



# Conservation Gap Analysis of Native U.S. Oaks

## Species profile: *Quercus austrina*

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### SPECIES OF CONSERVATION CONCERN

#### CALIFORNIA

Channel Island endemics:  
*Quercus pacifica*, *Quercus tomentella*

Southern region:  
*Quercus cedrosensis*, *Quercus dumosa*,  
*Quercus engelmannii*

Northern region and /  
or broad distribution:  
*Quercus lobata*, *Quercus parvula*,  
*Quercus sadleriana*

#### SOUTHWESTERN U.S.

Texas limited-range endemics  
*Quercus carmenensis*,  
*Quercus graciliformis*, *Quercus hinckleyi*,  
*Quercus robusta*, *Quercus tardifolia*

Concentrated in Arizona:  
*Quercus ajoensis*, *Quercus palmeri*,  
*Quercus toumeyi*

Broad distribution:  
*Quercus havardii*, *Quercus laceyi*

#### SOUTHEASTERN U.S.

State endemics:  
*Quercus acerifolia*, *Quercus boyntonii*

Concentrated in Florida:  
*Quercus chapmanii*, *Quercus inopina*,  
*Quercus pumila*

Broad distribution:  
*Quercus arkansana*, ***Quercus austrina***,  
*Quercus georgiana*,  
*Quercus oglethorpensis*, *Quercus similis*



# Quercus austrina Sarg.

**Synonyms:** *Quercus durandii* var. *austrina* (Small) E.J.Palmer **Common Names:** Bluff oak, Bastard white oak

**Species profile co-author:** Ron Lance, North American Land Trust  
**Contributors:** David Pivorunas, National Forest System, USDA Forest Service

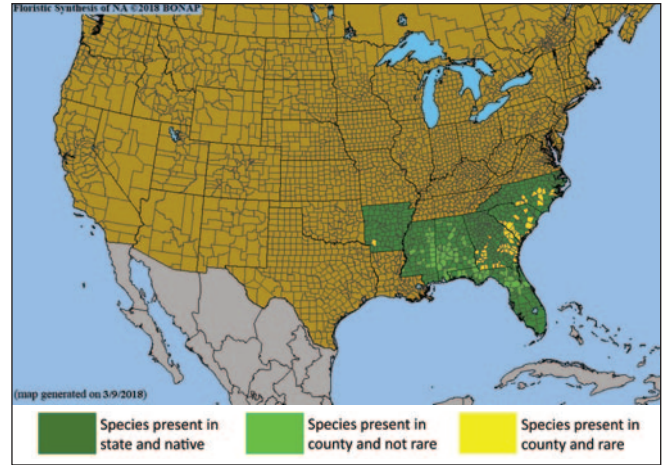
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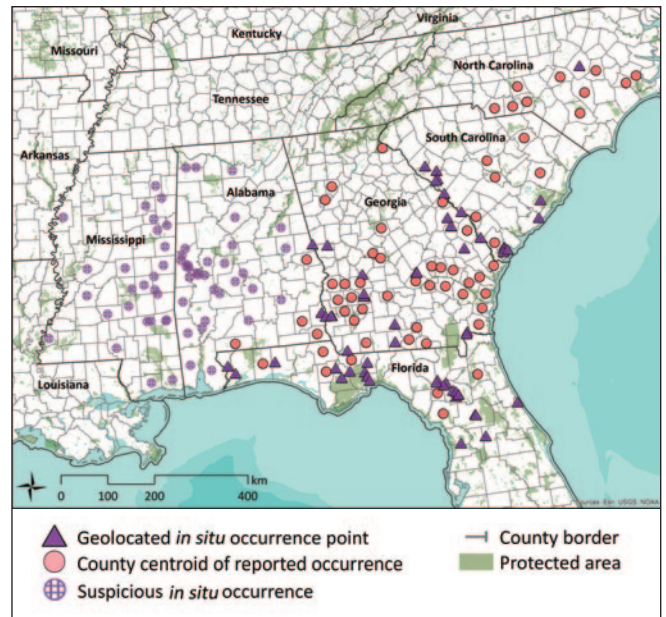
## DISTRIBUTION AND ECOLOGY

