

US University G.E. Tree Research



Universities play a critical role in conducting research which is largely if not solely funded by government grants and private corporations such as Monsanto and ArborGen. Below is a list of United States universities that are actively experimenting on and/or publicly supporting genetically engineered (GE) trees. There are currently 316.34 acres approved or pending for GE tree outdoor field trials of which 111.46 acres are permitted to universities. There is an unknown number of GE tree test plots on university land permitted to other corporations such as ArborGen, which is not disclosed to the public. Therefore the final acreage number of GE tree test plots on university land is unknown. Permits active and pending reviewed by Global Justice Ecology Project (GJEP) are those with the US Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS). Updated as of 07/26/2017.

Oregon State University

Professor Steven Straussⁱ has been conducting GE tree experiments for over 20 years at Oregon State University (OSU), and his research grants total over one million dollars per year. Some of his new work is on engineering sterility in poplars and other trees using genome editing, RNA interference, and other techniques. Strauss founded the Tree Biosafety and Genomics Research Cooperativeⁱⁱ which is made up of OSU, ArborGen, FuturaGene and SweTree Technologies.ⁱⁱⁱ TBGRC is sponsored by the US National Science Foundation. Associate Sponsors of TBGRC are Forest Molecular Genetics Programme at University of Pretoria in South Africa, Broadacres Nursery, Oregon Department of Agriculture and the Oak Ridge National Laboratory. In addition, OSU promotes a pro-biotech information website called agribiotech.info.

OSU has test plots in Oregon of GE poplar, apple and sweetgum, with a variety of traits. Currently, 24 acres of GE poplar are permitted for phenotypes ranging from herbicide tolerance, insect resistance, ability to glow, early flowering, altered fertility, altered growth, and others. OSU also has an active permit for 2 acres of sweetgum for modified flowering. Some of the information on their permits is hidden from the public as Confidential Business Information (CBI).^{iv}

Purdue University

Keeping one of the genes secret as CBI, Purdue University has field trials of GE poplars, with up to 4 acres with cell wall alterations in Indiana and Mississippi,^v and 9 acres in Indiana permitted for altered lignin content and composition.^{vi}

The department of forestry and Purdue University have teamed up to create the Hardwood Tree Improvement and Regeneration Center in Lafayette, IN. Their Genetics, Genomics and Tissue Culture department is a GE tree testing center. That center's main goal is "...to add value to fine hardwood tree species by genetically engineering them to express genes that impart commercially and

environmentally beneficial traits. Research projects include efforts to insert genes that affect the onset of maturation and the production of flowers, insect resistance, and herbicide tolerance, among others. Researchers are also trying to identify genes that regulate the transition from sapwood to heartwood and the formation of figured wood, which is highly valued but rarely occurs in nature.”^{vii} Lead researchers at this center are Dr. Keith Woeste, Dr. Paula Pijut, Dr. Rick Meilan, and Dr. Shaneka Lawson. Dr. Meilan owns a patent on a poplar tree named "Curly Poplar".^{viii} He has been awarded a \$12,000,000 grant from the US Department of Energy for research in converting biomass to biofuels and over the years has received \$313,000 from FuturaGene, a GE tree company which operates out of Israel, Brazil and China and is owned by Suzano, a Brazilian-based pulp and paper company.

Texas A&M University

Texas A&M University currently has 3.5 acres of permitted field trials for grapefruits, oranges and C-22 (a bitter hybrid citrus rootstock created by the USDA US Date and Citrus Station^{ix}, engineered for resistance to Citrus Canker, Huanglongbing (citrus greening), Alternaria, Alternata, Kanamycin, Oomycete and Tentoxin.^x Portions of the permit are CBI. In June of 2015 they let a trial permit lapse of 43 acres of the same items and phenotypes in both Texas and FL.^{xi}

Washington State University

As of 2014, Washington State University (WSU) reports that they have about 12,000 GE poplars on 11 Acres in western Washington. WSU has had large field trials of GE poplars permitted since 2012. Current permits cover up to 26.33 acres of GE poplars with altered lignin, altered wood development and synthesis of phenylalanine.^{xii} Professor Norman Lewis^{xiii} believes this represents the biggest ongoing field test of genetically engineered trees in the country — and perhaps the world. In addition to changes in wood structure, in 2014 WSU pursued production of rose, basil and clove scent^{xiv} using GE poplars, with the goal of making more 2-phenylethanol in the poplars that could be extracted to be used to produce those scents.

WSU leads the Advanced Hardwood Biofuels Northwest (AHB) consortium. Professor Rick Gustafson is the primary investigator for the project.^{xv} AHB is a research project to make poplars a commercially viable producer of liquid biofuels and biochemicals in the Northwest, from Northern California to Washington. AHB received \$40 million in funding from the USDA under the Agriculture and Food Resource Initiative number 2011-68005-30407.^{xvi} Partners in this are the University of Washington, Washington State University, Oregon State University, Agriculture Center of Excellence, ZeaChem, Greenwood Resources, University of California Davis, University of Iowa, and others.

