



QUERCUS BOYNTONII CONSERVATION ACTION PLAN

Inclusive participatory conservation action planning

QUERCUS BOYNTONII CONSERVATION ACTION PLAN



THE
CHAMPION
of TREES



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This action was led by The Morton Arboretum's Global Tree Conservation Program, following IUCN's Conservation Planning Specialist Group guidelines and design, and was made possible by generous support from workshop participants.

To note: IUCN's Conservation Planning Specialist Group (CPSG) encourages meetings, and workshops for the analysis of conservation issues. IUCN CPSG believes that reports of these meetings are useful when disseminated broadly. However, the views expressed in this report by the authors may not necessarily reflect the formal policies of IUCN, its Commissions, its Secretariat or its members.

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Qboy leaves and acorns, Jefferson County AL

Acronyms and Abbreviations

(BGCI)	Botanic Gardens Conservation International
(CPSG)	Conservation Planning Specialist Group
(GCCO)	Global Conservation Consortium for Oak
(IUCN)	International Union for Conservation of Nature
(USFS)	US Forest Service
(Qboy)	<i>Quercus boyntonii</i>

Recommended citation:

Byrne, A., and Thompson, P. (2022). *Quercus boyntonii* Conservation Action Plan 2022-2026.



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Anu Goedhart looking at a *Q. boyntonii* seedling planted at an ex situ conservation site



Patrick Thompson holding *Q. boyntonii* Seedling (Marcus Warwell)

EXECUTIVE SUMMARY

Importance of Oaks

Comprising around 450 species, oaks are found in forest and shrubland ecosystems throughout the northern hemisphere. As keystone species, they exhibit an astonishing array of morphological and ecological diversity, thriving in the subtropical forests of southeast Asia, the deserts of Mexico, and the temperate hardwood forests of North America. Their two centers of diversity are in Mexico and eastern Asia, both of which harbor nearly 200 native species.

Oaks are prized for their sturdy timber and are valuable sources of wood for building ships, wine barrels, and fine furniture. They are the source of many other non-timber products such as cork, tannins and nutritious acorns for feeding livestock. These iconic trees grace the flags of many nations and states and hold cultural and religious value for people around the world.

Despite their great economic, ecological, and cultural value, many oaks are under threat of extinction. The Red List of Oaks (Carrero et al., 2020) reveals that at least one-third of the world's oak species are at risk of extinction. Species identified as at risk of extinction require conservation action to ensure that they not only survive but are also resilient to the threats they face. This entails protection of threatened wild populations of plants in their natural habitats, and ex situ conservation in botanic gardens and seed banks. Because oaks are “exceptional species” – their acorns do not survive the low temperature and humidity conditions of a standard seed bank – these species require alternative methods for effective ex situ conservation of genetic diversity. Living collections of trees and cryopreservation of embryos and vegetative (growth) tissues are two solutions to this challenge, but these require more time, expertise, and management than standard seed banking. Thus, oaks are in urgent need of a coordinated, global effort to efficiently and effectively preserve species and populations both in their native habitats and in ex situ collections.

Given the large, global distribution of oaks and their myriad of threats, the Global Conservation Consortium for Oak (GCCO), which falls under Botanic Gardens Conservation International (BGCI), was launched to coordinate a network of institutions and experts to collaboratively implement comprehensive conservation strategies to prevent extinction of the world's oak species. The GCCO is led by The Morton Arboretum and has successfully established the network in the US, Mexico and Central America, China and Southeast Asia. In the US specifically, the GCCO is focusing on conservation efforts for 30 priority threatened species, 28 of which were assessed in the Conservation Gap Analysis of Native US Oaks (Beckman et al., 2019). The US region for the GCCO is divided into three sub-regions, based on where the species are distributed geographically. There is the Eastern US, Texas Southwest and the Western US sub-regions, all of which focus on 10, 10, and 10 priority species, respectively.



Oak acorn cupule



Our vision

Quercus boyntonii is assessed as Critically Endangered according to the IUCN Red List. It is also one of the 28 species of conservation concern identified in the Conservation Gap Analysis of Native US Oaks (Beckman et al., 2019), and one of the 30 species of focus for the US region of the Global Conservation Consortium for Oak (GCCO). Due to its vulnerability, restricted distribution in Alabama, and more information surfacing regarding the wild, native populations, it is important to focus on this high risk species and work together nationally through the established GCCO network to initiate and build upon priority conservation projects. In doing so, a foundation of trust and knowledge as a group will be built, helping to achieve the goals laid out in the plan and creating a template for developing additional priority oak conservation action plans in the future.

This plan covers the entire range of *Quercus boyntonii* (Qboy) and was developed in collaboration with stakeholders from a variety of sectors. This plan is open to feedback from other collaborators who were not involved in the Qboy conservation action plan workshops.



Matt Candeias with a larger than average *Q. boyntonii* specimen, St Clair County AL



Q. boyntonii tree

Vision Statements

1. In a collaborative effort, we have established a team from various sectors that meets on an annual basis and communicates frequently, who are monitoring* sites, gathering genetic data*, establishing ex situ conservation collections that are climate resilient* and of high genetic diversity, prioritizing in situ conservation, and managing habitat* for the species' success.

