

Report to Secretary of the Department of Interior and Director of Fish & Wildlife Service

Volunteer Actions of Torreya Guardians Support New Endangered Species Administrative Policies

by Connie Barlow

founder of Torreya Guardians
advocating as in individual
for policies encouraging more citizen volunteerism
in lieu of federal listings, actions, and payments

25 August 2019

SUMMARY: For 15 years citizen volunteers known as Torreya Guardians (not a formal, registered organization) have been using an "exception" in the Endangered Species Act to accomplish recovery (via our own new plantings along with documentation of "historic grove" planting successes) in locations 250 or more miles northward of the native range of Florida Torreya, a "glacial relict" that was unable to return north from its peak glacial refuge in Florida after the Ice Age subsided. Official institutions and their scientific advisors have repeatedly decided against northward plantings (and northward grove documentation), and have recently indicated that failure to progress toward recovery justifies seed placement in cryogenic facilities (Atlanta Botanical Garden), presumably awaiting genetic manipulation (proposed by Prof. Jason Smith of University of Florida). This report provides a record of correspondence, along with additional materials, by which the current administration may choose to celebrate our accomplishments and encourage other citizens (and private conservation land trusts) to follow our lead. Note: F&WS staff members have consistently been communicative and helpful, but they have apparently no power to move nongovernmental institutions that are conducting to the official recovery actions to be more responsive to citizen requests.

POLICY BENEFITS: Our actions and successes (a) demonstrate that citizens can indeed step up to help recovery of endangered plants and with no governmental funds, (b) may qualify as grounds for the administration to initiate **DOWNLISTING** of the endangered **FLORIDA TORREYA** to threatened status, and (c) offer strong **SUPPORT** for the **JOSHUA TREE DOWNLISTING DECISION**.

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(to undertake conservation actions without endangerment listing)

Part 1

Suggestions for Florida Torreya Plan Update Part A - Translocations

email by Connie Barlow to F&WS staff
12 August 2019

From: Connie Barlow <conniebarlow52@gmail.com>

Subject: Suggestions for Torreya plan update - Pt A Translocations

Date: August 12, 2019 at 8:18:02 AM PDT

To: Donald Imm <donauld_imm@fws.gov>, Catherine Phillips <catherine_phillips@fws.gov>

Re: Torreya plan update, Part A, "Translocations" are legal with no need to amend ESA

Don and Catherine -

Two law review articles posit that the existing Endangered Species Act and regulations would allow officials to move ahead with "assisted migration" with no need for modification of the law itself.

The 2 law articles:

- **"Biodiversity on the Brink: The Role of 'Assisted Migration' in Managing Endangered Species Threatened with Rising Seas"**, by Jaclyn Lopez, *Harvard Environmental Law Review*, 2015. https://www.biologicaldiversity.org/publications/papers/BiodiversityOnTheBrink_2015.pdf

Extract: However, a plain reading of the ESA reveals the Service has ample authority to help species thrive in new, climate-changed environments through active or passive assisted migration.... Furthermore, there are many examples of successful experimental populations, and the International Union for Conservation of Nature has stated that assisted migration may not be more risky than reintroduction and that ecological risks may be effectively mitigated through proper planning.³¹⁹ Two studies found that a majority of scholarly articles addressing assisted migration support its use and that it is the fourth most-cited climate adaptation strategy.³²⁰ This Article follows suit and argues the Service has a responsibility under the Endangered Species Act to use passive and active assisted migration as a means by which to buy species the time and space they need to adapt.

• **"Endangered Species Act to the Rescue? Climate Change Mitigation and Adaptation Under the ESA"**, by Olivia Bensinger, *NYU Environmental Law Journal* 2017. <https://www.nyuelj.org/2017/03/endangered-species-act-rescue/>

Extract: Importantly in the era of climate change, the definition of critical habitat also allows the FWS to designate “target land areas for future migrations.”^[57] ... While the original intent of the ESA is to preserve species in their original habitat, and while translocation might, on first glance, look like a “take,”^[65] there may soon be a time when there is no other choice. Under Section 10(j) of the ESA, “[t]he Secretary may authorize the release . . . of any population . . . of an endangered species or a threatened species outside the current range of such species if the Secretary determines that such release will further the conservation of such species.”^[66] This Section allows the Secretary to designate experimental populations to test how translocation might affect a species or ecosystem before authorizing the practice for a wide swath of species.^[67] FWS “[r]egulations interpreting this provision allow for the use of habitat outside a species’ historic range when the ‘primary habitat of the species has been unsuitably and irreversibly altered or destroyed.’”^[68] ... The ESA may have been written in 1973, but it has what it takes to protect species from the ecological problems of the twenty-first century. This requires only that we read the ESA, and act pursuant to it, in light of our changing world.

In order to reduce controversy, I suggest the recovery plan update use this language:

• **"Geographic translocation"** rather than "assisted migration" - the IUCN redlist still uses the term "translocation" (as in moving New Zealand flightless birds and Tuatara to offshore islands long ago) rather than "assisted migration". Translocation is the broader, established term.

• **"Testing for improved disease-resistance in northward habitats"** - Climate change need not be mentioned as a reason for initiating translocation experiments northward. Crucial to mention Torreya's plight as a stranded "glacial relict" in one of eastern North America's peak-glacial refugia, and that failure to thrive began in the 1950s. Link to Torreya Guardians "Historic Groves" page for preliminary data on the thrival of Florida Torreya in pre-ESA horticultural plantings in northward states (Biltmore and Harbison House NC, especially). Note: FR 1984 listing of Torreya, plus both 1986 and 2010 recovery plans characterize Torreya and/or its historic range as "relict" and "glacial refuge".

