, 120–150 goats browsed approximately three acres over one week, which is considered a heavy stocking rate. Goats appear to be most effective in woodlands with dense, inaccessible understories, as well as in savannas where woody vegetation needs to be controlled before it becomes too large to manage manually. In prairie habitats, goats tended to browse broadleaf forbs and vines, avoiding grasses. While this behavior may favor grass dominance over time, it did not result in long-term vine suppression, as many vines rapidly regrew after browsing. Goats have not yet been trialed in riparian areas (Units 7 & 8), but their ability to navigate difficult terrain could make them a valuable tool where equipment access is limited.

Site Preparation

Goats are not a sensitive management tool and cannot be directed with precision. Once they are within an area, they will browse any vegetation that they can reach. To protect desirable plants, especially seedlings, saplings or woody species with soft bark, physical barriers are necessary. Mesh wire can be wrapped around the trunk to a height of 5-6 feet, then secured to a lower branch using a zip tie or similar to prevent the goats from removing the wire. Seedlings and saplings, or groups thereof, can be protected with mesh wire wrapped and tied around t-posts staked into the ground. Even these precautions may not be enough in some instances, and some mortality of desirable species can be expected unless they are very well fortified.

Goats are typically confined to ~1-acre sections to ensure intensive browsing before relocation. A mild electric fence installed by the goat herder contains the animals. In dense woodland, Arboretum staff may need to clear paths to allow fence installation.

Follow up actions

Targeted herbivory is not a perfect solution. Many plant species, especially woody ones, resprout quickly, often within days. Even trees with girdled trunks may regenerate from the base. However, goats create access in previously impenetrable areas, allowing staff and volunteers to follow up with manual cutting. The stumps can be treated immediately with herbicide, or the small clumps of regrowth can be sprayed with herbicide several months later. This staged approach reduces the need for large-scale herbicide application and minimizes collateral damage to native or desirable species.

PRESCRIBED FIRE

Historically, naturally occurring fires burned through this region every 2–3 years, helping control woody vegetation and maintaining prairies, savannas, and open woodlands. However, decades of

surrounding urban development have excluded fire from the Arboretum. As a result, woody species, both native and invasive, have proliferated unchecked, transforming formerly open areas into closed-canopy forests with dense, overgrown understories that likely reduce biodiversity across all canopy layers.

While mechanical, manual, and chemical removal methods can reduce woody overgrowth, they are resource-intensive. Prescribed fire is often the most efficient and ecologically effective tool for restoring and maintaining a healthy, diverse landscape at the Arboretum.

Planning and Coordination

Prescribed burns require careful planning and coordination with multiple stakeholders to ensure safety and success. Preparations should begin months in advance to allow time for notifications, permitting, and approvals. The Houston Fire Department (HFD) and Houston Parks and Recreation Department (HPARD) are the two entities that must be contacted to begin the planning process, but there are many other entities to notify throughout the planning process. Arboretum staff should also be regularly updated throughout the planning process. With proper planning, areas of the Arboretum may still remain open to the public the day of the prescribed fire. The primary goal is that no one should be surprised that a prescribed burn will be conducted.

Timing is one of the most challenging aspects. Burns typically occur during the dormant season, when dry vegetation provides fuel and cold fronts from the northwest help direct smoke away from nearby roads. The last two weeks of January and first two weeks of February are often optimal. Coordination with staff is critical to avoid conflicts with events, rentals, or classes. For example, a paid event scheduled months in advance should not be expected to take place in a recently burned or blackened area.

A draft Burn Plan should provide detail of the burn unit and day-of operations using a standardized template. The plan can be amended and reused for future burns in the same area or adapted for similar conditions elsewhere. The draft should be submitted to HFD and HPARD for revision, then the finalized copy should be signed by all necessary parties before submitting to HFD and HPARD for final signatures, finally followed by City of Houston permit approval.

Unit Selection

Burn units should be chosen months ahead depending on date of last burn, current vegetation conditions, available personnel, and the surrounding event calendar. A unit may consist of an entire MU or a combination of Subunits. Ideally, every area of the Arboretum would experience fire every 5–10 years, except for areas where landscape, features and facilities where fire may be impractical or ecologically inappropriate Unit 1 Turf Lawns, Unit 2 Gardens, Unit 3 Woodway Ponds and Unit 4A (Courtyard, Nature Center, and Nature Playscape).

