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Barlow is the founder, webmaster, and chief spokesperson for **Torreya Guardians**. She has been **quoted in many media reports** on her activism in behalf of the **critically endangered Florida Torreya** tree, *Torreya taxifolia*. **Torreya Guardians** has no board, no by-laws, no outside funders; the comments submitted here are entirely Barlow's and should not be considered representative of the group. Barlow is a retired science writer (author of 4 biology books) and the lead author of 2004 "**Bring Torreya taxifolia North – Now.**"

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Summary and List of Topics

Part 1: Florida Torreya Tree as case study for endangered PLANTS - why the ESA contains an intentional "exception" for PLANTS that has enabled our group, TORREYA GUARDIANS, to move ahead with ASSISTED MIGRATION poleward of a GLACIAL RELICT, while the agency and institutions constrained by the official plan have made no progress in arresting species decline in its current (and historic) range.

Part 2: Comments on Proposed Regulations (424.11 and 424.12)

2A "Foreseeable Future" - *not applicable to Torreya taxifolia*

2B "Critical Habitat - Designation of Unoccupied Areas" - *not applicable to Torreya taxifolia*

2C "Known distribution of a species" - **strong recommendation** for plants

Part 3: Torreya-Specific Insights and Recommendations

3A End wastage of seeds in ex situ plantings - **strong recommendation**

3B Establish policy on genetic engineering - **strong recommendation**

3C Host a seminar - **strong recommendation**

Part 1: Florida Torreya Tree as Case Study for Endangered PLANTS

my perspective as founder (14 years ago) of Torreya Guardians,
citizen activists moving north the endangered *Torreya taxifolia*

The following recommendations on USF&WS regulations for implementing the Endangered Species Act come from **my personal experience** collaborating for 14 years as founder of a loose group of **citizen volunteers** who, thanks to **an "exception" in the Endangered Species Act that applies only to plants**, have been **exercising our rights** to plant the critically endangered **Florida Torreya** (*Torreya taxifolia*) onto **our own lands** far north of the tree's native habitat in a well-known "**peak glacial refuge**" of northern Florida.

Our efforts have been recognized in the media, in book chapters, and in academic journals. In fact, we have been so successful in our efforts to assist the migration northward of this **climate-endangered "glacial relict" tree** that in December 2017 an **editorial** in one of the top science journals reported,

"... A common prediction for how plants will respond to climate change is that it is humans who got them into this mess and so it is humans who will have to get them out of it. That's why the idea of assisted migration of species, although often illustrated with the proposal to

shift polar bears to the Antarctic, crops up more frequently in conversations about how to preserve iconic trees. Indeed, **in one of the only real-world examples of assisted migration so far, campaigners have planted the seeds of the critically endangered conifer *Torreya taxifolia* hundreds of miles north of its Florida home...**" — *Nature* 552, 5-6 (2017)

The above excerpt uses the British term "campaigners" to speak of our role as activists volunteering in behalf of this "**critically endangered**" tree. We call ourselves "**Torreya Guardians**". We plant this **climate-endangered "glacial relict"** northward, and we do so **experimentally** in a wide range of habitats as well as latitudes. See, for example, linked lists of our plantings in **North Carolina, Tennessee, and Ohio**. We also do plantings as far north as **Michigan** and **New Hampshire** and have documented an **historic planting of mature trees in Pennsylvania**. These northern-most states are testing the limits of *Torreya*'s cold-hardiness in today's climate, while safeguarding opportunities for the tree to flourish at those latitudes in the later decades of this rapidly warming century.

We **document our results** openly (failures as well as successes) via our **website**. These results contribute to our own **learnings** and our honing of **best practices**. By featuring **photos and videos** of our projects, we hope that **academics**, horticulturalists, and seasoned naturalists anywhere in the world will engage in offering their own interpretations and advice, without having to personally visit the sites.