For Torreya,
Connie Barlow

Part 2

Suggestions for Florida Torreya Plan Update Part B - Actions for DOWNLISTING

email by Connie Barlow to F&WS staff
12 August 2019

From: Connie Barlow <conniebarlow52@gmail.com>
Subject: Suggestions for Torreya plan update - Pt B actions for downlisting
Date: August 12, 2019 at 9:05:48 AM PDT
To: Donald Imm <donald_imm@fws.gov>, Catherine Phillips <catherine_phillips@fws.gov>

Re: Suggestions for Torreya plan update - **Pt B actions for downlisting to "threatened"**

Don and Catherine -

Go to our **Historic Groves webpage** (new in 2018) and then scroll down to see the image I also attach at bottom.

<http://www.torreyaguards.org/historic-groves.html>

That image is molded from several components of **your "Recovery Plan Ad Hoc Report"**, linked from USF&WS main torreya page:

<https://ecos.fws.gov/ecp0/reports/implementation-activity-status-ore-report?documentId=600127&entityId=1191>

See that **Torreya Guardians (via Historic Groves documentation) has fulfilled on Action 51 "Inventory plantings at botanical gardens."**

1986 HISTORY: Page 8 of the original **1986 Recovery Plan** includes in its "Step-Down Outline" a set of sanctioned actions. The page 9 action excerpt reads:

5. Establish experimental collections of torreya outside its native habitat.
51. Inventory plantings at botanical gardens and arboreta.
52. Supplement existing plantings
53. Establish new plantings

2010 HISTORY: Notice that the whole set of Action 5 inventories and supplementations was dropped from the 2010 plan update.

WHAT TO DO:

1. REINSTATE ACTION 5 set (from 1986 plan) into the plan update.

2. Create an **ACTION LIST FOR DOWNLISTING to "threatened" status** that establishes the historic groves inventory as justification for downlisting. Below I use the template I found on your new Chapman's Rhododendron plan update, so that I offer actual wording for you to use. Notice that nothing is mentioned about climate; it is entirely about **testing whether northward habitats are capable of helping existing genotypes of Florida Torreya in fighting all lethal diseases** — with no need for CRISPR insertion of Fusarium resistance. Best case would be if Fusarium torreyae is found to be present in one or more northward plantings (I recall that Jason Smith has found it at the Biltmore), **but that it is not destructive of stems in northward realms**. That way, the need to be scrupulous in moving seeds/seedlings will be diminished, and the agency can request that Atlanta Botanical Garden and Jason Smith cease accusing us of recklessly endangering conifers in northward realms.

SUGGESTED LANGUAGE FOR DOWNLISTING ACTIONS:

Downlisting Recovery Criteria

Torreya taxifolia should be considered for downlisting when:

1. Two or more instances of horticultural plantings northward of Georgia have been documented as (a) maintaining health in a mature state, (b) producing reproductive cones, (c) evidencing naturalization via establishment (with no human assistance) of multi-aged seedlings, which are also unaffected by diseases.
2. The managers of the above horticultural plantings have agreed to accept and plant seeds supplied by the agency and/or its institutional collaborators that will serve to supplement the horticultural plantings with more specimens and of diverse genetics.
3. The above horticultural plantings have been safeguarded with "conservation easements" issued by a local or regional land trust.

Note: BILTMORE and HARBISON HOUSE in NC would together fulfill for downlisting when Action 2 and 3 are accomplished, whilst the Torreya Guardians "Historic Groves" page is accepted as fulfillment of Action 1. Biltmore has an ideal north-facing deciduous canopy forest mountainside directly next to the century-old Torreya grove. Staff has periodically translocated seedlings into that forest, while weeding out the botanical beds. So it is ideal. Harbison House is privately owned (visited by Torreya Guardians regularly, with owner welcoming us and even allowing us to collect seeds and collect basal leaders for rooting); nearly the entire acreage is untended regrowth forest, including Basswood canopy overtopping the set of half-dozen century-old torrey trees.

For Torreya,

USF&WS Recovery Plan Ad Hoc Report Results

Action Number	Action Description	Action Status	Estimated Initiation Date	Estimated Completion Date	Action Lead Agencies	Responsible Parties	Work Types	Labor Types	Comments
51	Inventory plantings at botanical gardens 	Not Started			Other	Georgia Department of Natural Resources, Center for Plant Conservation, USFWS Regional Office 4 - Atlanta, U.S. Fish and Wildlife Service - Endangered Species Program	Work type not yet selected	Labor type not yet selected	
62	Supplement existing plantings	Unknown			Other	Center for Plant Conservation, USFWS Regional Office 4 - Atlanta, U.S. Fish and Wildlife Service - Endangered Species Program	Work type not yet selected	Labor type not yet selected	Various botanical gardens may be implementing this task. However, no alert has been made to determine

Part 3

Details for updating key sections of the 2010 Recovery Plan for Florida *Torreya*

by Connie Barlow 25 August 2019

Page 4 of the 2010 Recovery Plan Update lists **4 recovery actions**.

