# *Torreya taxifolia*
# (Florida torreya)

## 5-Year Review:
## Summary and Evaluation

*Torreya taxifolia (Liberty County, Florida) and reproductive female (top, 2018) and male (bottom, 2021) cones. Photos by Atlanta Botanical Garden, US FWS, Florida Native Plant Society.*

**U.S. Fish and Wildlife Service**
**Southeast Region**
**Florida Ecological Services Field Office**
**Panama City, Florida**

**March 2026**

# 5-YEAR REVIEW
# *Torreya taxifolia* (Florida Torreya)

## GENERAL INFORMATION

**Current Classification:** *Endangered*

**Lead Field Office:** Florida Ecological Services Field Office, Panama City Field Office

**Review Author:** Dr. Vivian Negrón-Ortiz

**Reviewers:**
**Lead Regional Office:** Southeast Region, Carrie Straight.
**FL Ecological Services Field Office**: Nikki Colangelo

**Date of original listing:** February 22, 1984 (49 FR 2783; January 23, 1984)

**Methodology used to complete the review:** In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants (50 CFR 424.11). The U.S. Fish and Wildlife Service (Service) evaluated the best available information about the *Torreya taxifolia* (Florida Torreya) biology, habitat, and threats to inform this status review.

We announced the initiation of this review in the Federal Register on June 6, 2024 (89 FR 48437) with a 60-day comment period and received several peer-reviewed articles. We received one public comment during the 60-day open comment period. In conducting this 5-year review, we relied on the best available information pertaining to historical and contemporary distributions, life histories, genetics, habitats, and threats of this species. We used a variety of information resources, including the Recovery Plan of September 1986, unpublished field survey results, reports of current research projects, peer-reviewed scientific publications, unpublished field observations by Service, State and other experienced biologists, and personal communications. The completed draft review was sent to the Atlanta Botanical Garden; they provided edits, comments, and new information. All comments were evaluated and incorporated as appropriate. This review was completed by the U.S. Fish and Wildlife Service, Florida Ecological Services Field Office. All literature and documents used for this review are on file at the Field Office.

**FR Notice citation announcing the species is under active review:**
June 6, 2024 (89 FR 48437)

**Species' Recovery Priority Number at start of 5-year review (48 FR 43098): 5**

| Degree of threat | Recovery Potential | Taxonomy |
|---|---|---|
| High | Low | Species |

**Review History:** Previous 5-year reviews recommending no change in status were published in 2010 and 2020 (Service 2010, 2020). Additionally, a 5-year review for this species was noticed on November 6, l991 (56 FR 56882). In this review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors, threats, etc. as they pertained to the individual species. The notices summarily listed these species and stated that no changes in the designation of these species were warranted at that time. In particular, no changes were proposed for the status of the species in this review

*Petition for reclassification and 90-day findings*
The Service received a petition from Ms. Connie Barlow (Torreya Guardians) in 2019, requesting that the Florida torreya be downlisted from endangered to threatened because the species does not meet the definition of an ‘‘endangered species’’ under the Act. The 90-day findings determined that the petition did not provide substantial information indicating that the primary threats to the species have been reduced or eliminated and, therefore, reclassification of the Florida torreya was not warranted (86 FR 53937).

## REVIEW ANALYSIS

### Listed Entity

**Taxonomy and nomenclature**
*Torreya taxifolia* is an accepted species (Catalogue of Life https://www.catalogueoflife.org/data/taxon/7CJ69; Atlas of Florida Plants https://florida.plantatlas.usf.edu/plant/species/2330, Mo et al. 2023), and therefore, it is considered valid by the Service. For details, see reviews conducted by the Service in 2010 and 2020.

### Recovery Criteria

**Recovery Plan**

Recovery plans are not regulatory documents and intended to provide guidance to the Service, States, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. If the recovery criteria defined in the plan are still valid, meeting recovery criteria can indicate that the species no longer require protection under the Act. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act (84 FR 45020).

The Florida Torreya Recovery Plan (Service 1986) includes two recovery objectives: 1) production of a collection of sexually mature, healthy trees in cultivation representing the gene pool of the plants from the field; these plants serve as stock for possible reintroduction into the native habitat; and 2) maintain the integrity of the torreya’s native habitat. The Recovery Plan projected that downlisting (i.e., reclassification to threatened) could be considered when 5 populations with sexually mature offspring (viable or reproducing individuals) are established in secure portions of its native range. Delisting could be considered if 15 self-sustaining populations are established in separate ravine systems. An appropriate minimum population size and minimum land area for each population must be determined.

Based on the 1986 recovery plan, recovery and delisting could be considered if 15 self-sustaining populations are established in separate ravine systems The recovery criteria address listing factors A and C. Factors B and D, although relevant to this species, were not addressed.

This criterion is currently not met, as the four objectives listed in the recovery plan are ongoing. In summary,

1) Management is an ongoing action at The Nature Conservancy's Apalachicola Ravines and Bluffs Preserve (TNC); the Torreya State Park (TSP); the Army Corps of Engineers' (Corps) Lake Seminole, GA; and on a few private properties.
2) Propagation of the species has been conducted by several botanical gardens, including the Atlanta Botanical Garden (ABG) which has the most comprehensive collection of Torreya trees.
3) Several investigations have been undertaken, providing some understanding about pathogens, but determining how to control this species' decline is still ongoing.
4) Several outplanting efforts have been undertaken and are still ongoing. Seeds from ex situ collections are being used as experimental outplantings in Torreya native habitat (ABG 2024).

