BEFORE THE SECRETARY OF THE INTERIOR

Petition to List Hidden Bluecurls (*Trichostema latens*) as Threatened or Endangered Under the Endangered Species Act and to Designate Critical Habitat

Credit: Kevan Schoonover McClelland, PhD

Submitted by:
Center for Biological Diversity
Kevan Schoonover McClelland, PhD

December 5, 2024

NOTICE OF PETITION

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Dear Secretary Haaland,

Pursuant to Section 4(b) of the Endangered Species Act (ESA), 16 U.S.C. § 1533(b); section 553(e) of the Administrative Procedure Act (APA), 5 U.S.C. § 553(e); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity and Dr. Kevan Schoonover McClelland hereby petition the Secretary of the Interior, through the U.S. Fish and Wildlife Service (USFWS), to protect hidden bluecurls (*Trichostema latens*) as a threatened or endangered species under the ESA.

This petition requests listing of Hidden bluecurls based on historical, current, and imminent threats from habitat destruction, degradation, and fragmentation; invasive species; pollinator declines; climate change; inherent vulnerability from being a narrow-ranging endemic species; and inadequate regulatory measures to address these mounting threats and vulnerabilities. Petitioners also request that

critical habitat be designated concurrently with the listing, pursuant to 16 U.S.C § 1533(a)(3)(A) and 50 C.F.R. § 424.12.

The USFWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on USFWS. USFWS must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533 (b)(3)(A). USFWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition."

The Center for Biological Diversity (Center) is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law, supported by more than 1.7 million members and online activists. The Center works to secure a future for all species, great or small, hovering on the brink of extinction.

Dr. Kevan Schoonover McClelland has a Ph.D. in Biology with a focus on Evolution, Ecology, and Organismal Biology. His research topics focused on plant nomenclature, taxonomy, phylogenetics, ecology, and biogeography. He co-authored research establishing seven new species of *Trichostema*, including *Trichostema latens*.

We submit this petition on behalf of our staff and members who hold an interest in protecting hidden bluecurls.

Submitted this 5th day of December, 2024.

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Executive Summary

Named in part for their history of eluding identification as a discrete species and in part for experts' hopeful belief that more populations are "hidden" and awaiting discovery, exceptionally rare hidden bluecurls are found only along a six-mile stretch of coast in Franklin County, Florida (McClelland et al. 2023, p. 113). They are currently known from only a few locations (McClelland et al. 2023, p. 113). Recently identified as a distinct species in 2023, this rare flower is known to occur in only two populations. These few populations are at risk of extinction because of historical habitat destruction, ongoing and imminent threats of more habitat destruction for development, habitat degradation from lack of fire, invasive species, and climate change. Existing regulatory mechanisms are insufficient to protect hidden bluecurls from the individual, cumulative, and synergistic effects of these threats.

The ESA requires USFWS to protect species by listing them if they are endangered or threatened.[1] 16 U.S.C. § 1533(a)(1). A species is endangered if it is at risk of extinction in all or a significant portion of its range. *Id*. § 1531(6). A species is threatened if it is at risk of becoming endangered in the foreseeable future in all or a significant portion of its range. *Id*. § 1531(20). USFWS must make its listing determination solely on the following five factors:

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;
(B) overutilization for commercial, recreational, scientific, or educational purposes;
(C) disease or predation;
(D) the inadequacy of existing regulatory mechanisms; or
(E) other natural or manmade factors affecting its continued existence.

Id. § 1533(a)(1). To be listed as endangered or threatened, a species need only face a sufficient threat under a single factor. *See Humane Soc'y of the U.S. v. Pritzker*, 75 F. Supp. 3d 1, 7 (D.D.C. 2014) (citing *Sw. Ctr. For Biological Diversity v. Babbitt*, 215 F.3d 58, 60 (D.C. Cir. 2000)). Any combination of threats, considered cumulatively under multiple factors, will also support listing.

As detailed in this petition, Hidden bluecurls warrant listing under the ESA because of their inherent vulnerability due to their extremely small range and limited suitable habitat, and unabated threats from habitat destruction, degradation, and

[1] The ESA defines "species" to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. § 1532(16).

fragmentation; invasive species; pollinator declines; and climate change. ESA protections—including designated critical habitat—would ensure hidden bluecurls' survival and recovery by officially acknowledging the species' vulnerability to extinction, intentionally designating the species' most important habitat, and comprehensively planning for increasing threats from invasive species, lack of prescribed fire, and climate change.

Introduction

Hidden bluecurls are flowering annual plants with dark purple-blue blooms that feature deeply curved, blue-stalked stamens and a mostly white lower petal bedecked with dark blue spots. The species' Latin name *latens* refers in part to its history of eluding identification and in part to the hope that other populations of this rare flower still lay hidden, awaiting discovery (McClelland et al. 2023, p. 113).

Exceedingly rare, hidden bluecurls grow only along a short coastal stretch of Franklin County, Florida (McClelland et al. 2023, p. 113). Because of the species' exceedingly small range, and that only three occurrences are known, hidden bluecurls face a significant risk of extinction—most notably from habitat destruction and degradation.

Alarmingly, one of the three known occurrences of hidden bluecurls exists along a roadside (McClelland et al. 2023, p. 113), making it exceptionally vulnerable to extirpation. Until USFWS lists hidden bluecurls under the ESA and concurrently designates critical habitat, it is likely that the species will continue to be threatened by incompatible management decisions that threaten to degrade or destroy their habitat.

I. Natural History and Biology of Hidden Bluecurls

a. Taxonomy

Kingdom	*Plantae*
Phylum	*Anthophyta*
Class	*Dicotyledoneae*
Order	*Lamiales*
Family	*Lamiaceae*
Genus	*Trichostema*
Species	*Latens*

Hidden bluecurls (*Trichostema latens* K. S. McClell.) are in the mint family, specifically, a genus of mints endemic to North America (McClelland et al. 2023, p. 95). First described in 2023, the species was separated from the forked bluecurls (*T. dichotomum*) based on genetic, as well as morphological and geographic, distinctions (McClelland et al. 2023, p. 113; NatureServe 2023).[2] *T. latens* differs

[2] Building upon whole-genus studies of *Trichostema* by Lewis (1945, 1960) and Huang et al. (2008), McClelland et al. (2023) used a multi-pronged approach assessing morphological, ecological, cytological, and genetic diversity, resulting in the identification of seven new species (McClelland et al. 2023, entire).

from *T. dichotomum* by its oblong to oblanceolate leaves (*vs*. lanceolate to elliptic), obtuse to emarginate leaf apices (*vs*. acute to obtuse) shorter fruiting calyces of 5.44–5.89 mm (*vs*. 5.91–7.24 mm), style branch ratio of 1:2–1:4 (*vs*. 1:1–1:2), and shorter mature nutlets of 1.61–1.77 mm (*vs*. 1.75–2.16 mm) with small alveoli (*vs*. mid-sized to large alveoli) (McClelland et al. 2023, p. 113).

