



Which Live Oak Is It?

A Botanical Update for Gulf Islands National Seashore

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A large live oak tree from Gulf Islands National Seashore with a circumference of 11.9 feet (diameter at breast height [DBH] of 1.15 meters). Image Credit NPS/GULN

Summary and Objectives

This Special Topic Brief provides an overview and some key updates to our understanding of how live oaks (*Quercus virginiana*) fit into the cultural and ecological landscapes of Gulf Islands National Seashore. Here, the focus is on the Naval Live Oaks Area in Gulf Breeze, Florida, but other portions of the National Seashore's Florida District are discussed as well. The goals of this brief are threefold: (1) to explain the relevance of live oaks to the National Seashore; (2) to review key features that distinguish 'Virginia' live oak from a close and occasionally co-occurring sister species, sand live oak (*Quercus geminata*); and (3) to explain how previous authors have either over- or under-emphasized the spatial extent of the large-statured members of these species in the Naval Live Oaks Area. In doing so, we can correct misconceptions, improve scientific accuracy, and enrich the park's already deep understanding of its natural and cultural resources. Given the historical significance of the Naval Live Oaks Area and its ties to U.S. naval shipbuilding ambitions in the early- to mid-1800s, the distinguishing features of the park's live oak species deserve special and accurate recognition.

Introduction to Live Oaks and the National Seashore

The live oak (*Quercus virginiana*) is an emblematic tree throughout coastal regions of the southeastern U.S., with its massive, arching branches and layers of Spanish moss, resurrection ferns or lichens. The species is found in all states with coastlines from Texas to North Carolina, with natural populations starting at the coast and extending inland up to 200 miles. Throughout this large geographic region, locals take pride in directing visitors to their resident oak giants, such as the champion ‘seven sisters’ live oak tree in Mandeville, Louisiana, which in 2019 had a multi-stem trunk circumference of 41.3 feet. Using the standard terminology used by forestry professionals, this equates to a 4-meter diameter at breast height (DBH).

National Park Service properties in the southeastern U.S. are home to many exceptional live oak trees. For example, in the Big Woods unit of Jean Lafitte National Park and Preserve, Louisiana, several of the towering live oak trees have a DBH of over 2 meters. At least one of the large live oaks at Cumberland Island National Seashore, Georgia, also reaches the >2-meter DBH size class. In Florida's Gulf Islands National Seashore, the park's live oak recognition is not so much for tree size, but tree history. Specifically, the focus is on how the species was once considered critical to our nation's defense strategy, as its high-quality wood produced superior naval ships. The famous USS Constitution, also known as ‘Old Ironsides’ from the War of 1812, is an impressive example combining a white oak outer hull with a live oak structural framework (Snell 1983).

The park's historical relationship with live oak trees is centered on the Naval Live Oaks Area in Gulf Breeze, Florida, and specifically along the Brackenridge Trail (Figure 1). This shady, forested path passes through the site of the nation's first government-owned oak plantation, then called the Deer Point Plantation. The plantation was established in 1828 under the management of Judge Henry Brackenridge, with the goal of increasing the Navy's cache of suitable live oaks for future shipbuilding. There was a 200-acre field for growing trees from acorns, as well as several hundred mature live oak trees already present on surrounding undeveloped lands (Snell 1983). The plantation operated for about 30 years, but there was limited opportunity to contribute to the nation's warship supply, as the Navy transitioned away from wooden ships after the Civil War. The federal government retained the property until the 1940s,



Figure 1. The Brackenridge Trail of the Naval Live Oaks Area of Gulf Islands National Seashore. Image Credit NPS/GULN

after which it was transferred to the state of Florida and partially leased as Boy and Girl Scout camps.

The National Park Service acquired the Naval Live Oaks Area as part of Gulf Islands National Seashore in 1971. Although most of the property was never inhabited or developed, there is evidence of past timber harvest of oak and pine, turpentine of pine, cattle grazing, and other human-caused disturbances (Ruth 2003). Hurricanes, fires, and periods of fire suppression have also changed the park's vegetation over the past 200+ years. In such a dynamic setting, it should be assumed that oak populations and distributions have changed as well, even as the dominant plant communities have likely stayed the same. Today, large-statured live oaks are found in just a few sections of the Naval Live Oaks Area including along the Brackenridge Trail; yet each place where they occur offers unique clues into the park's ecological and cultural history.