*Quercus austrina*, or Bluff oak, is endemic to the Southeastern Coastal Plain of the U.S., distributed from North Carolina to Georgia, and possibly west to Arkansas; it stretches from maritime forests near the coastline, inland to sandy coastal plains. The species was described in 1918 as “although not generally distributed is not rare.”<sup>1</sup> Since then, habitat clearing and disturbance by human activities may have led to a decline in the species’ prevalence. It is also possible that further taxonomic research and skill in identification have created the illusion of decline. In 1997 Bluff oak was described as “apparently abundant only in local areas,” and “nowhere common” in 2015.<sup>2,3</sup> In 2005 NatureServe recorded only 38 occurrences that were not historic or extirpated.<sup>4</sup> This limited abundance is largely a response to *Q. austrina*’s habitat specificity and rarity. Flat tops of wooded bluffs and nearby stream ravines currently harbor most remaining *Q. austrina*, in addition to hardwood hammocks; further occurrences sprinkle the woods of the sandy coastal plains where regeneration can be difficult. There is potential to find *Q. austrina* in any deep, mesic or sub-mesic sandy soil with high organic content (R. Lance pers. comm., 2015).<sup>3,5</sup> Bluff oak is a relatively small or medium-sized tree, typically reaching 20 to 26 meters in height, and thrives at 0 to 200 meters above sea level.<sup>2</sup>

Significant work remains in understanding the distribution of Bluff oak. Species records within Arkansas, Mississippi, and Alabama are highly suspicious and need further investigation. It is likely that many of the herbarium specimens have been confused with *Q. sinuata*. Recent expert surveys in Alabama have not positively identified any *Q. austrina*, and if the species is present within the western half of its currently-recorded range, it is certainly not common. Herbarium and field work could substantially change the range and conservation status of this species, and is a vital element of analysis moving forward (R. Lance & D. Pivorunas pers. comm., 2018).



**Figure 1.** County-level distribution map for *Quercus austrina*. Source: Biota of North America Program (BONAP).<sup>6</sup>



**Figure 2.** Documented *in situ* occurrence points for *Quercus austrina*. Protected areas layer from U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).<sup>7</sup>



## VULNERABILITY OF WILD POPULATIONS

**Table 1.** Scoring matrix identifying the most severe demographic issues affecting *Quercus austrina*. Cells are highlighted when the species meets the respective vulnerability threshold for each demographic indicator. Average vulnerability score is calculated using only those demographic indicators with sufficient data (i.e., excluding unknown indicators).

Demographic indicators	Level of vulnerability						Score
	Emergency Score = 40	High Score = 20	Moderate Score = 10	Low Score = 5	None Score = 0	Unknown No score	
Population size	< 50	< 250	< 2,500	< 10,000	> 10,000	Unknown	-
Range/endemism	Extremely small range or 1 location	E00 < 100 km <sup>2</sup> or A00 < 10 km <sup>2</sup> or 2-4 locations	E00 < 5,000 km <sup>2</sup> or A00 < 500 km <sup>2</sup> or 5-9 locations	E00 < 20,000 km <sup>2</sup> or A00 < 2,000 km <sup>2</sup> or 10+ locations	E00 > 20,000 km <sup>2</sup> or A00 > 2,000 km <sup>2</sup>	Unknown	5
Population decline	Extreme	>= 80% decline	>= 50% decline	>= 30% decline	None	Unknown	5
Fragmentation	Severe fragmentation	Isolated populations	Somewhat isolated populations	Relatively connected populations	Connected populations	Unknown	20
Regeneration/recruitment	No regeneration or recruitment	Decline of >50% predicted in next generation	Insufficient to maintain current population size	Sufficient to maintain current population size	Sufficient to increase population size	Unknown	10
Genetic variation/integrity	Extremely low	Low	Medium	High	Very high	Unknown	10
Average vulnerability score							10.0
Rank relative to all U.S. oak species of concern (out of 19)							9

## THREATS TO WILD POPULATIONS

### High Impact Threats

**Genetic material loss — inbreeding and/or introgression:** Hybridization is a likely threat, as hybrid swarms are reported surrounding almost all Bluff oak populations. The extent of isolated occurrences also causes concerns of introgression or the complete loss of genotypes as unique pockets disappear (R. Lance pers. comm., 2016).

