

Forest Health Initiative

Advancing Forest Health Through Biotechnology

April 2010

Annual Report 2009

Summary of Accomplishments: October 1, 2009 – March 31, 2010

It has been approximately one year since the Forest Health Initiative (FHI) was launched. The three groups – Science, Regulatory/Policy and Social/Environmental – organized under the FHI have been very active in the past several months in pursuing the objectives of the initiative. The FHI conducted its first annual meeting in March, 2010 to enable interaction across the three arms of the initiative and encourage integration of work between science and social/environmental goals. Based on reports, discussions and planning at that meeting, the FHI is on schedule to accomplish its goals within the three year period for which it has been established. Accomplishments are detailed below.

Background

Over the last 50 years, America's forests have faced increasing stress from diseases, pests, fungi, pollution, a changing climate, and other forces. The number of threats to tree species across the nation's forests are the highest they have ever been. Destructive invasive threats contributed to about 10 million acres of tree mortality in forests in 2004.

With continued globalization and a changing climate, threats to forests will increase in coming years potentially leading to catastrophic change to forest ecosystems. While traditional tree breeding and propagation approaches will continue to have a prominent place in forest management and restoration, the severity and types of threats facing the nation's forested areas require the U.S. to respond more quickly to protect the future of our nation's forests. Biotechnology can play a vital role in the ability to tackle today's environmental problems. However, advances in biotechnology are needed to effectively address these challenges if forest health is to be maintained and enhanced. Further, it is important to determine the limitations of biotechnology for individual species restoration and for the protection from catastrophic loss. Acquiring this knowledge will enable partners to better respond to short- and long-term conservation needs and demands. We recognize that science is only part of the answer. Biotechnology can play a critical role in addressing forest health threats when strong societal support and robust regulatory processes undergird the use of these scientific tools.

Program Summary

In an effort to advance the country's understanding and use of biotechnology to address some of today's most pressing forest health challenges, conservation partners came together to create the Forest Health Initiative --*Advancing Forest Health through Biotechnology*. This three-year initiative's initial focus is on restoring a test species and an icon of eastern U. S. forests – the American chestnut – whose numbers were decimated during the past century by chestnut blight. Efforts to aid in restoring the American chestnut will augment current tree breeding efforts and promote the genetic modification of the target species. Responsible and sound scientific methods and practices will be a cornerstone of the project.

While working to restore the American chestnut as the "test tree", the program will discover new approaches to enhance the health and vitality of other trees, forests, and forest ecosystems. The program combines the resources from USDA Forest Service, Non-

governmental organizations (NGO), universities, foundations, and others to develop a strategic approach to examine and evaluate the science, societal, and regulatory issues related to the use of biotechnology as a tool to appropriately address challenges to forest health in America. The project is implemented through a partnership consisting of a diverse range of partners. Charter sponsors are the USDA Forest Service, the U.S. Endowment for Forestry and Communities and Duke Energy. The initiative calls for aggressive collaboration from various public and private entities across the research, regulatory and NGO sectors.

The specific goals of this program include developing:

1. A holistic approach for biotechnology to address emerging forest health threats by assessing not just the science but the societal and regulatory issues concurrently.
2. Biotechnology tools (i.e., the science and technology) derived from transforming American chestnut to be used to save other forest tree species that are threatened by catastrophic loss.
3. Concurrent dialogue with all stakeholders to better understand concerns, inform our science and regulatory efforts, and create a more informed citizenry about forest threats and opportunities to overcome these threats.
4. Acceptable protocols for testing transgenic forest trees, integrating biotechnology with traditional breeding and silvicultural practices, and using these for forest health purposes.

The project provide funds to accomplish objectives in three areas: 1) Scientific development of genetically engineered (GE) trees for forest health and, in particular, expansion of GE American chestnut as a model for testing forest health issues; 2) Regulatory and Intellectual Property needs/issues for GE forest trees, utilizing GE American chestnut as a test case; and 3) Addressing societal concerns about GE developed trees to answer forest health problems.

The project is organized around three fully coordinated groups in pursuing the initiatives objectives through a "braided" approach. These include a Science Group, a Social/Environmental Group and a Policy/Regulatory Committee. The effort is overseen by a Steering Committee.