Large live oaks are not restricted to the Naval Live Oaks Area; they are also present in other areas of the park's Florida and Mississippi Districts. Most notably, several of the historic military structures in the Fort Pickens Area and on Perdido Key are surrounded by large live oak trees (e.g., Figure 2). These trees were apparently planted in 1941 to provide camouflage for the military installations when they were still relatively new (Looney et al. 1993). In several cases, the planted trees are now quite large, with DBH values of up to 1.15 meters (see cover photo). This is an impressive size for a barrier-island tree less than 100 years old.

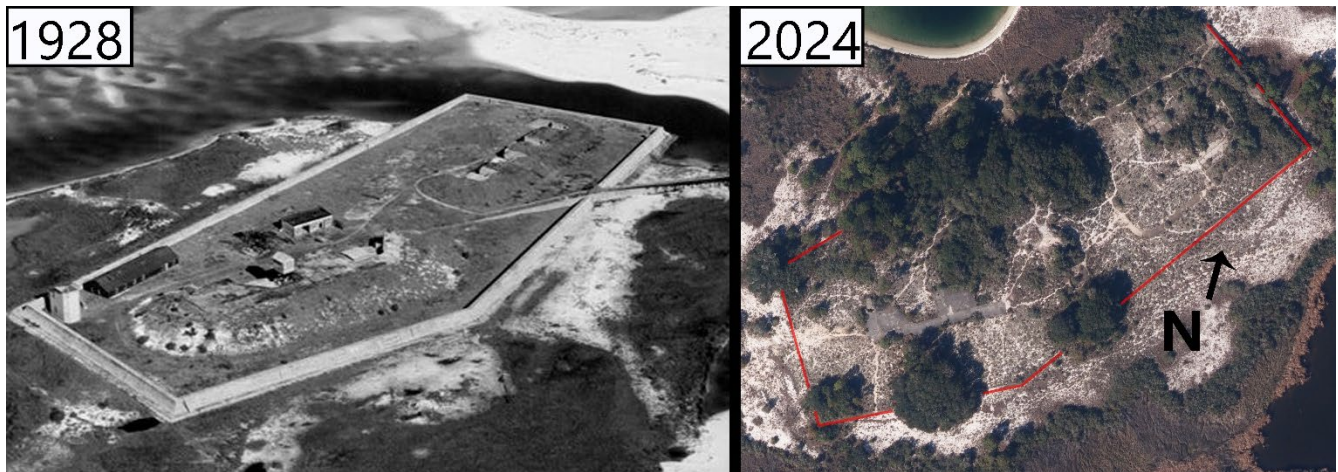


Figure 2. Imagery of the historic military district on the eastern tip of Perdido Key and its surrounding seawall in 1928 and 2024. In the 2024 image, portions of the seawall are obscured by oaks but are otherwise outlined in red to facilitate image comparisons. A north arrow was also added. Image credits: 1928, National Archives and Records Administration; 2024, Florida DOT imagery, Escambia County.

Based on these and other plantings around the park, live oak trees were clearly of great value to early land managers for their shade, cover and wood, but these were not their only benefits. Since long before European settlement, the area's live oaks have provided habitat for diverse wildlife and, most likely, sheltered some of the seashore's early human inhabitants as well.

With their many benefits to park ecology, visitor experience and cultural history, there is no question that Gulf Islands National Seashore treasures its live oaks. But how well do we actually *know* these oaks, which in some places include not just one but two species: live oak (*Quercus virginiana*) and sand live oak (*Quercus geminata*)? Sand live oak is generally classified as a scrub oak, with many slender stems and a short (<5 meter) growth form. It is most often found on relic dunes or in sandy shrublands with sand pine (*Pinus clausa*) and other scrub oaks. Yet when sand live oak trees grow on more fertile soils, they can become quite large, making them hard to distinguish from regular 'Virginia' live oaks. This physical overlap presents a challenge for accurate identification by today's botanists, and most likely was difficult for early land managers as well.