Hidden bluecurls are one of 10 unique species of bluecurls that can be found in Florida (McClelland et al. 2023, pp. 129–130). Shaped by millions of years of dynamic geologic change, Florida's xeric landscapes support a high number of endemic taxa and exhibit distinct biogeographic patterns that are observed in few other areas of the world with similar geological and climatic conditions (McClelland et al. 2023, p. 95). In particular, the ridge systems of peninsular Florida have provided isolated xeric habitats where speciation has occurred, notably in the genus of North American mints, *Trichostema*, which includes morphologically and ecologically distinct entities that occur on various xeric ridges of Florida's peninsula and barrier island chains (McClelland et al. 2023, p. 95). In addition to hidden bluecurls, the other species of bluecurls found in Florida are: *T. dichotomum* (forked bluecurls), *T. setaceum* (narrow-leaf bluecurls), *T. suffrutescens* (Florida scrub bluecurls), *T. floridanum* (Florida coastal bluecurls), *T. fruticosum* (bushy bluecurls), *T. latens* (hidden bluecurls), *T. bridgesii-orzellii* (Bridge's and Orzell's bluecurls), *T. gracile* (flatwoods bluecurls), *T. microphyllum* (small-leaved bluecurls) (McClelland et al. 2023, pp. 129–130).

b. Species Description

Hidden bluecurls are partially woody, branching perennial plants that grow up to 50 centimeters tall (McClelland et al. 2023, p. 113). This species branches primarily in the middle or upper part of the plant (McClelland et al. 2023, p. 113). Their buds are dark blue-purple (McClelland et al. 2023, p. 113). Their blooms are also dark blue to blue or blue-purple with five petals, the lower and largest of which has a white patch with dark purple spots, and long, blue-purple, deeply curled stamen (McClelland et al. 2023, p. 113). Their stems have downwardly curved hairs, and their leaves are widest toward the tip or near the middle (McClelland et al. 2023, p.113). They also produce very small fruits, called nutlets that have ridges (McClelland et al. 2023, p.113). Hidden bluecurls have both mildly fragrant flowers and aromatic foliage that effuse gentle, sweet, minty scent.

McClelland et al. (2023) provide a detailed description:

> Herbaceous to woody annual to 50 cm tall; branching primarily in the middle to upper part of the plant; stem hairs downwardly curved, rarely spreading to two, occasionally to three, cells long, with sessile glands; node hairs downwardly curved, rarely spreading, to two, occasionally to three, cells long; leaves widest towards the tip or near the middle,

> rarely widest towards the base, (1.8–)1.97–3.33(–3.6) × (0.42–)0.53–0.99(–1.1), average of 2.65 × 0.76, cm, (3–)3.18–3.95(–4.52), average of 3.56, times long as wide, base cuneate to attenuate, margin entire, apex rounded to emarginate; inflorescence hairs spreading, rarely upwardly or downwardly curved, to two, occasionally to three, cells long, with sessile and spreading glands to two, rarely to three, cells long (including gland); bracts widest towards the tip, occasionally widest near the middle, (4.1–)4.36–8.02(–9.8) × 1–2.23(–3), average of 6.19 × 1.61, mm, (3.27–)3.49–4.45(–5), average of 3.97, times long as wide, base cuneate to attenuate, margin entire, apex obtuse, occasionally ±90° or rounded, rarely acute or emarginate; fruiting calyx (5.3–)5.44–5.89(–5.9), average of 5.67, mm long; buds dark blue-purple, corolla dark blue or blue-purple to blue or blue-purple; anthers dark blue or blue-purple to blue or blue-purple; style bifid, the longer arm 2–4 times as long as the shorter; mature nutlets alveolate, (1.6–)1.61–1.77(–1.8), average of 1.69, mm long, hilum (0.4–)0.45–0.57(–0.6), average of 0.51, mm long, (0.25–)0.27–0.34(–0.35), average of 0.3, times the length of the nutlet alveoli small, ridges short to mid-sized . . . .

(McClelland et al. 2023, p. 113).

Figure 1: Herbaceous to woody growth, branching primarily in the middle to upper part of the plant (credit: Kevan Schoonover McClelland, PhD)

c. Life History

Hidden bluecurls are annuals, which means they complete their life cycle in one growing season (McClelland et al. 2023, pp.113, 130). The species flowers and fruits (called "nutlets") September to November (McClelland et al. 2023, p.113).

Bluecurls are a nectar source for a variety of insects (butterflies, hoverflies, small bees, ants), but pollination is solely by bees (McClelland 2021, at 5:56–6:16; FNPS undated, entire). When a bee lands on the flower, it bends the flower, which brushes the stamen on the back of the bee, depositing pollen, which can then be picked up by the stigma of the next flower (McClelland 2021, 6:39–7:06). Forked bluecurls (*T. dichotomum*), which are in the same genus as hidden bluecurls, have been documented to attract *Caupolicana electa* (a species of plasterer bee) and *Dialictus placidensis* (a species of sweat bee) (Deyrup et al. 2002), as well as bumblebees (McClelland 2021, at 6:16–6:38).

d. Habitat Requirements

Hidden bluecurls occur in near-coastal scrub and scrubby flatwoods, roughly 0–5 meters above sea level (McClelland et al. 2023, p. 113; NatureServe 2024, entire).

Scrub communities are found on dry, infertile, sandy ridges and are characterized by evergreen shrubs, with or without a canopy of pines (FNAI 2010, p. 49). Some scrubs are dominated by Florida rosemary, especially on drier ridge crests and recently stabilized dunes on Florida Panhandle barrier islands (FNAI 2010, p. 49). Rosemary-dominated scrubs tend to retain openings between the shrubs, even long after fire, in contrast to oak-dominated scrubs where vegetation tends to fill in openings with time since fire (FNAI 2010, p. 49). Scrub dominated by sand pine is usually found on the highest sandy ridgelines and have an understory of scrub oaks or Florida rosemary (FNAI 2010, p. 50). Scrub occurs on either white (St. Lucie, Archbold) or yellow (Astatula, Paola), low-nutrient, acid sands with little organic matter (FNAI 2010, p. 50). Scrub is located on dry, infertile, sandy ridges that often mark the location of former Plio-Pleistocene shorelines (FNAI 2010, p. 50). Scrub is a fire-maintained community; however, it is not easily ignited, which suggests that it burns less frequently than other communities (FNAI 2010, p. 50).

Scrubby flatwoods occur on slight rises in transitional areas between scrub and mesic flatwoods (FNAI 2010, p. 65). have open canopies of widely spaced longleaf or slash pine trees with low, shrubby understories dominated by scrub oaks and saw palmetto, often interspersed with areas of open white sand (FNAI 2010, p. 65). Primary canopy species include longleaf pine (*Pinus palustris*) and slash pine (*P. elliottii*) in northern Florida, with a shrub layer that may include scrub oaks, other shrubs and dwarf shrubs, forbs, and grasses (FNAI 2010, p. 65). Bare sand openings are often present but generally small (FNAI 2010, p. 65–66). Soils are moderately

well-drained sands with or without a spodic horizon, including, for example, Pomello and Satellite sands (FNAI 2010, p. 66).

Because scrubby flatwoods have a more continuous ground cover, they burn more readily than scrub and somewhat less readily than mesic flatwoods (FNAI 2010, p. 66). Light ground fires in the surrounding mesic flatwoods tend to enter the scrubby flatwoods and extinguish, leading to a patchwork of recently burned and unburned portions (FNAI 2010, p. 66). The natural fire interval is believed to have been highly variable, occurring more than 5 years and less than 15 years (FNAI 2010, p. 66).

More research is needed on optimal habitat conditions and how this species responds to fire (NatureServe 2024, entire). However, information is available about habitat conditions in communities where the species persists.

Hidden bluecurls have been observed in Tate's Hell State Forest (McClelland 2023, p. 113). Tate's hell has approximately 659 acres of scrub and 926 acres of scrubby flatwoods (FDACS 2019, p 1). On the High Bluff Tract of the state forest, scrub occurs on ancient dunes that are sometimes as tall as 60 feet above sea level, making them some of the highest points in Franklin County (FDACS 2019, p 33). Likewise, the scrubby flatwoods occur on slight rises within mesic flatwoods and in transitional areas between scrub and mesic flatwoods (FDACS 2019, p. 62). Soils of the scrubby flatwoods in the state park are moderately well-drained sands with or without a spodic horizon FDACS 2019, p. 62).