### Moderate Impact Threats

**Human use of landscape — agriculture, silviculture, ranching, and/or grazing:** On private lands across the floodplains and forests of the Southeast, the vast majority of natural landscape has been severely altered either for agriculture or timber harvesting.<sup>8</sup>

**Human use of landscape — residential/commercial development, mining, and/or roads:** Oil exploration and other land disturbances have been documented as causing stress to *Q. austrina* on private land.<sup>8</sup>

**Human modification of natural systems — disturbance regime modification, pollution, and/or eradication:** A majority of the previously-farmed land in Bluff oak's range has been abandoned due to poorly drained soils, and has subsequently succumb to shrubs and woody vines that crowd out *Q. austrina*.<sup>8</sup>

### Low Impact Threats

**Human use of landscape — tourism and/or recreation:** Within state parks, *Q. austrina* undergoes stress from maintenance and recreational disturbances, which decrease the tree's ability to successfully reproduce. Because some individuals decline visually in response to these disturbances, the chance of removal within frequently-visited parks increases due to aesthetic concerns (R. Lance pers. comm., 2016).

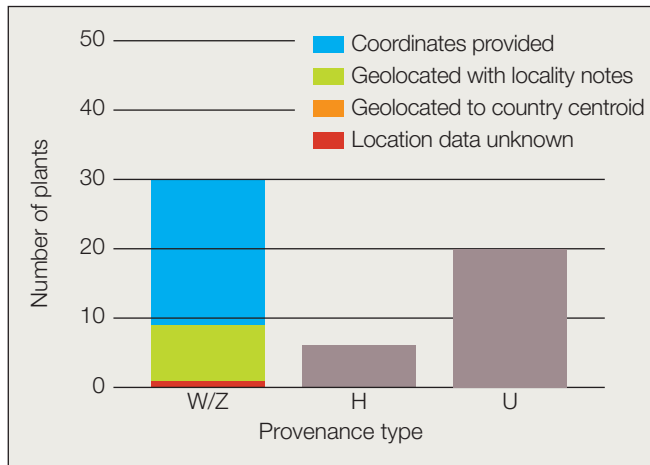
**Climate change — habitat shifting, drought, temperature extremes, and/or flooding:** Dry-season fires are a rising concern as they increase in the southeastern U.S. In 2016 the National Significant Wildland Fire Potential Outlook predicted "to see a large area of above normal significant fire potential for November and December." Severe droughts as well as stronger winds have been persisting in fall and winter across the region in response to climate change.<sup>9</sup>

## CONSERVATION ACTIVITIES

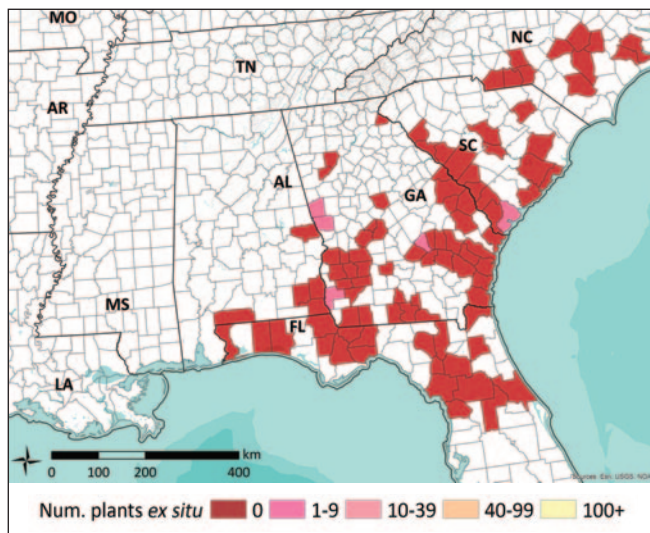
In 2017 *Quercus* accessions data were requested from *ex situ* collections. A total of 162 institutions from 26 countries submitted data for native U.S. oaks (Figures 3 and 4). Past, present, and planned conservation activities for U.S. oak species of concern were also examined through literature review, expert consultation, and conduction of a questionnaire. Questionnaire respondents totaled 328 individuals from 252 organizations, including 78 institutions reporting on species of concern (Figure 6).