**monitoring: monitoring sites in a three year rotation, for acorn development, pests and diseases, and responses to extreme weather.*

**genetic data: sampling to see how the species gene pool develops/changes over time, and better understanding of the species representation across sites in the wild and in collections*

**climate resilient: taking into account predicted, future climate change impacts, the established plantings are well-suited to their environment, so they are healthy and productive now and well into the future*

**managing habitat: reintroduction, fire regimes, removing invasives and woody competition*

2. The information and research that are gathered on the species through surveys, monitoring, and genetic work, are disseminated widely through outreach and educational opportunities, so as to recruit more partners to join our efforts in filling information gaps, and so that public and private stakeholders have the tools and guidelines to mitigate threats, manage, promote, value and conserve the species.

Our Goals (summary)

Through the implementation of this action plan, we will achieve success once we have met the following goals outlined below. Our plan to achieve these goals is as follows:

1. Develop and execute a growing Qboy awareness and monitoring campaign; as we gather and learn more information about the species, we can better inform a variety of sectors to engage them in our conservation efforts.
 - a. We will distribute an initial survey to gauge an understanding of what people know about Qboy and how they feel about the species. From there, we will develop and distribute a variety of outreach materials over the course of a year and then survey the same population to see if their knowledge and/or opinions on the species has changed.
2. Expand advocacy efforts to have Qboy recognized regionally by the state of Alabama so it falls under their conservation efforts, and can qualify for resources and support.
 - a. Advocate for Qboy to be a part of the Alabama State Wildlife Action Plan (SWAP)-- this will allow the species to receive state funding to support its conservation.



Amy Byrne (GCCO Coordinator), John Evans (Atlanta Botanical Garden) and USFS partners looking at a map of Beech Creek Seed Orchard (USFS) for a potential ex situ site for Qboy

3. Increase Qboy representation by having more individuals from each genetically distinct population in more ex situ collections to capture and conserve the genetic diversity of the wild populations, and to increase our understanding of the genetic diversity conserved and the management of it long-term.
 - a. After further genetic analyses, have a strategic collecting plan in place to ensure the populations, or individuals that need further representation in collections, are identified and collected from.
4. Address genetic threats or issues *in situ*, which includes better understanding and protecting of *in situ* populations (and integrating with the knowledge gained from the ex situ conservation goal) and supporting demographic and genetic viability.
 - a. Monitor and survey current and new populations and monitor current levels of genetic diversity in ex situ collections which will inform future collections.
5. Encourage and support research on burn intensity and frequency at amenable sites where woody encroachment consists of a diversity of species to understand the role of fire on Qboy ecology.
 - a. Once a collaborator is identified to conduct this research, we will conduct control burns at the applicable sites to assess the efficacy of this management practice on the species population's viability.
6. Conduct population assessments to identify both the invasive species that represent the biggest threats to Qboy as well as any desired species present among each population to make better recommendations to landowners so as to best manage Qboy populations.
 - a. Through the population assessments, identify what kinds of invasive species controls best suit each situation and develop management approaches that address those. Also, develop a valid monitoring interval to assess the efficacy of said management protocols.

INTRODUCTION

Species name and description

Species name: *Quercus boyntonii* Beadle, Biltmore Bot. Stud. 1(1): 47–48. 1901.

Synonyms: N/A

Common names: Alabama Sandstone Oak; Boynton's Oak; Scrub Post Oak; Boynton's Sand Post Oak

Description:

Shrubs, rarely small trees, deciduous or sub evergreen, shrubs low, under 2 m, often trailing, rhizomatous, trees to 6 m. Bark brown, scaly. Twigs light brown, 1.5-3 mm diam., densely tomentulose. Buds are reddish brown, ovoid, 2-3(-4) mm, apex acute or rounded, sparsely pubescent. Leaves: petiole (4-)5-10(-15) mm. Leaf blade obovate or oblanceolate, (39-)50-100(-125) × 20-60(-91) mm, base cuneate, margins minutely revolute, broadly 3-lobed distally or with 3-5 rounded, irregular lobes in distal 1/2, secondary veins curved, 6-8 on each side, apex broadly ovate or triangular-

lobed; surfaces abaxially grayish or silvery, densely tomentulose-glandular with minute, appressed-stellate hairs, abaxially dark green, glossy, glabrous or with minute, scattered, simple hairs. Acorns 1-2, on peduncle 2-10(-35) mm; cup deeply or shallowly cup-shaped, 5-10 mm deep × 10-13 mm wide, including 1/3-1/2 nut, scales closely appressed, gray, tomentulose; nut light brown, ovoid, 10-17 × 7-13 mm, apex rounded, glabrous. Cotyledons are distinct. Flowering spring. Deep sands and crevices in pine forests, along streams; of conservation concern; 0-200 m; Ala. (*Flora of North America*.)