From the AHB Website:

“AHB is focused on laying the foundation for a renewable biofuels and bio-based chemical industry. High value chemicals, such as acetic acid, ethyl acetate, ethylene, and cellulosic ethanol, which are produced during the first stages of the biofuel production process, can be used to make bioproducts including paints and plastics. The longer-term goal is to develop poplar-based biofuels including jet fuel, diesel, and gasoline that can supplement fossil fuels. These biofuels will be certified to run in conventional car, truck, and aircraft engines and will be 100% compatible with existing infrastructure.”^{xvii}

AHB is still active doing public outreach and research. The Greenwood Resources poplar tree farm announced it's closing in November of 2015. The poplar farm was Zeachem's primary feedstock, so the Zeachem facility ended it's biofuel project in 2015.^{xviii} There are currently 4 other locations where different poplars are grown for feedstock: Pilchuck, Washington, Hayden, Idaho, Jefferson, Oregon and Clarksburg, California totaling 295 acres.^{xix}

Auburn University

Auburn University has never applied for a USDA permit for GE trees, however, according to an article published in AL.com, the university's Gulf Coast Research and Extension Center hosted and may still continue to host ArborGen's GE eucalyptus trees on their property in Fairhope, Baldwin county, Alabama.^{xx}

University of California Davis

The University of California, Davis has active test plots for 1.68 acres of GE walnut trees in California. Some of the traits are CBI. Engineering of the walnuts is for crown-gall disease resistance, *Xylella fastidiosa* resistance, over-expression of shikimate dehydrogenase and altering polyphenol oxidase levels.^{xxi xxii}

Michigan State University

Michigan State University has 2 acres of GE poplars in Pennsylvania for increased height, biomass, secondary cell wall thickness, and root growth.^{xxiii}

University of Florida

The University of Florida (UF), based in Gainesville, has active permits for 2.58 acres of GE grapefruit and Carrizo citrange for bacterial resistance to Citrus Canker, viral resistance to Citrus Tristeza virus and decreased flavanoid level.^{xxiv} They also have 17 acres approved for the same species and traits above in addition to testing on Sweet Orange and Mexican Lime. Additional traits they are genetically engineering for are Huanglongbing resistance, fungal resistance to scabs, and insect resistance to *Diaphorina citri*.^{xxv} In 2011, the University of Florida was issued a \$6.3 million dollar grant^{xxvi} under the Department of Energy's (DOE) Advanced Research Project Agency-Energy (ARPA-E) program to genetically engineer Loblolly pine to increase the levels of terpenes up to five times for liquid biofuel production. Terpenes are the substance in conifers that makes them flammable." ArborGen served on their research team in Florida.

University of Georgia

The University of Georgia is doing field trials of GE American chestnut. Scott Merkle, a researcher at the University of Georgia has been researching the chestnut blight since 1989. With the assistance of ArborGen they developed a method of inserting fungal resistance genes into the American chestnut.^{xxvii} University of Georgia has permitting for 0.002 acres of GE American chestnut in SC for resistance to Phytophthora root rot, the antibiotic kanamycin and another gene marker.^{xxviii} It has 1.05 acres permitted of GE American chestnut in GA for the same resistances in addition to chestnut blight resistance and herbicide tolerance (phosphinothricin = glufosinate).^{xxix xxx}

From the Merkle Lab site:

"For the past seven years, we have been collaborating with scientists at SUNY-ESF, Penn State, Clemson University and the U.S. Forest Service in an effort called the Forest Health Initiative to regenerate transgenic American chestnut trees engineered with candidate anti-fungal genes."^{xxxi}

University of Arizona

The University of Arizona has 0.25 acres permitted in AZ for GE poplar hybrids.^{xxxii}

University of Wisconsin/Madison

The University of Wisconsin/Madison has two active permits for 1.2 acres of GE poplar in Wisconsin, with traits for easier "digestibility," suggesting it would be for processing into liquid biofuels.^{xxxiii}

State University of New York College of Environmental Science and Forestry (SUNY ESF)

Under the guidance of William Powell and Charles Maynard, SUNY ESF is conducting field trials of GE American chestnut trees in NY for Chestnut blight resistance, Phytophthora resistance, herbicide resistance, and markers such as kanamycin resistance.^{xxxiv} Currently there are 14.5 acres permitted in New York. Both Powell and Maynard are scientists who are publicly working toward “saving” the American chestnut from its near extinction through GE. Unlike other GE trees under development, the GE American chestnut is being designed with the intent of releasing it in a fully fertile state into wild forests in order to genetically contaminate non-GE American chestnuts with the blight resistance gene. The impacts this would have on wild forest ecosystems is unknown.

University of Connecticut

The University of Connecticut has an active permit for 0.7 acres of GE poplar to inhibit flowering and formation of root suckers.^{xxxv} Presumably, these projects are to reduce chances that GE poplars will spread.

From the University of Connecticut:

“This project is identifying poplar varieties for field evaluation and demonstration followed by characterization of genetically improved poplar with enhanced growth rate and altered wood chemical compositions. Subsequent tasks included development of a method for genomics-guided mutation breeding of poplar for bioenergy applications as well as preparation and characterization of heterogeneous catalysts for biomass conversion.”^{xxxvi}

Mississippi State University

Although Mississippi State University currently has no active GE field trials, it historically had permits for GE poplars on up to 40 acres in the state of Mississippi.^{xxxvii} Experiments were permitted until the end of 2014, which appeared to have the most genes engineered into poplar to date.

West Virginia University

West Virginia University has an active permit for 0.5 acres of Eastern cottonwood and 0.5 acres of Hybrid aspen for increased growth rate in West Virginia. Some traits are hidden as CBI.^{xxxviii} It also has an active permit for 3 acres of testing on the American chestnut blight fungus itself in the state of Maryland.

Cornell University

Cornell University has an active permit for 1 acre of GE apple for seven different traits altering sorbitol and sucrose synthesis, decreasing the sugar and sorbitol transport, and more.^{xxxix}

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