Fulfillment of actions 2, 3, and 4 have been significantly enhanced by the volunteer citizen group [Torreya Guardians](#).

The following list, provided by Torreya Guardians founder Connie Barlow, specifies how the groups' actions have assisted recovery — perhaps to the extent that **downlisting to "threatened" status may be in order**. Suggestions here are written in a way that they could be directly inserted into a 2019 Recovery Plan update for Actions 2 through 4.

EXISTING LANGUAGE: 2. Produce cultivated plants of *Torreya* and conduct empirical investigations of methods to control the decline in cultivated plants.

BARLOW SUGGESTS ADDING:

The citizen-led **Torreya Guardians organization has been testing geographic translocation as a method for enhancing *Torreya*'s ability to fend off native (and potentially non-native) diseases.** This organization is [widely reported on in the media](#) for its volunteer actions and citizen science regarding "[assisted migration](#)" of a climate-endangered plant. Thus far, they have detected no disease-caused failures-to-thrive in locales north of Georgia, but supplementation of their citizen observations by scientists would be in order. Their METHODS in geographic translocation experimentation are two-fold:

- DOCUMENT HISTORIC GROVES IN NORTHWARD STATES: **Torreya Guardians has documented the existence and evaluated the health (and reproductive abilities) of *T. taxifolia* specimens that were horticulturally planted outside of its historic range** prior to ESA listing of this species in 1984. In 2018 the group aggregated results and published these as a new webpage, [Historic Groves](#), on the Torreya Guardians website. The full title is "Historic Groves of Torreya Trees: Long-Term Experiments in Assisted Migration, with Evidence of Northward (1) Thrival and (2) Non-Invasiveness."
- NEW LONG-TERM NORTHWARD EXPERIMENTAL PLANTINGS. **Torreya Guardians has established new long-term experiments on private lands owned by volunteers at least 250 miles north** of the species' "historic range" in Florida. Some (but possibly not all) volunteer planters engage in "assisted migration" experimentation because they regard "historic range" as an ultimately defeatist approach for selecting locales for "supplementary populations." This is because *Torreya taxifolia* is scientifically established as a glacial relict. Its historic range along the Apalachicola River is a well known peak-glacial refugium. The [1984 Federal Register listing](#) of Florida Torreya as an endangered species portrays the relictual status this way:

"... The Florida torreya and other endemics of the Apalachicola River system have received much attention from scientists and local residents. The **relictual nature of this area** accounts for the presence of many unique species (James, 1967). **During recent glaciations, species migrated southward by way of the Apalachicola River system, which served as a refugium during cooling periods.** The Apalachicola River is the only Deep River system that has its headwaters in the southern Appalachian Mountains. With the receding of the glaciers, cool moist conditions persisted on the bluffs and ravines of the

Apalachicola River after climatic change rendered the surrounding area much drier and warmer...."

Sought-after locales for **poleward experimentation by Torreya Guardians** are those likely to have been part of the "**deep-time range**" of this Jurassic-age genus in the southern Appalachian Mountains prior to significant climatic cooling during the Plio-Pleistocene. In anticipation of super-interglacial anthropogenic warming, some volunteers are testing survivability in far northern locales that may not have been occupied by eastern North America's *Torreya* species since the Paleocene-Eocene Thermal Maximum. (The group achieved [outdoor seed production in 2018 of specimens planted in Cleveland, Ohio.](#)) Barlow and Martin 2004 distinguished "deep-time range" from "historic range" this way:

- * Historic range - the range of confirmed specimen locations as evidenced by written or other human records.
- * Near-time range - the range of the plant during prehistoric human occupation.
- * Deep-time range - the range of the plant (species or genus) in any time period from its origin to the arrival of the first humans.

Note: The above list is drawn from August 2004 "[Standards for Assisted Migration](#)", which was intended to accompany the published advocacy piece, "[Bring *Torreya taxifolia* North — Now.](#)" by Connie Barlow and Paul S. Martin, *Wild Earth*, Winter 2004/05. [The Natural History of *Torreya*](#) page of the *Torreya Guardians* website presents the paleoecological perspective in detail.

EXISTING LANGUAGE: 3. Investigate the decline to determine its cause and, if possible to find a cure.

BARLOW SUGGESTS ADDING:

Since publication of the 2010 recovery plan update, **Prof. Jason Smith** (University of Florida) has authored or coauthored a number of papers identifying and evaluating a distinct stem pathogen, which he named *Fusarium torreyae*. An analysis of Smith's published *F. torreyae* papers conducted by *Torreya Guardians* founder Connie Barlow (and published online [here](#)) contends that **it is mistaken for anyone to conclude or imply that the putative lethal agent *F. torreyae* is non-native**. As well, she presents that it is **scientifically deficient and ethically questionable to advocate for genetic manipulation to infuse *Fusarium* resistance into the *Torreya taxifolia* genome** (as proposed by Smith during the March 2018 [Torreya Symposium](#)) until it has been demonstrated in a peer-reviewed paper (with full methodology specified) that translocation of *Torreya* into northward, cooler climates (especially those that regularly experience winter freezes) cannot by itself "cure" the disease problem — either by environmentally enhancing *Torreya*'s physiological ability to fight off the disease or by

stressing or killing the *Fusarium* pathogen. Barlow cites a paragraph in the 1986 recovery plan for *T. taxifolia* that makes a distinction between ultimate and proximate cause of disease vulnerability:

"... The decline of *Torreya taxifolia* in its native habitat may **ULTIMATELY be due to environmental factors** that stressed the trees, including alteration of its forest habitat, alteration of vegetation above the ravines it inhabits, alteration of water seepage into the ravines, or droughts. The **PROXIMATE causes of the decline** are an assortment of fungal infections, resulting in stem cankers, stem and leaf blight, and possibly other problems (see p. 6). The decline has affected all wild Florida trees (Godfrey and Kurz 1962) and possibly all cultivated trees...." (p. 2, emphases and caps added)

EXISTING LANGUAGE: 4. Introduce cultivated plants into secure habitat within its former range.