Eco-geographical information

Quercus boyntonii, or Boynton oak, has a restricted distribution and is believed to be endemic to Alabama, U.S. Boynton oak is best known from a few main populations, including Oak Mountain State Park, Moss Rock Preserve, and Hind's Rock.



Figure 1. Wild distribution of Qboy (2023). Map: Kate Good.

There are localized occurrences reported from nine Alabama counties along glade margins, sandstone outcrops, rarely scattered within pine-oak-hickory forests and on sandy ridges.

The [APGA/USFS Tree Gene Conservation Partnership 2020 Collecting Trip Report](#) for Qboy contain the most up to date information on the species native populations and collections for ex situ conservation

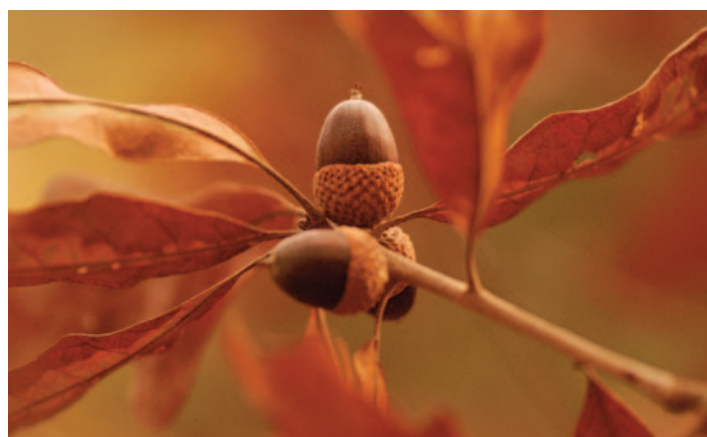
- 1,824 plants counted from 21 populations, 9 Counties,
- 667 acorns collected from 17 maternal lines 2020
- 673 acorns collected from 19 maternal lines 2022
- 1120 acorns collected from 30 maternal lines 2023

Research and knowledge summary/gaps

Qboy has lower genetic diversity in the wild compared to most oaks and compared to other threatened oaks like *Q. oglethorpensis* and *Q. georgiana* (looking at heterozygosity and allelic richness metrics).

When Sean Hoban and his team at The Morton Arboretum compared the seven sites they sampled in the wild, they found that there is not much difference among the sites in basic genetic parameters (heterozygosity and allelic richness).

- In sites with a small census size (less than 50-100 trees), populations may become inbred and lose diversity over time, so looking at restoring/ augmenting populations by planting seedlings will be of high importance for Qboy as most known locations have very small census.
- Additionally they did identify clones in cases where the species occurs in rings or bunches (in other words, stems within 2 meters might be clones).



Qboy acorns held to maturity despite all foliage succumbing to drought.



Typical Qboy with 3 lobes in the distal third of the leaf

Ex situ- how are we doing in regards to genetic diversity capture?

- About 60-70% of all alleles are captured in ex situ collections, but collections capture 100% of the common alleles; this is about average for the threatened species examined by the Hoban lab- not poor, but not yet sufficient.
- How good is our ex situ conservation, genetically? Good, but we could be more efficient with better sampling to capture more of the rare alleles; seed needs to come from all spatial locations, from many mother trees: 10-30 mother trees is a good range to aim for at each spatial location.

Hybridization-- is Qboy maintaining itself?

- It would be good to genetically analyze each wild population and as many garden plants as possible to quantify the rate of hybridization with other oak species.

Summary:

- Historically and presently the genetic status of Qboy is good in the wild, but populations need to recover/grow.
- Ex situ collections: we need to focus future collecting efforts on targeting more maternal lines at each spatial location. Tracking the survival rates of acorns distributed through TGCP will inform horticultural protocols and future collecting efforts.

THREATS AND THEIR DRIVERS

Threats to Qboy have been classified into three groups: **High Impact Threats**, **Moderate Impact Threats**, and **Low Impact Threats**. These are summarized below.

High Impact Threats:

1. Catastrophic fire and/or drought
2. Genetic material loss- inbreeding and/or introgression: hybridization could be a genetic threat, and some populations are extremely small and therefore will likely face inbreeding in the near future
3. Limited habitat (limited available acreage where sandstone, the medium they grow in, occurs)
4. Need for continued research of the species natural history, more information on implementing fire regimes, horticultural techniques
5. Human modification of natural systems: invasive species competition

Moderate Impact Threats:

1. Human modification of natural systems - disturbance regime modification, pollution and/or eradication: experiencing woody encroachment due to fire suppression
2. Lack of federal/local regulations and protections
3. Climate change

Low Impact Threats:

1. Human use of species- wild harvesting; can be used for firewood
2. Human use of landscape - residential/commercial development
3. Human use of landscape - tourism and/or recreation
4. Lack of public and landowner awareness/understanding of the species



Qboy tree in its habitat St Clair County AL

PAST AND CURRENT CONSERVATION ACTIONS

A summary of past and current conservation actions and by whom. This concerns previous and ongoing work undertaken by several individuals and organizations, relating to Qboy.

