FOREST.HEALTH TREE PROTECTION WORKSHOP PROCEEDINGS

November 28 – 29, 2018
Washington, D.C.

Proceedings of the Forest.Health Tree Protection Workshop

November 28 – 29, 2018, Washington, D.C.

Day 1 Page

Day 2

APPENDIX

Synopsis

The Forest.Health Tree Protection Workshop assembled a wide range of expertise and perspectives on the challenge of identifying the state of knowledge in novel tree protection technologies. The outcomes of the workshop reflected the broad range of participant viewpoints presented.

The workshop objectives were: (1) to identify the state of knowledge in novel tree protection technologies with a focus on North American ash as a current genus under threat and using American chestnut as an example of how an intervention strategy can be implemented; (2) to identify research gaps in tree protection focusing on the host tree; and (3) to set recommendations for research priorities and next steps.

In response to the fundamental question "Can biotech play a role in addressing forest health challenges at the speed of need?", the American chestnut model as presented suggests that multiple biotech avenues are indeed available and applicable, and that the biotech field is evolving rapidly. A focus on lingering ash trees - using individual trees observed to exhibit some degree of resistance to emerald ash borer (EAB) as a source of resistant material - emerged as among the more promising of starting points. Other R&D avenues, including biotech, were discussed and should be pursued to address the extent to which the species is being impacted. An integrated, framework approach is required.

At the same time, many participants observed that the tree breeding infrastructure required to propagate and produce improved trees at a scale sufficient to ensure the required genetic and phenotypic variety, and to reintroduce the trees across the ecological range of ash, has eroded over the past several decades. On the US side, revitalization of state and federal led tree breeding infrastructure, or establishment of novel partnerships involving private sector growers and potentially, citizen science, will be required to successfully pursue development of resistant ash trees as a "moonshot" project.

The broad question to ask, as formulated by one participant, could be: "*How can we build a comprehensive program in forest health that includes forest management and tree improvement, that involves all stakeholders interested in trees and forest ecosystems, including commercial and non- commercial species in rural to urban environments?*"

Later discussion suggested the ultimate "moonshot" for a tree protection project would be, using ash as a foundational building block, to utilize biotech and other available tools to establish forest health as a science and policy priority, then move beyond a North American forest health model to develop a global approach, i.e. to …

Moonshot: Build a global network of people who anticipate forest health issues at the speed of need.

November 28, 2018, Day 1

Welcome and Workshop Perspective

Carlton Owen, U.S. Endowment for Forestry and Communities

Carlton set the backdrop to the workshop with reference to recent, costly forest disturbance events (the Fort McMurray fire in Alberta and the Camp Fire in California), representing a convergence of forest health challenges driven by climate change, social, and ecological factors. These events, while tragic, bring into focus the importance to North America of forests, ecosystem services, and forest products. Society is not investing sufficiently in forest health (less than 0.5% investment in research and development across the sector in U.S.). The Forest Health Initiative (FHI)[1] offered the opportunity to employ biotech knowledge to address forest health, to work and think differently, to reduce decades of research time to years, and to increase the relevance of that research within political cycles. The cost of damage to North American forests, and the forest area currently in need of restoration, suggests this is a time to step up and to work with a broad set of new partners to address the need. Time is a factor.

Introductions, Goals and Outcomes

Monica Lear, USDA Forest Service, Rory Gilsenan, Canadian Forest Service

Monica and Rory referred to the January 2018 US – Canada Forest Health and Innovation Summit in Ottawa, as a starting point to the present biotech-focused workshop. They noted the extent to which economic impacts of forest invasive pests are driving collaboration and referred to significant decreases in budgets which demand leveraging and cooperation. A challenge was issued to workshop participants to utilize innovative approaches – citizen science, partnerships represented by the Summit process and communication – to develop a high-profile biotech project, "a moonshot," in a short period of time (perhaps 12 – 18 months). The six-year USFS – CFS partnership needs directed outcomes to be able to move forward on biotech and tree breeding solutions. Common approaches will be needed to build resistance in host trees. Ash is a model, but workshop participants were encouraged to think broadly.

