USDA APHIS **Petition for Determination of Nonregulated Status: State University of New York College of Environmental Science and Forestry; Blight-Resistant Darling 58 American Chestnut**

Biofuelwatch comment Submitted 10-19-20

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I have a background in biology and ecology, with a PhD from the University of Michigan. I currently hold a position as codirector of Biofuelwatch.

With colleagues at Global Justice Ecology Project, I coauthored "Biotechnology For Forest Health: The Test Case of The Genetically Engineered American Chestnut" (attached). This report followed the National Academy of Sciences workshop "Biotechnology for Forest Health". Following participation in that workshop we sought to provide a comprehensive detailed argument against the GE chestnut. Our report lays out well-researched reasoning which leads us to advise that USDA reject the petition for deregulation of Darling58 chestnut.

In broad terms, the deregulation of Darling 58 chestnut would set dangerous precedents: first it would set precedent for the release of engineered forest tree species with intent to spread

freely. Second it would set precedent for the use of genetic modification for “forest health and restoration”. Third it would set precedent for the regulatory processes as applied to forest tree species.

These are critically important precedents that should not be established in absence of broad public debate and detailed evaluation of ecological and social considerations. The Darling58 chestnut petition is an attempt to overshadow and bypass this important public debate - winning over a reluctant public by focussing on restoration of a single, popular, iconic species, (aptly named “Darling”).

Indications are that Darling58 is highly unlikely to succeed at its intended purpose to restore the AC to forests (for reasons outlined further below and in the attached report). If deregulated, it would succeed however in establishing unfortunate and dangerous precedents for the use of biotechnology in addressing forest health, and on the processes for regulating biotechnology applications to forest tree species.

The Convention on Biological Diversity has called for a “precautionary approach” to GE trees while the Forest Stewardship Council and the Sustainable Forestry Initiative ban their use from certification. The precautionary approach was formulated to avert harm by delaying action until safety can be proven, and is the appropriate framework for considering the release of GE trees into forest ecosystems.

Darling58 chestnut have only been field tested in nut-derived trees approximately 3 years of age. For trees that may live 200 years, experiencing many changing, uncontrolled environmental conditions, evaluation of 3 year old trees provides no grounds for claiming “proof” of safety.

ENGINEERING FUNGAL PATHOGEN RESISTANCE/TOLERANCE HAS MET WITH VERY LITTLE SUCCESS - FOR IMPORTANT REASONS.

Petitioner acknowledges that conferring resistance or tolerance to fungal pathogens is tricky. Experience has shown that it can result in unanticipated consequences on plant growth, heightened susceptibility to other pathogens, and lack of long term effectiveness given that fungal pathogens can engage an “arms race” and evolve rapidly to overcome engineered defenses. They then point to OXO as a well understood mechanism for conferring resistance/tolerance to fungal pathogens. Indeed there has been considerable research including on valuable commercial crops such as peanut and soya.

Notable however is the fact that none of those research efforts have led to successful stable resistance sufficient for deregulated commercial applications. In a 2010 review (Collinge et al 2010, attached) report that as of 2010 853 field test applications for fungal pathogen resistance had been submitted to the USDA. To date (to our knowledge) the Simplot potato is the only

commercial crop released that has engineered fungal pathogen resistance (albeit not involving OXO).

Further, to our understanding, a single gene construct is unlikely to be effective on its own in conferring durable blight resistance. Blight resistance in the Chinese chestnut is known to involve combined activity of many genes acting together.

Given the challenges so far with engineering fungal pathogen resistance in common well known commercial species, the potential for successful and durable resistance/tolerance in a long-lived forest tree species in the wild, appears quite remote.

Petitioner states: “This tolerance mechanism (OXO) should provide a uniquely stable plant defense, as the likelihood of a pathogen evolving to overcome a tolerance trait is minimized in the absence of a strong selective pressure (Section 5.3).” (pg 22). However, they did not provide reasoning for this assumption that there will be no strong selective pressures.

EVEN IF BLIGHT RESISTANCE/TOLERANCE IS SUCCESSFUL AND STABLE, ANOTHER INTRODUCED PATHOGEN, LETHAL TO AMERICAN CHESTNUT WILL LIKELY PREVENT SUCCESSFUL RESTORATION OF THE SPECIES

Phytopthera cinnamoni was already decimating American chestnut in the southern part of its' range prior to the introduction of *Cryphonectria parasitica* (blight). Darling58 has no defenses engineered or otherwise against *Phythopthera* (Petition pg.143 and Appendix 1). Meanwhile, the range of *Phythophthera cinnamoni* has expanded in the past decades and likely will continue to extend further north under changing climate conditions. (Treena et al 2016 - attached).

If Darling58 trees are planted where Phythopthera is prevalent they are likely to succumb.

Nelson 2014 (attached) states: "*For sustainable blight and Phytophthera resistance, it will be necessary to pyramid both types of genes. As with most tree species, producing durable resistance will be achieved by stacking genes that enhance resistance tby different mechanisms. Identification of multiple genes will facilitate such stacking*."

IT IS NOT VALID TO EXTRAPOLATE FROM VERY YOUNG TREES IN CONTROLLED CONDITIONS TO 200 YEAR OLD TREES IN WILD FORESTS

To date Darling58 chestnuts have only been field tested in controlled conditions, in trees up to about 3 years old. This provides meager and unsound basis for extrapolation about the potential future for trees that can live 2 centuries and will in the process face with many diverse environments that can impact gene expression, including for example droughts, pests, floods, heat etc).

In one of the only studies of trees grown out in forest settings rather than orchards (Clark et al 2018- attached) researchers compared blight resistance in backcross hybrid trees, to earlier backcross lines, resistant Chinese chestnut and susceptible American chestnut. They state trees less than 8 years old are "*too young to determine durable resistance*". Further: "*Interactions between planting location and breeding generation affected resistance ranking, suggeting that the longer term testing is needed to determine resistance of a particular breeding line across a variety of sites."* They point out the (common sense) finding that "*studies of pure AC indicate disease incidence and tolerance are affected by weather conditions, canopy conditions and blight strains, all of which are dynamic*".

Conducting meaningful and sufficient review and assessment of the impacts of introducing an engineered wild tree, with the

intent to allow it to spread freely and "restore" a functionally extinct species would appear near impossible to successfully implement. The National Academy of Sciences concluded: "*Forest health is not accounted for in the regulations for the use of biotechnology or for other approaches to mitigating forest tree insect pests or pathogens….There are no specific regulations or policies that those agencies apply to biotech trees*."

FOREST HEALTH UNDER ATTACK

SUNY ESF researchers specify that Darling58 is intended to be for "restoration" of the species. As such this would be the first time a forest tree species has been engineered with "forest health and restoration" as its primary purpose. North American forests are under threat from an overwhelming array of forces - from excessive logging, wildfires, introduced pests and pathogens and climate change. It is imperative that we address the underlying causes of these various threats which cannot be addressed by manipulation of the genomes of affected tree species, given the time frames for action and the potential risks and difficulties with assessing those risks.

The Darling58 chestnut is unlikely to achieve the stated intent of restoring the species to North American forests. It is not worth taking the risks, or rushing into a process for evaluation based on 3 year old nut-derived trees given this will be precedent setting and have broad and long term consequences.