Steering Committee:

Carlton Owen, *Chair*, President & CEO, US Endowment for Forestry & Communities; sponsor

Dr. Ann Bartuska, Deputy Chief for Research and Development, USDA Forest Service; sponsor

Dr. Steven Hamburg, Chief Scientist, Environmental Defense Fund

Mariann Quinn, Director, EHS Policy and Strategy, Duke Energy; sponsor

Dr. Peter Roussopoulos, Retired – USDA Forest Service

Dr. Paul Trianosky, Director of Forest Conservation, Southern US Region, The Nature Conservancy

Accomplishments: October 1, 2009 – March 31, 2010

The Science, Social/Economic and Regulatory/Policy groups actively organized and pursued the objectives of the FHI over the past several months. The first Annual Meeting was held in Washington, DC, March 30 -31, 2010. Forty-five participants attended the meeting from the Steering Committee, Science Advisory Committee, Science Team, Social and Environmental Group, Regulatory and Policy Committee, as well as representatives from the regulatory agencies and invited experts. The meeting was specifically designed to enable interaction across the three arms of the initiative and encourage integration of work between science and social/environmental goals. The "braided" approach has been widely accepted and is being implemented via cross-populating committees and direct interaction during meetings.

Meeting materials are attached to this report:

- Agenda
- Biological Research report
- Social/Environmental group reports
- Meeting Participant List

I. Science Highlights

Progress as of 3.30.2010 (depending on research area, from 6 to 8 months into project)
The following details can be matched to the Research Work Flow chart (attached).

Genomics –Genome sequencing

- >50 Gigabases of Chinese chestnut (CC) reference genome sequence obtained.
- 15x genome coverage on 454 platform; 47x on Illuminaplatform.
- CC sequence assembly is ongoing, AC resequence to happen this summer.
- Web portal up and running (hosted by Clemson University).

Germplasm–Coordination

- Crosses made, embryos collected from The American Chestnut Foundation (TACF), Connecticut Ag Experiment Station (CAES), American Chestnut Cooperators Foundation (ACCF), Virginia Division of Forestry (VDF).
- Currently lining up partners for clonal field testing.

Germplasm–Population Genotyping

- QTL map for F2 population refined; 118,272 DNA genotypes scored (# of SNP markers x # of progeny).
- Chestnut /Peach genome overlay shows 3 of 4 blight resistance QTL co-locate with powdery mildew QTL;
 - for each QTL, about 10 genes (from CC) can be identified as candidates for transgenic testing (in AC).
 - evidence for pathogen isolate specificity identified at one QTL.

ClonalTesting –Early Blight Resistance Screen

- Three early screen protocols evaluated;
 - stem test in greenhouse; stem test in tissue culture; leaf test in greenhouse.
- Early screening workshop scheduled for May 18-19, 2010, Asheville, NC.

ClonalTesting –Transgenic Testing

- Four new transgene vectors built for transferring candidate blight resistance genes into AC.

- Eighteen transgene constructs (vector x candidate gene combinations) at various stages of evaluation;
 - including 3 with a CC laccase gene and 5 with “stacked” (ie, more than 1 transgene) transgenes.
- Candidate genes from CC QTL intervals to be cloned and transformation-ready later this year.

Clonal Testing –Vegetative Propagation

- >9000 embryos cultured with a ~1% capture rate.
- Cryostorage of captured lines initiated to allow revival/regeneration tests.

II. Social/Environmental Highlights

The multi-stakeholder FHI Social/Environmental Group (SEG) was established by the Steering Committee in mid-2009 with the following working goal: ***Within three years develop broad social and environmental stakeholder understanding on how biotechnology may be used to preserve and restore forest health.***

Much like the broader FHI, the SEG has embarked on a three-pronged, parallel and fully coordinated (braided) approach to achieving its goal. Three Work Groups of the SEG have been established:

- Issues Work Group: addressing key questions, issues and concerns by stakeholders.
- Principles Work Group: indentifying and integrating principles for responsible deployment of biotechnology to address current and emerging forest health threats.
- Outreach & Communications Work Group: developing and executing a plan to solicit broad input and engage key stakeholders that result in broad stakeholder understanding and acceptance of the FHI.

An initial objective of the SEG was to attract a diversity of participation. There is a high level of Interest in the FHI. As a result, the SEG has been able to recruit the following organizations:

American Bird Conservancy	National Parks Service
American Forests	National Association of Conservation
American Forest Foundation	Districts
Appalachian Regional Reforestation Initiative	National Association of State Foresters
Appalachian Wildlife Foundation	DOI, Office of Surface Mining
ArborGen	Pinchot Institute for Conservation
Association of Fish and Wildlife Agencies	Resources for the Future
Association of Consulting Foresters	Society of American Foresters
Extension Service	The American Chestnut Foundation
Forest Guild	The Conservation Fund
Forest Landowners Association	University of Georgia, Warnell School
Health Law Institute	

Soliciting additional participation will remain a priority for the SEG throughout the life of the FHI. Participation is open to any organization or individual that desires to work constructively towards the goals of the FHI. We expect additional participation as we begin to aggressively execute our Outreach & Communications Plan.