When the Alabama Conservation Alliance started in 2010, one of their first projects focused on Qboy conservation. To start, there was not a lot of information known about the populations; there were only three records of the species in the Natural Heritage Program database. Since the start of the alliance in 2010, a team of dedicated conservationists conducted scouting trips to gather more information on the species native range, identify new populations, and collect acorns when possible. This has been an ongoing effort for the past 14 years. As a result, we now know a great deal more about the species native range, where the species was extirpated, which populations need reinforcement and more. Additionally, the species is growing in many more collections as a result of the material collected from the multiple scouting trips. More recently, *ex situ* surveys were conducted in 2017; the data was included in the *Conservation Gap Analysis of Native US Oaks* (Beckman et al., 2019) as Qboy is recognized as one of the 28 species of conservation concern identified from that analysis. Following this, an additional survey was conducted in 2020 to get an update on the status of collections to identify target populations to collect from in the future. This survey was conducted through the Global Conservation Consortium for Oak (GCCO). The GCCO launched in 2019, and it is a network of institutions and experts working together to implement comprehensive, conservation strategies to prevent the extinction of the world's oaks species. The GCCO US is focusing its conservation efforts on the 28 species of conservation concern identified in the gap analysis. Therefore, the GCCO is in place to support the continued conservation of Qboy. Additional conservation efforts include: continued research on understanding the population

genetics to better inform future collections, increased publicity on social and traditional forms of media by the Alabama Plant Conservation Alliance. This increase in awareness has led to the identification of three new occurrences of the species. There are currently four protected Qboy sites managed by Forever Wild, North American Land Trust, Alabama State Parks, and the City of Hoover. Finally, collecting and surveying trips are still being conducted to further understand the natural history of the species, collect material to propagate for living collections and to reinforce in the wild populations.

Looking ahead, a number of these activities will continue, and new activities that are highlighted in the action tables below will be of focus in the near future. However, further support through collaborations, resources and funding will be critical to the implementation and success of these activities. For more information on how to get involved/support these efforts, please contact the [GCCO Coordinator](#) and [Species Action Plan Manager](#).



Variations in size of Qboy acorns

STRATEGY FOR CONSERVATION

Vision

1. In a collaborative effort, we have established a team from various sectors that meets on an annual basis and communicates frequently, who are monitoring* sites, gathering genetic data*, establishing ex situ conservation collections of high genetic diversity, prioritizing in situ conservation, and managing habitat* for the species' success.

*monitoring: monitoring sites in a three year rotation, for acorn development, pests and diseases, and responses to extreme weather.

*genetic data: sampling to see how the species gene pool develops/changes over time, and better understanding of the species representation across sites in the wild and in collections

*managing habitat: reintroduction, fire regimes, removing invasives and woody competition

2. The information and research that are gathered on the species through surveys, monitoring, and genetic work, are disseminated widely through outreach and educational opportunities, so as to recruit more partners to join our efforts in filling information gaps, and so that public and private stakeholders have the tools and guidelines to mitigate threats, manage, promote, value and conserve the species.

Goals

The overall goals (both short and long-term) for the effective conservation of this species and a set of indicators to demonstrate when the targets have been achieved.

Goal 1:

Develop and execute a growing Qboy awareness and monitoring campaign; as we gather and learn more information about the species, we can better inform the public, and a variety of other audiences, to engage them in our conservation efforts.

Goal 2:

Expanding our outreach efforts to have Qboy recognized regionally by the state so it falls under their conservation efforts, and can qualify for resources/support.

Goal 3:

Ex situ conservation: To better capture and conserve the genetic diversity of the wild populations, we will increase Qboy representation by having more individuals from each genetically distinct population in more *ex situ* collections, and we will also increase our understanding of the genetic diversity conserved and the management of genetic diversity long-term.

Goal 4:

In situ conservation: Address genetic threats or issues *in situ*, which includes better understanding and protecting *in situ* populations (and integrating with the knowledge gained from the *ex situ* conservation goal) and supporting demographic and genetic viability including by increasing population sizes if possible.

Goal 5:

To understand the role of fire on Qboy ecology, we will conduct research on burn intensity and frequency at amenable sites where woody encroachment consists of a diversity of species.

Goal 6:

To understand how to best manage Qboy populations, we encourage per population assessments to identify both the species that represent the biggest threats to Qboy as well as any desired species present among each population to make better recommendations to landowners.