Although sand live oaks and Virginia live oaks can look very similar as large trees, they have many physical and ecological differences. Each tends to be found in very different plant communities and on different soils (Cavender-Bares and Pahlich 2009), although they do occasionally co-occur. They also differ in phenology (i.e., timing of flowering and leaf replacement), have distinct qualities of their leaves and wood, and are likely preferred differently by some insects and animals.

This Special Topic Brief by the Gulf Coast Inventory and Monitoring (I&M) Network dives deep into the natural and cultural history of live oaks at Gulf Islands National Seashore. The goal is to help visitors and professionals better understand the characteristics and habitats of the two live oak species that occur there. It also aims to correct previous misinformation about how widely each species is distributed in the park and where they can be found today. This information will help strengthen scientific accuracy in future park communications, whether for technical or interpretive materials. Sorting out these differences can also help clarify the interplay between these focal species and the past human inhabitants of the park, from Native Americans to oak plantation operators to military personnel.

Identifying Sand Live and Virginia Live Oak

The two live oak species at Gulf Islands National Seashore are closely related; they were once classified as members of the same species with different subspecies designations. They have nevertheless been recognized as full and separate species for many decades, including by prominent regional ecologist Dr. Andre Clewell in his 1986 overview of the vegetation in the Florida panhandle (Clewell 1986). In 2004, Dr. Jeanne Cavender-Bares studied the morphological (physical structure) and genetic differences between the two species, collecting detailed data in 10 co-occurring populations throughout peninsular Florida (Cavender-Bares and Pahlich 2009). Her study built on previous taxonomic work (e.g., Kurz and Godfrey 1962; Nixon and Mueller 1997) to provide a solid

basis for distinguishing these species in the field today. Key features include:

- Differences in the timing of flowering and leaf replacement (phenology). Virginia live oak trees shed last year's leaves, produce male and female flowers, and regrow fresh leaves over a ~2-week period in March or April, and this occurs roughly 2-3 weeks ahead of the same process in sand live oak trees (Figure 3A).
- Leaf size and leaf margins (Figure 3B). Virginia live oak leaves are relatively flat and broad, whereas sand live oak leaves are smaller with edges that are strongly inrolled, curling towards the bottom of the leaf. In this way, the leaf resembles an upside-down canoe. Shade leaves of sand live oak can sometimes be large and flat, however, in which case this trait is unreliable.
- Leaf venation (Figure 3B). Veins are deeply indented on the upper surfaces of sand live oak leaves, whereas Virginia live oak leaves have fairly smooth upper surfaces with only slight indentations at veins.
- Hairiness of leaf-undersides (Figure 3B). The lower surfaces of sand live oak leaves are covered in dense, short hairs that create a thick layer masking the actual leaf underside. The lower surfaces of Virginia live oak may appear hairless or have sparse hairs.
- Growth form, size, and habitat (Figure 4A-G). Virginia live oaks generally grow faster and larger in their natural environments, which are most often moister with richer soils (Figure 4A-B). Even so, Virginia live oaks are found quite

close to the shoreline in some parts of the Naval Live Oaks Area (Figure 4C). Sand live oaks, in contrast, are typically smaller, slower growing, and found on drier, sandier soils with lower nutrients (Figure 4D-F). On relic dunes, these trees can grow into large, low-growing 'mottes' that are shaped by salt spray and prevailing winds (Figure 4E). In scrubland areas that have been burned, sand live oak individuals resprout with multiple stems from belowground root systems and often remain short (<5 meters tall; Figure 4D). In higher-quality sites that are protected from fire, however, they can grow into tall, single-stemmed trees (Figure 4G). These are the individuals that are often misidentified as Virginia live oaks. In fact, many of the large live oaks along the Brackenridge trail are sand live oaks, including the largest individual of this species recorded in the Florida District (1.2 meters DBH). For comparison, the largest Virginia live oak recorded in the District was only slightly larger, at 1.4 m DBH. It is uncertain as to whether the large sand live oaks currently growing along the Brackenridge trail were planted or occurred there naturally.

In April 2026, a crew from the Gulf Coast I&M Network visited the park's Florida District to better understand the traits and distribution of live oaks in the park. They made many observations of both species, which were in different phenological stages at the time. Sand live oak was in the process of shedding its leaves and flowering, whereas Virginia live oak had completed that stage and had already replaced its leaves with fresher, bright green ones. This timing helped accentuate the differences between species, aiding in positive identification.

