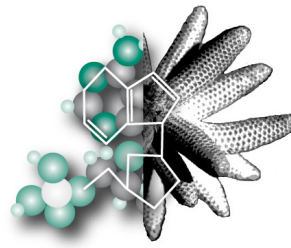


Pine Genome Initiative



Based on Science - Benefiting Society

The Pine Genome initiative (PGI) is about conifers. Depending on the geographic region, the conifer of choice can vary from Douglas-fir in the Pacific Northwest to loblolly pine in the Southeast. Though conifers have a genome seven times larger than humans, the science of DNA sequencing has advanced to put the pine genome sequence within our reach. When we do unlock the secrets of a reference genome, the benefits to society and the environment will be tremendous. Healthier forests, advanced biofuels, more carbon sequestration, and better forest products are just the beginning.

Advanced biofuels from trees is superior to starch (food-based) sources for several reasons, including future fuel yield and increased greenhouse gas reductions. Scientists are scrambling to overcome the remaining technical difficulties surrounding biofuel production. The PGI benefits sustainable biofuel efforts by giving researchers a fundamental understanding of the genes that control wood formation in trees. With this knowledge comes the possibility of growing more biomass, faster, on less land, with less water, less fertilizers, less pesticides, and providing a more efficient feedstock to convert into energy. In the near future, much of our biofuels will start with wood.

Healthy forests are critical to maintain the ecosystem services we take for granted. It would cost a small fortune to engineer systems providing the clean water, air, and recreation that forests give us. They provide 30 percent of the oxygen we breathe, recycle our water, and provide habitat for millions of species. Society needs healthy forests, and conifers are often the keystone species that provide stability for the entire forest ecosystem to thrive. Our forests are under attack from invasive species and a changing climate. A conifer genome sequence will give us tools to thwart these threats by breeding robust trees to protect our forests.

More carbon sequestration is possible by developing faster growing trees that assimilate CO₂ from the atmosphere more efficiently and developing trees which can produce more-durable, longer-lasting products. If climate change is the biggest challenge of our time, then understanding why conifers are the largest and longest living organisms on our planet will help us design trees that are even better at sequestering carbon dioxide from the atmosphere. After all, the giant sequoia and loblolly pine are conifers that store huge amounts of carbon. Enhancing trees to sequester more carbon will be a powerful tool in our fight against a changing climate.

Better forest products are made from better trees. With advanced forest biotechnologies and a decoded pine genome, tree breeders will be able to grow highly specialized trees. Trees that are straighter have more usable wood for making lumber, which reduces production waste and uses fewer trees per product. Trees that have more cellulose and less lignin will require less pulping chemicals and use less energy to make into paper. Better, faster growing trees are more profitable for small tree farms, putting the economic incentive back into keeping our lands forested and rural economies flourishing.

We are at a point where the social and environmental benefits far outweigh the costs of decoding the pine-genome. Thanks to the rapid advances in sequencing and grants for conifer genomic research from the U.S. Forest Service (USFS) and the Cooperative State Research, Education, and Extension Service (CSREES), the National Science Foundation (NSF) and the Department of Energy (DOE), decoding a representative conifer genome is attainable now.

The 2008 Farm Bill, Sec. 9012 Forest Biomass for Energy, has authorized \$15 Million for 4 years for research. If appropriated with new money, agency managers will have the authority to further support the PGI. From the Farm Bill's Manager's Report on this section, "As part of this program, the Managers encourage the Secretary to work closely with the Pine Genome initiative (PGI), which would promote healthy forests and the development of new biofuels technology."

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How We Work

The Pine Genome Initiative does not fund projects. It promotes pine tree (conifer) genomics by:

- ✓ Organizing the needs of the scientific community into a comprehensive genomic initiative
- ✓ Educating decision makers to support conifer genomic research with more competitive grants
- ✓ Giving international research organizations a mechanism to collaborate in this work

Support

Leadership for PGI has been come from both public and private sources. However, the U.S. Forest Service (USFS) and the commitment of Dr. Ann Bartuska has been instrumental in elevating the benefits of the PGI among other federal agencies to make the it a priority on many agendas.

- PGI's Implementation Committee
- U.S. Forest Service (USFS) – Including Dr. Ann Bartuska, Dr. Randy Johnson, and Carlos Rodriguez-Franco
- US Department of Agriculture's Forestry Research Advisory Council
- American Forest and Paper Association – Including Nadine Block and Alberto Goetzel
- Agenda 2020 Technology Alliance
- ArborGen – Including Dr. Maud Hinchee and Amie Brown
- The Forest Landowners Association – Including Dr. Harry Haney
- IFB's Forest Biotechnology Partners – Including Dr. Robert Kellison

Recent Project Funding >\$10,000,000

1. \$6,000,000 From CSREES/ U.S. Forest Service; *Conifer Cap – Conifer Translational Genomics Network*; UC Davis
2. >\$1,000,000 From DOE/JGI; *Conifer EST Sequences*; University of Georgia
3. \$5,060,737 From NSF; *Association Genetics of Natural Genetic Variation and Complex Traits in Pine*; UC Davis
4. \$963,729 From NSF; *Genomics of Loblolly Pine Embryogenesis*; Georgia Tech University
5. \$1,668,611 From NSF; *Accelerating Pine Genomics Through Development and Utilization of Molecular and Cytogenetic Resources*; Mississippi State University / USFS
6. \$278,000 From NSF; *A Phylogeny of Pinus Based on Six Low-Copy Nuclear Genes*; Oregon State University / USFS
7. \$505,122 From NSF; *Comparative Resequencing in the Pinaceae*; UC Davis
8. >\$1,000,000 From DOE/JGI; *Advancing Pine Genomics through Targeted and Random BAC Sequencing*; Mississippi State University

Management

The Institute of Forest Biotechnology (IFB) manages the Pine Genome initiative. An Implementation Committee of experts from academia, government, and industry organizations make sure the PGI benefits society. Science Advisors and Jeff Dean, PGI's Science Liaison, make sure the PGI is consistently based on science. Adam Costanza, IFB President, and Randy Johnson, National Program Leader for Genetics Research at the U.S. Forest Service, co-chair the PGI.

Contact

The best resource for information about the PGI is online at www.pinegenomeinitiative.org. Please speak with one of the PGI contacts directly if you have additional questions or ideas.

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