**Biology and Habitat Summary**

This species of the yew family (Taxaceae) is an endemic tree found in the slope forest that covers hammocks, steep, deeply shaded limestone slopes and wooded ravines along the eastern bank of the Apalachicola River in northern Florida (Gadsden and Liberty counties) and in Georgia (Decatur County) (Figure 1). The west side of the Apalachicola River in Jackson County was surveyed more than 20 years ago, and no live trees were found, although logs were located. Therefore, *Torreya taxifolia* is considered extirpated from Jackson County, and its current range has declined from four to only three counties (Figure 1). Based on GIS coverage, the range of the species is about 55,239 ha (Schwartz et al. 2000a; Figure 1). A recent genetic study indicates that *Torreya taxifolia* consists of a single interbreeding wild population (Eserman-Campbell (2022).

Prior to the 1950s, *Torreya taxifolia* was estimated to be the seventh most abundant tree species within the Apalachicola Bluff regions; over 600,000 individuals were estimated (Schwartz 1993). Surveys conducted in areas with known high tree densities suggested that *Torreya taxifolia* has lost at least 98.5% of its historical population size. The pathogen that may have caused the reduction of trees in the 1950s is unknown, but the extant population is severely affected by a canker disease caused by *Fusarium torreyae* (Smith 2011; Aoki et al. 2013; Dreaden et al. 2020). The 2010 5-year status review estimated less than 1,000 individuals distributed in 33 occurrences across the landscape (Service 2010). The 2020 5-year status review estimated around 750 plants, a decline resulting from damages of Hurricane Michael (Service 2020). To date, there are about 861 wild *Torreya taxifolia* (Table 1) distributed across the current projected range (Figure 1), with a high abundance of trees found on private lands and in Torreya State Park (Table 1). Most of the wild population persists as stump sprouts. But based on the 2019-2024 census height data for 423 wild trees, 25% of the trees are taller than 5 feet, with 20 trees being taller than 10 feet (X. Loy, ABG, 2025, pers. comm.).

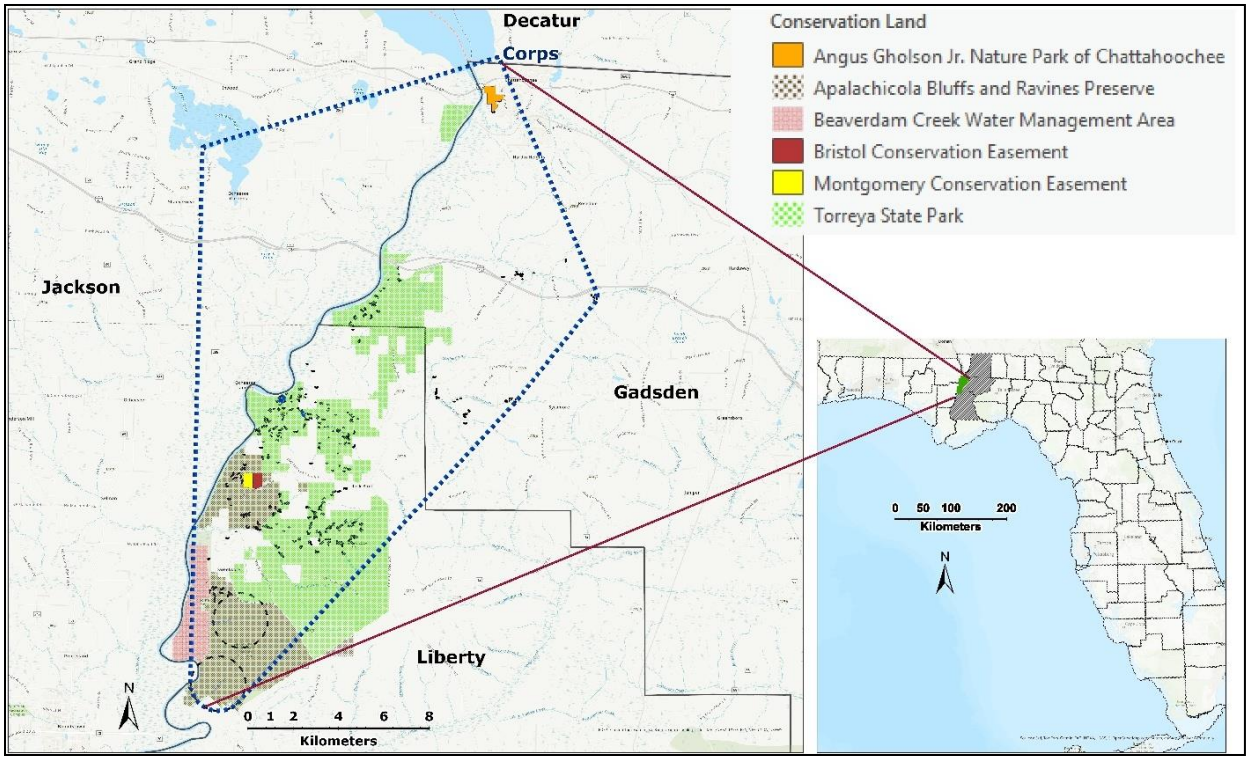


*Figure 1. Right, counties of current occurrence (shaded, striped fill) and range (green) of Torreya taxifolia. Left, historical range (dashed blue outline) showing the conservation lands with documented Torreya taxifolia (black polygons and internal circular-dashed outline). Torrreya taxifolia is considered extirpated from Jackson County. The Nature Conservancy includes 1) Apalachicola Bluffs and Ravines Preserve, 2) Montgomery Conservation Easement, and 3) Bristol Conservation Easement. Corps = United States Army Corps of Engineers. Data from FNAI (2025).*

