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Biotech Forests: An Environmental Blessing?

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Genetically modified grains, fruits and vegetables have become ubiquitous on U.S. farms and in supermarkets. Biotechnology investments initially focused on modifications that would be profitable relatively quickly, such as inserting genes in plant genomes to produce pest-resistant, faster growing or more productive food crops.

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These biotech foods benefit the environment and human health. But there are other beneficial genetically modified species besides food crops. Cotton plants, for example, have been genetically modified to produce an insecticide against pests that feed on them.

Genetically modified trees could be a boon as well. Critics argue that genetically modified plants violate the U.N. Convention on Biodiversity, and the U.S. Department of Agriculture has yet to allow commercial production. In laboratories and test plots, however, scientists have increased yields of useful materials from biotech trees.

Benefits of Genetically Modified Trees. If commercialized on a large scale, genetically modified trees would provide numerous benefits. For instance:

- Tree species can be modified to enable them to resist pathogens and destructive pests.
- Trees modified to produce high yields of cellulose could be a cost-effective source for cellulosic ethanol production, a renewable transportation fuel.
- Forests of biotech trees could remove carbon dioxide, a greenhouse gas, more efficiently from the atmosphere than unmodified trees.

Commercial development of genetically modified trees could reduce the need for timber products companies to expand into virgin forests and lessen the demand from forests already being harvested.

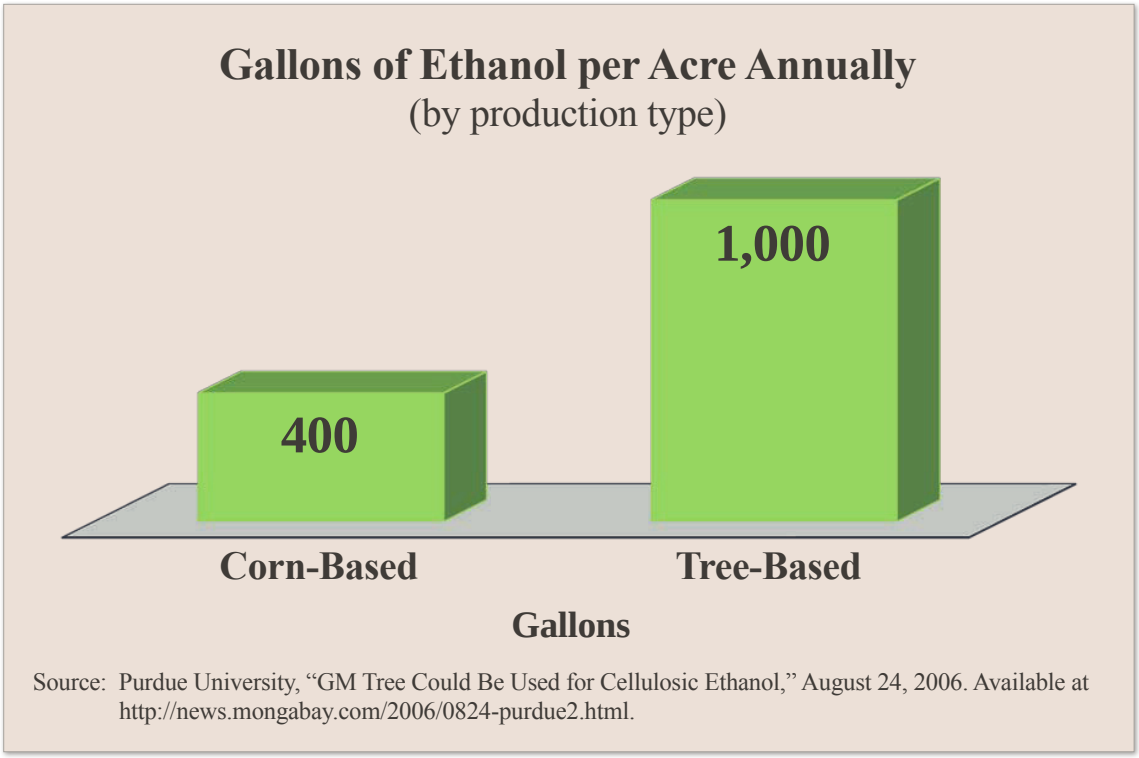
Growing Larger Trees Faster. Due to the high demand for wood products by the timber and chemical industries, biotechnology companies have been experimenting with ways to increase yields from a variety of trees. For instance, researchers have successfully increased the pulp, stem, leaf and root growth of aspen trees, which can be used in a variety of chemical applications. In addition, they have increased the rate at which trees add mass. Researchers have also modified aspens and other trees to lower the amount of the organic polymer lignin, increasing the efficiency of enzymes used to break down wood fibers. This reduces the cost and energy required to turn raw lumber into finished paper.

These genetic modifications will allow paper and timber companies to harvest more product from the same number of trees.

Making Trees Less Susceptible to Invasive Pests. In the 1970s, two diseases infected or killed more than 20 million mature elm trees in

the United Kingdom. Indeed, many British elms are still at risk for these diseases today. However, researchers have discovered methods to transfer specific genes into leaf and stem cells that allow them to produce antifungal proteins.

Similarly, infestations of the cottonwood leaf beetle are a recurring problem in many parts of the United States. Researchers at Oregon State University have determined that manipulation of *Bacillus thuringiensis* toxin genes may produce beneficial bacteria that help trees resist a range of insects and other pests by producing more effective toxins.



Source: Purdue University, "GM Tree Could Be Used for Cellulosic Ethanol," August 24, 2006. Available at http://news.mongabay.com/2006/0824-purdue2.html.

Turning Trees into Fuel. Renewable fuel production in the United States has focused largely on corn-based ethanol. Recently, steps have been taken to develop other sources of ethanol, such as cellulose. Cellulosic ethanol is made from nonedible plant materials such as switchgrass and wood. Both the Bush and Obama administrations have devoted considerable resources to the development of cellulosic ethanol as an alternative to corn-based ethanol.

Regardless of whether ethanol is worth pursuing as a transportation fuel, tree-based ethanol would be a welcome alternative to corn-based ethanol because of trees' ability to grow in various environments and their greater mass relative to corn. In addition, trees require much less water and fertilizer. Trees can also be modified to more easily access the parts of the plant that can be converted into fuel by altering their lignin. Moreover, cellulosic ethanol would reduce diversion of corn from human and animal consumption, which could lower corn prices.

Researchers are currently modifying various types of poplar trees and have estimated that with the right lignin composition yields could top 1,000 gallons of ethanol per acre annually, compared to 400 gallons per acre with the most efficient corn production method. [See the figure.]

What about the Dangers? Environmentalists warn of the dangers of genetically modified trees. For instance, they have speculated that biotech trees could result in the development of superbugs or uncontrollable crossbreeding with nonbiotech trees of the same species (or with other nontarget species). These fears have also been raised with respect to biotech foods but have not materialized, despite hundreds of millions of acres of biotech crops under cultivation around the world. Additionally, more than one million modified trees have been planted alongside unmodified trees in China without incident.

Conclusion. Genetically modified trees have many potential benefits. The federal government should not allow unsubstantiated fears to inhibit this potentially beneficial line of research, nor should it prohibit commercialization through excessive regulation in response to such fears, absent proof of likely harm.

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