March 26, 2004

Hello Torreya Group:

This is Connie Barlow. I am dedicating today to Torreya taxifolia, as I need to catch up with you all with thoughts and conversations that have come my way over the past few weeks, and which only now I am having a chance to assimilate and pass on. Bascially, since I last wrote to you in depth, I have visited the T. taxifolia propagation effort at Atlanta Botanical Garden (Ron Determann and Carol Denhoff), the thriving grove of T. taxifolia at the Biltmore Gardens in Asheville (Bill Alexander), the office of Hazel and Paul Delcourt at University of Tennessee Knoxville (from which I walked off with a lot of useful papers to read and a lot of sobering thoughts), and a potential private preserve for rewilding T. tax along the east side of the Cumberland Plateau.

Probably the best way to convey some of the pieces is in the form of 10 QUESTIONS FOR DISCUSSION. (I may have more in a separate email to follow.)

1. MIGHT TORREYA TAXIFOLIA HELP TAKE THE ECOLOGICAL PLACE OF EASTERN HEMLOCK, IF THE LATTER IS WIDELY EXTIRPATED FROM THE SOUTHERN APPALACHIANS BY THE WOOLLY ADELGID AND/OR CLIMATE WARMING?

This idea was suggested to me this past weekend by JOHN JOHNSON, while I was visiting 340 acres of private woodland, where he lives, on the east slope of the CUMBERLAND PLATEAU, a few miles north of Whitwell Tennessee, near the Sequatchie River. John is very interested in our Torreya conversation, and I hope he will become a key player on the ground, as well, for these reasons:

(a) John will likely be energetic about advocating and implementing test "REWILDING" of T. tax with the owner of the PROPERTY on which he lives, which is deciduous woodland slope with ravines (most of the pines have died from beetle infestation). Hemlock grows wild pretty much only along the creek at the bottom of the canyon that cuts deeply into the east side of the Cumberland Plateau, but hemlock does well when planted by hand in gentle ravines running up the side of the canyon (their property is south-facing).

(b) John is now a field research assistant, working for a graduate student of PETER WHITE on a forest research project pertaining to an exotic tree.

(c) John is active in ecological protection of his bioregion and recently met LEE BARNES, of our Torreya Group, who is one of the leaders of the bioregionalism movement in the Katuah Bioregion (Smokies/Asheville)

(d) John recently encountered Hazel DELCOURT's book, "Forests In Peril: Tracking Deciduous Trees from Ice-Age Refuges into the Greenhouse World," and almost bought it -- so he was delighted when I lent him my own marked-up copy.

2. WHAT IS THE ECOLOGICAL IMPORTANCE OF T. TAX AND ITS POSSIBILE INTERCHANGEABILITY WITH HEMLOCK/TORREYA IN SHADING STREAMS AND SEEPS IN THE SOUTHERN APPALACHIANS?

JOHN JOHNSON'S suggestion immediately struck me as signficant. Consider: several of us have pointed out (most recently PETER WHITE) that it will be important to ensure that T. tax won't supplant existing southern Applachian plants before large reintroductions take place into the wild in posited new "native" range. RON NICHOLSON, who clonally propagated T. tax genotypes from the remaining Apalachicola population, responded to Peter's point, from personal experience with T. tax and T. cal, that, "on a scale of 1 to 100, l would imagine the weed potential [of T. tax] is below 10." MARK SCHWARTZ, author of many papers on T. tax, responded similarly: "T. tax, by all stretches, is not likely to become an invasive weed problem," and he gave 4 arguments to support that conclusion. So perhaps we can consider that problem largely settled for the moment (though it would have to be fleshed out in any paper) and go on to the next consideration in our discussions:

That is, might T. tax might actually be able to play an ECOLOGICALLY IMPORTANT role, filling an ecological "gap" created by an exotic insect, and a gap that might widen anyway as climate shifts, even if the adelgid does not extirpate the HEMLOCK? John JOHNSON mentioned his concern for what will happen to the TEMPERATURE OF CREEKS and seep drainages if the evergreen hemlock is lost in those environments. What do any of you think? Note: JOSH BROWN directed our attention early on to an important paper by Michael Soule et al, 2003, "Ecological Effectiveness: Conservation Goals for Interactive Species," Conservation Biology 17:1238-1250, which HAZEL DELCOURT and I have read.