Based on field-observations, hidden bluecurls have been found along roadsides and in a clearing (McClelland pers. comm. 2024). Like other bluecurls in the group that these belong to (*T. seteaceum-T. suffrutescens* group), hidden bluecurls need open, sunny areas with lesser competition and would likely benefit from a fire regime (McClelland 2024, pers. comm.). In related species, smoke exposure was also observed to increase germination rate (McClelland 2022, p. 299–317).

e. Current and Historical Range

Hidden bluecurls are endemic only to a small area in Franklin County, Florida (McClelland et al. 2023, p. 113–114). Their historical range includes a narrow strip of near-coastal scrub and scrubby flatwoods along the coast, extending approximately 22 linear kilometers from the Bluffs of St. Theresa southwest to the town of Carrabelle, roughly 0–5 meters above sea level (See Figure 2) (McClelland et al. 2023, p. 113; NatureServe 2024, entire).

Despite intense study, populations are only known from two collection sites, one of which is located along a roadside and the other which is located within Tate's Hell State Forest St. James Island Unit (one at the front entrance and one near the rear entrance) (McClelland et al. 2023, p. 113; NatureServe 2024, entire; McClelland

2024, pers. comm.). Two more occurrences were identified in iNaturalist in 2023 (see Figure 3) (Mwenda 2023). There are potentially other currently existing populations; however, they have not been documented to date, despite much searching (McClelland et al. 2023, p. 113).

Figure 2: Approximate historical range of *Trichostema latens* based on field data and herbarium records (McClelland et al. 2023, p. 114).

Figure 3: Extension of estimated historical range of *Trichostema latens* with known extant populations (Map credit: Curt Bradley, Center for Biological Diversity; data from McClelland 2024, pers. comm.).

f. Population status

The species may have suffered minor historical declines from habitat loss caused by development (NatureServe 2024, entire). There are only three known occurrences of hidden bluecurls despite much searching (McClelland 2023, p. 113; NatureServe 2024, entire). One of these populations is on a roadside, making it extremely vulnerable to threats (McClelland 2023, p. 113). another population is in Tate's Hell State Forest (NatureServe 2024, entire). One population has good viability because it receives some management, but the roadside population is at risk of improper management such as herbicide application, which could lead to local extirpation (McClelland 2024, pers. comm.). The species' extremely small range makes all the populations inherently vulnerable to current and future threats described below (NatureServe 2024, entire).

Hidden bluecurls have a NatureServe status of G1 (Critically Imperiled) because of their small endemic range (~22 linear km) and because of the small number of known occurrences (NatureServe 2024, entire). Additionally, the species is a habitat specialist restricted to coastal and near-coastal scrubby flatwoods in Franklin County, Florida, whose key requirements are scarce (NatureServe 2024, entire).

II. Threats to Hidden Bluecurls (Five ESA Listing Factors)

a. Present or threatened destruction, modification, or curtailment of habitat or range

Hidden bluecurls are threatened by past, present, and threatened habitat destruction, fragmentation, and degradation. Hidden bluecurls may have suffered minor historical declines from habitat loss due to development (NatureServe 2023, entire). Development may still be a threat in the species' limited range. For example, a roughly 35-acre parcel called "Timber Island Plantation" in nearby Carrabelle, Florida, recently went to auction and sold as a "unique coastal development opportunity" (Seven Hills Auctions 2024, p. 2).

Relatedly, hidden bluecurls are threatened by habitat fragmentation, which has an overall large and negative effect on plant pollination and plant reproduction (Aguilar et al. 2006, entire).

Even where their habitat has not been destroyed, hidden bluecurls are threatened by habitat degradation resulting from fire suppression (NatureServe 2024, entire). Long-term fire exclusion has degraded habitat quality at both hidden bluecurls collection sites, although the impact is unknown (NatureServe 2024, entire). Historical fire suppression has changed the natural processes and composition of many fragments of Florida scrub (MacAllister & Harper, p. 4). Existing urban development around existing scrub within the bluecurls' limited range makes

necessary prescribed fire application more difficult (FDEP 2014, pp. 20, 23; USFWS 2006, p. 25; *see* Kupfer et al. 2022, p. 4 (describing constraints on prescribed burning in longleaf pine ecosystems, including public concern and nearby development)).

Both scrub and scrubby flatwoods require periodic fire to maintain ecological health (FNAI 2010, pp. 50, 65). A number of rare plants in scrub ecosystems require the structure of open patches of sand and vegetation that are created under a natural fire regime (MacAllister & Harper, p. 4). Therefore, available literature suggests that prescribed burning that mimics natural burn patterns is necessary to maintain most of Florida's scrub communities (MacAllister & Harper, p. 4). While scrub is a fire-maintained community, it is not easily ignited, suggesting that scrub naturally burned less frequently than communities with a more easily ignited grassy groundcover, such as sandhill and mesic flatwoods (FNAI 2010, p. 50). In coastal scrub habitat, prescribed fire should occur during the growing season every 10–25 years (NatureServe 2024, entire; *see also* FNAI 2010, pp. 49–53).

Management with prescribed fire has proven difficult within the bluecurls' limited range. For example, in Tate's Hell State Forest, most of the scrub sites have been excluded from fire for many years and now have dense stands of sand pines (FDACS 2019, p 33). The majority of scrubby flatwoods have been converted to pine plantation in the past and are now similar to the natural condition, but with a denser canopy of slash pines that will likely need to be thinned (FDACS 2019, p. 63).

b. Overutilization for commercial, recreational, scientific, or educational purposes

Overutilization is not known to threaten hidden bluecurls. However, given the species' limited range and small number of populations, collection activities could present a significant threat.

c. Disease or predation

Disease and predation are not known to threaten hidden bluecurls.

d. Inadequacy of existing regulatory mechanisms

Existing federal, state, and local regulatory mechanisms are inadequate to protect against threats to hidden bluecurls, which include habitat destruction, degradation, and fragmentation; invasive species; and climate change. Existing mechanisms have not prevented the loss of suitable habitat within the bluecurls' historical range and cannot prevent threats driven by climate change and recurring development plans that would destroy critically important habitat in the species' highly limited range.

State Regulatory Mechanisms

State Native Plant Protection Laws

State native plant protection laws and associated regulations do not adequately protect hidden bluecurls. The Preservation of Native Flora of Florida statute (PNFFS), Fla. Stat. § 581.185 (2024), and the related Endangered Plant Advisory Committee statute (EPACS), *id.* § 581.186, provide state legal protections for rare plants in Florida (Regan 2003, pp. 72–73; Regan 2004, p. 125). These statutes regulate the "harvesting"[3] and commercial exploitation of listed, protected plant species (Regan 2004, P. 143).

The PNFFS was intended to "provide recognition of those plant species native to the state that are endangered, threatened, or commercially exploited." Fla. Stat. § 581.185(1). The statute provides for the goal of protecting native flora from unlawful harvesting on both public and privately owned lands. It also establishes a permitting system in an effort to "provide an orderly and controlled procedure for restricted harvesting of native flora from the wild, thus preventing wanton exploitation of native species of flora." *Id.* The Florida Department of Agriculture and Consumer Services (FDACS) administers the PNFFS. PNFFS authorizes FDACS to adopt rules relating to the "listing, delisting, and changing from one category to another category any plant on the Regulated Plant Index." *Id.* § 581.185(4). The Regulated Plant Index[4] is the list of plant species that FDACS designates as "endangered,"[5] "threatened,"[6] or "commercially exploited."[7]

The Endangered Plant Advisory Council, a committee created by the EPACS, consists of seven members and has specified duties. *Id.* § 581.186. These duties include advising the department about proposals for revising the two statutes, reviewing the species on the Regulated Plant Index, and considering native plants proposed for inclusion. *Id.* § 581.186(3). The council considers a number of factors including occurrences, abundance, range, existing protections (if any), degree of

[3] Under the PNFFS, "harvest" means "to dig up, remove, or cut and remove from the place where grown." Fla. Stat. § 581.185(2)(c).
[4] The list of protected plants can be accessed at Florida Administrative Code Rule 5B-40.0055 (2020)
[5] Endangered plants are "species of plants native to the state that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue." Fla. Stat. § 581.185(2)(b). This definition also includes ESA-listed species. *Id.*
[6] Threatened plants are "species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in such number as to cause them to be endangered." *Id.* § 581.185(2)(h)
[7] Commercially exploited plants are "species native to the state which are subject to being removed in significant numbers from native habitats in the state and sold or transported for sale." *Id.* § 581.185(2)(a).

threat, and special considerations like endemism or rarity of pollinators (FDACS Division of Plant Industry (undated), entire; Anderson 2021, at 11:03–18:24).