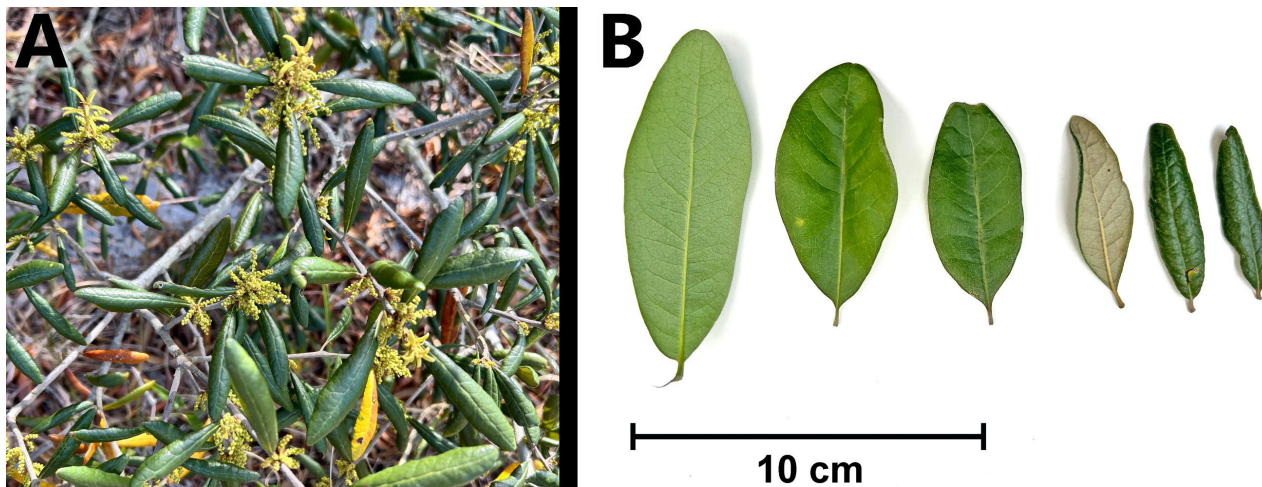


Figure 3. Leaf and floral features of live oaks. (A) Male reproductive parts, called catkins, on sand live oak. In mid-April 2026, catkins were apparent on many sand live oaks, but they had already dried and fallen off of Virginia live oaks. (B) Leaf size, texture, and hairiness comparisons of Virginia live oak (three leaves to the left) and sand live oak (three leaves to the right).