Recently, we have put more effort into documenting (including photos and videos) **plantings of *Torreya taxifolia* around the USA**, featuring those northward of Florida. We pay special attention to **the mature groves** planted in horticultural settings before the species was listed in 1984, as these plantings offer **ready-made, long-term experiments** for ascertaining the tree's ability to thrive — and reproduce — hundreds of miles north of where *Torreya* became stranded in Florida at the end of the Pleistocene glaciations. Botanists recognized *Torreya* as having been **stranded in a glacial refugium** as early as **1905**.

Because **we operate outside the bounds** and strictures of the official recovery plan for *Torreya taxifolia*, we easily attract volunteers who value biodiversity and are **concerned that climate change will further distress endangered species**. Citizens who do not accept the reality of climate change are unlikely to volunteer. This is an advantage we hold as a citizen cooperative that **the federal government lacks**. American citizens and elected leaders do not all have to agree on climate change in order for some of us to step ahead and use **our liberties** to aid endangered plants. Please do **review our results**; I suggest that we are really good at it — and **we cost taxpayers nothing**.

In 2010 the Fish & Wildlife Service **invited the advisory panel** for *Torreya taxifolia* to **consider launching an assisted migration "pilot project"** as a component of the recovery plan update. That project was voted down (**list of participants**, p. 22). The **two Torreya Guardians** included in the panel's deliberations were **the only commenters to vote "yes."** Thus, while the vote could not limit *Torreya* Guardians from continuing northward plantings, it seems to have **halted the agency and the institutional implementers from even beginning to experiment** these past eight years with using the simple, inexpensive, and **legal tool** that *Torreya* Guardians regularly employs to recover Florida *Torreya*: "**assisted migration**".

Note: **Two law review articles** (2015 and 2017) posit that the Endangered Species Act and regulations (unamended) already allow officials to move ahead with "assisted migration" with no need for modification.

Part 2: Comments on Proposed Regulations

from the perspective of endangered PLANTS recovery
and focusing on "glacial relict" species, e.g. *Torreya taxifolia*

2A. "Foreseeable Future" (section 424.11)

My experience in moving Florida *Torreya* northward is that, for any plant listed as threatened or endangered *and that is deemed by paleobotanists to be a "glacial relict"*, the phrase "foreseeable future" is not an issue. This is because a "glacial relict," by definition, already had to **cope in place with 6,000 years of post-glacial warming** (from the peak cold spell 18,000 years ago to the beginning of Holocene climate stability 12,000 years ago). A glacial relict has been unable to disperse poleward on its own from its "glacial refugium." **If it is stressed now, then "foreseeable future" is a moot point.** **"Assisted migration"** poleward needs to be the core management tool right now for working toward full recovery and delisting. (For *Torreya taxifolia*, **severe problems** with reproduction in its Florida range manifested in the 1950s, while **horticultural plantings in northward states** are still doing well.)

2B. Critical Habitat - Designation of Unoccupied Areas (section 424.12)

Torreya State Park was established in the 1930s. It embraces the core territory of its namesake, Florida *Torreya*. **No "critical habitat" designation** was therefore necessary for this plant when it was **listed in 1984** — especially because *Torreya* habitat that extends north and also south of the park were acquired by **The Nature Conservancy**. As well, **private landowners near the park** that have wild *Torreyas* on their properties have been so enthusiastic about helping this species that they **voted down a proposed recovery action in 2010 to authorize a "pilot project" of "assisted migration"** northward. Understandably, they were not willing to let go of their own stewardship hopes so that better-placed (northward) landowners could join the effort.

Landowner enthusiasm (and the fact that, unlike animals, rooted life forms stay put) serve to minimize government–private conflicts for plants. Indeed, if endangered plant species were capable of dispersing beyond existing habitat, they likely would not have been listed in the first place. They would have tracked climate change and other deteriorating landscape factors on their own.