Florida torreya seed-bearing trees in the wild are rare; Florida torreya is subdioecious, rarely monoecious. However, between 2020 to 2024, about 26 trees were observed coning in the wild; this included 12 females and 14 males (ABG 2025). Other seed-bearing trees are found in various botanical gardens. Specifically, the Atlanta Botanical Garden, which has the most comprehensive collection of Torreya trees [512 unique accessions, ABG 2025], has reported 22 females, 43 males, and 447 of unknown sex. Viable seeds have been observed in both cultivated and natural settings (Dreaden et al. 2024), and seedlings from the collections have become reproductive within a span of 12 years. In the wild, the last known seedling died in 2022, and since then no new seedlings have been recorded (ABG 2025).

The information presented below about the state of current trees and habitat is summarized from two main long-term surveys carried out by the Atlanta Botanical Garden and the Florida Native Plant Society (FNPS). The long-term surveys are the results of projects funded by the Service grants # F20AC00357 (Fighting Extinction of *Torreya taxifolia* through Collaborative Partnerships; ABG 2025) and F21AC01054 (Landowner Outreach to Conserve Florida Torreya; FNPS 2024).

*Surveys*

*Post-Hurricane Michael*

The Florida panhandle and southwest Georgia took a direct hit from Category 5 Hurricane Michael in 2018, and the entire native range of *Torreya taxifolia* was impacted with an estimated 80-90% canopy loss (Liberty and Gadsden counties, Florida, and Decatur County, Georgia); 60% of the GA trees counted in 2017 survived Hurricane Michael (Table 1).

These are key findings from post-Hurricane Michael surveys (Loy 2022, ABG 2025):

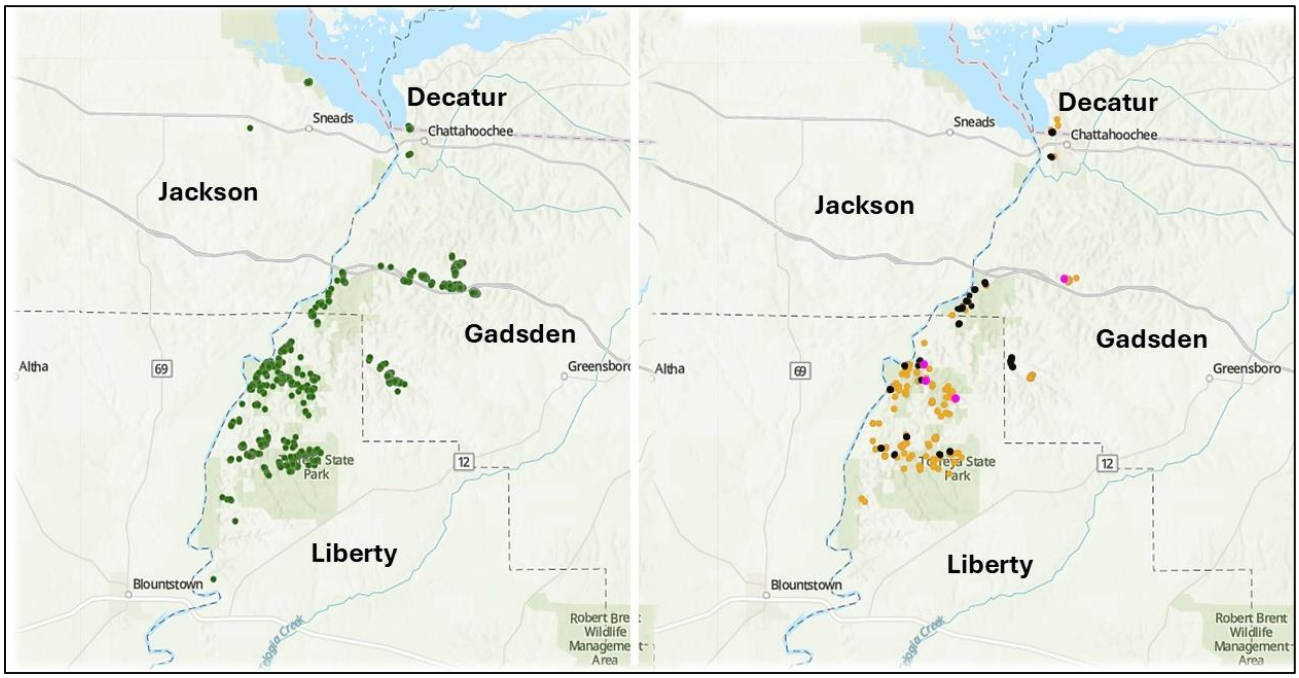


*Figure 2. Population census 2019-2024 within the current Torreya taxifolia range. Symbols for trees: green, alive; black, dead; yellow, searched not found; pink, no landowners permission. Maps provided by the Atlanta Botanical Garden.*

- The Atlanta Botanical Garden staff and partners surveyed 751 documented *Torreya taxifolia* trees from 2019-2024 (Figure 2); about 68 percent of the trees revisited are still alive, but many have not been found (Figure 2).
- The Atlanta Botanical Garden staff and partners found 368 undocumented trees, of which 27 were on public lands and the rest were on private lands.
- *Torreya taxifolia* trees that survived Hurricane Michael appear to be adjusting to the habitat changes.
- A multi-year study is being carried out by the Atlanta Botanical Garden and partners at the Torreya State Park to examine the long-term effects of habitat changes caused by Hurricane Michael (Loy 2022).
    - It involves 40 wild *Torreya taxifolia* trees; selected trees were of similar size and alive in the spring following Hurricane Michael. Growth and health conditions of each tree, forest damage surrounding each of the trees, and environmental variables such as temperature and humidity have been measured since Hurricane Michael.

