Doug's Bullet Points for GE Tree Press Conference

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Eucalyptus: Freeze tolerance for pulp or biomass. Current southern pine plantations occupy about 32 million acres, and area half as big as California. The freeze tolerance trait is expected to increase the area where eucalyptus can grow in the US by about ½ a climate zone, a Forest Service analysis estimated up to about 3 million acres in the US South might be devoted to eucalyptus plantations for these GE hybrids. This could displace habitat for native species.

1) Eucalyptus species, including the GE cold tolerant hybrid, are not native to the US. This means that US wildlife will often not be able to thrive or survive in Eucalyptus plantations. Although native pine plantations are less diverse, and therefore less suitable, habitat than a natural forest, the pine species have co-evolved with those native species and therefore provide habitat for many. That will not be true for eucalyptus. This results in what has been described as a "green desert", although this is not entirely accurate, because in fact actual deserts contain considerable biodiversity!

2) Eucalyptus trees are particularly flammable. When combined with possible increasing droughts related to climate change, this could lead to increased and highly destructive wildfires.

3) In some places outside of their native range where eucalyptus have been grown they have been invasive. To that extent, they may escape from plantations if sterility fails, or if they breed with other compatible eucalyptus planted in the area, and thereby displace native species.

4) Eucalyptus species use more water than many other tree species, and may thereby negatively impact water supplies if widely grown.

5) Higher growth rates will not likely spare wild land. So-called land sparing from higher productivity in agriculture has often not occurred because when higher efficiency leads to higher profitability, it often leads to planting on increased wild acreage, not less. This is especially true if demand for biofuels and biomass globally continues to increase.

American Chestnut (dangers of engineering trees for forest restoration). The chestnut was once the dominant tree in much of the eastern US forest. It was decimated by chestnut blight starting early in the 20th century, and also ink disease in the southern part of its range. Restoration effort focus on genetic engineering or hybridization with naturally resistant Chinese chestnut (or both in some cases)

1) The risks of pursuing GE chestnut:
    - So far, it seems likely that traits that are being explored will not provide adequate resistance. And if, in the rush to get these trees out, resistance is overcome after widespread deployment, their loss could lead to the same kind of huge ecosystem gaps as when the disease first invaded. Also need to develop resistance to ink disease in southern part of range (could range move north with climate change?), and most resistance traits that work for blight will not work for

ink disease.

- We don't understand well the stability of transgene expression over long lifespan of these trees, unlike engineered annual crops. So it will take a long time to adequately understand whether these artificially chosen genes will work over long term. Will they express well in older mature trees (problem seen in several commercial current Bt transgenes, in cotton for example), or leave them vulnerable?

- By contrast, hybrids with Chinese Chestnut are working with natural assortment of multiple genes that evolved in the presence and adaptation of the pathogen over very long periods of time, leading to durable resistance.

- Some fungal resistance traits may harm important beneficial fungi in the soil.

Loblolly Pines and Poplars:

- Poplars are native species, they could have all of the problems with spread, ecosystem disruption, and so forth as the other native trees we talk about, but also have ranges beyond many of those trees, and therefore could affect additional parts of the country. Traits like insect resistance could harm benign of beneficial insects that contribute to forest diversity and health.

- Loblolly pines have been engineered for increased wood density for biomass. Density can be associated with insect and disease resistance properties, with unknown consequences. As with any engineered species, If the range of genetic diversity found in the natural populations are not bred into the engineered variety (which will have more limited genetic diversity) in order to preserve the genetic diversity of the native species, resilience to pests and climate are likely to be reduced.

- Loblolly pine is also an important example of an engineered crop that fell through USDA regulatory plant pest loophole.

All of this points to the need for stronger regulation of GE trees
The biotech regulatory process is being overhauled 30 years the initial regulation under the so-called coordinated framework. Currently, USDA is mainly responsible for regulation of environmental risks, FDA regulated for food safety risk, while EPA is the main agency for pest-protected trees—both for health and environment. Regulations need to be GE process-based, so all trees will be reviewed. It should be precautionary to ensure that any meaningful risk is prevented.

1) **USDA/APHIS**, mainly regulates for environmental impacts, mainly under Plant Protection Act of 2001, but also NEPA and ESA. Regulation under plant pest provisions of PPA alone ignore congressional mandate of broad noxious weed authority. Plants pests and not usually plants, including trees, but pathogens, so USDA virtually never denies deregulation. Especially, not about indirect effects, e.g. resistance, ecosystem effects, etc. Also need to maintain regulatory authority, ability to mitigate, and post approval monitoring (e.g. NRC 2002). Contradictions of the grass examples.

2) New genome editing technologies are GE, according to long-standing definitions, but it is unclear what USDA will do. Need to be included, especially because of huge range of things that can be done with genome editing.

3) EPA. Focuses mainly on short-term and direct harm. Need more robust over time, especially ecosystem effects.

4) FDA process for plants is voluntary review, with no safety approval, no required tests (up to companies), no protocols, no long term testing. Must be made a mandatory approval process with approved tests and protocols, including long-term safety tests.