Our experience with *Torreya* is that, **the less bureaucracy the better**. Our **volunteer landowners are thrilled to host the species**, especially since they know that their efforts may contribute not only to full recovery but that their monitoring and suggestions could enhance management in the future: honing **best practices** for where and how to plant seeds and ways to ongoingly encourage species success. If these volunteers were required to accept "critical habitat" designation as part of the deal, I'm not sure that all would agree. Ideally, **local and regional land conservancies will some day take the lead in recruiting volunteer planters and documenting results**, while offering conservation easements as a possibility, too. Easements would ensure that plantings would be maintained when the property is sold. Note: Our **Torreya planter in northern Michigan** not only planted seeds within her conservation easement; she wrote the forest plan for the property.

2C. "Known distribution of a species" (section 424.12)

All endangered plants (not just "glacial relicts") would likely **benefit in this century of rapid climate change** if the "known distribution of a species" were interpreted in a more expansive way. To begin, consider that the Endangered Species Act was **intentionally written** in a way that offered a great deal of **freedom for individuals to host an endangered plant** on their properties **far beyond the plant's native range**. *It made no sense for the Act to require arboretums and estates to remove a species from their grounds upon its listing as endangered.*

Indeed, the nearly century-old *Torreya* groves at the **Biltmore Gardens** (Asheville NC) and **Harbison House** (Highlands NC) do more than produce genetically valuable seeds. These **groves are scientifically precious for what they teach us** about *Torreya*'s (a) cold-hardiness, (b) ability to thrive within different types of forest settings; (c) reproductive strategies (we were the **first to document** that both male and female branches may be found on the same specimen), and (d) many other aspects of **natural history**.

RECOMMENDATION: A new regulation should require that plant listings and recovery plan updates must include **an additional category of "known distribution": horticultural settings**. This approach could bypass the contentious issue of "foreseeable future." The **controversy over "assisted migration"** would be substantially lessened as well. Simply, at which horticultural locations is the species healthiest right now? Why is it thriving there — perhaps even better than in its range in the wild? **Experimental**

plantings in wild or semi-wild settings *beyond the current native range* could then, over time, clarify preferred habitats and plant associations, ultimately leading to **population expansion** and thus delisting.

Had that expanded form of "known distribution" been considered for Florida *Torreya* when the first recovery plan was adopted in **1986**, the ex situ plantings for "safeguarding genetic material" and "preventing extinction" (see [here](#) and [here](#)) would surely be located in the southern Appalachian mountains. **Highlands NC** would likely have been designated as the **geographic center for recovery plantings**. Perhaps, too, this species could have been delisted by now.

Part 3: *Torreya*-Specific Insights and Recommendations

to improve landowner-agency relations, reduce costs,
and speed recovery (and delisting) of plant species

3A. End wastage of seeds in ex situ plantings

In 2005 *Torreya* Guardians initiated its seed distribution to landowners and botanical gardens, thanks to **donations of seeds to us from the Biltmore Gardens** (NC). Rapidly, we had more landowners asking for seeds than we had seeds to distribute. A breakthrough came in 2011. From then through autumn of 2015 we had cooperation with the **Blairsville GA location of ex situ seed production**, culminating in our receiving 4,000 seeds in 2014 and 7,000 in 2015. In 2016 **Frank Callahan donated 3,900 seeds** to us from a bumper crop at his **horticultural planting in Medford OR**. In 2017 we had no donations of seeds. An abundance of seeds donated to *Torreya* Guardians for six years thus made possible experimentation with putting seeds directly into forest soil (rather than into pots), **while learning best practices** to curtail rodent predation. Our volunteer with the greatest acreage and with early success in having **seeds germinate in wild forest** is the owner of a 232-acre "stewardship forest" on the Cumberland Plateau of Tennessee, with results documented ongoingly.

Management of seed production at the other ex situ location (**Smithgall Woods State Park, GA**) by recovery plan implementers declined to donate seeds to *Torreya* Guardians. Results of a **Freedom of Information Data Request** I submitted March 2018 confirmed their failure to count and record seed quantities produced annually from 2007 to 2017 at Smithgall Woods. And there is no documentation of seeds being distributed and to whom during that time.