The PNFFS makes it unlawful for any person to willfully destroy or harvest any plant that is listed as endangered on the Regulated Plant Index from private or public land without first: obtaining written permission from the landowner or legal representative of the landowner *and* obtaining a permit from FDACS.[8] *Id.* § 581.185(3)(a). However, PNFFS does not prohibit landowners from destroying endangered plants on their own property. *Id.* Species listed as threatened on the Regulated Plant Index have reduced protection than species listed as endangered, as no permit is required to destroy or harvest them. *Id.* § 581.185(3)(b). For species listed as commercially exploited on the Regulated Plant Index, permission from the landowner is required to destroy or harvest any plants, but a permit is only required if three or more plants are destroyed or harvested. *Id.* § 581.185(3)(c). The PNFFS also makes it unlawful to sell, offer to sell, or transport to sell plants listed on the Regulated Plant Index, except for species listed as threatened, even if a private landowner obtained the plants from their own land. *Id.* § 581.185(3)(d).

Hidden bluecurls are not on Florida's Endangered Plant List, Threatened Plant List, or Commercially Exploited Plant List. 5B-40.0055 F.A.C. (2020). Even if they were, the PNFFS does not adequately protect them against habitat destruction and degradation. The PNFFS states that the regulated plant index is "not to be used to regulate construction or other land alteration activities on any property," Fla. Stat. § 581.185(12), which is a significant threat to the bluecurls and their habitat. The statute specifically exempts "clearing or other disturbance of land for agricultural purposes, fire control measures, or required mining assessment work," "clearing or removal of regulated plants from a canal, ditch, survey line, building site, or road or other right-of-way by the landowner or his or her agent," and "the clearing of land by a public agency or a publicly or privately owned public utility when acting in the performance of its obligation to provide service to the public." Fla. Stat. § 581.185(8)(a)–(c). Therefore, the statute provides no protection from the activities that destroy habitat and individual bluecurls (Regan 2003, entire). A significant limitation of Florida's rare plant protection statutes is that they only attempt to regulate the harvesting and commercial exploitation of rare plants as opposed to providing comprehensive protection for rare plant species and their habitats (Regan 2003, entire). The protected status afforded to plants listed on the regulated plant index can only be used for regulating the harvesting of plants.

[8] If a species is federally protected under the ESA, activities must be consistent with federal law. *Id.* § 581.185(3)(a).

Furthermore, the PNFFS limits use of the Regulated Plant Index to its own uses, and other agencies may not use it regulatory or conservation purposes (Regan 2003, entire). As the EPACS explains:

> The regulated plant index must be used *solely for the purposes specified in § 581.185 and may not be used for regulatory purposes by other agencies*. However, this section does not preclude another agency authorized to protect endangered plants from including one or more species listed on the regulated plant index on a list developed by that agency under its own regulatory authority.

Id. § 581.186(3) (emphasis added). Florida agencies engaged in conservation do not have the authority to list plant species; therefore, they cannot use the Regulated Plant Index as a basis for decision-making or conservation programs, including review of projects that may destroy listed plants' habitat (Regan 2003, entire). Although the PNFFS allows for cooperation between conservation agencies and the Endangered Plant Advisory Council, *id*. § 581.186(4), the extent of cooperation has reportedly been limited (Regan 2003, entire).

In summary, hidden bluecurls are not protected on Florida's Endangered Plant List, Threatened Plant List, or Commercially Exploited Plant List, 5B-40.0055 F.A.C., and even if they were, these state law protections do not protect the bluecurls from past, ongoing, and future threats to individual plants and their habitat.

State Public Lands

Although hidden bluecurls are present on state lands—Tate's Hell State Forest — the laws and regulations governing these lands are insufficient to protect the bluecurls from threats from habitat destruction, degradation, and fragmentation, and from invasive species and climate change.

Florida's state forests, as state owned lands, must be "managed to serve the public interest by protecting and conserving land, air, water, and the state's natural resources" and "shall be managed to . . . ensure the survival of plant and animal species and the conservation of finite and renewable natural resources."[9] Fla. Stat. § 253.034. However, Florida state forests are managed for multiple uses, Fla. Stat. § 253.034(1), some of which could be inconsistent with the conservation of rare plants like hidden bluecurls. *See* 259.032(7)(a)2. (explaining that lands must be "[m]anaged in a manner that will provide the greatest combination of benefits to the public and the resources"). For instance, if authorized by a land management plan, "the Florida Forest Service of the Department of Agriculture and Consumer Services

[9] Associated "lands acquired for conservation and recreation purposes may be for use as state-designated . . . wildlife management areas . . . or other state-designated recreation or conservation lands." *Id*. 259.032(3).

may grant privileges, permits, leases, and concessions for the use of state forest lands . . . for management purposes, timber, and forest products." *Id.* § 587.011(1). The Florida Forest Service may also grant easements for transmission lines, oil and gas pipelines, and public roads. *Id.* § 587.011(2).

Each manager of a state forest must prepare and submit a management plan at least every 10 years, with required updates for significant changes to use, management, or additions to the forest. Fla. Stat. § 253.034(5). The management plan should address short-term and long-term goals for habitat restoration and improvement, sustainable forest management, public recreation, and exotic and invasive species maintenance and control, among other things. *Id.* § 253.034(5)(b). The plan is then reviewed periodically by a land management review team that, among other things, "evaluate[s] the extent to which the existing management plan provides sufficient protection to threatened or endangered species, unique or important natural or physical features, geological or hydrological functions, or archaeological features" and "the extent to which the land is being managed for the purposes for which it was acquired."[10] *Id.* § 259.036(2)–(3). The land manager must use the findings and recommendations from the review team in finalizing the required 10-year update of its management plan. *Id.*

The Florida Forest Service may also adopt and enforce rules necessary for the protection, utilization, occupancy, and development of state forest lands and may prohibit activities that interfere with management objectives. *Id.* § 587.011(5)–(6).

Tate's Hell State Forest does not currently provide management mechanisms that are adequate to protect hidden bluecurls from ongoing threats. Aside from one mention of a 2018 research project involving *Trichostema* (FDACS 2019, p. 34), the land management plan does not address management of hidden bluecurls (FDACS 2019, entire). The next management plan update is not due until October 18, 2029 (FDACS 2019, cover letter).

More broadly, the State of Florida has demonstrated management decisionmaking that conflicts with sound conservation of endangered and threatened species like hidden bluecurls. Most recently, in August 2024, the Florida Department of Environmental Protection (FDEP), which oversees and manages Florida's state parks, proposed development of golf courses, lodges, pickleball courts, and other amenities in nine state parks (FDEP 2024a, entire; FDEP 2024b, entire). A proposed plan amendment for Jonathan Dickinson State Park included "construction of public golf courses and associated facilities," which would also "necessitate the relocation of existing park entrance, management office complex, staff residences, and other ancillary facilities" to "other park areas" (FDEP 2024c, entire). Notably,

[10] This review must occur at least every 5 years for areas, like Tate's Hell, that exceed 1,000 acres in size. *Id.* § 259.036(3).

the conceptual land use map for the proposal showed the footprint of the proposed golf facilities directly overlapping with Hobe Mountain (FDEP 2024d, entire), which is where Jobé bluecurls are known to occur (McClelland 2021, at 44:30–44:34).[11] Recent reporting also indicates that Florida approved a land swap that gave 324 acres of state forest to a golf course developer (Chesnes & Mahoney 2024, entire). These are just two examples of management decisions that fundamentally conflict with rare plant conservation on state public lands, which underscore a deeper inadequacy of state management.