### Results of 2017 *ex situ* survey

Number of <i>ex situ</i> collections reporting this species:	16
Number of plants in <i>ex situ</i> collections:	47
Average number of plants per institution:	3
Percent of <i>ex situ</i> plants of wild origin:	64%
Percent of wild origin plants with known locality:	97%



**Figure 3.** Number and origin of *Quercus austrina* plants in *ex situ* collections. Provenance types: W = wild; Z = indirect wild; H = horticultural; U = unknown.

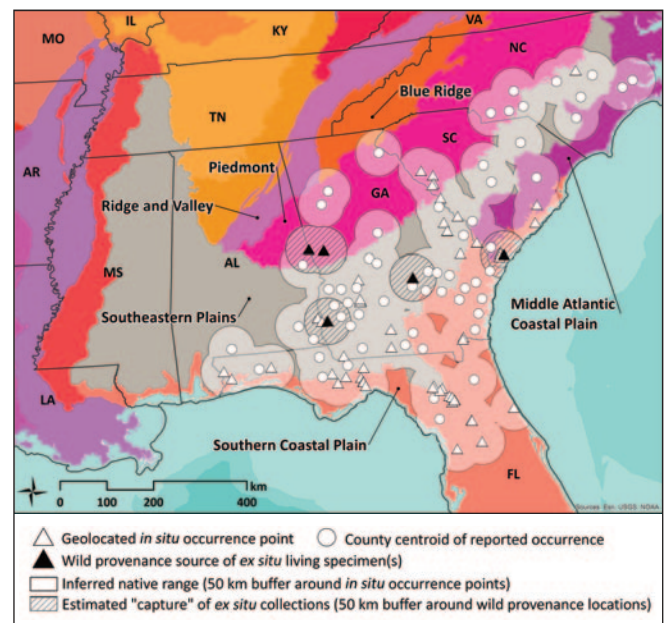


**Figure 4.** *Quercus austrina* counties of *in situ* occurrence, reflecting the number of plants from each county in *ex situ* collections.

A spatial analysis was conducted to estimate the geographic and ecological coverage of *ex situ* collections (Figure 5). Fifty-kilometer buffers were placed around each *in situ* occurrence point and the source locality of each plant living in *ex situ* collections. Collectively, the *in situ* buffer area serves as the inferred native range of the species, or “combined area *in situ*” (CAI50). The *ex situ* buffer area represents the native range “captured” in *ex situ* collections, or “combined area *ex situ*” (CAE50). Geographic coverage of *ex situ* collections was estimated by dividing CAI50 by CAE50. Ecological coverage was estimated by dividing the number of EPA Level IV Ecoregions present in CAE50 by the number of ecoregions in CAI50.