- Preliminary results reveal
  - Some trees with signs of sun damage to their leaves in the summer following Hurricane Michael
  - Annual growth significantly varied by year, with an increased in tree growth immediately post-hurricane.

*Private properties*

Davis and Anderson-Messec (FNPS 2024) worked with private landowners to locate and document the condition of wild trees, and to collect seeds and cuttings for offsite propagation. Permits and permissions were received from many of the 60 contacted properties. The following summarizes current findings from their efforts and others:

- About 1,275 acres were surveyed from 53 private parcels (Table 1).
- 341 unrecorded trees were documented during a 3-yr survey (Table 1).
- 17 trees (8 females, 9 males) were observed coning on private lands (ABG 2025).
- Seed germination trials were established at Torreya State Park and private properties.
- 343 cuttings were collected and transferred to the Atlanta Botanical Garden for propagation and safeguarding
- 127 canker samples were collected and sent to Dr. Jason Smith's laboratory at the University of Florida (UF) for his research on *Fusarium torreyae.*
- Best management practices materials were provided to landowners; a copy of the brochure can be found here: https://torreyakeepers.fnps.org/data/uploads/brochures/torreyakeepers-broch-2_bmps.pdf.
- Surveys in 2022 revealed a new fungal blight, a novel species identified as *Parvodontia relampaga*, spreading across some properties in the Torreya region. It was observed on 26 Torreya trees, two *Taxus floridana* trees, and other species (Anderson-Messec, 07/24/2025, per. comm.). Needle loss and branch dieback were observed on *Torreya taxifolia*. J. Smith and collaborators (UF, Florida) are currently working on this fungus/threat.
- Education on the conservation of *Torreya taxifolia* was promoted through multiple videos, online presentations, and in-person workshops.

Existing preserves that contain areas with *Torreya taxifolia* are managed by The Nature Conservancy, Torreya State Park, the Corps, and several private landowners including the Torreya Keepers (TK) (Table 1, Figure 1). The Torreya State Park management plan includes constructing enclosures to prevent damage from deer, restoring adjacent uplands, preventing erosion in the sandhill and slope forests, and exotic species control. The Corps has no written management plan, and we do not have information for The Nature Conservancy.

Table 1. Total number of *Torreya taxifolia* trees by state and landowner. Symbols: ♣= number of outplanted *Torreya* trees; * and ■ represent counts from 7 (Service 2020) and 53 private parcels (FNPS 2024), respectively. The 2021-2024 information was provided by Loy (ABG, 06/11/2025, pers. comm.). Unk. = unknown. Corps = United States Army Corps of Engineers; Chattahoochee = Angus Gholson Jr. Nature Park of Chattahoochee.

| State | Landowner | 2007-2017 Total trees | 2007-2017 Caged trees (proportion caged) | 2021-2024 Total trees | 2021-2024 Caged trees (proportion caged) |
|---|---|---|---|---|---|
| **Florida** | Torreya State Park | 451 | 127 (0.28) | 323 | 150 (0.47) |
| **Florida** | The Nature Conservancy | 112 | 2 (0.02) | 73 | 0 (0) |
| **Florida** | Chattahoochee | 4 | 0 | 2 | 1 (0.50) |
| **Florida** | Private Landowners | 140* | 5 (0.04) | 449■ | 5 (0.01) |
| **Florida** | Three Rivers State Park | Unk. | Unk. | 9♣ | 0 |
| **Georgia** | Corps | 23 | 23 (1.0) | 14 | 2 (0.14) |
| | Total | 730 | 157 (0.22) | 870 | 160 (0.18) |

*Outplantings*

*Trees outside Torreya's native habitat*: The Atlanta Botanical Garden and the Georgia Department of Natural Resources outplanted *Torreya taxifolia* in Georgia at the Smithgall Woods (White County), and Vogel State Park (Blairsville County) (Service 2020). The outplanting purpose was to safeguard populations of *Torreya* that were propagated at Atlanta Botanical Garden in backup collections at more than one location. Seeds and seedlings were distributed to numerous institutions from 2016-2019. After the detection of pathogens on the seed coat and seedlings, Atlanta Botanical Garden halted any distribution of plants and seeds until more efficient methods of ensuring and testing for disease-free material could be developed.

The *Torreya* guardians, a self-organized group based in northern Georgia, translocated seedlings of *Torreya taxifolia* to multiple states (pdf-historic-groves-torreya.pdf). Their efforts are extensively described in their website that includes the growth, reproduction, and conditions of the planted trees and the *Torreya* guardians' activities as well. They aim to save *Torreya taxifolia* from extinction (http://www.torreyaguardians.org/save.html). Within their website, a report on outplantings that have been conducted over the years in multiple states across the United States or abroad was summarized by Camire (2018, https://www.torreyaguardians.org/historic-list.pdf). This report includes outplanting information both current and historical, in nurseries, botanical gardens, private and public lands.