Federal Regulatory Mechanisms

Federal Conservation Laws

hidden bluecurls are not currently protected under the ESA, which is designed to "halt and reverse the trend toward species extinction, whatever the cost." *Tenn. Valley Authority v. Hill*, 437 U.S. 153, 180, 184 (1978). There are no other federal laws with the explicit purpose to protect endangered or threatened native plants from the type of threats the bluecurls face.

To the extent the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321, *et seq.*, may govern federal actions affecting hidden bluecurls, it is inadequate to protect the species from the threats it faces. Although NEPA requires federal agencies to consider the environmental impacts of their actions, they are unlikely to specifically consider hidden bluecurls because they are not designated on Florida's Regulated Plant Index or listed under the federal ESA. Furthermore, NEPA confers no substantive protections because it does not require any particular outcome. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332 (1989).

As USFWS has repeatedly acknowledged in species status assessments for other Florida species, currently there are no regulatory mechanisms or conservation measures that address the impacts of climate change, including shifting seasonal patterns of rainfall and temperature, sea level rise, and storms of increasing intensity (e.g., USFWS 2021, p. 18; USFWS 2020, p. 33).

The U.S. has made small but insufficient reductions in fossil fuel emissions, remaining far behind the cuts needed to meet national and international climate pledges (UNEP 2024, entire). Currently, U.S. climate policy is inadequate to meet the international Paris Climate Agreement 1.5°C climate limit and avoid the worst damages of the climate crisis. The U.S. is the world's biggest cumulative emitter of greenhouse gas pollution, responsible for 25% of cumulative global CO_2 emissions since 1870 (Global Carbon Project 2021, p. 85), and is the world's second highest

[11] This location amidst scrub habitat in the park was proposed despite FDEP's claim that "[a]voidance of sensitive habitat will be a priority in the design of the proposed facilities." (FDEP 2024c, entire).

emitter on an annual basis and highest emitter on a per capita basis (Global Carbon Project 2021, p. 19–20). Estimates of an equitable U.S. "fair share" of emissions reductions needed to meet a 1.5°C climate limit equate to cutting U.S. domestic emissions by at least 70% below 2005 levels by 2030 and reaching near zero emissions by 2040, paired with financial and technological support for large-scale emissions reductions internationally (Muttitt 2020, entire; U.S. Climate Action Network 2020, entire; ActionAid USA et al. 2021, entire).

Yet U.S. policy is significantly off-track to limit warming to 1.5°C or even 2°C and must greatly accelerate greenhouse gas emissions reductions (Climate Action Tracker 2023, entire; UNEP 2021, p. 15; UNEP 2024, entire). As summarized by the Fifth National Climate Assessment,

> While U.S. greenhouse gas emissions are falling, the current rate of decline is not sufficient to meet national and international climate commitments and goals. U.S. net greenhouse gas emissions remain substantial and would have to decline by more than 6% per year on average, reaching net-zero emissions around midcentury, to meet current national mitigation targets and international temperature goals; by comparison, US greenhouse gas emissions decreased by less than 1% per year on average between 2005 and 2019.

(Jay et al. 2023, p. 1–15; Davis et al. 2023, entire). Importantly, to meet a 1.5 °C limit, most U.S. and global fossil fuels must remain undeveloped including an immediate halt to new fossil fuel production and infrastructure, paired with a phase-out of existing production and infrastructure within the next several decades (IPCC 2018, entire; Oil Change International 2019, entire).

U.S. policies that promote fossil fuel production and infrastructure include enabling fracking by exempting it from the Safe Drinking Water Act, lifting the crude oil export ban, and providing billions in government subsidies to the fossil fuel industry (Erickson et al. 2017, entire; Oil Change International and Greenpeace 2020, entire; Stockholm Environment Institute et al. 2021, at 39). For example, after Congress lifted the 40-year-old crude oil export ban in December 2015, U.S. crude oil exports increased by 750% so that by 2019, one quarter of all U.S. oil production was exported (Oil Change International and Greenpeace 2020, entire). Exports continue to average more than four million barrels per day (U.S. Energy Information Administration 2024a, entire).

Although President Joe Biden committed to tackling the climate crisis upon taking office (White House 2021, entire), in practice, the administration has failed to take the necessarily ambitious actions needed to combat the climate crisis, and his administration is instead promoting fossil fuel production that undercuts his plans

to deploy renewable energy and secure environmental justice. For example, in his first year in office, President Biden approved more oil and gas drilling permits on public lands than President Trump, approving about 3,700 drilling permits through November 2021, 35% more than the Trump administration approved in its first year in office (Public Citizen 2021, entire). In 2022, the US continued to reach record highs in oil and gas production and exports, and it is planning to increase its LNG export capacity by more than 40% by 2026 (Climate Action Tracker 2023, entire). Despite campaign promises to halt new oil and gas drilling on public lands and waters, in March 2023, the Biden administration approved a major oil drilling project on federal land (the Willow project in Alaska) (Climate Action Tracker 2023, entire). In July 2023, the Supreme Court authorized the construction of the Mountain Valley Pipeline—a 500-km-long project to transport gas from West Virginia to Virginia (Climate Action Tracker 2023, entire).

Greater U.S. domestic production of oil and gas, facilitated through various domestic policies, will contribute greenhouse gas emissions that undercut efforts to meet the international Paris Agreement 1.5°C climate limit and avoid the worst damages of the climate crisis.

To meet the Paris Agreement target, the US needs to average a 6.9% emissions reduction every year from 2024 through 2030—more than triple the 1.9% drop in 2023" (King et al. 2024, entire). Scientific assessments (e.g., IPCC, International Energy Agency, United Nations) make clear that to meet the 1.5°C Paris climate benchmark, governments must immediately stop approving new fossil fuel extraction and infrastructure projects and phase out existing fossil fuel development (IPCC 2023, entire; Tong et al. 2019, entire; Stockholm Environment Institute 2019, entire; International Energy Agency 2021, entire; Trout et al. 2022, entire; International Energy Agency 2023). Yet the U.S. government has failed to use its existing authority to stop new fossil fuel projects or phase out existing projects. The U.S. is currently the world's top oil and gas producer. The U.S. has produced more crude oil than any nation in history for the past six years. The U.S. is now the world's largest exporter of petroleum products and fossil gas, with the largest planned expansion of oil and gas extraction (U.S. Energy Information Administration 2024a, entire; Stockholm Environment Institute 2023, entire; U.S. Energy Information Administration 2023b, entire; Oil Change International 2023, entire; Center for Biological Diversity 2019, entire).

President-elect Donald Trump has pledged to "unleash American oil and natural gas production," speeding federal drilling permits and "remov[ing] all red tape" delaying oil and natural gas projects, including speeding up approval of natural gas pipelines into the Marcellus Shale in Pennsylvania, West Virginia, and New York (Donald J Trump for President 2024, entire). He has also pledged to exit the Paris

Climate Accords and oppose existing climate policies (Donald J Trump for President 2024, entire).