Site Preparation

Preparation should begin weeks to months prior, depending on size and location of the burn unit. Brush, pine needles, and leaf litter should be cleared at least six feet from structures, fences, benches, field stations, culverts, irrigation valve boxes or dead snags that must be preserved or could pose fire hazards. Rooftops cleared of flammable debris, and vines that serve as ladder fuels should be cleared from nearby fuels and made note of.

Public Notification

Educational signage should be installed at the burn unit at least one week prior to inform visitors. On the day of the burn, temporary traffic signage should be placed at entrances and along Woodway Drive, as indicated in the Burn Plan. Trail closures may require additional signs and staff or volunteers stationed at key trail intersections.

HFD communications team operates with the assistance of Arboretum staff to canvass nearby neighborhoods, alert media, and provide additional public notifications.

Execution and Safety

HFD currently oversees prescribed burns at the Arboretum, providing the personnel, tools, and equipment necessary for safe operations. Arboretum staff trained and certified in wildland firefighting may assist in day-of operations with HFD approval. All other staff should observe from a designated safe area. All public visitors are banned from entering the burn unit, and staff or volunteers must be posted at key trail intersections to prevent anyone from sneaking in, and the burn unit should be walked prior to ignition to ensure no visitors are still in the area.

During the planning process, a range of potential dates are selected. Weather conditions are monitored daily and compared to parameters outlined in the Burn Plan. If conditions appear favorable, a three-day spot forecast is requested from NOAA. On the morning of the burn, onsite weather equipment will confirm whether conditions are within the approved range. If any Burn Plan criteria are unmet, including staffing, equipment, or weather, the burn must be postponed, even if all personnel are on standby.

Post-Burn Considerations

Not all areas within a burn unit need to be burned, and leaving unburned patches provides vital wildlife refugia. Once HFD clears and demobilizes the site, the area is safe for visitors. Downed logs and stumps may smolder for days and should be closely monitored. A water wagon may be used to suppress hot spots, although immediate extinguishment is not always possible.

Roadway and trail closure signage can be removed shortly after the prescribed fire if conditions allow. Educational signage should be left in place until burned areas become less visible, often several weeks later.

Post-burn CAs may include spot herbicide treatments on resprouting woody or invasive species, as well as broadcast seeding or native plant installation to accelerate restoration.