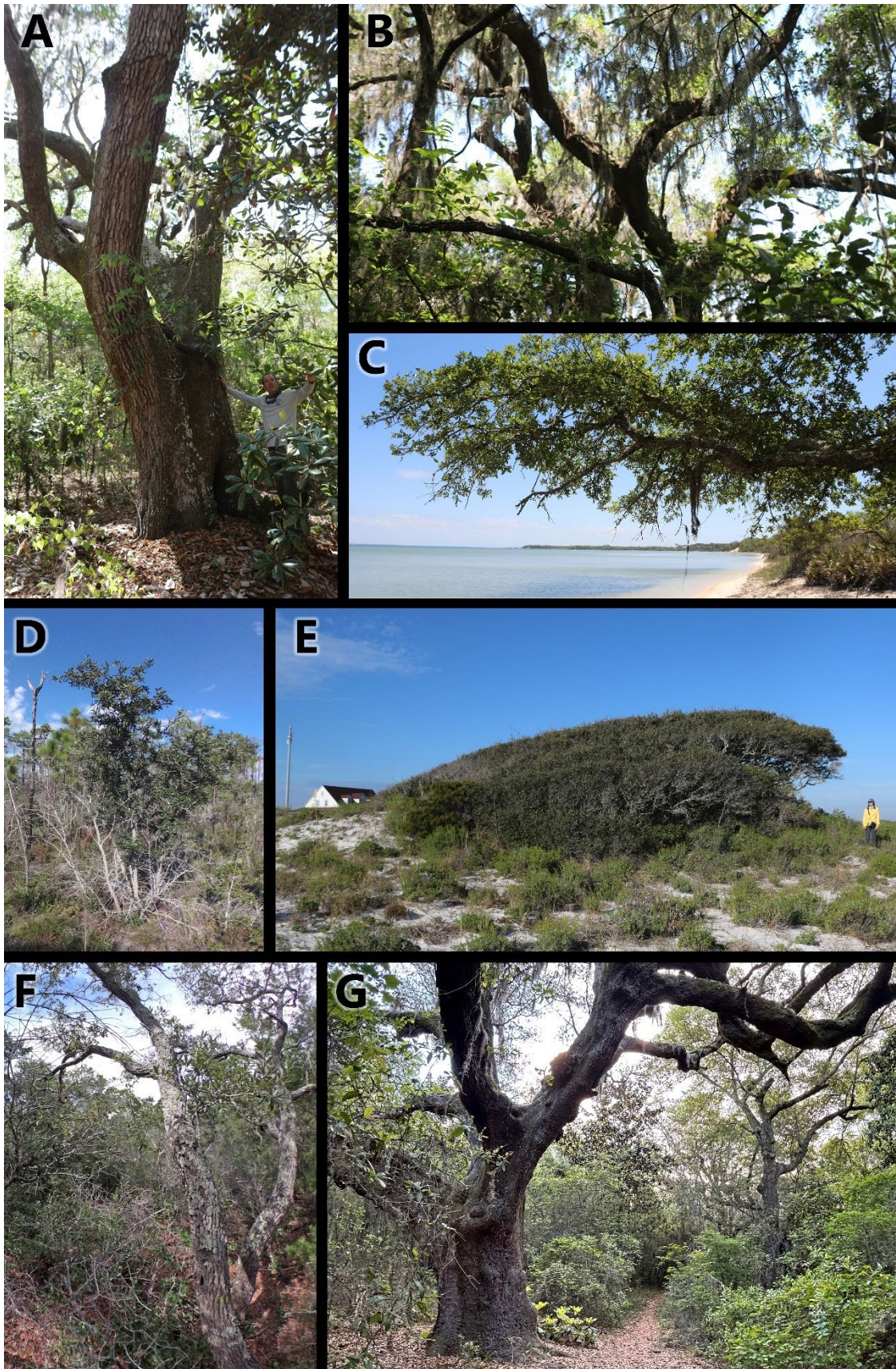


Figure 4. Growth form and habitats of live oaks at Gulf Islands National Seashore, Florida. A-C are Virginia live oak, and D-G are sand live oak. Image credits: NPS/GULN

During the April 2026 visit, I&M crew members also made note of the general distribution of each live oak species in the park. Many of the trees in visitor-focused areas appeared to have been planted for landscaping, shade or shelter. These included clusters of sand live oak trees around the historic houses near Fort Pickens, in the Fort Pickens campground, and in the picnic area at Battery Worth. Some of these trees were apparently planted during the Fort's Florida State Park era in the 1950s, prior to NPS ownership in 1971 (e.g., Figure 5).

Some of the most striking live oak plantings in the park were on the historical military batteries and associated structures. These oaks were planted as camouflage in the 1940s (Looney et al. 1993), including sand live oak, Virginia live oak, and sand laurel oak (*Quercus hemisphaerica*). The most prominent oak-cloaked batteries were Battery 233 within the seawall on Perdido Key (seawall built in 1910, battery built in 1943; Figure 3, Figure 6A), Battery 234 near Fort Pickens (built in 1943), and Battery Langdon near Fort Pickens (built in 1923; Figure 6B). By 2026, these trees were very large and out-of-context with the surrounding natural environments.

Naval Live Oak Literature: What Did We Get Wrong and What Did We Get Right?

Historical Documents Have Over-Emphasized the Potential for Large Live Oaks Throughout the Area

Early documents on the history of Deer Point Plantation can give the impression that there were once extensive tracts of forests containing large-statured live oaks, whether Virginia live oak or sand live oak. For example, Brackenridge himself described the 1338-acre Deer Point Plantation and its surroundings as follows: "This point where I

reside may contain about 4,000 acres, and, until we reach the open grassy woods of long leaf pine, the whole or nearly the whole is already thickly set with live oaks of every size, and will require no planting, but they are intermixed with short leafed or old field pine, with a variety of shrubs and water oaks, rendering the whole an impassable jungle." He followed this with "there may be found about 400 full grown trees fit for any purpose of ship building, and about 4,000 thrifty young trees from four to 12 inches in diameter, which, with proper care, may be fit for use in 10 or 15 years." (from Snell 1983, page 50).