[1] The FHI was an U.S. Endowment and USDA Forest Service sponsored program to plumb the potential of modern biotechnology as a tool to address forest health issues using the American chestnut as the test organism, http://foresthealthinitiative.org

Presentations, Core Messages, Discussion

Session 1: Lessons Learned

John Davis, University Florida – The Forest Health Initiative Experiment

- Science - Policy - Society considerations are each required to contribute to successful biotech outcomes
    - The science approach requires strong integration and collaboration and challenging team members to accelerate normal timelines
    - A science – policy interface: the research approach may be altered as a result of the regulatory changes, some genome editing methods will not be regulated in certain countries the same as transgenetic modification

Jason Holliday, Virginia Tech University – Genetic and genomic tools to accelerate American chestnut restoration

- Biotech solutions to forest health threats are faster than conventional breeding, but still slow.
    - Pursuing different approaches in parallel is more likely to yield the ultimate goal of durable resistance
    - The research model used allowed increased control of focus on outcomes
    - The timeline to develop an effective population of resistant American chestnut trees may be a few decades away, due to the limited number of nuts available for outcrossing

Session 2: Species in Peril

Kevin Potter, North Carolina State University – Overview of Ranking Research (CAPTURE) – Results and external reviewer input

- CAPTURE is a national, data-driven, expert-guided project that identified, categorized and prioritized forest tree species at risk from insects and diseases.
    - The most vulnerable tree species were prioritized as candidates for intervention effort based on the added criteria of economic, societal, ecological and practical considerations
    - The tool does not necessarily capture overall values or comparisons, but serves as a guide for forest heath going forward
    - The inherent difficulty in predicting the tree species that might be impacted by invasive and alien species (IAS) in future depends on perspective, the tool identifies known vulnerabilities

Jennifer Koch, USDA Forest Service – Ash: A Model for Developing an Integrated Strategy That Can Be Extrapolated for Other Imperiled Species

- "Lingering ash" (trees that should have been rapidly EAB-killed but instead persisted longer than neighboring trees) may have some level of genetically-based resistance that allows them to live longer than other attacked individuals.
    - Selecting and breeding resistant trees can be accelerated through efficient vegetative propagation of parent trees, shortening the breeding cycle (early flowering under high intensity light conditions) and rapid phenotyping (selection of resistance)
    - A primary challenge is the need for identifying, sampling, and confirming phenotypic material
    - Forest ecosystems are a focus, but resistant trees can be screened in urban settings

Daniel Doucet, NRCan Canadian Forest Service – Overview of Canadian Ash Research

- The Canadian Forest Service research focus is on pests, but host research is emerging, e.g.
    - Host response and ecology, to identify factors in ash restoration
    - Identification of up-regulators in Manchurian ash
    - Genetic expression triggered by EAB larvae
    - Addressing EAB population dynamics using pheromones (e.g. mating control) not known to be studied at present

Sessions 1 & 2 Panel Discussion: What was Said

Decline in tree selection and breeding infrastructure in US is a hurdle to regional collaboration on tree breeding and research.

There is a need to think broadly about a forest health initiative that will address a range of challenges, including increasing available infrastructure. This will require working in partnership with all stakeholders, commercial and non-commercial.

Citizen science (private landowner and citizen identification of lingering ash) combined with working with States, Provinces, and non-profit organizations may be a way to move beyond infrastructure limitations, but a structured approach to doing so is required.

For propagating ash across the landscape, population statistics and the equivalent of seed zones (potentially, hardiness zones) will be necessary to support restoration, as the impact of EAB requires replanting entire ash populations. Restoration ecologists are currently studying this question.

Comparison of research models: Genome Canada is a traditional model, employing matching of funding by Provinces, Gantt charts and scientific advisory boards employed to meet goals. The

design can generate some kind of inertia. In contrast, the FHI model allows for aggressive mid-course research adjustment, because the research model is intended to be flexible.

With no natural resistance evident, the experience of biotech development for avocado and citrus showed that commercial species had a strong supporting voice from industry. Similarly, non-commercial tree species under threat, and the acceptance and registration of biotech solutions for them, will also require identification of a champion – a voice.

Genetically-engineered (GE) American chestnut must by definition meet the regulatory requirements for all three agencies in the U.S. How a GE tree produced for restoration will be handled will also determine approaches for other pests to come.

EAB impact on ash in Canada was not an industry issue but a municipal one, involving costs to cities and citizens. Municipalities could be clients in developing resistant replacement trees.

Regarding the CAPTURE model: it is possible that species identification and rankings could change, depending on ranking priorities. Insects and diseases are the immediate focus, but longer term considerations such as climate change can be included as well. Any focus on economics will depend on perspectives, and the values considered to be at risk (lumber values, but potentially ecosystem services or ecological contributions).

Use of "sentinel trees" (planting of species outside their natural range and monitoring for potential pests and pathogens) was noted as a useful means to predict candidate tree species at risk.

To validate restoration approaches for improved trees, consider seed transfer zones and approaches suited to current and to future conditions. Doing so will require quantitative and structural approaches, including about where to collect and plant current material and, for known locations, where to obtain appropriate material.

The range-wide definition of the chestnut genotype may inform approaches to restoration, using local genotypes.

The most effective approach may be to include a number of different factors associated with restoration, and also incorporating climate change, to develop population group choices.

Session 3: Expanding Our Thinking – Speed Talks

Rocco Saracina, Sustainable Forestry Initiative – SFI Perspectives

- Current SFI certification standards do not permit use of genetically modified organisms, but standards are revised every five years, an opportunity exists to address GMO restrictions.