APPENDIX B: INVASIVE & HIGH-DENSITY NATIVE SPECIES

Scientific Name	Common Name	Family	Status	Form	Known Unit	Preferred Removal Method
<i>Aeschynomene indica</i>	Budda Pea	Fabaceae	Invasive	Wetland Forb	3, 4	Hand pull
<i>Alternanthera philoxeroides</i>	Alligatorweed	Amaranthaceae	Invasive	Wetland Forb	3, 6	Aquatic rated herbicide application
<i>Ambrosia artemisiifolia</i>	Common Ragweed	Asteraceae	Native	Annual Forb	4	Hand pull or foliar herbicide; Rhizomatous
<i>Ambrosia trifida</i>	Giant Ragweed	Asteraceae	Native	Annual Forb	4	Hand pull
<i>Baccharis halimifolia</i>	Sea Myrtle	Asteraceae	Native	Shrub	3, 4, 5	High-density full sun shrub; Remove where necessary
<i>Bidens pilosa</i>	Beggarticks	Asteraceae	Invasive	Annual Forb	3, 4	Hand pull
<i>Bothriochloa ischaemum</i>	KR Bluestem	Poaceae	Invasive	Perennial Grass	3, 4, 5, 6	Hand pull or foliar herbicide; Edges of trails, sunny areas
<i>Campsis radicans</i>	Trumpet Creeper	Bignoniaceae	Native	Perennial Vine	All	Foliar herbicide (preferably after resprouting from mow)
<i>Celtis laevigata</i>	Hackberry	Ulmaceae	Native	Tree	All	High-density tree; Thin out or remove seedlings/saplings where necessary
<i>Chloris cantherae</i>	Paraguayan Windmill Grass	Poaceae	Invasive	Perennial Grass	3, 4, 5	Hand pull or foliar herbicide; Edges of trails, sunny areas
<i>Cinnamomum camphora</i>	Camphor Tree	Lauraceae	Invasive	Tree	7, 8, 9	Cut & treat or foliar herbicide (preferably after resprouting from mow)
<i>Cyperus enterianus</i>	Deep Rooted Sedge	Cyperaceae	Invasive	Perennial Graminoid	3, 4, 5, 6	Hand pull or foliar herbicide
<i>Dichanthium annulatum</i>	Kleberg Bluestem	Poaceae	Invasive	Perennial Grass	3, 4, 5, 6	Hand pull or foliar herbicide; Edges of trails, sunny areas
<i>Dichanthium aristatum</i>	Angleton Bluestem	Poaceae	Invasive	Perennial Grass	3, 4, 5, 6	Hand pull or foliar herbicide; Edges of trails, sunny areas
<i>Fraxinus pennsylvanica</i>	Green Ash	Oleaceae	Native	Tree	5	High-density tree; Thin out or remove seedlings/saplings where necessary
<i>Hydrilla verticillata</i>	Waterhyme	Hydrocharitaceae	Invasive	Wetland Forb	3, 6	Aquatic rated herbicide application
<i>Ilex vomitoria</i>	Yaupon	Aquifoliaceae	Native	Shrub	All	High-density understory shrub; Remove where necessary
<i>Ipomea cordatotriloba</i>	Morning Glory	Convolvulaceae	Native	Annual Vine	3, 4	Hand pull or cut; Fast growing & can cover desirable vegetation
<i>Lantana camara</i>	Largeleaf Lantana	Verbenaceae	Invasive	Shrub	5, 6, 9	Foliar herbicide (preferably after resprouting from mow)
<i>Ligustrum japonicum, lucidum, quihoui, sinense</i>	Non-native species Privet	Oleaceae	Invasive	Shrub	All	Cut & treat or foliar herbicide (preferably after resprouting from mow)
<i>Lonicera japonica</i>	Japanese Honeysuckle	Caprifoliaceae	Invasive	Perennial Vine	All	Hand pull or foliar herbicide (preferably after resprouting from mow)

ECOLOGICAL RESTORATION & RESILIENCY PLAN
Appendix B: Invasive & High Density Native Species