While recognizing that Brackenridge's description is geographically vague, it is unlikely that large-statured (or future large-statured) live oaks would have occurred throughout most of the area he described. The soil types underlying most of the Naval Live Oaks Area would be unsuitable for growing sizable trees of either species. Although the vegetated landscapes have undoubtedly changed over the past 200 years, the underlying soils are relatively static, preventing transitions between strongly-contrasting communities like dry scrublands and moister forests.

The potential shortcomings in Brackenridge's perspective did not go unnoticed at the time. In an inspection report from Commodore John Rogers of the U.S. Navy Commission, a more ecologically-based interpretation of the plantation property was offered: "On the tract purchased of Judge Brackenridge, [...] one-fourth of the whole may be considered what is commonly denominated hammock land, --the soil from 12 to 18 inches deep, consisting of decomposed vegetable substances and oyster-shells, intermixed with the fine white sand, forming by nature so large a portion of the soil of Florida, particularly that part bordering on the Gulf of Mexico. On one part of these hammocks, one

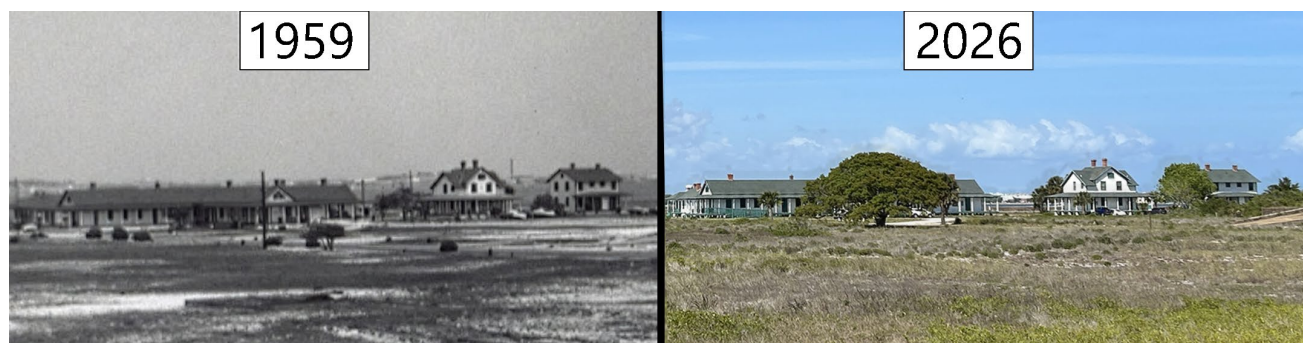


Figure 5. Photos of the historical buildings near Fort Pickens in 1959 and 2026. The small, planted sand live oaks seen in the 1959 image are approaching the height of the 2-story buildings by 2026. The DBH of the larger tree in the foreground of the 2026 photo was approximately 50 cm when the photo was taken. Image credits: 1959 image: photographer unknown; 2026 image: NPS/GULN.