### Estimated *ex situ* representation

Geographic coverage:	10%
Ecological coverage:	36%

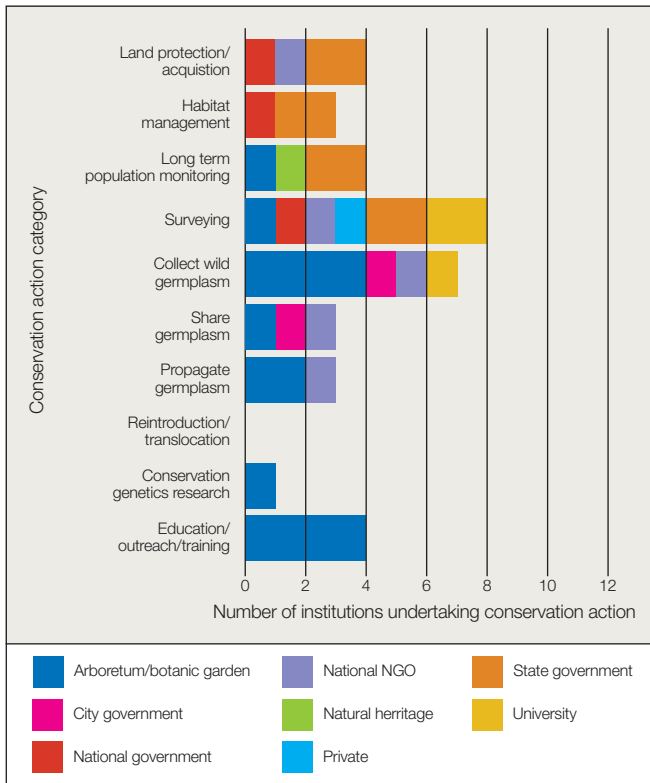


**Figure 5.** *Quercus austrina* *in situ* occurrence points and *ex situ* collection source localities. U.S. EPA Level III Ecoregions are colored and labeled.<sup>10</sup> County centroid is shown if no precise locality data exist for that county of occurrence. Email [treeconservation@mortonarb.org](mailto:treeconservation@mortonarb.org) for more information regarding specific coordinates.



Shirley Denton





**Figure 6.** Number of institutions reporting conservation activities for *Quercus austrina* grouped by organization type. Seventeen of 252 institutions reported activities focused on *Q. austrina* (see Appendix D for a list of all responding institutions).

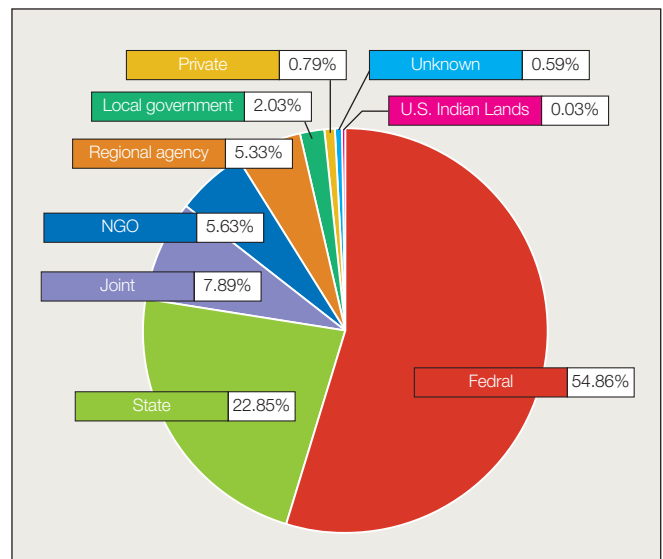
**Land protection:** Within the inferred native range of *Q. austrina*, 13% of the land is covered by protected areas (Figure 7). Although the vast majority of *Q. austrina* occurrences are on private land where management and future use are uncertain, there are a few well-protected populations within high quality habitat. However, these areas do not capture the wide variety of ecological adaptations present within the species large but fragmented range.