A concern with outplantings, due to lack of pathogen-free planting stock, is introducing fungal infections to established/existing *Torreya taxifolia* and its surrounding areas (Dreaden et al. 2020). According to the *Torreya* guardians, site visits to the outplanted *Torreya taxifolia* in 2006, 2015, 2017, and 2021 observe no apparent evidence of diseased branches on the plants or stressed saplings or seedlings. However, the Atlanta Botanical Garden has observed canker disease on

trees outplanted at Vogel State Park, indicating that there is a risk of spreading the *Fusarium torreyae* pathogen into the southern Appalachian Mountains and the fungus moving onto other threatened species of tree. To avoid fungal infection spread, it is recommended to screen *Torreya taxifolia* plants or seed before they are moved to new locations using the assay developed by Dreaden et al. (2020).

*Seed germination trials*. Seeds from Torreya trees in *ex situ* collections at the Atlanta Botanical Garden are being used as experimental outplantings in Torreya native habitat (ABG 2024). The Atlanta Botanical Garden and collaborators have established five seed germination trials across the Torreya State Park and private lands following a protocol they developed (ABG 2025). Of the 210 seeds planted in 2018, less than 45 percent germinated, and about 19 percent survived as seedlings 5-year post-germination in 2023. The study suggests that for germination, caging and appropriate soil conditions are important factors for higher germination rates (ABG 2025). But for seedling survival, the lower canopy (small trees, shrubs, and other vegetation that grow in the shade of taller trees) is a key element, while caging appears to have no effect on their survival.

Additional information on seed production, dissemination and propagation, and reestablishing Torreya in its native habitat can be found in the previous 5-year review (Service 2020).

*Summary.* In general, the current wild population is dominated by resprouts and limited to small individuals that are failing to achieve reproductive maturity. Although recent survey efforts documented more than 300 unrecorded trees, the current total number of *Torreya taxifolia* trees has remained similar since 2010, with fewer than 1,000 trees (Service 2010). This could be explained by tree mortality directly related to the damage caused by Hurricane Michael in 2018. In 2000, Schwartz et al. (2000a) estimated 1,400 individuals; consequently, the current population size has decreased, with an estimated loss in the past decade ranging between 4 and 31 percent of the trees (ABG 2025). Multiple outplantings outside the range were undertaken, but the detection of pathogens on the seed coat and seedlings has prevented the continuation of this effort until more efficient methods of ensuring and testing for disease-free material could be developed. The combined effect of fungal disease (Aoki et al. 2013), natural disasters, and the lack of seedling recruitment, even if seeds occasionally occur in the wild, has brought *Torreya taxifolia* to the brink of extinction (Dreaden et al. 2024, Schwartz et al. 2000b).

**Genetics, genetic variation, or trends in genetic variation: Two genetics studies were conducted by Eserman-Campbell (2022) and Dreaden et al. (2024):**

Eserman-Campbell (2022) in collaboration with colleagues at the University of Georgia, FNPS, and the Royal Botanic Gardens Edinburgh examined the genetic diversity contained within 353 *Torreya taxifolia trees* distributed across the extant range. The ‘target gene capture’ technique was used to target sequencing on specific loci as the genome of this species (and other gymnosperms) is large with repetitive nuclear genomes. The study demonstrated that *Torreya taxifolia* harbors low to moderate (Ho = 0.136) genetic diversity; all plants comprise a single interbreeding population; and there is no evidence for inbreeding (Fis = -0.0257) (Eserman-Campbell, 04/30/2025, pers. comm.). Therefore, since the genetic makeup of trees from different ravines is largely overlapping, the collection efforts for safeguarding the species do not need to focus on specific locations but should instead be spatially dispersed (Eserman-Campbell 2022).

Dreaden et al. (2024) developed a panel of 12 microsatellite markers for examining genetic diversity, structure, and apomixis in *Torreya taxifolia*. This study sampled plants from both the in-situ population and the ex-situ collections from the Atlanta Botanical Garden. Heterozygosity ranged from 0.067 to 0.721, demonstrating locus specific variation in heterozygosity. Genotypes were spread across the natural population, showing little geographically-structured population genetic diversity. Finally, the study tested for apomixis and could not reject the hypothesis that some seedlings were produced as a result of apomixis. However, the panel of 12 microsatellite loci were not able to differentiate individual trees.

Summary of other genetic studies can be found in the previous 5-year review (Service 2020).

**Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

*There is a new or potential threat to Torreya taxifolia (see Factor C discussion below) beyond those discussed in the most recent 5-year review (Service 2020); however, the extent or magnitude of the threat is unknown. Unless stated, the threats remained as presented in the previous 5-year review (Service 2020).*

**Factor A. Present or threatened destruction, modification or curtailment of its habitat or range:**

Habitat loss was not a factor in the decline of this species. Two other habitat-related factors have been speculated as potential threats: changes in soil chemistry associated with disruption of hydrology when upland topsoils were plowed in the 1950's, and perhaps fire suppression (Schwartz et al. 1995). In addition, a Woodruff dam construction at Lake Seminole in Chattahoochee, Georgia coincided with the decline but based on dendrological evidence, Atchley (2004) concluded that the construction of the dam was not a major factor contributing to the decline of *Torreya taxifolia* (Service 2010, 2020).