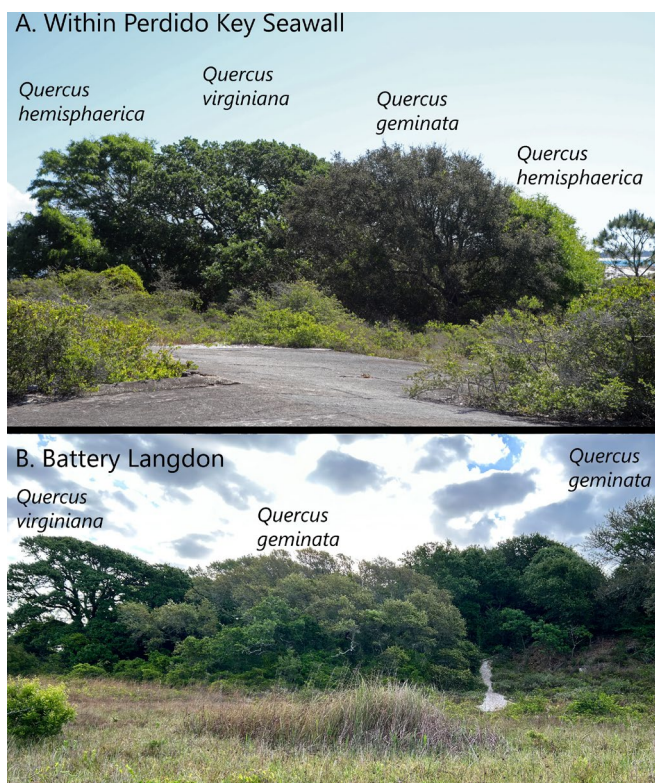


Figure 6. Views of two oak-covered military structures at Gulf Islands National Seashore, Florida. Field-identified trees are labeled accordingly in the photos. (A) View facing the seawall on Perdido Key, near Battery 233, and (B) view of Battery Langdon from the west. Battery Langdon is the tallest (man-made) point on the western end of Santa Rosa Island.

hundred or more live oak trees of large growth are to be seen, and on others, large stumps of the same tree are found; thus furnishing, if not conclusive, strong presumptive evidence that a soil that had once given growth to such timber, might, with care and proper management, be made to produce it again..." (from Snell 1983, page 182-183).

Based on the recent Vegetation Community Mapping project (Ley et al. 2023), less than 20% of the Naval Live Oaks Area is, in fact, forested. The remaining 80% is populated by longleaf or slash pine flatwoods (18%), oak or sand pine scrub (53%), and wetlands (3%). While Virginia live oak does not occur in these non-forest communities, sand live oak often does. It is a dominant member of the oak scrub and sand pine scrub communities, typically in its multi-stemmed, shrublike form or as a small tree. In these settings, sand live oaks would not be expected to grow to ship-building sizes. Growth would be limited by soil characteristics as well as by occasional fires. Under natural conditions, most non-forested habitats within the Naval Live Oaks Area would be expected to burn every 1-3 years or 20-80 years, with the frequency varying by community.

Within the 20% of Naval Live Oak Area that is forested, there are two main forest types, xeric (dry-land) hammocks and maritime hammocks. Xeric hammocks, which are more widespread in the area, are dominated by sand live oak, other scrub oak species, saw palmetto (*Serenoa repens*), and sand pine. This community is often presumed to exist due to prolonged fire suppression in what would otherwise be sand pine scrub, a non-forest community that requires fire every ~20-80 years to promote sand pine regeneration and prevent sand live oak overgrowth (Florida Natural Areas Inventory 2010). At Naval Live Oaks Area, xeric hammocks intergrade with sand pine scrublands that are fire-suppressed to varying degrees; whether classified as xeric hammock or scrub, however, soils are sandy, well drained, and found at relatively high elevations.

Maritime hammocks, in contrast, are found on richer soils with more organic material that are naturally protected from fires. Within the Naval Live Oaks Area, these sites are generally restricted to the near-shore flats and bluffs on the area's northern and southern coastlines. Maritime hammock is the only natural community that would support large Virginia live oaks (or large sand live oaks), such as can be seen along the Brackenridge trail. These forests also contain diamond oak (*Quercus laurifolia*), sand laurel oak (*Quercus hemisphaerica*; likely Brackenridge's 'water oak'), pignut hickory (*Carya glabra*), eastern red cedar (*Juniperus virginiana* var. *silicicola*), red buckeye (*Aesculus pavia*), mulberry (*Morus* sp.), and cabbage palmetto (*Sabal palmetto*). The understory is home to several calciphilic (calcium-loving) plant species that are characteristic of maritime hammocks and shell middens throughout the Gulf and Southern Atlantic Coasts (Clewett 1986; Florida Natural Areas Inventory 2010). These features make the park's maritime hammocks distinctive and easy to recognize in the field, but with their ties to specialized soils, they have likely always been rare on the landscape.

The Vascular Plant Inventory Overlooked the Maritime Forest and its Virginia Live Oaks

The park's vascular plant inventory was conducted from 2005 to 2007 by a team of botanists from Louisiana State University (LSU; Urbatsch et al. 2009). Their work produced a list of 968 taxa, which they split into individual lists for most units in the park's Florida and Mississippi Districts. The only units that were not covered in the inventory were Perdido Key and Cat Island. Over 2,600 specimens were accessioned in the LSU herbarium and are currently available online through the Southeastern Regional

Network of Expertise and Collections (SERNEC) portal. Both Virginia live oak and sand live oak were listed as present by Urbatsch et al. (2009), but only in certain units. For the Florida units specifically, they considered any reports of Virginia live oak to be false or a misidentification of sand live oak.