Qboy habitat, Shelby County AL (Sean Hoban)

Actions

These action tables outline the activities that will be implemented to address the identified threats and will align with the outlined goals above. For each numbered activity, they will be classified into categories, categories will be indicated in parentheses at the end of each activity. The categories are as follows:

- Ongoing (it is currently happening, but will have a completion date in the near future)
- Need more resources (e.g. funding, personnel)
- Pending initiation (a prerequisite activity needs to take place in which the outcome of that activity will impact the initiation of the activity at hand)
- In the near future (there are no current plans to initiate the activity, but it will be of focus in the near future, once other activities are completed)
- Ongoing indefinitely (it is ongoing, and will need to continue to be implemented until the foreseeable future)



Shrub form Qboy in habitat, Jefferson County AL

ACTION #1

THREAT(S):

Need for continued research of the species natural history, more information on implementing fire regimes, horticultural techniques; Lack of public and landowner awareness/understanding of the species

GOAL:

Develop and execute a growing Qboy awareness and monitoring campaign; as we gather and learn more information about the species, we can better inform the public, and a variety of other audiences, to engage them in our conservation efforts

OBJECTIVES	ACTIONS	INDICATORS OF SUCCESS
1. Gather more data on the natural history of Qboy (this can take place in conjunction with Action #4)	<ol style="list-style-type: none"> Conduct surveys Monitoring in place Gather and organize information to package it to disseminate to a wide variety of audiences to engage them in understanding about the species more 	<ul style="list-style-type: none"> Receiving feedback from >10 people on the first survey Noticing a change in opinion/value of Qboy from >10 people from the follow-up survey
2. Find and reach audiences within the counties of known Qboy occurrences to share an initial survey with to get a baseline understanding of who knows what about Qboy, attitudes toward the species, etc. (ongoing)	<ol style="list-style-type: none"> Identify audiences to target: Master Gardeners, community colleges, known landowners, state parks 	<ul style="list-style-type: none"> Additional occurrence data collected from the public/landowners

OBJECTIVES (Cont'd)	ACTIONS (Cont'd)	INDICATORS OF SUCCESS (Cont'd)
3. Develop additional outreach/engagement materials	<ul style="list-style-type: none"> a. Develop and distribute the “wanted”/“how to ID” poster to a variety of audiences --include information that the general public can identify and understand more about Qboy <ul style="list-style-type: none"> i. distribute in public areas (i.e. post offices, schools) that is built for a more general audience, and distribute on scouting/collecting trips b. Brochure/sticker/poster: “Do you know Qboy?” to pique people’s interest - will link to a page on the GCC website c. Develop an article for a local newspaper, magazine (e.g. Treasured Forest) <ul style="list-style-type: none"> i. Develop article for Treasured Forest magazine – framing as a small range species d. Develop a Qboy project on iNaturalist where the general public can add information on occurrences they see <ul style="list-style-type: none"> i. Incorporate this call to action in workshops, wanted poster, other informational messaging e. Develop powerpoint presentation that explains Qboy, broad overview 	<ul style="list-style-type: none"> • Share engagement materials at over 10 conferences/workshops and more than 50 new partners • Distribute more than two articles detailing more information about <i>Q. boyntonii</i> and current conservation efforts • Develop an iNaturalist project to gather occurrence data on <i>Q. boyntonii</i> and that has recruited 20 new members that are actively contributing observations to the project
4. Conduct educational presentations/workshops	<ul style="list-style-type: none"> a. Developing workshops and hosting them through the state parks, public gardens, master gardeners network, etc. to present on a number of topics that relates to Qboy such as identification, invasive species management approaches and work the wildlife management angle. <ul style="list-style-type: none"> i. Bring in local representatives to the workshops b. Guided walks with the group at Hind’s road, OMSP, etc. c. Work with AL Extension Service to promote and host educational opportunities <ul style="list-style-type: none"> a. Utilizing information gathered from scouting/monitoring trips – building off activities in action #4 b. Being able to inform ecological rules and regulations such as overharvesting and recreational use, using the science to make better ecological regulations moving forward c. Including information/messaging on what we are looking for in public-facing documents, message as: 	<ul style="list-style-type: none"> • Increased outreach at as many venues as possible - presentations at parks and gardens, etc.
5. Hold a Qboy boosters club where landowners can meet every so often (e.g. meet at Oak Mountain State Park, various localized venues, several landowner meetings)-- following the model of the longleaf alliance		<ul style="list-style-type: none"> • Develop a <i>Q. boy</i> boosters club

OBJECTIVES (Cont'd)	ACTIONS (Cont'd)	INDICATORS OF SUCCESS (Cont'd)
6. Better understanding of the species to make better ecological decisions moving forward (what are we interested in finding more about the species?)	continue to conduct surveying trips to document invasive species in Qboy habitat and other important data to make more informed ecological decisions for the species preservation moving forward	<ul style="list-style-type: none"> • Creating ecologically informed guidance documents to implement and inform restoration projects that will benefit the species populations on public and private lands
7. Follow-up survey to measure difference of opinions at the end year one of distributing educational materials		<ul style="list-style-type: none"> • Share the survey with more than 50 people • More than 20 people take the survey to provide feedback on what they have learned about <i>Q. boyntonii</i> since the implementation of this conservation action plan
<p>Responsible parties: Donald E. Davis Arboretum, Huntsville Botanical Garden, The Morton Arboretum, DCNR Oak Mountain State Park</p> <p>Collaborators: AL Natural Heritage Program</p>		



Up-close photo of Qboy leaves (Sean Hoban)

ACTION #2

THREAT(S):

Lack of federal/local regulations and protections

GOAL:

Expand our outreach efforts to have Qboy recognized regionally by the state so it falls under state conservation efforts and can qualify for resources/support

OBJECTIVES	ACTIONS	INDICATORS OF SUCCESS
1. Alabama Plant Conservation Alliance will work with the state to get a plant-specific amendment incorporated into the State Wildlife Action Plan before the 2025 edition of the SWAP is published		<ul style="list-style-type: none">• Addition of the plant amendment into SWAP before publication of the 2025 edition
2. Meetings will be held with AL SWAP to get the plant amendment written (timelines laid out for this action)	<ol style="list-style-type: none">a. Communicate to AL SWAP that plants are important to the survival and health of other wildlifeb. Setting up a meeting to discuss the amendment	<ul style="list-style-type: none">• Qboy recognized as a SGCN or Species in Greatest Conservation Need• Receive funding to support Qboy-specific conservation projects

Responsible parties: Donald E. Davis Arboretum, Alabama Natural Heritage Program

Collaborators: AL SWAP authors



Qboy's consistently dark green glossy leaves, St Clair County AL



ACTION #3

THREAT(S):

Catastrophic fire; catastrophic drought; genetic threat, and some populations are extremely small and therefore will likely face inbreeding in the near future; limited habitat (limited available acreage where sandstone, the medium they grow in, occurs); climate change

GOAL:

Ex situ conservation– to better capture and conserve the genetic diversity of its wild populations, we will increase Qboy representation by having more individuals from each genetically distinct population in more ex situ collections, in addition to increasing our understanding of the genetic diversity conserved and the management of genetic diversity long-term

OBJECTIVES	ACTIONS	INDICATORS OF SUCCESS
<p>1. Use genetic data to provide minimum numbers recommended for the size of ex situ collections</p>	<p>a. The Morton Arboretum is working through a new genetic dataset for Qboy and will provide more recommendations to increase the genetic diversity of the metacollection, specifically from each genetically, geographically, and ecologically unique <i>in situ</i> populations</p> <p>b. Genetically analyze ex situ individuals in collections to determine levels of relatedness and potential inbreeding</p>	<ul style="list-style-type: none"> • Increase in the size and breadth of ex situ collections- increase number of Qboy trees and Qboy representation in and across garden collections
<p>2. Use genetic data to provide better understanding of which ex situ collections represent “true species” and which represent hybrids</p>	<p>a. Genetically analyze each wild population and as many garden plants as possible to detect hybrids</p> <p>i. Received a grant to support this work: Morton Arboretum submitted an IMLS grant to better understand hybridization in ex situ collections</p>	<ul style="list-style-type: none"> • Publications, reports, posters, presentations and other outreach events/materials are developed as a result of the genetic analysis and research conducted regarding ex situ collections
<p>3. Conduct supplemental field collections to get more plants in ex situ collections</p>	<p>a. Continue to work through the APGA/USFS Tree Gene Conservation Partnership grants to fund supplemental field collections</p> <p>b. Submit proposals to other funding opportunities to continue to support supplemental field collections</p> <p>c. Collecting vegetative and woody material to propagate</p> <p>i. Target maternal lines that are not producing acorns to grow in tissue culture</p> <p>ii. Collect scion material to graft for clonal propagation of each known population</p> <p>d. Develop a collaborative propagation protocol that can be widely shared</p>	<ul style="list-style-type: none"> • Successfully collect germplasm from each known occurrence of <i>Q. boyntonii</i> • Have each occurrence represented at more than five collections, ex situ • Successfully develop and distribute a propagation protocol



OBJECTIVES (Cont'd)	ACTIONS (Cont'd)	INDICATORS OF SUCCESS (Cont'd)
4. Develop conservation groves of Qboy	<ul style="list-style-type: none"> a. Grow current collaborations with the USFS to execute the development of one-two pilot conservation groves a. Expand collaborations to develop additional conservation groves of Qboy a. Work with institutions from various sectors to learn more about their current or soon to be developed collection of Qboy, and develop relationships to share material across sites 	<ul style="list-style-type: none"> • Conservation groves established, maintained and reproducing
5. Tracking accessions in living collections-- tracking events (e.g. mortality) and associated factors like climate	<ul style="list-style-type: none"> a. Ensure institutions who hold a collection of Qboy are tracking the necessary data to support later analyses and research projects <ul style="list-style-type: none"> i. Might help us understand where the species can survive a. Phenological monitoring in ex situ collections (have an understanding of when Qboy set seed each year) 	<ul style="list-style-type: none"> • Data istracked, and stored in BGCI's PlantSearch to refer back to for further research, and being able to identify potential collection gaps

Responsible parties: The Morton Arboretum, Huntsville Botanical Garden, Donald E. Davis Arboretum
Collaborators: DCNR Oak Mountain State Park, USFS Region 8, Stephens Lake Park Arboretum, Chicago Botanic Garden, Atlanta Botanical Garden, Birmingham Botanical Garden, The University of Alabama in Huntsville, Athens State University, The Colonial Williamsburg Foundation, Longleaf Botanical Gardens, US National Arboretum