"The Sandhill habitat adjacent to Torreya's Sweetwater slope forests was converted to industrial pine plantation when in private ownership. Under Florida Department of Environmental Protection ownership for the last 20 years, over 90% of the park Sandhill habitat has now been restored" (Service 2020).

Former Florida Department of Environmental Protection biologists suggested that the non-native earthworms in leaf litter are affecting the forest health (Service 2020).

As to fire, it has been stated that many of the lower slopes do have longleaf pine and wiregrass down in the ravines and may have a long fire interval. However, the areas where *Torreya taxifolia* occurs are unlikely to have had fire in the past given the type of topography and the presence of a river on one side (Harper 1914). In addition, the Mola et al. (2014) study of leaf litter flammability suggested that extant *Torreya taxifolia* contributes little to the litter fuels because it has declined in both abundance and height, and increased fire in the ravines may further imperil this species and other rare ravine taxa.

According to McCormick (2012, upubl. report), *Torreya* is strongly dependent on arbuscular mycorrhizal fungi and native populations have sufficient diversity of mycorrhizal fungi available to support healthy tree growth. However, *Torreya* in native

populations that were heavily shaded and diseased was found to be less extensively colonized by arbuscular mycorrhizae than in other areas. Thus, to help increase colonization by arbuscular mycorrhizal and improve pathogen resistance, the study suggested that management activities could increase light available to native populations (Service 2020).

Since the habitat continues to be restored due to past logging, the plants in outplanted areas grow but eventually die, and native populations have sufficient diversity of mycorrhizal fungi to support tree growth, habitat alteration may not be a current threat.

**Factor B. Overutilization for commercial, recreational, scientific, or educational purposes:**

Many of the largest Florida torreya trees were harvested and used for fenceposts, shingles, and as fuel for riverboats (Schwartz et al. 2000a). Also, the species has been cut for Christmas trees, but in 1980 and 1981 there were only a few Florida torreya tall enough to be used for this purpose. However, the species is rare across the landscape, many occur on protected lands, and their size limits their usefulness, therefore, there is no evidence to suggest that harvest or overcollection is a current or future threat.

**Factor C. Disease or predation:**

**Disease:** Fungal disease is one of the primary threats responsible for the species' decline and appears to be limiting recovery. Presently, *Fusarium torreyae* is causing canker development on *Torreya taxifolia* and is likely the cause of stem dieback (Smith *et al.* 2011, Aoki et al 2013).

In addition to *F. torreyae,* a recent novel thread blight pathogen caused by *Parvodontia relampaga* was documented in the Torreya State Park area and in various plant species including *Torreya taxifolia and Taxus floridana* trees. Needle loss and branch dieback were observed on *Torreya taxifolia*. According to Paez et al. (2024), the pathogen has a wide host range.

Although research is ongoing to help arrest the fungal infestations, there is no identified treatment to control these pathogens, and *Torreya taxifolia* will most likely continue its decline until a treatment is found. Therefore, fungal pathogens remain a primary threat to the species.

**Deer damage:** As discussed in the previous 5-year review (Service 2020), deer rubs can cause significant cambial bark tissue damage to young shoots from each branch, further stressing trees. Dr. Coffey (2024, pers. comm.) and collaborators discontinued fencing Torreya trees, as no significant impacts from the deer were found in their 5-year study.

Therefore, the impact of deer damage on *Torreya taxifolia* has been investigated and seems to be minimal.

**Factor D. Inadequacy of existing regulatory mechanisms:**

The Endangered Species Act (Act) of 1973, as amended prohibits the removal of federally listed threatened and endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered plants on non-federal areas in knowing violation of state law or regulations or in the course of any violation of a state criminal trespass law. However, the Act does not provide protection for plants on private lands or unless it is in violation of state law. Several *Torreya taxifolia* occur on private land and Eserman-Campbell et al. genetic research suggest living wild trees comprise a single population.

The State of Florida requires permission from private landowners to collect state-listed plants from their property. *Torreya taxifolia* is protected under Florida State Law, chapter 85-426, which includes preventions of taking, transport, and the sale of the plants listed under the State Law. The rule Chap. 5B-40, Florida Administrative Code, contains the "Regulated Plant Index" (5B-40.0055) and lists endangered, threatened, and commercially exploited plant species for Florida; defines the categories; lists instances where permits may be issued; and describes penalties for violations (http://www.virtualherbarium.org/EPAC).

Florida torreya is ranked S1 by the Georgia Department of Natural Resources, indicating that it is critically endangered in Georgia. This endangered species designation offers some protections under Rule 391-4-10 (https://rules.sos.ga.gov/gac/391-4-10) and Georgia's Wildflower Preservation Act of 1973. This rule provides protections for the species on any public lands from cutting, digging, pulling, or removing unless the State has authorized such acts.

The existing regulatory mechanisms are inadequate for plants, because they do not provide protections for plants on private property (which account for almost half of the current individuals), and they do not protect the species from the current primary threat which is disease and death from fungal infections.

**Factor E. Other natural or manmade factors affecting its continued existence:**

**Catastrophic events**: As the warming air and ocean surface temperature continues to increase in the future, drought and hurricane intensity, and associated extreme precipitation events in Florida and Georgia are projected to rise (Franson et al. 2022; Runkle et al. 2022). These changes in temperature, precipitation, and weather are expected to be an increasing threat to rare plants and wildlife.