Altamaha Grit outcrops of Georgia, also called sandstone outcrops, house *Q. austrina* and boast a few conservation lands with high-quality examples; these include Flat Tub Wildlife Management Area and Broxton Rocks, which is a private preserve.<sup>11</sup> Other protected areas in Georgia containing *Q. austrina* include George L. Smith State Park (87 hectares), Charles Harrold Nature Preserve (28 hectares), and Fort Stewart Military Base (162 hectares).<sup>12</sup>

**Sustainable management of land:** The neighborhood of SouthWood, Florida, keeps all native, mature trees and works to maintain them, including *Q. austrina*.<sup>13</sup> George L. Smith State Park is managed by the Georgia Department of Natural Resources, and consists of sandhill habitat that undergoes prescribed fires. Charles Harrold Nature Preserve is a sandhill and wetland depression ecosystem, managed by The Nature Conservancy, and was not fire managed until recently. Fort Stewart Military Base undergoes prescribed burns directed by the U.S. Army.<sup>12</sup>



Ron Lance



**Figure 7.** Management type of protected areas within the inferred native range of *Quercus austrina*. Protected areas data from the U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).<sup>7</sup>



**Population monitoring and/or occurrence surveys:** A few Bluff oak experts have sought the species while carrying out other botanical exploration and land management responsibilities, but no formal occurrence surveys or monitoring programs are currently known (R. Lance pers. comm., 2018).

**Wild collecting and/or *ex situ* curation:** Seven institutions reported this activity in the conservation action questionnaire, but no other details are currently known.

**Propagation and/or breeding programs:** The Florida Native Plant Society Citrus County Chapter sold *Q. austrina* at their annual plant sale in 2017.<sup>14</sup> The Florida Association of Native Nurseries' Urban Forestry Services of Alachua County also offers *Q. austrina*.<sup>15</sup> Coastal Wildscapes and Georgia Native Plant Society have published a brochure informing landscaping with native plants in coastal Georgia, which includes a ranking of plants based on their availability in nurseries; Bluff oak is ranked as least available compared to other natives.<sup>16</sup>

**Reintroduction, reinforcement, and/or translocation:** No known initiatives at the time of publication.

**Research:** One institution reported conservation genetics research in the conservation action questionnaire, but no other details are currently known.

**Education, outreach, and/or training:** Four institutions reported this activity in the conservation action questionnaire, but no other details are currently known.

**Species protection policies:** No known initiatives at the time of publication.

## PRIORITY CONSERVATION ACTIONS

The sporadic distribution of Bluff oak suggests a need for increased conservation attention in the protected areas where small numbers of individuals are known. Where mature specimens of this oak occur, land management should be geared toward recruitment of seedlings. The hazard of damage to mature specimens or their habitat is most significant where there are very few plants extant, therefore a need exists for education of managerial staff. Mechanisms for the protection of valuable populations on private land, such as conservation easements, should also be considered. Additionally, there is a void in the understanding of how local genotypes may differ across the fragmented range of the species. Barring extensive analytical work of the genetic variation, an increased *ex situ* representation of known populations is recommended.

The taxonomic integrity of this species has been variously treated in the past. Morphological similarity and possible genetic relationship to *Q. sinuata* is one issue that needs elucidation, particularly in the western half of Bluff oak's range (Alabama, Mississippi, Arkansas). The slight differences in leaf morphology that appear among plants in the eastern portions of its range suggest there may be distinct genotypes and/or genetic mixing with other *Quercus* species in local populations. It is likely that *Q. austrina* is often confused with leaf mimics that occur from hybrid events involving other oak taxa, most notably *Q. alba*, *Q. margarettae*, *Q. similis*, *Q. sinuata*, and *Q. stellata*. Plants that are intermediate between typical *Q. austrina* and other taxa are usually made apparent by differences in early season vestiture. An intensive herbarium study and genetic research could aid in resolving residual taxonomic questions, range confirmations, and perhaps address genetic origin. Subsequent field work and field surveys of the variation would be an aid to both *in situ* and *ex situ* conservation efforts.

### Conservation recommendations for *Quercus austrina*

#### Highest Priority

- Population monitoring and/or occurrence surveys
- Sustainable management of land
- Wild collecting and/or *ex situ* curation
- Research (demographic studies/ecological niche modeling; land management/disturbance regime needs; population genetics; taxonomy/phylogenetics)

#### Recommended

- Land protection
- Education, outreach, and/or training



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