If rewilding is to take place, then:

3. WHAT ABOUT SOUTH V. NORTH FACING SLOPES AND A POSSIBLE COMPLEMENTARITY OF HEMLOCK AND TORREYA? I visited the T. tax GROVE AT THE BILTMORE GARDENS in Asheville about 10 days ago and was impressed by how "wild" the grove was. There are about a dozen elder trees, all planted from seed collected in the Apalachicola in 1939, plus various ages of younger trees seeded by those elders. Some of the elders (and all the younger ones) are growing as middle- and understory in a narrowish ravine with a tiny flow of water in the bottom, in which the slopes are all fairly "wild", not mowed. It is so great to see healthy Torreya, thriving! The canopy of this ravine is mostly old white pine with some hardwoods. The T. tax looks gorgeously healthy. BILL ALEXANDER reports that this grove survived a 5 year drought in the 1980s, and in 1985 survived temperatures of minus 16 degrees F. A few years ago they began spraying adult trees for fungus not specific to Torreya, though the young trees show no sign of any problem. Significantly, the ravine trends E-W. HEMLOCKS are the dominant understory of the north-facing slope (with a bit of rhododendron and holly) and T. tax dominates the SOUTH-FACING - thick in parts! I asked Bill Alexander whether this SEGREGATION OF HEMLOCK AND TORREYA BY NORTH AND SOUTH SLOPES was intended, but there are no historical records as to why T. tax was planted south-facing. He does say that the pine canopy over the little ravine used to be denser, but storms and beetles have thinned them out.

4. IS BIOLOGICAL CONTROL (BREEDING AND TESTING OF AN ASIAN LADYBUG THAT DINES ONLY ON WOOLLY ADELGID) A SERIOUS POSSIBILITY FOR SAVING THE EASTERN HEMLOCK? While I was at Sequatchie Valley Institute, Carol Kimmons, a plant pathologist at U. Tenn Chatanooga, told me about ongoing work to make feasible biological control of the woolly adelgid. Is this a serious possibility? In other words, am I too hastily looking at T. tax as a possible hemlock substitute?

5. SHOULD WE ALSO BE TALKING ABOUT FLORIDA YEW? Speaking of ecological replacement, what about FLORIDA YEW? Florida yew grows only in the Apalachicola. The trees I saw there were all very old, looked in excellent health. Apparently, unlike Torreya, the mature trees are doing fine, but there is little if any replacement. The thought is that deer are nibbling away the young ones. Note: another reason the Sequatchie/Cumberland property might be ideal for rewilding T. tax is that it is in a very backwoods area of traditional hill folk (so we can count on DEER POACHING to give any plantings a good chance). The ATLANTA BOTANICAL GARDEN (Determann and Denhoff) also have seedlings of

Florida yew that they are propagating, so potentially there would be a source.

I understand that Florida yew (Taxus floridana) is more closely related to the relict populations of yew in the highlands (cloudforest) of Mexico (Taxus globosa) than it is to the Canadian yew (Taxus canadensis) of the northern Appalachians. IS A YEW "MISSING" from the southern Appalachians? Could the "Florida" yew be that yew? Should we even be discussing yew?

6. DID TORREYA ARRIVE IN NORTHERN FLORIDA WELL BEFORE ONSET OF GLACIALS? HAZEL DELCOURT gave me an old copy of PAUL MARTIN'S CLASSIC 1957, "The Pleistocene History of Temperate Biotas in Mexico and Eastern North America," Ecology 38: 468-480. In that paper, Paul elegantly uses taxonomic affinities of lungless salamanders in the Appalachians v. Mexican highlands to answer a botanical question that had seemed intractable: Did moist-loving flora that presumably evolved in the Appalachians arrive in Mexico (via a continuous band of moist forest along the Gulf coastal plain from Florida thru Texas into Mexico) during the Pleistocene glacials and then become disjunct? Or did the spread and disjunction occur much earlier, with plants "arriving" in highland Mexico from their presumed source in the Appalachians by the mid-Cenozoic and then becoming disjunct (Texas gap) during the arid Pliocene? Paul uses salamander affinities to conclude the latter: that the flora arrived in Mexico by mid-Cenozoic and then became DISJUNCT WELL BEFORE THE PLEISTOCENE.