Given that ***Torreya* Guardians is the first example of dedicated volunteerism** in making use of the plant exception in the ESA to assist climate adaptation of an endangered species, I regard the management disagreements and **conflicts (2014 and 2018)** that arose between we citizens and the institutions/agency implementing the recovery plan as unavoidable (yet valuable) learnings. The mis-steps evident in this trial run for ramping up citizen involvement (and hence more success and less cost for recovery) can clear the way for improved partnerships to evolve and perhaps for additional plant species to benefit. (See my **proposal to the Atlanta Botanical Garden**, dated 7 August 2018: **Part 1** and **Part 2**.) **Let us congenially discuss** our successes and failures. Let us see if a partnership might emerge to **launch a new phase of recovery** that aims to turn around the **"extinction is imminent"** assumption at the 2018 "*Torreya* Symposium" — which led to the shocking announcement that **genetic engineering** is a necessary next step (see 3B below).

RECOMMENDATION: "No Seed Left Unsown" is a possible name for a project that would **play to each of our strengths**: the official program's great success in generating seeds and our group's success in enlisting private landowners to plant seeds and report results. Together we could guide Florida *Torreya* recovery to **align with the bottom-up and cost-cutting imperatives** manifesting in America now, while ensuring that management **keeps clear of the conservation hot-button issue of genetic engineering**. All this, could, of course be accomplished during the 2019 update of the recovery plan. But here is possible language if it makes sense to write it into the Regulation amendments:

PROPOSED LANGUAGE FOR THE REGULATION: When implementation of recovery plans for listed plants have progressed to the point that, in any year, seeds produced in ex situ collections exceed the numbers deemed necessary for recovery actions under the official plan, the excess seeds will be made available for citizens to plant on their own properties. Responsibility for inviting and administering citizen involvement, for

submitting a species-specific recovery plan, for documenting results, and for communicating results in a publicly accessible form and to the federal agency will be handled by sponsoring organizations, such as land trusts, garden clubs of botanical gardens, and conservation organizations.

3B. Establish policy on genetic engineering

The results of the 2018 invitation-only "**Torreya Symposium**" (organized in part by Jason Smith, head of the **Forest Pathology Lab** at University of Florida) were shocking. "**Scientists outline novel approach to save endangered torreya**" was the report of the conference that was published in the **Tallahassee Democrat** newspaper. The approach was said to be "**gene editing technology**." The report was written by a public relations specialist at the University of Florida. The final paragraph reads:

"When funded, this holistic strategy, involving many scientists and institutions, could give us a fighting chance at saving the torreya. This isn't typically how conservation is done, so we're excited to be trying this novel approach," Smith said. "With the rate at which genetic technologies are advancing, as well as the programs we already have in place, the goal is to have a method we can implement in the next three to five years."

Online research indicates that the Forest Pathology Lab is part of University of Florida's School of Forest Resources and Conservation. Within that school is an "**Emerging Threats to Forests Research Group**." Near the bottom of that linked page is a **list of sponsors**, which includes just two: Rayonier and Weyerhaeuser. On **Rayonier's website**, I see no indication that the company uses genetic engineering to improve their timber breeding and seed services. However, an online search showed **Weyerhaeuser** has been involved in genetic engineering at least since 1995 (for **Douglas-fir**). Crucially the issue of genetic engineering of trees for planting on private timber properties in the USA was dealt with by the **USDA** in 2017 (re a freeze-resistant exotic Eucalyptus tree). Negative public opinion managed to beat back the proposal: "**Quarter of a million people say 'no' to first ever GE forest tree proposed for U.S.**" Surely, negative public opinion would be even stronger for a proposal to utilize genetic engineering on a USA endangered species.