- Current public perception of GMOs may be addressed through consideration of values at risk and potential to use biotech to mitigate threats to forest health.

Meaghan Parker, World Resources Institute – Citizen Science and Adventure Scientists

- Engaging citizen scientists in collection projects can significantly reduce project costs and time, while allowing consistency in collection methods and data capture on a single platform.
  - The project focused on using volunteers to collect samples to generate a DNA database of bigleaf maple from CA to BC to be used to identify illegal logging of the species.
  - A reference database for all available xylaria is also a part of the approach.
  - WRI and Adventure Scientists are seeking suggestions for the next tree species to consider after bigleaf maple

Leigh Greenwood, The Nature Conservancy – Stakeholder Engagement

- Stakeholder engagement needs to be considered up front in a project, not as an afterthought. It must be built into the work program and intentionally adapted throughout the course of the project as new needs arise.
  - Outside perspectives can bring new solutions, those left out can be impediments

Mike Born, Fender Guitars – Industry Impacts

- Fender has used green (swamp) ash in its electric guitars since 1951.
  - At this point, there is no suitable substitute, Fender is looking for a replacement

Rick Cooksey, USDA Forest Service – Evaluation protocols for Species on the Horizon

- Using an investment perspective tool to make good consensus decisions.
  - Tool takes an integrated approach (conservation, restoration, resistance) to forest genomics
  - Ecosystem services not currently accounted for, difficult to include
  - The tool is very close to completion, first utilization by a working group anticipated

Carrie Pike, USDA Forest Service – Forest Restoration and Deployment

- Merging forest health needs with tree improvement and breeding programs is a necessary paradigm shift
  - Protocols (e.g. for whitebark pine) exist for determining minimum number of source trees and maintaining genetic diversity

Carlton Owen, U.S. Endowment for Forestry and Communities – How This All Fits Together

- The lesson learned from the Forest Health Initiative is to consider the whole research problem, not parts thereof:
  - It is imperative to get all partners in the room, and work from a common bond (i.e. forest health).

- Commit to go where the information leads, to constantly verify the direction with stakeholders
- Focus on social benefit – a social good focus changes the conversation
- Rather than encouraging competition, select a team based on capacity need and availability
- Operate transparently and in the open (not the usual research environment)
- Time to an outcome matters

Susan McCord, Institute of Forest Biosciences – Forest.Health, The Framework for Ash

- A roadmap and integration provide a foundation to help us scale from ash to meet the needs of multiple species.
- Varied Policy Oversight Considerations.
    - The USDA does not regulate or have any plans to regulate plants that could otherwise have been developed through traditional breeding techniques. This definition includes some genome editing methods. In Canada, determinations are based on if the plant has a novel trait, not the process by which it was derived.
- We will need to think about our social license as we engage stakeholders, local communities, and publics.
    - As we think about the connection piece, how can we take advantage of all the mobile tools available to us – TreeTaggr and broad public engagement tools with no barriers to use? Can we add sensors into this network and begin to create an internet of trees?

Expanding our Thinking Panel Discussion: What was Said

We need to choose outcomes that will resonate across sectors and articulate those in layman terms.

The USFS investment perspective tool is useful in project planning and could, with further development, be used by this group. There is usefulness in broadening its application.

To influence decision makers, it is critical to agree on the precise value proposition. Telling the story effectively is challenging when considering invasives, fire, and other forest health impacts.

Thought is required as to what is the best story to tell – the big economic impact numbers or vignettes, personal stories about individuals?

Fender Guitars is a great example of an engaged forest product company, focused on ash. We should note there are other groups we can reach out to – baseball bat manufacturers (Louisville Slugger), and baseball teams. There is a need to achieve a greater sense of urgency about ash and about forest health.

There are opportunities to address nursery and production gaps. Private nurseries and State nurseries are potential stakeholders (although some laws and regulations currently work against collaborative outcomes between private and State nurseries).

Traditional vertically-integrated forest product companies are no longer the industry norm and most have reformed as smaller, single-product entities. The resulting reduction in issues perceived as being held in common requires creating "collegial approaches", through North American forest partnerships, using forests as a common tie.

One of the challenges we need to address is transparency among those involved in the ash framework – do we know what are the challenges to sharing (possibly) proprietary data?

Historical data and institutional knowledge loss is a challenge across the sector – infrastructure is declining and getting information while it is available for mining is critical for avoiding reinventing research that has already been done. The new USFS interest in synthesizing information not yet digitized leads in the right direction.

There may be an opportunity to engage corporations in citizen science, in projects like the bigleaf maple project.

Google is engaged in a project to align all available data on invasive alien species, but such efforts become complicated when sensitive IAS location data is made public.