SUGGESTED REWRITE OF ACTION 4:

"Translocate cultivated plants and/or surplus seeds from ex situ groves into experimental habitats beyond the historic range that may offer enhanced environmental conditions for disease, climate, and herbivory resistance."

BASIS FOR THE ABOVE SHIFT FROM "FORMER RANGE" TO AN UNBOUNDED SPECIFICITY OF GEOGRAPHY:

The phrase "within its former range" is an unnecessary and unhelpful constraint re species reintroduction for any plant that is known or suspected to be a glacial relict that was apparently unable to disperse from its peak glacial refugium (or cryptic refugium) in accordance with climatic warming during the 12,000 years of the Holocene epoch. This is undisputably the case for *Torreya taxifolia*. Barlow advocates that **rewriting of this criterion could end the impasse** that has, to date, stalled institutional partners sanctioned by the recovery plan from authorizing any of the thousands of ex situ seeds produced each year from being planted in experimental plots anywhere north of the state of Georgia. In contrast, northward experimental plots are crucial for testing geographic translocation as a "cure" to restore this species to health without genetic (CRISPR) manipulation (as proposed by Jason Smith). Such experimental plots do not need to be regarded as "assisted migration," if this tactic seems too radical a move for such institutions. Rather, experimental **"geographic translocations for conferring disease resistance"** would be a suitable label (and goal), which is also the language globally used via the IUCN Redlist of Endangered Species. Nonetheless, *Torreya* Guardians contends that their own experiments in wild or semi-wild contexts (conducive to mycorrhizal assistance and thus photosynthate transfers from neighboring plants) points to the importance of offering *T. taxifolia* a chance to demonstrate its **natural viability and disease-fighting strength with the help of its co-evolved forest**

partners (which likely include, at minimum, deciduous canopy protection, evergreen fern herbivory camouflage, and upslope water seepage during summer heat and droughts). The Torreyia Guardians "[Learnings](#)" page lists these and other key findings from the group's ongoing experiments in northward states.

Part 4

Details for Reinstating (and updating) sections of the 1986 Florida Torreyia Recovery Plan

email by Connie Barlow to F&WS staff
25 August 2019

Page 8 of the **original 1986 Recovery Plan** includes in its "Step-Down Outline" a set of sanctioned actions. Though apparently not pursued in subsequent years by the official institutions implementing the plan, the category 5 actions have been greatly moved forward voluntarily by the citizen-led group **Torreyia Guardians**.

ACTION 5 EXISTING LANGUAGE: The page 9 action excerpt reads:

5. Establish experimental collections of torreyia outside its native habitat.
 51. Inventory plantings at botanical gardens and arboreta
 52. Supplement existing plantings
 53. Establish new plantings

SUGGESTED RESTORATION OF 1986 RECOVERY PLAN ACTIONS INTO UPDATED PLAN LANGUAGE:

5. Establish experimental collections of torreyia outside its native habitat.
 - 51a. Inventory plantings at botanical gardens and arboreta
 - 51b. Document other private plantings containing mature specimens
 52. Supplement existing plantings
 53. Establish new plantings

HOW TORREYA GUARDIANS HAVE FULFILLED ON CATEGORY 5 ACTIONS:

Our new **HISTORIC GROVES** webpage **documents both 51a and 51b**. The groves of mature, seed-producing specimens are of highest value as they have fulfilled the need to document Florida Torreyia's ability to thrive and even naturalize (disperse seeds which

establish next generation specimens) in locales 250 or more miles beyond the species' historic range.

Action 52 cannot be fulfilled without intervention by the federal agency to ensure redistribution of surplus ex situ seeds to the plantings that already exist. The two institutions that control seed distribution from all of the ex-situ plantings (of rooted branchlets of wild Florida stock) in northern Georgia have thus far released only a very small percentage of seeds produced (from 2010 onward) for botanical garden plantings in states other than Georgia and Florida. In fact, **an FOIA inquiry** launched by Connie Barlow in March 2018 confirmed that **neither the Atlanta Botanical Garden nor the State Botanical Garden of Georgia (the two institutions in charge of the official ex situ plantings in Georgia) had submitted documentation of annual seed production and seed "ultimate destinations" in any year**, despite the 2010 Recovery Plan itself mentioning that seed production was already occurring:

Page 6 of 2010 Recovery Plan: "After 10 years in cultivation as part of the conservation collection at ABG, a large proportion (>60) of the *Torreya* trees began producing reproductive cones. Seedlings from these mature plants also became reproductive within 10 years. According to R. Determann (Conservation Director, ABG), the Callaway Garden has a partial duplicate set of ABG cutting inventory trees that had produced seeds, however, they are in decline. ... In ex situ collections, cones on female seed bearing trees are caged at the ABG and at one of the safeguarding locations at Georgia Department of Natural Resources Smithgall Woods/Dukes Creek Conservation Area (Smithgall Woods) to protect seeds and facilitate collection for propagation (Cruse-Sanders, 2010, pers. comm.)"