Federal Public Lands

There are no known populations of hidden bluecurls on federal public lands; accordingly, regulations governing federal public lands do not protect the species.

e. Other natural or manmade factors affecting the continued existence of the species

Hidden bluecurls are also threatened by invasive species, pollinator declines, climate change, and the inherent vulnerability associated with being a narrow-ranging endemic species.

i. Invasive species

Exotic and invasive species are a significant threat to biodiversity worldwide, including in hidden bluecurls' scrub and scrubby flatwoods habitat. Invasive exotic species can out-compete, displace, or destroy native species and their habitats, often because they have been released from the natural controls of their native range (FDEP 2012, p. 55). If left unchecked, invasive exotic plants alter the character, productivity, and conservation values of the natural areas they invade (FDEP 2012, p. 55). In Tate's Hell State Forest, where one occurrence of hidden bluecurls has been documented, non-native invasive plant species are present, including: mimosa (*Albizia julibrissin*), Chinese tallow tree (*Sapium sebiferum*), Japanese climbing fern (*Lygodium japonicum*), cogon grass (*Imperata cylindrica*), torpedo grass (*Panicum repens*), Johnson grass (*Sorghum halepense*), air potato (*Dioscorea bulbifera*), Chinaberry (*Melia azedarach*), and camphor tree (*Cinnamomum camphora*) (FDEP 2019, p. 43). The other documented bluecurls population is along a roadside, which is also vulnerable to species invasions, as roadsides can serve as both habitat and a conduit for nonnative plant invasions (Christen & Matlack 2009, entire; Lemke et al. 2018, entire).

ii. Pollinator Declines

Documented declines in native pollinators—specifically, insects— also threaten hidden bluecurls because the species is pollinated by native bees (McClelland pers. comm. 2024). There is growing evidence of global declines in both wild and domesticated pollinators, as well as corresponding declines in plants that rely on them (IPBES 2016, entire; Potts et al. 2010, entire; Biesmeijer et al. 2006, entire). The most comprehensive global report thus far on the status of pollinators found that more than 40 percent of them, mostly bees, are facing extinction (IPBES 2016, entire). A systematic review of the status of 4,337 North American and Hawaiian

native bees concluded that, among native bees with sufficient data to assess, more than half (749 species) are declining, and nearly 1 in 4 (347 species) is imperiled and at increasing risk of extinction (Kopec & Burd 2017, entire). For many of the bee species lacking sufficient population data, it is likely they are also declining or at risk of extinction (Kopec & Burd 2017, entire). In forests in the southeastern United States, declines in pollinators were detected over a 15-year period from 2007–2022 (Ulyshen & Horn 2023, entire). Researchers observed and documented declines in the richness and abundance of bees, as well as the abundance of butterflies (Ulyshen & Horn 2023, entire). These findings suggest that pollinator declines may be occurring even in areas with relatively undisturbed habitat (Ulyshen & Horn 2023, entire). Relatedly, plant-pollinator coextinctions are projected to become more frequent as habitat alteration and climate change continue to threaten pollinators (Vieira et al. 2013, entire). Because hidden bluecurls depend on native pollinators to reproduce, ongoing and projected pollinator extinctions threaten their existence.

iii. Climate change

Climate change and associated changes in temperature, precipitation, sea level, and storm intensity also threaten hidden bluecurls. Karl et al. (2009) predict that as climate change affects southeastern environments, "[e]cological thresholds are expected to be crossed throughout the region, causing major disruptions to ecosystems" (Karl et al. 2009, p. 115). The warming climate will likely cause ecological zones to shift upward in latitude and altitude and species' persistence will depend upon, among other factors, their ability to disperse to suitable habitat (Peters & Darling 1985, pp. 709–712). For narrowly endemic plant species like hidden bluecurls, adapting to or dispersing as a result of climate change may prove difficult—if not impossible—without human assistance.

Indeed, while habitat destruction has been widely considered the greatest threat to plant species worldwide, experts believe the impacts of climate change have been underestimated (Silva et al. 2019, p. 3). Local extinctions of plant species are likely already widespread and presumably will become more prevalent as global climate change increases (Wiens 2016, entire). As climate change advances, hidden bluecurls will face increasing threats from rising local temperatures, changes in precipitation, sea level rise, and storms of increasing intensity. These threats will act individually and synergistically, threatening both the species and its limited remaining habitat.

Rising Temperatures

Global average surface temperature rose by 2°F (1.09°C) between 1850–1900 and 2011–2020, with larger increases over land than over the ocean (IPCC 2021, at SPM-5 and SPM-6). Each of the last four decades has been successively hotter than any preceding decades since 1850 (IPCC 2021, at SPM-5 and SPM-6). Global

temperatures of the last decade are likely the hottest it has been on Earth in 125,000 years (IPCC 2021, at SPM-9).

In the United States, average temperatures rose by 1.8 °F (1.0°C) between 1901 and 2016, with the most rapid heating occurring after 1979 (Hayhoe et al. 2018, p. 76). U.S. temperatures are expected to rise by an additional 2.5 °F (1.4 °C), on average, by mid-century relative to 1976-2005, and record-setting hot years will become commonplace (USGCRP 2017, p. 11). By late century, much greater heating is projected, ranging from 2.8 to 7.3°F (1.6 to 4.1°C) under a lower emissions scenario and 5.8 to 11.9 °F (3.2 to 6.6 °C) under a higher emissions scenario (USGCRP 2017, p. 17 and 136). Even if there was an immediate and aggressive reduction in human produced GHG emissions, there would still be expected continued increases in surface air temperature (IPCC 2018, pp. 1–11).

In Florida's scrub ecosystems, increased average summer temperatures are projected to cause an increased risk of wildfires, increased frequency and intensity of wildfires, and reduced opportunities for prescribed fire (FWC 2016, p. 6–30). Increased temperatures, along with extreme events (e.g., flood, drought, fires) will also work synergistically to enhance invasive species processes, from introduction through establishment and expansion (Ward et al. 2019, entire). Finally, as noted above, changing temperatures could drive changing ecological conditions which make hidden bluecurls' existing habitat unsuitable (Peters & Darling 1985, pp. 709–712).

Changes in Precipitation

Climate change is increasing the frequency and intensity of extreme weather events, particularly heat waves and heavy precipitation events (Herring et al. 2017, pp. S1–S3; USGCRP 2017, pp. 18–20; IPCC 2021, p. SPM-10). In the southeast, climate change will increase the incidence and severity of both drought and major storm events (Karl et al. 2009, pp. 33–36).

The percentage of the southeast region experiencing moderate to severe drought has already increased over the past three decades. Since the mid-1970s, the area of moderate to severe spring and summer drought has increased by 12 percent and 14 percent, respectively. Fall precipitation tended to increase in most of the southeast, but the extent of region-wide drought still increased by nine percent (Karl et al. 2009, p. 111).

Precipitation patterns are also changing. Annual average precipitation has increased by 4 percent since 1901 across the entire United States (USGCRP 2018, pp. 745–808; Hoffman et al. 2023, pp. 22–11, 22–38) and 5 to 10 percent since 1900 in south Florida (USFWS 2017, p. 4). Shifts in seasonal rainfall events as well as increases in average precipitation are currently being documented (USGCRP 2018,

pp. 745– 808). The south Florida dry season (November through April) has become wetter, the rainy season (May through October) has become drier, and current projections show that this trend will continue.

These projected changes in precipitation threaten hidden bluecurls' coastal scrub habitat. Increased rainfall is expected to cause increased above-ground biomass, altered community structure or composition, and increased flooding and flash flooding in Florida's scrub ecosystems (FWC 2016, p. 6–30). Decreased rainfall or drought is expected to cause increased wildfires, reduced opportunities for prescribed fire, and altered species ranges and extents of occurrence in scrub habitat (FWC 2016, p. 6–30).

Scrub systems typically do not flood or stay flooded for a long period of time; however, if precipitation and/or extreme events (e.g., storms, floods) increase, this community may experience saturated soils or flood conditions (Ward et al. 2019, entire). This could lead to a change in plants species as those that have a low tolerance to more hydric conditions are replaced by those that can withstand wetter conditions (Ward et al. 2019, entire).