So: Does this mean that T. tax arrived in the Apalachicola prior to the Pleistocene too, rather than having been forced down during the glacials? NOTE: I will be visiting with Paul Martin in about 2 weeks; my business travels just happen to be putting me in easy proximity to visit, over the course of 3 months: the Apalachicola, Atlanta Botanical Garden, the Biltmore, Lee Barnes (south of the Smokies), Hazel Delcourt in Knoxville, the Cumberland land prospect and John Johnson along the Sequatchie Valley, and Paul Martin in Tucson!

7. DID T. TAX EVER MAKE IT BACK TO THE S. APPALACHIANS DURING PREVIOUS INTERGLACIALS? There is no question that the onset of the glacials extirpated Torreya taxifolia from its possible range in the southern Appalachians and either drove it into the Apalachicola at that time or simply made pre-existing southern pockets the only remaining habitats. The question then becomes this: Once the southern Appalachian populations were lost, does it seem that Torreya was unable to move back north from the

Apalachicola "refuge" during ANY previous interglacial? Remember: Only in eastern North America is there no altitudinal relief for the Torreya species from its glacial refuge; in contrast, in California and Asia, there were mountains nearby. Another useful point of information: I recall that Earth enters a glacial episode slowly, so there is a lot of time for plants to move south, but that Earth traditionally comes out of a glacial swiftly, so there is less time to move back north.

Although PAUL MARTIN'S 1957 paper did not delve into when Torreya taxifolia arrived at its "pocket refuge" of the Apalachicola in Florida, the paper (and the discussion I had with Hazel and Paul DELCOURT last week in their office at U. Tenn. Knoxville) opens up the question as to WHETHER T. TAX EVER MADE IT BACK TO S. APPALACHIANS DURING PREVIOUS INTERGLACIALS (each about 10,000 years in duration). I had presumed that it had, but after speaking with the Delcourts, I am chastened. There is no empirical evidence that T. taxifolia existed in the southern Appalachians during previous interglacials. In other words, once North America entered the Pleistocene 2.5 mya, T. tax was doomed to be a relict species in pocket refuges along the Gulf coast, vulnerable to extinction if any interglacial warmed too much -- owing to lack of access to an altitudinal means of quickly dispersing into cooler conditions. This then brings up the next question:

8. IS THE MODERN HUMAN EFFECT ON GREENHOUSE GASES A BIGGER CAUSE OF T. TAX ENDANGERMENT THAN HAVE BEEN THE PALEOINDIAN EFFECTS THAT ELIMINATED SOME SEED DISPERSERS (TORTOISES, though squirrels still remain) AND/OR PALEOINDIAN ESCALATION OF WILDFIRES? That is, if T. taxifolia never made it back north in previous interglacials, then it doesn't really matter that paleoindians might have made the return journey even less feasible during the current interglacial. What matters now is that the industrial era has already moved greenhouse warming to a level higher than any previous interglacial, and that a threshold for T. tax was apparently reached several 40 or 50 years ago when summer heat and drought stressed T. tax in the Apalachicola (but not at the Biltmore in North Carolina) to the point that various fungal diseases took their toll.

This is an important question: For, If there is consensus that T. tax did not make it back to the southern Appalachians in previous interglacials, then my own work on the loss of tortoises as dispersal agents (as published in my 2001 book, "The Ghosts of Evolution," and in a 2002 issue of Arnoldia magazine) and PAUL MARTIN'S and HAZEL DELCOURT'S expertise on ecological effects of Paleoindian use of fire need not enter

into the argument, virtually at all. Rather, the focus becomes a matter of how this interglacial differs from previous interglacials temperature-wise, and the role of the INDUSTRIAL human in exacerbating that effect in the very near future (and, for T. tax, already by mid-20th century). Note: The Delcourts' book, "Prehistoric Native Americans and Ecological Change" will be published in May 2004 (Hazel gave me an advance copy). Paul Martin has a retrospective on his own 55 years of work coming out this fall, I believe, U. Calif Press.

