



Opening Pandora's Box: Genetically Engineered Trees

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Genetically Engineered Trees

Gene flow question:

**Will novel inserted genes into
GE trees, if released, escape and
move into native forests and
National Parks?**

Genetically Engineered Trees



GE tree plantations with wild relatives pose more serious contamination hazards in the US than annual GE crops lacking wild relatives



Genetically Engineered Trees

**GE trees with wild relatives and
possessing plantation potential:
Pine, Poplar, Cottonwood and
other species**



Genetically Engineered Trees

New gene engineered tree traits:

- **Insect resistance - Bt production**
- **Herbicide & Disease resistance**
- **Low Lignin production**
 - **Drought, salt, cold & wet tolerance**

Potential for

Long-Distance Dispersal of GE Pollen

and

Long-Distance Dispersal of GE Seed

Pollen transport modeling studies show that small amounts of pollen can be carried by winds over long-distances, but the majority of pollen falls close to the source.

Air particle model applied. (Goris & Avissar, 2004)

Pollen transport model used by modelers at Duke - Langrangian Particle Dispersal Model (LPDM) - the pollen is modeled as a small particle, a principle widely applied in the field of air pollution modeling demonstrating long-distance transport. (Goris & Avissar, 2004)

In addition to the Lagrangian Particle Dispersal Model (LPDM), they used a Regional Atmospheric Modeling System for simulations of the atmospheric conditions and modeled pollen transport during a two week spring flowering period.

(Goris & Avissar, 2004)

Pollen transport model - tree pollen can be ejected and wind blown up above the atmospheric boundary layer (ABL) and there it can be transported for hundreds and hundreds of miles, up to 1400 km north into eastern Canada from South Carolina forests. (Goris & Avissar, 2004)

Parallel: air pollution particles and pollen

Long-distance transport of air pollution particles is well recognized through not only modeling studies, but air monitoring networks where particles are collected and analyzed to determine their source.

(US EPA)

Air pollution transport in the ABL is responsible for carrying combustion particles over several thousand miles such as from Africa to the US and from China to the US and other nations and continents. (US EPA)

Containment of GE conifers?

GE pollen long-distance dispersal modeling

Transgenic conifer pollen can readily travel 8 km in less than one hour without escaping the ABL. The larger the tree, the greater the distance pollen traveled.

(Katul et al., 2004)

Containment of GE conifers?

GE pollen long-distance dispersal model:

At reproductive onset - 8.6 km to 21.0 km

At harvesting age - 13.5 km to 33.5 km

(Katul et al., 2004)

Containment of GE conifers?

GE pollen long-distance dispersal model:

Pollen survival for many kilometers below the ABL avoiding exposure to cold air and excess UV-B radiation, achieving LDD, shows a greater sustained GE pollen viability than was thought possible. Ecological risk assessment needs to consider this possibility. (Katul et al., 2004)

Containment of GE conifers?

GE seed long-distance dispersal modeling

Transgenic forest-seed dispersal plays a vital role in predicting gene flow of GE *Pinus taeda* to the wild loblolly relatives native to southeastern US.

Containment of GE conifers?

GE seed long-distance dispersal modeling

Small percentage of GE loblolly seeds were transported by LDD methods above the forest canopy at distances from 11.9 - 33.7 km.

(Williams et al., 2004)

Containment of GE conifers?

Seed modeling shows that GE loblolly seed containment without 1 km from a tree plantation is not feasible using fertile transgenic trees.

(Williams et al., 2004)

Long-distance plant dispersal

Long-distance plant dispersal is recognized as contributing to the spread of many species far beyond their natural boundaries into remote habitats.

Long-distance plant dispersal

Two lines of evidence for LDD of plants:

- **Ecological studies of small scale dispersal**
- **Biogeographical studies of intercontinental disjunctions of remote islands (Hawaii) and across the Atlantic Ocean.**

First US GE tree contamination

GE viral-resistance papaya was deregulated by the USDA/APHIS in 1998 and contamination of native and organic papaya crops occurred rapidly by 2004, more rapidly than USDA thought likely.

Preventing GE tree gene flow into wild relatives?

Gene flow from GE trees is best prevented by banning the commercial release of fertile GE trees in US plantations due to wild relatives even if they are hundreds of miles away.

**Opening Pandora's Box by releasing
GE conifer and deciduous trees will
have long-term irreversible ecological
consequences for native forests and
National Parks**