I posted on the Torreya Guardians website **my strong disagreement** as to the symposium's proclaimed outcome. Also upsetting was **the absence of a governmental statement** clarifying that no **genetic engineering of an endangered species** can be undertaken or implemented by an institution operating under the official recovery plan without an opportunity for the public to comment (ideally through the usual process of recovery plan update). With respect to the announcement to pursue genetic engineering of *Torreya taxifolia* I offer several oppositional details: (1) Among conservationists, genetic engineering is more controversial than our own efforts to assist the northward migration of this glacial relict tree. (2) **Century-old horticultural plantings** in northward states indicate that Florida Torreya is far more disease-resistant in cooler climes and is capable of reproducing there, expanding its numbers while remaining non-invasive. (3) None of the **published research documents** isolating a distinct **stem canker pathogen** of *Torreya taxifolia* conclude that this *Fusarium* is an exotic. Even if it is exotic, surely scientific best practices would first test whether the pathogen is able to survive and whether it is lethal in **Torreya horticultural plantings** in the Appalachian Mountains and northward. **These issues must be resolved** before any genetic engineering proposal is accepted for consideration as a new recovery plan action proposal.

RECOMMENDATION: Issue a new regulation to **clarify that genetic manipulation of the genome of an endangered species will not be considered**, nor offered for public comment, until all proposed non-genetic actions have been tested first.

Note: My understanding is that symposium attendees were given no opportunity to **learn about assisted migration as it pertains to glacial relict plants**. Torreya Guardians was not invited to send a speaker to the symposium. Perhaps if we had been given an opportunity to speak, the attendees would have regarded assisted migration as the preferred next step for Torreya recovery, rather than genetic engineering. Prior to the gathering, I communicated with some of the scheduled speakers in order to advocate that they consider assisted migration. I received **a hostile communication** from Dr. Emily Coffey (Atlanta Botanical Garden), in response to **my email** (originally to Carrie Radcliffe). At that time, Torreya Guardians (two of us in communication) decided not to attend the symposium. Note: **My February 20 response to Dr. Coffey** has 6 people in the cc list, including staff of the USF&WS.

3C. Host a seminar

A way forward following the divisive outcomes of the "Torreya Symposium" and the conflict-ridden relationship between Torreya Guardians and Georgia institutions could be this:

RECOMMENDATION: Host a seminar. Bring together staff from the USF&WS, the implementing institutions (Atlanta Botanical Garden, University of Georgia, University of Florida), Torreya Guardians, and representatives of eastern USA land trusts, garden clubs, conservation organizations, and interested citizens to **assess the Torreya taxifolia actions as a valuable case study** for improving agency/implementer/citizen relations for endangered plant recovery actions. A proposal for the group to evaluate would be: **Might land trusts, garden clubs of botanical gardens/arboretums, and state chapters of conservation organizations volunteer to serve as the bridge between citizens in their area and agency/institutional staff charged with implementing the official recovery plan?**

Attendees would be taught about the **"exception" for plants** in the Endangered Species Act and why the exception was deemed important in 1973. Torreya Guardians would be positioned to explain **why it is even more valuable now**: that is, the exception cuts through the climate-change debate. It can liberate the entrepreneurial spirit and **goodwill of private landowners** and help build community relationships. It elevates horticultural and natural history skills freely applied by **folks who know their landscapes** and deeply care for the biodiversity legacies they will be passing on. **It shifts agency implementation** away from technical and costly scientific research (see p. 78, line 400 for **Torreya expenditures**) and **toward actual management**, beginning with **mapping the horticultural distribution** and gathering the **oral histories** of how each horticultural planting was managed over time. Overall, this enhanced use of the ESA plant exception generates **citizens eagerly volunteering** to participate in experimental learnings and recovery of an endangered plant on their own lands.

Finally, the **history of Torreya Guardians** actions demonstrates that enhanced recovery of endangered plants is not only possible by enlisting citizens. Taxpayer funding can be lessened. Landowner conflicts can be reduced. And at least this one glacial relict species (possibly more) can indeed be **expeditiously moved toward actual recovery and eventual delisting**.

END OF COMMENTS SUBMITTED BY CONNIE BARLOW.