Qboy leaves, Shelby County AL



Qboy leaves and acorns, Jefferson County AL

ACTION #4

THREAT(S):

Catastrophic fire; catastrophic drought; genetic threat, and some populations are extremely small and therefore will likely face inbreeding in the near future; limited habitat (limited available acreage where sandstone, the medium they grow in, occurs); climate change; human modification of natural systems—disturbance regime modification, pollution and/or eradication; experiencing woody encroachment due to fire suppression; human modification of natural systems, i.e. invasive species competition

GOAL:

In situ conservation— address genetic threats or issues *in situ*, which includes better understanding and protecting *in situ* populations (and integrating with the knowledge gained from the *ex situ* conservation goal) and supporting demographic and genetic viability

OBJECTIVES	ACTIONS	INDICATORS OF SUCCESS
1. Continued effort to understand and learn more about Qboy's range-- continue survey work	a. Continue to work through the APGA/USFS Tree Gene Conservation Partnership grants and other relevant opportunities to survey and monitor the populations b. Continue to gather and report occurrence data to AL Natural Heritage Program	<ul style="list-style-type: none"> • More personnel involved in the monitoring of <i>in situ</i> populations
2. Establish an <i>in situ</i> monitoring plan (ensuring that the same data form can be utilized across all sites)	a. Monitor populations every three years and record the following data: acorn production, threats to the species (e.g. invasive plants, pests, diseases, land-use change), baseline mortality, recruitment	<ul style="list-style-type: none"> • <i>In situ</i> monitoring plan successfully drafted and reviewed by relevant partners and collaborators
3. Apply for at least one grant or funding proposal to support this work— considering community involvement, and education/outreach components as part of the proposal (e.g. community science projects, etc.)		<ul style="list-style-type: none"> • At least one grant received to fund <i>in situ</i> conservation work of Qboy
4. Replanting to reinforce smaller populations		<ul style="list-style-type: none"> • Smaller populations are reinforced successfully



Prostrate form Qboy in habitat, St Clair County AL



Amy Byrne, Patrick Thompson and USFS Partners at Beech Creek Seed Orchard (USFS) discussing a Qboy conservation grove (Marcus Warwell)

OBJECTIVES (Cont'd)	ACTIONS (Cont'd)	INDICATORS OF SUCCESS (Cont'd)
5. Highlighting the climatic factors that would make for the ideal site	a. Plantings at Moss Rock Preserve, neighborhood, and city park populations, and other near situ sites and documenting the climate at each site over time and collect the plant's growth and survival rate as well b. Educational plantings (e.g. plantings at Oak Mountain State Park) c. Outreach to private landowners to identify additional planting sites i. Utilizing the resources and material developed from Action #1 to foster collaborations with private landowners to plant out at d. Having an understanding of the value of outplanting within the range where extirpated populations existed	<ul style="list-style-type: none"> Numerous new sites are identified for future <i>in situ</i> plantings and climate and plant health data are collected and tracked each year to better understand the species response to the given climate and changes in climate
6. Maintaining the level of genetic diversity of populations through monitoring, and management actions	a. Conduct an ecological niche model to identify suitable habitat for the species under future climate scenarios to increase species representation <i>in situ</i> and <i>ex situ</i>	
7. Preserving the land that we have left, specifically, the habitat that supports Qboy growth	a. Being able to identify other areas of land that are similar to native Qboy habitat to plant out additional Qboy	<ul style="list-style-type: none"> Increased care and value for private entity populations More support for continued monitoring and management of <i>in situ</i> populations and remaining land

Responsible parties: Huntsville Botanical Garden, Donald E. Davis Arboretum, Moss Rock Preserve, AL Natural Heritage Program, DCNR Oak Mountain State Park
Collaborators: The Morton Arboretum



Variation in shape and maturation of Qboy acorns collected in situ, Jefferson County AL

ACTION #5

THREAT(S):

Catastrophic fire; catastrophic drought; human modification of natural systems– disturbance regime modification, pollution and/or eradication; experiencing woody encroachment due to fire suppression; human modification of natural systems– invasive species competition; climate change

GOAL:

To understand the role of fire on Qboy ecology, we will conduct research on burn intensity and frequency at amenable sites where woody encroachment consists of a diversity of species

OBJECTIVES	ACTIONS	INDICATORS OF SUCCESS
1. Identify collaborators to conduct this research	a. Brainstorm potential candidates (find professors and students)	<ul style="list-style-type: none"> • At least 5 collaborators identified and contacted
2. Set up monitoring plots to do controlled burns at with potential to incorporate mechanical and chemical treatments as well	a. Identify sites to set this up at: <ol style="list-style-type: none"> Oak Mountain State Park (on the glades) Hinds Road Outcrop– has high levels of fuel, so needs to be handled ahead of time prior to burning Cornellian Falls North American Land Trust b. Prep sites for controlled burns: <ol style="list-style-type: none"> Hinds Road Outcrop c. Monitor and report Qboy response (more eyes on the ground to see the effects post-burn) <ol style="list-style-type: none"> assess slope and aspect prior to burning to see if there is any difference between burns in different populations based on the slope and aspect of the site Systematic studies in known habitats could be done 	<ul style="list-style-type: none"> • Candidate sites are identified, approved, and appropriately prepared for controlled burns • Quantitative and qualitative data, such as recruitment numbers and growth response of adults are recorded at each site following the burns to monitor species response • Acres and percentage of habitat burned