Sea Level Rise

Global average sea level rose by roughly eight inches between 1901 and 2018, as the oceans have warmed and land-based ice has melted (IPCC 2021, p. 5). Sea level rise is accelerating in pace with almost half of recorded sea level rise occurring since 1993. The Fourth National Climate Assessment estimated that global sea level is very likely to rise by 0.3–0.6 feet by 2030, 0.5–1.2 feet by 2050, and 1.0-4.0 feet by the end of the century relative to the year 2000, with sea level rise in excess of 8 feet possible (Hayhoe et al. 2018, p. 84–86). The National Oceanic and Atmospheric Administration (NOAA) projects low to high scenarios ranging from 0.3–2.0 meters of global mean sea level rise by 2100 (Sweet et al. 2022, p. 20). Projections between the intermediate-low and intermediate scenarios are consistent with the current observed acceleration of sea level rise, which, if extrapolated, would yield about 0.24 meters (0.8 feet) by 2050 and 0.69 meters (2.3 feet) by 2100 (Sweet et al. 2022, p. 20–21). However, these projections include only physical processes in which there is at least medium confidence in the current scientific understanding, and therefore they do not include the largest potential contributions to long-term global mean sea level rise from ice-sheet processes in which there is currently low confidence (Sweet et al. 2022, p. 21). Projections that include these processes could give rise to significantly higher projections (Sweet et al. 2022, p. 21). Regardless of the precise scenario considered, the impacts of sea level rise will be long-lived: under all emissions scenarios, sea levels will continue

to rise for many centuries and many changes will be “irreversible” for centuries to millennia (IPCC 2021, p. 21; Hayhoe et al. 2018, pp. 84–86, 102).

Recent NOAA analyses indicate an accelerated rate of sea level rise above the global range for the contiguous United States and eastern Gulf (Sweet et al. 2022, pp. 20, 23; Sweet et al. 2017, p. 25; Carter et al. 2014, pp. 401–403; Park and Sweet 2015, entire). For the contiguous United States, NOAA projects a rise between 0.6–2.2 meters (3.9–7.2 feet) above the 2000 baseline by 2100 under the full range of scenarios (Sweet et al. 2022, p. 20). Similarly, for the eastern Gulf, NOAA projects sea level could increase by between 0.6–2.2 meters (2.0–7.2 feet) by 2100 (Sweet et al. 2022, pp. 20–21, 23). Focusing in on projections for the year 2050, observation-based extrapolation of past sea level rise trends indicate that the eastern Gulf is tracking between the intermediate-high and high scenarios and could see between 0.45–0.51 meters (1.47–1.67 feet) of sea level rise relative to the baseline of 2000 by 2050. NOAA notes that “[h]igher global temperatures increase the chances of higher sea level by the end of the century and beyond” (Sweet et al. 2022, p. xiii).

As sea level rises, tides, storm surge heights, and coastal flooding will also increase (Sweet et al. 2022, p. 60). Because of sea level rise, coastal areas are increasingly more vulnerable to high tide flooding which is rapidly increasing in frequency, depth, and extent (Sweet et al. 2018, p. 3).

The Florida Fish and Wildlife Conservation Commission projects that Florida will experience significant declines in scrub habitat due to sea level rise, with as much as 38,161 acres (~10 of the total area of scrub habitat) projected to be lost with 3 meters (9.8 feet) of sea level rise (FWC 2016, pp. 6–28; Ward et al. 2019, entire). Sea-level rise is projected to inundate coastal scrub, causing habitat loss and fragmentation, altered distribution of habitat, and altered range extent or occurrence of species (FWC 2016, pp. 6–30). The Climate Adaptation Explorer for Florida provides an interactive map that shows losses of coastal scrub habitat at 1 meter (3.2 feet) and 3 meters (9.8 feet) of sea level rise across hidden bluecurls’ range (see Figures 4 and 5, below) (Ward et al. 2019, at https://climateadaptationexplorer.org/habitats/terrestrial/1210/map).

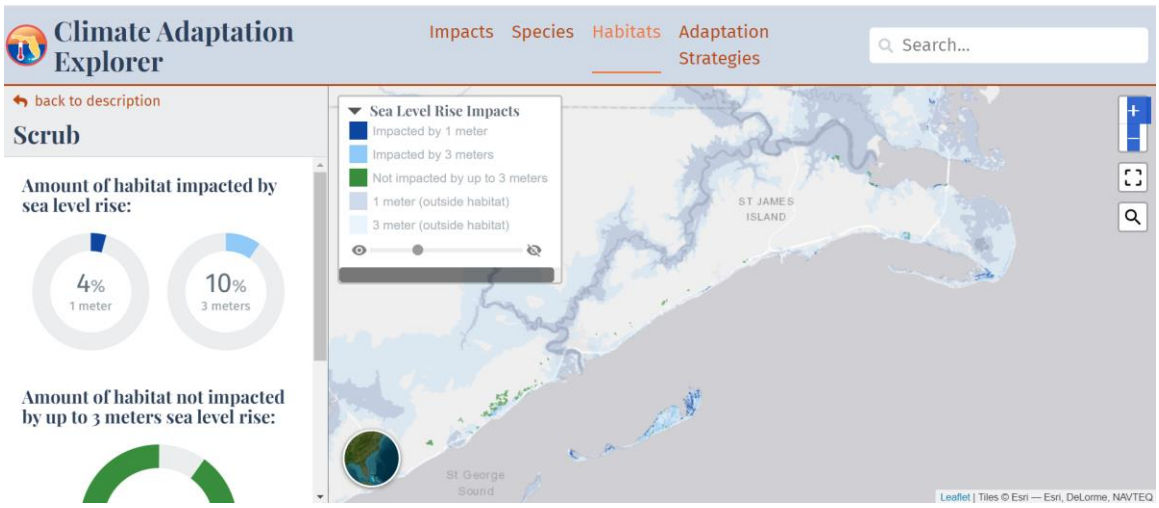

Figure 4: Projected loss of scrub habitat in hidden bluecurls' range

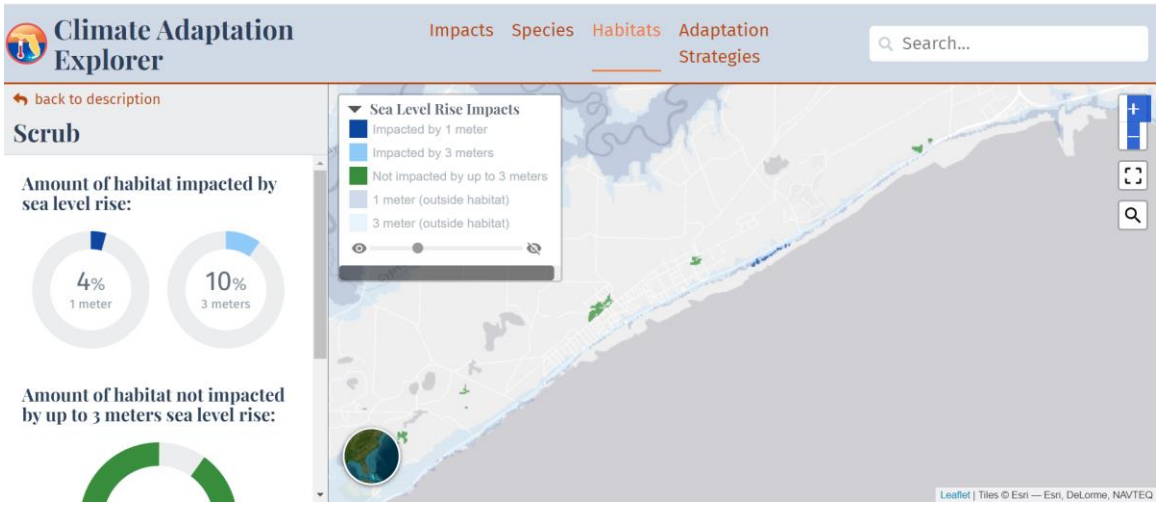

Figure 5: Close-up of projected loss of scrub habitat along U.S. 98 at 1 meter (3.2 feet of sea level rise)

Sea level rise will also affect coastal scrub through changes in soil salinity driven by saltwater intrusion and flooding, which will alter distribution of habitat and fire regime (FWC 2016, pp. 6–30; Ward et al. 2019, entire). There is already evidence that sea-level rise has contributed to the conversion and loss of pine forest habitat in Florida to more halophilic (salt-loving) vegetation (Ross et al. 1994, pp. 152–154; Ogurcak 2016, entire). It is likely that hidden bluecurls cannot tolerate increased soil salinity (McClelland pers. comm. 2024). A related species, Florida coastal bluecurls (*T. floridanum*), can tolerate moderate amounts of salt wind without significant injury, but not long-term flooding by salt or brackish water (McClelland pers. comm. 2024; Gann et al. 2005–2016, entire). Another related species, forked bluecurls (*T. dichotomum*) are not salt tolerant (McClelland pers. comm. 2024).

