Genetically Engineering the American Chestnut Tree

American chestnut trees (Castanea dentata), at one time, were "kings of the forest" in the eastern United States. However, in the early 20th century, the American chestnuts began to be lost to a fungal disease, chestnut blight (Cryphponectria parasitica), which entered the United States on imported chestnut saplings around the turn of the century. Chestnut blight spread rapidly throughout the Eastern forest, affecting approximately 4 billion American chestnut trees by the 1950s. Estimates vary about how many individual American chestnut trees remain in their glory in the wild, but experts agree that the population was tragically decimated, changing the nature of the Eastern forest significantly.

There have been many attempts to restore American chestnut populations, and efforts continue. Scientists, community organizations and government have used fungicides against the blight unsuccessfully; have removed certain trees or parts of trees in attempts to stop or block contamination of other trees; are engaged in traditional plant breeding to cross the American chestnut with blight–resistant Asian chestnuts; and are genetically engineering a new tree, among other attempts. None of these attempts have been successful in restoring the American chestnut to its former status as of yet.

There is concern among the forest and conservation communities, and Indigenous people about one of these efforts in particular, the use of genetic engineering to create an altered tree, different from the American chestnut, but with the capacity and intention of cross–breeding the altered tree with the wild American chestnut trees that remain. The proposed genetically engineered (GE) American chestnut, if approved by U.S. regulatory agencies, would be the first GE organism developed and planted with the specific intention of having the tree cross–pollinate and spread in nature. Biotechnologists are not sure what will happen to the genome of current or future generations of trees, once genes from other species, such as bacteria or wheat, are inserted into the tree. GE is disruptive to the genome, and could result in harmful unintended changes. The risks and how to categorize them, the potential harm to other trees that cross–pollinate with a GE American chestnut, the potential adverse affects for forest ecosystems, including the insects, animals and humans reliant on the tree are all largely unknown. Given their capacity to produce up to 6,000 chestnuts per tree, and serve as an important bloom for pollinator species, these risks are important to understand. GE trees are an extension of GE crop technology, with the potential to result in similar problems. However, trees have special attributes that make the endeavor especially risky, such as their long life span, their ability to reproduce over long distances, and their ecosystem complexity. On top of the ecological risks, the efficacy of attempts to create a viable and thriving GE American chestnut adult tree is precarious and understudied, at best. As such, there are significant and widespread concerns with opening this particular "Pandora's box" within forests across the Eastern United States any time soon, or at all.

Despite the scrutiny and concern, William Powell and Charles Maynard, affiliated with the College of Environmental Science and Forestry at State University of New York (SUNY–ESF) and the American Chestnut Research and Restoration Project, continue working to develop, field trial and plant GE American chestnuts. Powell and Maynard have been backed by industry and government funding, most notably through the "Forest Health Initiative," a collaboration developed with industry partner Duke Energy, among others. Duke Energy has explored using GE trees to repopulate coal mountain top removal sites in an effort to reduce or offset emissions.

Regulatory approval of the GE American chestnut is uncertain; industry is in dialogue with USDA APHIS, EPA and FDA about this process, currently estimated to take place over 3–5 years, between 2015 – 2020. According to lead proponents of genetically engineering the American Chestnut Tree, between December 1, 2014 and October 15, 2015:

1. The last major step was completed for a new, high–production laboratory in the Central New York Biotech Accelerator. This lab is a joint project between the State University of New York (SUNY) Upstate Medical University and SUNY College of Environmental Science and Forestry.
2. They "staked a claim" on a sizable area on the Genetics Field Station, a college property 20 miles south of Syracuse, and began planting trees for a GE chestnut seed orchard.
3. They have made a number of GE crosses.

As of summer 2015, the ESF researchers selected a "lead event line" of GE American Chestnuts to go through the regulatory process. They are promoting the idea that this "lead event line" has the "same characteristics" as a surviving pure American Chestnut, and that there are no increased risks or harms to humans, animals, insects, flora and fauna in the forests. There is too little science to bear this claim, as field trials of GE American chestnuts only began in 2006, meaning the oldest GE American chestnut trees possible are only 10 years old, much younger than the life of a long–lived American chestnut tree, which is more than 100 years. As we understand the regulatory process thus far, there will – late in the process – be a period for public comment.

For updates, see the Global Justice Ecology Project and Center for Food Safety.

Key resources:

- *Genetically Engineered Trees, The New Frontier of Biotechnology*. Center for Food Safety, November 5, 2013
- Genetically Engineered American Chestnut trees are being developed and promoted by William Powell and Chuck Maynard through their organizations: the American Chestnut Research and Restoration Project and The American Chestnut Foundation – New York. Their latest update is here: http://www.esf.edu/chestnut/documents/firstyearreport.pdf
- Individual American chestnut trees remain: http://www.nytimes.com/gwire/2009/07/01/01greenwire-american-chestnuts-revival-may-combat-climate-45112.html , http://www.acf.org/pdfs/press_releases/2015/12.02.2015_TallestAmericanChestnutTree_Lovell-Maine_FINAL.pdf , https://www.americanforests.org/magazine/article/revival-of-the-american-chestnut/