As previously mentioned, the Florida Panhandle and portions of Georgia were impacted by Hurricane Michael in 2018. The distribution and abundance of *Torreya taxifolia* were already reduced from historical levels, and Hurricane Michael impacted the entire range of *Torreya taxifolia* by increasing plant loss, decreasing the number of occupied sites, exacerbating fragmentation, and increasing the threat of extinction. To date, some trees have been seen with signs of sun damage to their leaves in the summer following

Hurricane Michael (evidence of lost canopy / overstory vegetation). *For additional details, see information in the 'Post-Hurricane Michael' section above.*

**Invasive species.** Gorchov (2019) studied the invasive herb, *Tradescantia fluminensis* (Small-leaf Spiderwort), showing spread from the Apalachicola River floodplain to the slopes on the east side of the river. The study recommends raking and subsequent removal of *T. fluminensis* fragments within 2 meters of a Florida Torreya because dense patches have the potential to negatively impact recruitment or small Torreya trees. This suggestion is based on findings from New Zealand, where plots invaded by *T. fluminensis* had lower species richness and abundance of native tree seedlings than uninvaded patches of the same forests.

## Synthesis

*Torreya taxifolia* is a coniferous tree currently found in two Florida panhandle counties and one county in Georgia. It is extremely vulnerable due to its limited range, low population number, lack of sexual reproduction in recent decades, the rarity of its habitat, and various threats. It harbors low to moderate genetic diversity within a single effective population. Loss of *Torreya taxifolia* is thought to have primarily been a result of fungal pathogens during the 1950s and 1960s, as well as a combination of environmental stress and native pathogens; however, studies have yet to provide an explanation for this species' decline. The pathogen *Fusarium torreyae* is a key contributor to the continued decline of this species. The primary health issues affecting stems are canker disease. The magnitude of stem damage caused by deer rubbing is no longer considered a threat as no significant impacts from the deer were found in a 5-year study. A new fungal blight has been identified spreading across the Torreya region and is negatively affecting the needles and branches of *Torreya taxifolia*; however, the magnitude of the threat to *Torreya torreya* is unknown. Overcollection was a threat of high importance in the past but presently it is not of concern.

Current surveys indicate that we have fewer than 1,000 trees in the wild, a decrease from the estimated number in 2000. About 50 percent of them are found on private lands, underscoring the importance of private lands and collaborative efforts for the survival of this species. Based on current survey information, the Georgia population has declined over time.

Despite the conservation actions to protect and determine the cause of this species' decline, the degree of threat to its persistence remains high; therefore, the threat of extinction for *Torreya taxifolia* is imminent.

At this time, *Torreya taxifolia* continues to meet the definition of an endangered species under the Act.

## RECOMMENDATIONS FOR FUTURE ACTIVITIES

- **Immediate Activities [proposed by the Service (2020] and their status**
  - **Management**
    - ***Complete actions***

- The species distribution model conducted by Ramirez-Reyes et al. (2020) offered predicted guide for surveys on private lands.
- Complete a comprehensive assessment of Hurricane Michael damage to *Torreya* trees and habitat in Florida and Georgia- *see 'Post-Hurricane Michael' section, above.*
- Continue to build and maintain enclosures at TSP and GA (and other places if necessary) to protect the plants from deer herbivory and rubbing, and to better assess the impact of browsing on *Torreya taxifolia*.
    - *Dr. Coffey (2024, pers. comm.) stated that they have discontinued fencing Torreya trees, as no significant impacts from the deer were found in their 5-year study.*

- ***Ongoing actions***
    - Identify and acquire parcels with high density of *Torreya* trees and good quality slope forest.
        - *A Recovery Land Acquisition grant entitled, 'Wright Property Conservation Easement Establishment for the Protection of the Florida torreya (Torreya taxifolia)' was submitted in 2025. The proposed 490-acre easement would support several plants, animals, and natural communities of conservation value in the Apalachicola River basin. It contains numerous Torreya trees (including sexually mature trees in the wild).*
    - Survey private lands and collect plant material for ex-situ programs. *For a summary, see 'Private properties' section.*
    - Safeguarding of *ex-situ* collection should continue. Expansion of *ex-situ* collection is important to ensure continued genetic preservation of a wide range of *Torreya* individuals including long term storage of embryos.
        - *The Atlanta Botanical Garden planted 168 trees on their Conservation Safeguarding Nursery, a newly expanded facility in Gainesville, Georgia.*
    - Conduct surveys and related activities within a practical timeframe to inform accurate population trends (one or twice every 5 years).
        - *A standardized method to ensure consistency in collecting data is in place; it was developed by the Atlanta Botanical Garden and Florida Native Plant Society.*
    - Complete a comprehensive census/survey for all the current ravines containing *Torreya.*
        - Georgia population: Since plants are tagged, for each plant record height, circumference, # of branches, stems and leaf disease (e.g., stem canker, leaf yellowing) and reproduction (male vs. female cones). *See Table 1 for status: plant abundance declined.*
        - Florida population: mark a subset of the population and follow for each plant the above recommendations.
            - *The* Atlanta Botanical Garden *currently has 40 trees marked for detailed long-term tracking and evaluation of ecological factors that lead to greater longevity of individuals.*

    - Ms. Anderson-Messec's had monitored about 400+ trees, but current information about this effort is not available.
- ***Unknown status***: Avoid the use of fire practices within *Torreya* habitat.