Scientific Name	Common Name	Family	Status	Form	Known Unit	Preferred Removal Method
<i>Ludwigia erecta</i>	Yerba de Jicotea	Onagraceae	Invasive	Annual Forb	5, 6	Hand pull
<i>Lygodium japonicum</i>	Japanese Climbing Fern	Lygodiaceae	Invasive	Perennial Vine	7, 8, 9	Hand pull or foliar herbicide
<i>Macroptilium lathyroides</i>	Phasey Bean	Fabaceae	Invasive	Annual Forb	3, 4	Hand pull
<i>Marsilea minuta</i>	Dwarf Waterclover	Marsileaceae	Invasive	Wetland Forb	3, 6	Aquatic-rated herbicide application
<i>Mikania scandens</i>	Hempvine	Asteraceae	Native	Annual Vine	4, 9	Hand pull or cut; Fast growing & can cover desirable vegetation
<i>Morus alba</i>	White Mulberry	Moraceae	Invasive	Tree	All	Cut & treat or foliar herbicide (preferably after resprouting from mow)
<i>Myriophyllum spicatum</i>	Eurasian Watermilfoil	Haloragaceae	Invasive	Wetland Forb	3, 6	Aquatic rated herbicide application
<i>Nekemias arborea</i>	Pepper Vine	Vitaceae	Native	Perennial Vine	All	Hand pull or foliar herbicide (preferably after resprouting from mow)
<i>Nuphar lutea</i>	Spatterdock	Numphaeaceae	Native	Aquatic Forb	3, 4, 6	
<i>Nymphoides hydrophylla</i>	Crested Floating Heart	Menyanthaceae	Invasive	Aquatic Forb	3, 6	ProcellaCOR herbicide application
<i>Paederia foetida</i>	Skunkvine	Rubiaceae	Invasive	Perennial Vine	4	Hand pull; Rhizomatous
<i>Panicum repens</i>	Torpedograss	Poaceae	Invasive	Wetland Grass	3, 6	Foliar herbicide application depending on terrestrial or aquatic
<i>Paspalum urvillei</i>	Vasey Grass	Poaceae	Invasive	Perennial Grass	4, 5, 6	Hand pull or foliar herbicide; Edges of trails, sunny areas
<i>Perilla frutescens</i>	Beefsteak Plant	Lamiaceae	Invasive	Annual Forb	4, 7, 8, 9	Hand pull
<i>Prunus caroliniana</i>	Cherry Laurel	Rosaceae	Native	Tree	7, 8, 9	High-density tree; Thin out or remove seedlings/saplings where necessary
<i>Quercus phellos</i>	Willow Oak	Fagaceae	Native	Tree	4, 5, 9	High-density tree; Thin out or remove seedlings/saplings where necessary
<i>Rhus copallinum</i>	Shining Sumac	Anacardiaceae	Native	Tree	6	Foliar herbicide (preferably after resprouting from mow)
<i>Rosa bracteata</i>	McCartney Rose	Rosaceae	Invasive	Perennial Forb	6	Foliar herbicide (preferably after resprouting from mow)
<i>Rubus argutus</i>	Sawtooth Blackberry	Rosaceae	Native	Perennial Forb	3, 4, 5, 6, 9	Foliar herbicide (preferably after resprouting from mow)
<i>Salix nigra</i>	Black Willow	Salicaceae	Native	Tree	3, 5	Cut & treat or foliar herbicide (preferably after resprouting from mow)
<i>Salvinia minima</i>	Common Salvinia	Salviniaceae	Invasive	Wetland Forb	3	Aquatic-rated herbicide application
<i>Solidago altissima</i>	Tall Goldenrod	Asteraceae	Native	Perennial Forb	3, 4, 5	Hand pull or foliar herbicide; Rhizomatous
<i>Sorghastrum halepense</i>	Johnson Grass	Poaceae	Invasive	Perennial Grass	3, 4, 5, 6	Hand pull or foliar herbicide; Rhizomatous

ECOLOGICAL RESTORATION & RESILIENCY PLAN
Appendix B: Invasive & High Density Native Species

Scientific Name	Common Name	Family	Status	Form	Known Unit	Preferred Removal Method
<i>Sporobolus indicus</i>	Rattail Smutgrass	Poaceae	Invasive	Perennial Grass	3, 4, 5, 6	Hand pull or foliar herbicide; Edges of trails, sunny areas
<i>Torilis arvensis</i>	Spreading Hedgeparsley	Apiaceae	Invasive	Annual Forb	3, 4, 5, 6	Hand pull or foliar herbicide; Edges of trails, sunny areas
<i>Triadica sebifera</i>	Chinese Tallow	Euphorbiaceae	Invasive	Tree	All	Cut & treat or foliar herbicide (preferably after resprouting from mow)
<i>Typha x glauca</i>	Cattail Hybrid	Typhaceae	Invasive	Wetland Grass	3, 6	Aquatic-rated herbicide application
<i>Ulmus alata, crassifolia</i>	Winged & Cedar Elm	Ulmaceae	Native	Tree	3, 4, 5, 6, 9	High-density tree; Thin out or remove seedlings/saplings where necessary
<i>Verbena brasiliensis</i>	Brazilian Vervain	Verbenaceae	Invasive	Annual Forb	3, 4, 5, 6	Hand pull; Edges of trails, sunny areas
<i>Verbena rigida</i>	Rigid Vervain	Verbenaceae	Invasive	Perennial Forb	3, 4, 5, 6	Hand pull or foliar herbicide; Rhizomatous
<i>Xanthium strumarium</i>	Rough Cocklebur	Asteraceae	Invasive	Annual Forb	8	Hand pull