Page 7: "According to R. Determann (2010, per. comm.), ABG has 500-600 seeds in some years that they propagate and grow in the conservation collection at the garden, and in some cases disseminate to other botanical gardens, to universities for study, use for outreach (display), and long-term storage. The Biltmore Gardens harvested 300 seeds in 2009 and were distributed to interested parties (<http://www.torreyaguards.org/2009-seeds.html>). ... The ABG has the largest collection of seed bearing plants. About 60-65 trees have produced seeds that have been propagated, shared with our conservation or research partners, including with Dr. Jerry Pullman (Georgia Institute of Technology; Cruse-Sanders 2010, pers. comm.).

Barlow's inquiry, posted online (emphases added):

The Fish & Wildlife Service has not yet posted anything in its ongoing reports database as to the actual quantities of endangered *Torreya taxifolia* seeds produced year-by-year from ex situ plantings in Smithgall Woods and Blairsville GA, since those trees began producing seeds. It is important for the public to know the success of **seed production, year by year, and especially the final destinations of those precious seeds**, as

produced under the terms of the 2010 update of the ESA recovery plan for this endangered species. **My concern is that the seeds at Smithgall Woods may have been unharvested, and therefore "wasted" as food for local squirrels.** I have already checked the online "Record of Actions" at this USFWS url: <https://ecos.fws.gov/ecp0/reports/implementation-activitystatus-ore-report?documentId=600127&entityId=1191> No information is available there for any year. However, **the 2010 recovery plan, on p. 9, documented that the agency was already aware that at least the Smithgall Woods ex situ plantings were already producing seeds.** It says, "The material planted at Smithgall Woods was propagated from all Georgia source population material (Army Corps. of Engineers, site at Woodru Dam, Lake Seminole, in Georgia). The trees have grown quite large and are now reproductively mature producing male and female cones annually." As founder of the citizen activist group Torreya Guardians, I would like to know **documentation of seed production year by year, beginning in 2007.** I am aware that the Blairsville site has likely been producing seeds every year since 2007, yet there is no online documentation of quantities and year-by-year reporting of **ultimate destinations** of the precious seeds. Please provide me (and thereby our group of citizens) this information. You can access our group's website at <http://www.torreyaguardsians.org/>

FOIA RESULTS: All communications from and to Barlow are linked from an **FOIA chronological webpage** on the Torreya Guardians website, which Barlow created. Despite excellent communications by DOI staff, **no documentiion of seed numbers nor destinations were produced for any of the years requested (2007-2017).**

REQUEST FOR 2019 IMMEDIATE ACTION by F&WS: ***Please ensure that the Atlanta Botanical Garden and State Botanical Garden of Georgia file seed count documentation and destincations for the upcoming Fall 2019 harvest of seeds at their ex-situ Torreya plantings in Georgia. And please make that documentation accessible online to the public, with notice directly given to Barlow via email.***

Action 53: Our own experimental plantings (less than a dozen years old) constitute progress for Action 53: Establish new plantings. As well, our volunteer plantings offer valuable guidance for determining latitudes, elevations, slopes, aspects, associated plants, and other microsite features for selecting where to focus seed supplementation on the most vigorous such plantings. **North Carolina, Tennessee, and Ohio** have thus far proved to be excellent locales for species thrival and disease-resistance. Photo-rich essays (and videos) document our plantings and can be accessed from the state-by-state list on the [homepage](#) of Torreya Guardians. Because our first plantings occurred before the 2010 recovery plan update, our actions were mentioned in that plan:

Page 5: The Torreya guardians, created in 2004, translocated seedlings of *T. taxifolia* outside of the species native habitat (two sites in North Carolina

mountains). One of the identified goals of their intentional assisted migration was to save *T. taxifolia* from extinction (<http://www.torreyaguardians.org/save.html>).

Page 9: North Carolina: In 1939 nearly a dozen specimens of *T. taxifolia* were planted at the Biltmore Gardens; 31 seedlings were planted in 2008 at two locations near Waynesville; and 10 seedlings were planted at Bt. Highlands and Franklin (<http://www.torreyaguardians.org/north-carolina.html>).

ACTION 6 EXISTING LANGUAGE:

Importantly, the 1986 plan lists as **Action 6: "Place seed in long-term storage."** Because the Atlanta Botanical Garden (ABG) has recently determined that drying or cryo-preservation of intact seeds is unachievable, this aspect of the plan is impossible to achieve in a modest way. Instead, ABG has apparently determined that laboratory removal of the embryo, followed by cutting and "somatic embryogenesis" will produce viable materials that can survive cryopreservation (in their newly installed facilities). Unfortunately, for any genetic material to later be recovered from storage and utilized, sophisticated laboratory tools and techniques will also be necessary for reviving and germinating the embryo segments into actual plants. For this reason it is crucial that any seeds in excess of "genetic safeguarding" demands be made available for "experimental collections outside its native habitat."

IMPLICATIONS of CRYOGENIC STORAGE OF EMBRYOS: Neither the 1986 nor current (2010) recovery plans mention any possibility of genetic engineering as an officially approved action. Thus, **university press release and media accounts of Prof. Jason Smith's interest in proceeding with CRISPR engineering** of wild-stock genetics is not authorized and thus **cannot legally proceed** prior to an official update that is offered for public comment.