At the March 2010 FHI Annual meeting all FHI participants reviewed the work of the SEG, including:

- A draft Outreach & Communications Plan;
- draft Principles for the deployment of biotechnology to protect or restore forest health; and

- a draft Issue Paper to serve as a template for addressing key questions, issues and concerns raised by stakeholders.

As a result of thorough review and discussion by the FHI participants, the SEG will:

1. ***Begin to implement and continue to refine the Outreach & Communications Plan.*** The SEG will begin briefing target audiences – conservation organizations, policy makers (elected and agency) and community and civic organizations – on the substance and goals of the FHI. This effort will be closely coordinated with the FHI Regulatory/Policy Group and will include one-on-one briefings as well as roundtable discussions hosted by FHI participating organizations for stakeholder organizations in Washington, DC. As part of refining the plan the SEG will make recommendations to the Steering Committee as to whether outside expertise will be needed in helping to shape the key messages and/or dissemination of materials. Making the website more attractive and useful to interested stakeholders will also be a priority.
2. ***Use draft Principles as a vehicle to generate discussion and interest.*** The SEG will refine the draft Principles based on the recent review by FHI participants and begin using them as a discussion tool. The Principles are a very high level attempt to address many of the major issues raised or anticipated to be raised by stakeholder groups. The Principles describe how when biotechnology is deployed to protect or restore forest health: environmental and social implications will be evaluated; deployment will conform to existing regulation and protocols; solutions will be science-based and the process will be transparent.
3. ***Reevaluate approach to addressing key questions, issues and concerns.*** The recent review of the draft Issue Paper resulted in clear direction that the level of information must be tailored to the target audience. As a result the SEG will work closely with the Science and Regulatory/Policy Groups to develop a comprehensive overview of the FHI, including high level discussions of some of the important issues. Specific issue paper can be built out from this base report at the level of detail needed for the target audience. This will require writing complex scientific issues and subjects in a manner that is understandable to the average citizen.

The SEG is currently making the revisions suggested by the FHI participants and scheduling conference calls to execute all the updates approved by the FHI Steering Committee at the March meeting.

III. Regulatory/Policy Highlights

A patent landscape is currently being prepared by Lori Knowles, an attorney specializing in bioethics, law and public policy. Her presentation was directed to defining the areas in which the patent landscape will help the researchers.

What is a patent landscape?

It is particular to a specific field of research

- defines the direction that field is moving;
- provides identification of competitors;
- identifies geographic area where research is occurring;
- identifies potential patent problems that may interfere with future capabilities to conduct research or commercialize;
- does NOT provide an absolute freedom to operate; and
- does indicate where workarounds or licensing may be necessary.

Scope of patent landscape and methods: American Chestnut (Delphion) US only

1. Patent Identification: Delphion
 - Boolean Search - Collections searched: US (Applications - Full text)
 - a. Collect all patents identified in the Delphion database.
 - b. Read claims and flag patents relevant to the project.
2. Interviewing Scientists
 - a. Identify methodology of scientists.
 - b. Create flow chart and identify possible steps, techniques or methods that may have patent problems.
3. Identify potential problem patents
 - a. Go through identified patents with a view to finding patent conflicts with identified steps, techniques or methods.
 - b. Rerun any searches deemed necessary under new terms.
4. Final Patent List
 - Create patent list of potential problem patents and review with science team.

IV. Outcomes from the Annual Meeting – Next Steps

The discussions at the meeting not only resulted in refinements to the plans of the individual groups described above, but in a list of additional projects that will be integrated into the work of one or more of the groups. The three groups identified, and the Steering Committee approved, the following items to pursue:

1. Publish a “What is FHI” document. This would be done as a joint document between the Science and the Social/Environment Groups.
2. Create a Rapid Response template from the FHI to use with other species. This can be built from the Conceptual Overview of the Science Plan and should be a final product of the initiative for publication and use.
3. Create a dossier on American and Chinese chestnut – the biology, physiology, environmental characteristics, nut proteins, etc – for use with regulatory agencies. Draw upon traditional knowledge of the chestnut.
4. Enlist a consultant experience in tri-agency interactions of biotech products. Explore facilitated breeding with a biotech tree where transgenes are bred out in the final product.
5. Anticipate an EIS and note that:
The higher the quality of information in an application the easier an EIS will be.
Documenting stakeholder interaction is critical.
6. Create a whitepaper/academic paper outlining the FHI regulatory interactions.
7. Think through the long-term ecological issues utilizing case studies that have been done in other species.