## Research

- *Complete actions*.
    - Genetic studies, see section *Genetics, genetic variation, or trends in genetic variation*
    - Grafting experiments. This recovery action should be considered no longer appropriate and removed from the recovery plan because *T. californica* is exhibiting some issues with cankers caused by pathogens (Service 2020).
- *Ongoing actions*
    - Pathogen mitigation. Continuing and expanding studies related to the identification of pathogens. Research should include determining treatments and recommendations applicable for managing *Torreya* in its historic range.
        - *Dreaden et al. (2020) developed an assay to screen Torreya taxifolia plants or seeds before they are moved to new locations. To help improve this species' survival, additional effective fungicide treatments are needed to kill or inhibit the growth of all fungi.*
    - Conduct surveys for new populations (and potentially for sites for reintroduction) where similar habitat exists. Ongoing. *See 'Private properties' section.*
    - Expand ongoing *in-situ* seed germination and seedling survival throughout the species range. See '*Seed germination trials' section.*
    - Establish experimental reintroductions, and populations outside the range. This is an ongoing action and should be expanded. Before establishing populations outside the range, an outplanting strategy needs to be developed, including pathogen mitigation, considering genetics, and lessons learned from previous experimental populations.
- Further investigations
    - Management practices: There is no evidence that native Torreya habitats were deficient in mycorrhizal species McCormick (2012). The study recommended that management activities that increase light availability to Torreya in native populations may help increase colonization by mycorrhizal fungi and, consequently, enhance pathogen resistance.

**Preventing extinction emergency plan (PEEP)**

This plan was developed by the Service in 2020, and its status is ongoing. The Atlanta Botanical Garden (2025) has a 5-, 10-, and 20-year plan to help stabilize current populations of *Torreya taxifolia*. The objectives of their plan complement PEEP, and at large, include 1) pathogen mitigation, 2) augmentation, and 3) development of a national/regional metacollection (https://saveplants.org/metacollections-and-collaborations/).

| Actions | Purpose |
|---|---|
| Ensure funding is continually allocated (e.g., a proposal was submitted in 2025 to develop treatments for pathogen mitigation) | To implement actions from the recovery plan, 5-yr review, and catastrophic events such as hurricanes. |
| Ensure pathogen mitigation studies are completed. *Ongoing* | To best manage *Torreya* and its habitat within the historic range. |
| Maintain an *ex-situ* collection in perpetuity until in-situ populations are stable or increasing. *Ongoing* | Use the collection as insurance against extinction in the wild as well as a recovery strategy until the plants in the wild improve, overcoming factors limiting recovery |
| Develop approved guidelines for reintroduction, augmentation, and translocation (and/or managed relocation). *Ongoing* | For planning, implementing and monitoring (of growth, threats, and habitat).<br>▪ Use disease-free *Torreya taxifolia* material in environments in which the pathogens are not recognized and/or the habitat has been managed and cleared from the threat that brought the species to endangerment.<br>▪ Accurately map the proposed outplanting sites and use the GIS database as a permanent record of the source of a population and to track the propagules.<br>▪ Address present threats |
| Reintroduction within the historical site. *Ongoing* | Habitat characteristics of the source population must be matched as close as possible with the outplanting site (using aerial photographs and species distribution modeling methods), and there should be no remnant population to prevent disease spread. The Allison (1988) document should be revisited and evaluated. |
| Augmentation of an existing wild population | Use 1) approved guidelines (action 4) for this effort, and 2) the most recent genetic study conducted by the Atlanta Botanical |

| Actions | Purpose |
|---|---|
| | Garden and collaborators to choose the source stock for augmentation. |
| Managed relocation efforts, if necessary | Foster a working partnership with interested parties to help direct translocation efforts (introduction of a species to a site outside the known historical range). This effort could only be taken if: 1) reintroduction and augmentation *in-situ* strategies are not effective, 2) the site(s) provide(s) the only place safe from the threats that brought the species to endangerment; and it can be shown that there is a net gain for the species conservation, i.e., recovery unit. This management option should be carefully evaluated, and planning should be done with the best biological science. If a population has been already translocated, it could potentially be evaluated as an experimental population. |
| Outreach and Awareness Campaign, *ongoing, ABG (2025), FNPS (2023, 2024)* | To change public behavior towards species loss and mobilize action for a sustainable *Torreya taxifolia* future |

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**RESULTS / SIGNATURES**

**U.S. FISH AND WILDLIFE SERVICE**
**5-YEAR REVIEW of**
***Torreya taxifolia* (Florida torreya)**

**Status Recommendation:**

On the basis of this review, we recommend the following status for this species (50 CFR § 424.11). A 5-year review presents a recommendation of the species status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

___ Downlist to Threatened.
___ Delist:
___ *The species is extinct.*
___ *The species is recovered.*
___ *New information indicates the species does not meet the definition of an endangered or threatened species.*
____ *The listed entity does not meet the statutory definition of a species.*
_X_ No change needed.

**Review Conducted By:** Dr. Vivian Negrón-Ortiz, Panama City Field Office, Ecological Services Field Office.

**FIELD OFFICE APPROVAL:**

***Acting* Division Manager, Florida Ecological Services Field Office, U.S. Fish and Wildlife Service**

Approved: NICOLE COLANGELO Digitally signed by NICOLE COLANGELO Date: 2026.03.24 14:22:41 -04'00'

** In the Florida Ecological Services Field Office, the Classification and Recovery Division Manager has delegated authority to approve 5-year reviews that do not recommend a status change.*