9. IS IT POSSIBLE TO DISCUSS T. TAX AND ADVOCATE "ASSISTED MIGRATION" OF THIS ONE SPECIES WITHOUT TALKING ABOUT THE POSSIBLE NEED FOR WHOLESCALE MOVEMENT, BY HUMANS, OF FOREST ECOSYSTEMS AS THE CLIMATE RAMPS UP? My discussion last week, for several hours, with Hazel and Paul DELCOURT at their office in Knoxville was intellectually exhilarating, but emotionally depressing. I walked in there just wanting to help rewild Torreya, using what I like to call "deep-time eyes." Alas! Hazel, whose 2002 book, "Forests In Peril: Tracking Deciduous Trees from Ice-Age Refuges into the Greenhouse World" (which draws upon her 3 decades of work on this topic), opened my eyes to the scale and speed of forest upset that global warming is and will increasingly cause. Yikes! Wildlands corridors may be fine for mobile animals, but trees simply cannot move fast enough, and the generation times for trees are much longer than are those for animals. Already, HAZEL discerns that the Evergreen Magnolia-Beech climax forest, which used to be widespread south of the Appalachians yet barely exists anymore, would do quite well in the southern Appalachians right now. Climate warming is already that advanced. (Significantly, I was in such a forest in February when I was viewing the diseased T. tax on the eastern slope of the Apalachicola River.) See Hazel R. Delcourt, 1977, "Presettlement Magnolia-Beech Climax of the Gulf Coastal Plain: Quantitative Evidence from the Apalachicola River Bluffs, North-Central Florida," Ecology 58: 1085-1093.

A few days after I spoke with Hazel, I found myself on a wooded slope of the east side of the Cumberland Plateau, at Sequatchie Valley Institute, seeing a woodland losing its pine to beetle infestation, its hemlock to warming, while a (planted) evergreen southern magnolia was thriving by the house - and the owners talked of getting more!

9. IS THE CORRIDOR CONCEPT OF NATURAL MIGRATION INADEQUATE FOR THE PLANTS IN OUR DECIDUOUS FORESTS? Hazel DELCOURT also said we should be looking not just at Torreya in the Apalachicola but also at the southern BEECH. The genes of the beech that

still survives that far south may be the very genes that will allow the beech to survive in Michigan in 100 years! Preserve this essential genetic diversity! Hazel would thus suggest wholescale experimentation with rewilding into the southern Appalachians of genotypes of beech and southern magnolia drawn from the Apalachicola, as well as endangered yew and Torreya. She and Paul DELCOURT showed me climate model estimations (by others) that would force shifts in suitable habitat of beech for the next 100 years that were absolutely appalling: it may be that the southern-most suitable range for beech will soon be found in southern Canada, and that the northern suitable range will extend up alongside James Bay.

No bluejay can assist migration of a whole species that far and that quickly; and our once-grand traveler, the Passenger Pigeon, is gone. What would Aldo Leopold be saying in our time? Will the generation of children alive today be forced to plot and implement the continental movement of our grand eastern forests? Will the younger among us in this conversation right now be part of that effort? Should we be starting the first real discussions and tests of forest-scale assisted migrations now? And is the concept of wildlands corridors for natural migration of biodiversity simply too animal-centric? Corridors may work just fine for helping wide-ranging jaguars and wolves and grizzlies return to previous habitats and track changes in climate, but can corridors do much of anything useful for slow-maturing plants?

This realm of thought is very depressing for me, because I am a wildlands advocate and would vastly prefer us to simply make preserves big enough and corridors connected enough for nature to do what it needs to do without our meddling. The Fall issue of Wild Earth is on the theme of corridors, so what sorts of contributions might be generated from this group, from our discussion of T. taxifolia and all the ancillary thoughts that go along with that?

I look forward to hearing from many of you -- and please join the listserve so that I don't have to play the role of switchboard!

For Torreya (and, alas!, a whole lot more),
Connie Barlow