Part 5

Torreyia Guardians Citizen Actions Empower Joshua Tree Citizen Advocates (to undertake conservation actions without endangerment listing)

Because the Editorial Board of the Los Angeles Times posted an opinion critical of the official USF&WS decision to NOT LIST JOSHUA TREE AS THREATENED, Connie Barlow was motivated to submit an Op-Ed on why Joshua Tree conservation could actually benefit from non-listing. Her Op-Ed was not published, so she pastes it in below for DOI to ponder.

REQUEST: **The DOI Secretary and upper level staff are requested to consider how publicizing favorably the conservation volunteerism of Torreya Guardians could foster other citizen actions** that could be undertaken, such that fewer requests for federal listings of PLANTS need be undertaken in the future. PLANTS already have special "exceptions" in the ESA statute (which Torreya Guardians is the first group to make use of). Scientifically informed citizen (or conservation land trust) volunteerism in behalf of plants is our way into a more pro-active and fiscally sound way into the future.

UNPUBLISHED OP-ED BY CONNIE BARLOW
August 20, 2019

"Conservation in a Time of Climate Change: Rethinking the Value of Endangered Species Listings"

Tagline: The decision is in: Joshua Tree is not endangered. Why that's a good thing for conservation.

Last year the endangered plant that I have actively been assisting as a volunteer was threatened by its official implementers. A botanical garden and a university professor collaborated on proposing a final solution — genetic engineering of cryogenically preserved and cloned embryos.¹ Ever since, I have been wary of business-as-usual practices and advocacy by America's conservation establishment.

And so, I breathed a sigh of relief last week when the Trump Administration announced that Joshua Tree will not be awarded conservation protection² in accordance with the Endangered Species Act. In my view, this magnificent tree of the Mojave Desert will fare better if citizens retain full freedom to take action themselves. Necessarily, that action entails assisting the tree in moving north.

I can personally attest that northward "assisted migration"³ of a climate-weakened native tree can be initiated entirely on a volunteer basis and with no taxpayer or donor money. All it takes is one person to assemble the scientific evidence (I am a published author⁴ on botanical paleoecology) who then recruits skilled horticulturalists, naturalists, and private landowners with suitable habitats in a range of latitudes and

¹ Journalist report by Janet Marinelli in Yale 360, 27 March 2018 • <https://e360.yale.edu/features/for-endangered-florida-tree-how-far-to-go-to-save-a-species-torreya>

² <https://www.govinfo.gov/content/pkg/FR-2019-08-15/pdf/2019-17536.pdf#page=1>

³ https://en.wikipedia.org/wiki/Assisted_colonization

⁴ Connie Barlow, 2001, *The Ghosts of Evolution* (Basic Books)
FLORIDA TORREYA & JOSHUA TREE recommendations by Connie Barlow

plant zones to do the actual work of planting, tending, monitoring, and reporting results.

Florida *Torreya* is the tree I chose for my advocacy 15 years ago, beginning with a 2004 published paper I co-wrote with the late Pleistocene ecologist Paul S. Martin⁵: "Bring *Torreya taxifolia* North Now"⁶. In 2008 a core group of citizens, *Torreya* Guardians⁷, initiated our own northward plantings. (A website⁸ by that name documents our ongoing results.)

"Assisted migration"⁹ is easy to achieve for native plants that are healthy enough to produce abundant seeds and that are "unlisted." Thanks to the recent ruling, Joshua Tree is still in the unlisted category, and its range extends far enough north¹⁰ such that plant health (and seed production) is not yet compromised. If even a few percent of the editorial and blog writers who criticized the federal nonlisting decision would reroute their energies toward forming a Joshua Tree Guardians group for volunteer leadership, not only would the species benefit but so would the American spirit of can-do citizenship. Yes, we can do basic conservation ourselves.

In contrast, once a plant is declared endangered, work-arounds are not only necessary but must be carefully undertaken in order to remain legal.¹¹ That's what we *Torreya* Guardians have had to do, and it has been frustrating and difficult.

Despite the obstacles of Florida *Torreya*'s endangered status, we have achieved seed production as far north as Cleveland, Ohio¹². This past winter we documented *Torreya*'s evergreen leaves unharmed by a polar vortex shift that pushed -15 F into southern Michigan for three days¹³. Even so, North Carolina hosts the bulk of our plantings¹⁴ as well as both of the century-old horticultural groves¹⁵ that not only

⁵ https://en.wikipedia.org/wiki/Paul_S._Martin

⁶ <http://www.torreyaguardians.org/barlow-martin.pdf>

⁷ <http://www.torreyaguardians.org/guardians.html> also <https://orionmagazine.org/article/rescuing-species/>

⁸ <http://www.torreyaguardians.org/>

⁹ <http://www.torreyaguardians.org/assisted-migration.html>

¹⁰ <http://thegreatstory.org/climate-trees-legacy.html#joshua>

¹¹ <http://www.torreyaguardians.org/comments.html#shirey-2013>

¹² <http://www.torreyaguardians.org/ohio-cleveland.html>

¹³ <http://www.torreyaguardians.org/mi-capac.html>

¹⁴ <http://www.torreyaguardians.org/north-carolina.html>

¹⁵ <http://www.torreyaguardians.org/historic-groves.html>

produce seeds but have launched seedlings and saplings nearby, and with no human assistance. Documentation of a natural dispersal rate of a mere 40 yards in one century, however, confirms that this ancient genus cannot track climate range shifts without substantial human help.