GCCO partners in the field surveying for and collecting Qboy, Blount County AL



Oak Mountain State Park mug with a graphic of Qboy leaves and an acorn

OBJECTIVES (Cont'd)	ACTIONS (Cont'd)	INDICATORS OF SUCCESS (Cont'd)
<p>3. Remove woody species through hand pulling, cutting, and spraying with herbicide (overall contributing to prepping the sites for burns)</p>	<p>a. Start working groups to manage this (e.g. Friends of Moss Rock Preserve) and organize volunteer days at sites</p> <p>b. Identify other sites where this management needs to happen, and communicate with already established or amend working groups</p> <p>i. Irondale population needs management– residential neighborhood, could do some canvassing and promote the species</p> <p>c. Recruit and manage volunteers, schedule volunteers– coordination and execution</p> <p>d. Apply threat rubric to each population (scoring invasive species threats, etc.)</p> <p>e. Develop a valid monitoring interval to assess the efficacy of said management protocols</p>	<ul style="list-style-type: none"> • Working groups established to manage plant removal • Volunteer group organized with AL Extension Service • Establish and implement a monitoring method to assess management protocol efficacy
<p>4. Better understanding of the species to make better ecological decisions moving forward</p>		<ul style="list-style-type: none"> • Store and share information collected from these burns with relevant collaborators

Responsible parties: DCNR Oak Mountain State Park, DCNR Land Management
Collaborators: Jefferson State Community College, The Nature Conservancy of Alabama, Ruffner Mountain, Forestry Commission, John Kush (Auburn University), Joel Potter



Quercus boyntonii habitat (Sean Hoban)

ACTION #6

THREAT(S):

Human modification of natural systems– disturbance regime modification, pollution and/or eradication; experiencing woody encroachment due to fire suppression; human modification of natural systems– invasive species competition; climate change

GOAL:

To understand how to best manage Qboy populations, we will conduct per population assessments to identify both the species that represent the biggest threats to Qboy as well as any desired species present among each population to make better recommendations to landowners

OBJECTIVES	ACTIONS	INDICATORS OF SUCCESS
1. Population assessments to identify both the species that represent the biggest threats to Qboy as well as any desired species present among each population – looking for <i>Q. georgiana</i> , Georgia aster	a. Gather information from the APGA 2020 report and North American Land Trust b. Apply threat rubric to each population (scoring invasive species threats, etc.)	<ul style="list-style-type: none"> • Have the information and tools to work efficiently and effectively to better understand the vegetation at each of the <i>Q. boyntonii</i> populations so as to inform future restoration efforts • Monitoring more than three of the <i>Q. boyntonii</i> populations that have been restored through invasive species removal • Creating guidelines to share with landowners on how to care for and manage their native <i>Q. boyntonii</i> on their properties
2. Remove invasive species through hand pulling/cutting and spraying with herbicide	a. Start working groups to manage this b. Develop a valid monitoring interval to assess the efficacy of said management protocols	
3. Make better recommendations to landowners and what kinds of controls best suit each situation and develop management approaches that address those	a. Consult with landowners b. Hold workshops, etc. to distribute these	

Responsible parties: Huntsville Botanical Garden, Donald E Davis Arboretum, Oak Mountain State Park

Collaborators: Alabama Invasive Plant Council, Alabama Plant Conservation Alliance, Ruffner Mountain Group



Up-close view of Qboy leaf venation



Qboy leaves with reduced lobing and acorn cupule, St Clair County AL

NEXT STEPS



Ex situ conservation grove planting of Qboy at Beech Creek Seed Orchard (USFS)

This is a living document and was started in September/October of 2021 as a result of the *Quercus boyntonii* conservation action plan workshop. This plan is following a 10 year timeline but will be reviewed annually through communication via email and meetings. Also annual workshops will be held to assess the overall plan, discuss changes to be made to the plan and update one another on accomplishments, as well as gaps in our efforts. Additional information can be added at any time, given it is reviewed and accepted by all who were a part of the workshops and those who will be conducting activities laid out in the plan. Plans will be published on the Global Conservation Consortia website (including in draft format).

Each action table will have identified responsible stakeholders and collaborators—ultimately, a formed working group who will meet and communicate on a quarterly basis to ensure the activities are executed over the given timeframe. Overall, further support through collaborations, resources, and funding will be critical to the implementation and success of these activities. For more information on how to get involved/support these efforts, please contact the [GCCO Coordinator](#) and [Species Action Plan Manager](#).



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Herbarium voucher of Qboy branch and leaves



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Cover photo:
Quercus boyntonii in native habitat

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Design: John Morgan
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