APPENDIX C: DESIRABLE NATIVE WOODY SPECIES

Scientific Name	Common Name	Scientific Name	Common Name
<i>Acer floridanum</i>	Florida maple	<i>Maclura pomifera</i>	Osage orange
<i>Acer rubrum</i>	Red maple	<i>Magnolia grandiflora</i>	Southern magnolia
<i>Aesculus pavia</i>	Red buckeye	<i>Morella cerifera</i>	Southern wax-myrtle
<i>Asimina triloba</i>	Pawpaw	<i>Morus rubra</i>	Red mulberry
<i>Aralia spinosa</i>	Devil's walkingstick	<i>Ostrya virginiana</i>	Eastern hop-hornbeam
<i>Carpinus caroliniana</i>	American hornbeam	<i>Persea borbonia</i>	Redbay
<i>Carya aquatica</i>	Water hickory	<i>Pinus echinata</i>	Shortleaf pine
<i>Carya cordiformis</i>	Bitternut hickory	<i>Pinus palustris</i>	Longleaf pine
<i>Carya illinoensis</i>	Pecan	<i>Pinus taeda</i>	Loblolly Pine
<i>Carya ovata</i>	Shagbark hickory	<i>Planera aquatica</i>	Planertree
<i>Carya texana</i>	Black hickory	<i>Platanus occidentalis</i>	American sycamore
<i>Castanea pumila</i>	Ashe chinkapin	<i>Prunus angustifolia</i>	Chickasaw plum
<i>Chionanthus virginicus</i>	White fringetree	<i>Prunus mexicana</i>	Mexican plum
<i>Cornus florida</i>	Flowering dogwood	<i>Prunus serotina</i>	Black cherry
<i>Cornus foemina</i>	Stiffcornel dogwood	<i>Quercus alba</i>	White oak
<i>Crataegus brachyacantha</i>	Blueberry hawthorn	<i>Quercus falcata</i>	Southern Red Oak
<i>Crataegus crus-galli</i>	Cockspur hawthorn	<i>Quercus laurifolia</i>	Laurel oak
<i>Crataegus marshallii</i>	Parsley hawthorn	<i>Quercus lyrata</i>	Overcup oak
<i>Crataegus mollis</i>	Downy hawthorn	<i>Quercus macrocarpa</i>	Bur oak
<i>Crataegus opaca</i>	Mayhaw	<i>Quercus michauxii</i>	Swamp chestnut oak
<i>Crataegus spathulata</i>	Pasture haw	<i>Quercus pagoda</i>	Cherrybark oak
<i>Crataegus texana</i>	Texas hawthorn	<i>Quercus shumardii</i>	Shumard oak
<i>Crataegus viridis</i>	Green hawthorn	<i>Quercus stellata</i>	Post oak
<i>Fagus grandifolia</i>	American beech	<i>Sapindus saponaria</i>	Western Soapberry
<i>Forestiera acuminata</i>	Swamp privet	<i>Sassafras albidum</i>	Sassafras
<i>Forestiera pubescens</i>	Elbow bush	<i>Sideroxylon lanuginosum</i>	Gum bumelia
<i>Frangula caroliniana</i>	Carolina buckthorn	<i>Sophora affinis</i>	Eve's Necklace
<i>Fraxinus americana</i>	White ash	<i>Sophora secundiflora</i>	Texas Mountain Laurel
<i>Gleditsia aquatica</i>	Water locust	<i>Styrax americanus</i>	American snowbell
<i>Halesia diptera</i>	Two-wing silverbell	<i>Symplocos tinctoria</i>	Common sweetleaf
<i>Hamamelis virginiana</i>	American witch-hazel	<i>Tilia americana</i> var. <i>caroliniana</i>	Carolina basswood
<i>Ilex cassine</i>	Dahoon	<i>Tilia floridana</i>	Florida basswood
<i>Ilex decidua</i>	Possum-haw	<i>Ulmus americana</i>	American elm
<i>Ilex opaca</i>	American holly	<i>Vaccinium arboreum</i>	Farkleberry
<i>Itea virginica</i>	Virginia sweetspire	<i>Viburnum scabrellum</i>	Southern Arrow-wood
<i>Juglans nigra</i>	Black walnut	<i>Viburnum nudum</i>	Possum-haw viburnum
<i>Juniperus virginiana</i>	Eastern red cedar	<i>Viburnum rufidulum</i>	Rusty blackhaw
<i>Liquidambar styraciflua</i>	Sweetgum	<i>Zanthoxylum clava-herculis</i>	Hercules' club

APPENDIX D: REFERENCES

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