On the other hand, we have documented severe difficulties for Florida Torreyia when planted in acid, boggy soils in southern New Hampshire¹⁶. First-year torreyia seedlings are exposed to severe browsing where hunting pressure is inadequate to control overpopulated deer.¹⁷ We report all learnings¹⁸ — failures as well as successes.

Overall, our proactive volunteers have done more, I suggest, to assist America's most climate-endangered tree, Florida Torreyia, than have the institutions¹⁹ officially charged with that responsibility. Our actions have cost taxpayers nothing. In contrast, the U.S. Fish & Wildlife Service reports that \$650,000 federal dollars were spent on this single species during 1996-2016²⁰ (prior year budgets since endangered listing in 1984 were not species-specific).

Donor-funded conservation groups and land trusts could do substantially more for Florida Torreyia than we have achieved — but only if they are willing to acknowledge that climate change is, at least to some extent, unstoppable. That means it must be adapted to, not just endlessly protested against.

A good way to start is to find out just how far north Florida torreyia can live and reproduce, and whether colder conditions (especially deep winter freezes) can knock back its most aggressive pathogens. A good way to start, therefore, is to study what we Torreyia Guardians have already accomplished. And then, think about how our project could be extended to help Joshua Tree adapt to climate change — with or without any particular policy decision or budgetary help at the federal level.

Connie Barlow, author of *The Ghosts of Evolution*, is a retired science writer who volunteers with Torreyia Guardians.

¹⁶ <http://www.torreyaguardsians.org/new-hampshire.html>

¹⁷ <http://www.torreyaguardsians.org/freeplanting.html#4>

¹⁸ <http://www.torreyaguardsians.org/learnings.html>

¹⁹ <http://www.torreyaguardsians.org/comments.html#foia>

²⁰ <https://www.fws.gov/endangered/esa-library/index.html> Note: Barlow tallied a cumulative total by accessing the year-by-year species-specific data in each annual report to Congress.

Barlow 18 July 2019 Communication to Lead Author of the Joshua Tree Report Cited by News Media

From: Connie Barlow <conniebarlow52@gmail.com>

Subject: your Joshua Tree paper's press release

Date: July 18, 2019 at 9:44:43 AM PDT

To: lynn.sweet@ucr.edu

Cc: cbarrows@ucr.edu

Re: Suggestion to visit the "rewilded" horticultural planting of Joshua Trees in a subdivision northeast of its native range (Kayenta, Utah)

Lynn -

I am the founder of Torreyia Guardians. Because Florida Torreyia is the "poster plant" of climate disruption in the east, I have a google alert for the poster plant of climate disruption in the west. **Several publications printed the UC Riverside press release verbatim, including the unfortunate title.** Yes, I know that "extirpation" is not suitable for a non-technical title, but "extinction" is a powerful word that, in this case, is quite untrue.

As with Florida Torreyia, **horticulturalists have already planted Joshua Trees well to the north.** Florida Torreyia, a glacial relict, will go extinct in its historically native range (one of the small "peak glacial refuges") for eastern USA trees. But it is doing well in the Southern Appalachians and beyond, which is its putative pre-Pleistocene range (all 4 other species of genus Torreyia globally are found in mountainous habitats, including California). **For our Torreyia, we citizens visited and scrutinized the horticultural plantings** — and I posted videos of those site visits on youtube, so that anyone can "visit" the sites online and reach their own conclusions (thrival + naturalization, without invasiveness). Scientists working with institutions implementing the endangered species recovery plan have not made visits themselves. Indeed, because the large seeds are recalcitrant, Atlanta Botanical Garden is removing the embryos of their n. Georgia ex-situ plantings for cryopreservation, presumably awaiting **CRISPR insertion of a wheat gene to enable disease resistance:** very controversial (though advocated by U. Florida).

Assisted migration is so much less intrusive (and because of an intentional "exception" for plants, it is underway by Torreyia Guardians for 15 years now). In the case of Joshua Tree, it is well accepted that **extinction of Shasta Ground Sloth (and possibly camels) deprived Joshua Tree of an ability to get its seeds moved by anything other than rodents;** hence the huge loss of Pleistocene range down toward Mexico City during Holocene warming, without commensurate range gain to the north. It is unfortunate that Joshua Tree habitat at the now southern-most part of its range became the iconic named national park. So of course the drive to find refugia within the park is a worthy effort — but not to the exclusion of

studying how the species fares at its northernmost locales, and specifically what blocks natural migration there.

In 2017 I **videodocumented natural history observations of Joshua Trees in 2 locales in SW Utah** (and elsewhere). You can access the set of 5 Joshua Tree videos here: <http://thegreatstory.org/climate-trees-legacy.html#joshua> But it is the final two, below, that I recommend for you to scrutinize for opportunities of launching your own field surveys.

Pt. 3D: Baseline Documentation: SW Utah (2017)

Baseline documentation of this **northeastern-most population of Joshua Trees (Beaver Dam Mountains, SW Utah)** is crucial for (a) understanding the generational structure and health of outliers and (b) for being able to compare shifts in population health and structure in the decades ahead.