Following the first round of vegetation monitoring by I&M staff in 2024, it became clear that a few key sections of the Naval Live Oaks Area were missed during the 2005-2007 surveys, leading to two erroneous conclusions by Urbatsch et al. (2009). First, they stated that there was no maritime hammock in the Naval Live Oaks Area, and second, they stated that there were no naturally-occurring Virginia live oaks there. Relatedly, they recognized no naturally-occurring cabbage palmetto, and they missed detection of several of the understory species strongly associated with maritime hammock and shell middens. Given the historical importance of Virginia live oaks to the Naval Live Oaks Area and the species' local dependence on maritime hammock, these conclusions appeared illogical. To support a revised perspective, I&M staff went about searching for further evidence.

Herbarium specimens collected from the Naval Live Oaks Area between 1978 and 2000 provided more clues that corrections to Urbatsch et al. (2009) were in order. James Burkhalter, who is curator of the herbarium at the University of West Florida, visited the area repeatedly over several decades beginning in 1978, and he collected and accessioned several species strongly associated with maritime hammocks and the calcium-rich soils of shell middens. Burkhalter's accession records, which included Virginia live oak, were found online using the SERNEC portal. The I&M crew visited some of his sampling locations in April 2026 and confirmed that many of the same species were still present. They also confirmed that maritime hammock occurred in patches along the northern and southern shorelines as described above (Figure 4A-C). These same areas were also briefly mentioned in Clewell (1986), based on personal communication with archeologist Louis Tesar, as well as in Tesar (1973).

One additional line of support for maritime hammocks at Naval Live Oaks Area came from the park's Vegetation Community Mapping project (Ley et al. 2023). From 2016-2018, field crews recorded the dominant plant species and classified the vegetation type in 152 plots in the Naval Live Oaks Area. They classified four of these plots as maritime hammock, under the US National Vegetation Classification System name of *Quercus virginiana*-

(*Pinus elliottii*, *Sabal palmetto*) / *Persea borbonia* - *Callicarpa americana* Forest. The I&M visits revealed elements of an additional association that once may have been more prominent: *Juniperus virginiana* var. *silicicola* - *Zanthoxylum clava-herculis*- *Quercus virginiana* - (*Sabal palmetto*) / *Sageretia minutiflora* Woodland. Collectively, these observations show, again, that Virginia live oaks and maritime hammocks are indeed present in the park, but only within a few small areas.

The Truth Lies Somewhere in the Middle

A review of the literature has revealed two foundational but opposing perspectives on live oaks in the Naval Live Oaks Area, and both appear to be misleading. The proper characterization is more nuanced, with large-statured (presumably Virginia) live oaks occurring in a much smaller portion of the park than was portrayed in early cultural resource reports (e.g., Snell 1983) but being found in a much larger portion than what was suggested by the botanical inventory team (Urbatsch et al. 2009). The full extent of Virginia live oak within the park remains unclear, as does the frequency with which it co-occurs with sand live oak in natural areas or in plantings. Our understanding of species distribution and overlap will be expanded as visitors and professionals gain skills and confidence in differentiation of the two species.

Ecologically-based corrections like the ones described here are only possible due to a strong foundation of serious scholarship and investigation that came before. The early research on the antebellum history of the Naval Live Oaks Area is deep and extensive, and it has allowed the park to create thoughtful interpretive materials about the use of live oaks in naval shipbuilding. The findings reported here provide a fuller ecological context to this interpretation but leave the main story unchanged. Similarly, the park's vascular plant inventory was a massive scientific undertaking that produced many new botanical discoveries for the park. Having missed a single community within a small area of the park takes away nothing from the quality of their other findings and their top-notch species identifications.

Rather than detracting from earlier work, this Special Topic Brief builds on it—reducing logical inconsistencies and enriching the park's already comprehensive understanding of its resources. In the accumulation and refinement of our knowledge

base, we can better protect and interpret this treasured resource for the American public.

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