Sea level rise also puts coastal scrub in hidden bluecurls' range at risk from future development as people migrate out of more vulnerable waterfront areas and into higher-elevation areas with lower perceived flood risk (Ward et al. 2019, entire; Keenan et al. 2018, pp. 9–10; USFWS 2022, p. 66).

Increased storm intensity

The International Panel on Climate Change (IPCC) predicts with "high confidence" that stronger storms driven by climate change will increase at the global scale, including in the North Atlantic (IPCC 2021, p. 16; Knutson 2024, p. 1). Tropical storms and hurricanes are projected to be similar or fewer in number but stronger in force, with more Category 4 and 5 hurricanes (Knutson 2024, p. 1; Balaguru et al. 2022, entire; Bhatia et al. 2019, entire). In 2024, major hurricane Helene made landfall as a category 4 hurricane in Florida's Big Bend, bringing with it peak storm surge warnings as high as 15–20 feet (National Weather Service 2024, entire; WFTS 2024, entire).

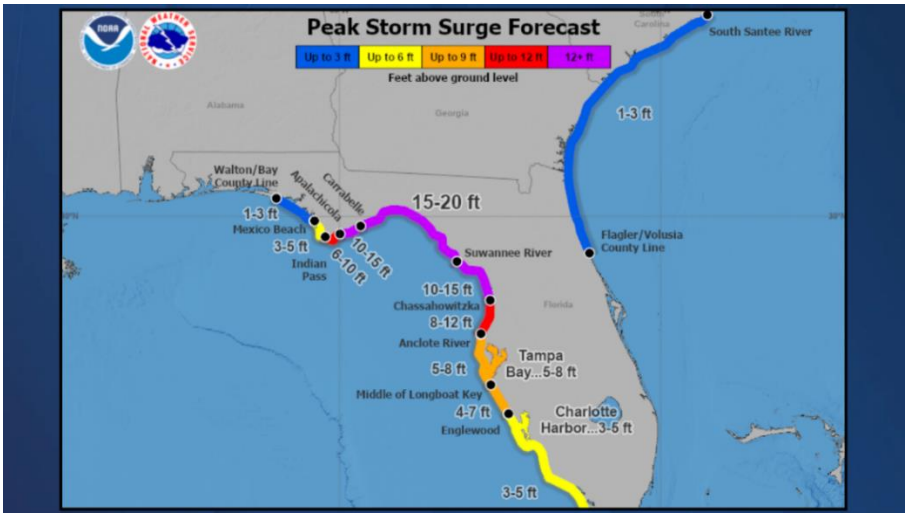

Figure 6: Storm surge warnings for Hurricane Helene (WFTS 2024)

Increased intensity and/or frequency of storms, along with sea level rise and changes in soil salinity, will cause habitat degradation, fragmentation and loss in Florida's coastal scrub (Ward et al. 2019, entire). Because hidden bluecurls have an exceptionally small, occupied range within coastal scrub in Franklin County, any degradation of that habitat is likely to further threaten the species' existence by reducing available habitat. Additionally, the species' small occupied range is vulnerable to range-wide negative effects from increasingly intense storms.

iv. Inherent vulnerability of narrow-ranged species

In general, narrow-ranged plant species face the greatest risks of extinction from multiple threats (Nic Lughadha et al. 2020, pp. 397–98; Newbold et al. 2018, entire; Enquist et al. 2019, p. 2, 9; Staude, Navarro & Pereira 2020, entire; Silva et al. 2019, p. 2). Plant species with narrow ranges, like hidden bluecurls, are at greater risk of extinction because it is more likely that threats like habitat destruction and degradation will affect their entire range (Newbold et al. 2018, entire; Staude, Navarro & Pereira 2020, entire). For this reason, a species' small range size can be a predictor of higher vulnerability to extinction driven by habitat loss (Staude, Navarro & Pereira 2020, p. 22). Narrowly distributed species can also have smaller populations, making them more susceptible to genetic drift and inbreeding, as well as narrower habitat tolerance and higher sensitivity to disturbance, which makes their survival highly dependent on habitat integrity (Silva et al. 2019, p. 2).

Generally, species with smaller or fewer populations are more likely to become extinct (Shaffer and Stein 2000, at 307; Wolf et al. 2015, at 5). For a species to be viable, it should have stable population sizes and growth rates (resiliency), a number of resilient populations over a broad geographic range (redundancy), and diverse populations of adequate size (representation) (USFWS 2016, at 6). Hidden bluecurls are found across approximately 22 linear km in only three known occurrences (NatureServe 2024, entire). This small number of populations over a small range reflects low resiliency, redundancy, and representation, which in turn makes the bluecurls more vulnerable to extinction driven by existing and future threats (Shaffer and Stein 2000, at 307; Wolf et al. 2015, at 5). For example, because of their small range and clumped distribution, the bluecurls are more susceptible to extreme weather events or harmful activities that could cause population declines or local extirpations.

III. Request for Critical Habitat

The Center requests that USFWS designate critical habitat for hidden bluecurls concurrently with listing, as required by the ESA. 16 U.S.C. § 1533(b)(6)(C). We request that USFWS designate critical habitat for hidden bluecurls in all areas where it is currently located, as well as areas of suitable habitat—whether occupied or unoccupied—deemed essential to ensure the survival and recovery of this species.

Federally listed species with designated critical habitat are more likely to make progress toward recovery than species lacking it (Taylor et al. 2005, pp. 361–363). This is particularly true for species—like hidden bluecurls—that are threatened by habitat destruction and degradation. Critical habitat designation provides the most effective means of ensuring that a listed species' habitat is managed to ensure the species' survival and recovery.

The ESA requires USFWS to designate critical habitat concurrent with a determination that a species is endangered or threatened. 16 U.S.C. § 1533(a)(3)(A). Critical habitat is defined as:

> (i) the specific areas within the geographical area occupied by the species, at the time it is listed . . . , on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
>
> (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . , upon a determination by the Secretary that such areas are essential for the conservation of the species.

16 U.S.C. § 1532(5). The designation and protection of critical habitat is one of the primary ways to achieve the fundamental purpose of the ESA, "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." 16 U.S.C. § 1531(b).

Hidden bluecurls will benefit from the designation of critical habitat. The added layer of protection provided by critical habitat will allow USFWS to mandate reasonable and prudent alternatives to federal activities that would destroy or adversely modify habitat that is necessary for the conservation—survival *and* recovery—of the species. For these reasons, we request that USFWS designate critical habitat concurrent with listing the species.

IV. Conclusion

For the foregoing reasons, the Center and Dr. Kevan Schoonover McClelland petition USFWS to list hidden bluecurls as an endangered or threatened species under the ESA. Listing is warranted because of its rarity and its extremely narrow range, which make it vulnerable to ongoing threats. The bluecurls are at risk of extinction because of at least three of the five ESA listing factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. The Center and Dr, McClelland also request that USFWS designate critical habitat for the bluecurls, in both occupied and unoccupied suitable habitat, concurrently with listing the species. Designating critical habitat for the bluecurls will support the species' survival and recovery in the face of significant threats to its limited existing habitat.

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