Pt. 3E: Baseline Documentation: SW Utah Landscaping

Assisted migration for Joshua Trees is already underway — inadvertently. **Landscapers** well beyond this species' wild populations routinely plant Joshua Tree as a beloved native. Here Connie records the plantings in Kayenta subdivision near St. George, Utah, while noting the **importance of gathering oral histories** of the plantings.

MY INTERPRETATION: What appears to be blocking further natural movement NE is a mountain range with passes too high for climate compatibility right now (camels could have easily traversed them before pooping out seeds). Yet on the other side of one such pass is a basin in which sits **the Kayenta subdivision** -- covenanted to plant only wild natives. Some Joshua Trees were planted by the developer even before lots were sold. None had begun producing seeds in 2017 when I did a quick video-survey. The huge opportunity there is that one can definitively ascertain that the surprisingly wide and prolific spread of juveniles around the tall Joshua Trees (brought in legally from BLM lands in the Beaverhead area to the SW) and know that they are **clones derived from spreading roots, not seedlings**. Once the trees start producing seeds, it will be a lot more difficult to make that distinction in noninjurious ways. It would be very interesting to **study how the cloning of JT in the park compares with the massive amount going on in Kayenta**. Observing this singular opportunity helped me understand that in fully wild settings where I have seen clusters of Joshua Trees of various ages, cloning is more likely than seeds to be the cause.

Note: I am the author of the 2001 book, "The Ghosts of Evolution: Nonsensical Fruit, Missing Partners, and Other Ecological Anachronisms". The late Paul S. Martin (U AZ) wrote the foreword. He was my coauthor for the 2004 Barlow and Martin, "Bring *Torreya taxifolia* North Now."

Connie Barlow

Aug 19 BACKGROUND BARLOW SENT TO F&WS EXTERNAL AFFAIRS (who wrote an article 2018 on Florida *Torreya*)

Basic background on JT.

1. MY INVOLVEMENT with JOSHUA TREE - In 2014 I started a new video series on youtube on climate troubles for specific North American trees as I travelled the country. I posted it on a separate website, as I have never asked citizen volunteers planting Torreyya whether they "believed" in climate change. So my specific climate activism had to be separate.

(Remember: My original grounding for moving Torreyya north was strictly its undisrupted status as a "glacial relict", which by definition means it was stranded in its peak-glacial "refugium." Because Florida Torreyya was well known in academia and international media as the first and best example of assisted migration success, I had some standing for looking at other native trees through that lens. Check out my VIDEO series here; Joshua Tree is episode 3.

<http://thegreatstory.org/climate-trees-legacy.html>

2. JOSHUA TREE POLITICS -

Below I paste in 2 maps. One is the current range of Joshua Tree. The other is a map of projected range losses and gains in accordance with IPCC projected climate shifts. It was produced by an elder researcher (Kenneth L. Cole) at Northern AZ U, Flagstaff, who had been a student of my own science mentor at U AZ, Paul S. Martin (who coauthored my 2004 "Bring Torreyya taxifolia North Now" manifesto). Anyway, Cole was slammed by an NPS scientist, in the media, for not showing little "refugia" that would continue to exist in high pockets on the north-facing slopes higher up in the park that JT now is found (look at the map in red below, complete wipeout). That really bummed him out. I spoke with him twice on the phone. Summer 2019, NPS now pops up with a new science report they funded with young scientist at UC Riverside that sounds the JT alarm — even just within the park.

One more thing to know: Unlike eastern USA trees, desert trees have a very different success strategy which is way tougher for volunteer planters to tap into. For Torreyya in our eastern plantings, if the seed is viable, and if we stick it into a good forest spot right away (and 4 inches deep so that rodents can't smell and steal it), then we can count on it germinating and establishing -- no matter what the weather is doing that year. It always works. In contrast, as Cameron Barrows himself inadvertently discovered when he resurveyed a baseline inventory he had done back in the 80s, is that JT seedlings will only carry forward if they germinate in a year in which August gets some rain. (And they only flower in a spring that has been preceded by a winter freeze; now that tells you something, too!) Anyway, JT has evolved to be successful even if seedlings establish only once every dozen or more years (timed with some El Nino or something). What that means is that it is crazy to let a planting time go by with no assisted migration experimentation northward, because the actual prospects are few and far between.

One more politics thing: Notice in the colorful map that California is situated where Joshua Tree is destined to be wiped out, whereas NEVADA AND UTAH WILL GAIN JT -- if humans

simply help move them. (My 2001 book, *Ghosts of Evolution*, documented that JT inability to "move" since peak glacial owes to its seed disperser, Shasta Ground Sloth, having gone extinct. Packrat middens, Ken Cole paper shows this, indicate lack of seed dispersal means the southernmost range that used to go near Mexico City has been shrinking as climate Holocene warming -- but no ability to move any farther north, even though climate opened up. That interpretation is now undisputed. So I personally have some authority on this subject.)

Note: I'll forward to you separately the email I sent July 18 to the lead author of the NPS JT paper, Lynn Sweet, and her coauthor Cameron Barrows. It was deliberately friendlier than I usually am, as I regard young researchers as simply ignorant of the assisted migration debate, and since they are unpublished along those lines they are more open to making a worldview shift than the elder published scientists are. Of course, I did not get a response from either of them. I don't expect to. I just want to keep poking at them so that maybe at a later date they will make the worldview shift on their own and start doing assisted migration experiments.

Connie