November 29, 2018, Day 2

Demonstration

Adam Costanza, National Council for Air and Stream Improvement – Technology Touch Tank Demonstration

- Developing an Internet of Trees, using Open-source, Low-cost Devises
    - Technology to monitor trees, but also to engage society in forest health

Technology Touch Tank Discussion:

- Hyperspectral monitoring of tree physiology is developing, using similar small-scale instrumentation
- Early detection of forest disturbance would be critical data to capture
- Fender Guitars utilizes similar monitoring technology in its factories

Review of Day 1: Jacinthe Leclerc, Canadian Forest Service

Jacinthe reminded participants of the "moonshot project" discussion on Day 1, and noted today's task would be to identify the most significant project for collaboration. Some questions that arose during discussions included:

- How to develop and deploy resistant trees "at the speed of need"?
    - How do we breed, grow and manage forest trees in a more efficient way?

- How to incorporate and integrate new or novel biotech, existing low-tech solutions, genetics, selection, ecological modeling, forest management and monitoring?

- How to intervene with host resistance as a key component of integrated pest management?

This lead one participant to posit:
"How can we build a comprehensive program in forest health that includes forest management and tree improvement and that involves all stakeholders interested in trees and forest ecosystems, including commercial and non-commercial species in rural to urban environments?

Doing so would provide the resources needed to rebuild our forest health capacity so that we can address current and future forest health issues, both native and invasive. The project could address:

1) Improved monitoring efforts to quickly identify pests and evaluate the risk.
2) Comprehensive efforts to detect and respond to risks through:
a) Improved forest management to develop more resilient forests and better mitigate risks.
b) Tree improvement efforts including traditional breeding and modern biotechnology to develop trees that are better adapted to resist pests including insect and diseases."

To lead discussion towards that outcome, five questions were presented that workshop participants would later have the opportunity to address:

1. People: Who should we engage to become the Champion (the "voice"), for what purpose, and how?

2. Urban Landscapes: How do we replace ash in urban settings and how do we engage the industry that produces stock?

3. Efficiency: What research can be combined to achieve greater efficiencies and broader influence? What are the gaps?

4. Resources: What financial resources and expertise are available, or missing?

5. The Moonshot: Are there broad areas emerging beyond ash that could bring us to the moonshot? What are the priorities in 12 – 18 months? In 3 – 5 years?

Workshop Breakout Session on the 5 questions: Development of Research and Programmatic Design

1. People

Who should we engage to become the Champion (the "voice"), for what purpose, and how?

Suggested Short- to Mid-term Actions:

- Engage a professional marketing firm to craft a clear and communicable message
- Engage the socially responsible investment community to build momentum and incentivize others
- Develop a communications effort focused on the societal importance of preserving and improving forest health

Messaging:
Focus on public well-being, preserving green spaces, a call for action of forest health, iconic symbols (baseball bats, guitars) and iconic forest places. Identify and cultivate influential voices

Insider Champions:
Foresters (State and Private), Entomologists, geneticists
Regulators (CFIA, APHIS, PPQ)
Urban landscapers
Wood industry associations
Politicians, decision-makers
Municipalities and cities
Timberland Investment Management Organization (TIMO) /Real Estate Investment Trust (REIT)

Outsider Champions
Amazon, Microsoft, Google, AWS and other tech companies
ENGOs
Fishermen, hunters
Indigenous communities
Master Gardeners
Big Box stores
Retirees

2. Urban Landscapes

How do we replace ash in urban settings and how do we engage the industry that produces stock?

- Diversification (of both species and intra species cultivars on the market) is key
- Increase understanding of challenging urban environments (climate, soil, salinity, etc.)
- Create linkages with municipal and regional planning (awareness of science solutions)
- Communicate the value of urban trees and forests in creative ways
- Engage tree-planting audiences – municipalities, private landowners
- Foster relationships with stakeholders – nurseries, arborists, public works, landscape architects
- Incorporate the human dimension – social engagement, citizen science, education
- Develop test grounds (demonstration plots) for biotech – resistant ash and other species
- Identify and engage champions (the Arbor Day Foundation, Tree City USA, Tree Canada) who will integrate urban forests into their messages

3. Efficiency

What research can be combined to achieve greater efficiencies and broader influence and what are the gaps?

A: Using a "value-chain" approach, develop:

- a Lingering Ash identification protocol (some components are already in place and can be refined, extended);
- a systematic, sharable approach for long-term monitoring plots and ensure a source of EAB rearing is available for supplying research;
- a propagule collection and screening pipeline (a screening network to validate resistance in identified lingering ash individuals, and protocols);
- an info-portal as a means to share information across countries and agencies (Information exchange is critical);
- a best practice protocol on how to manage EAB where present (e.g. Michigan State University SLAM – "Slowing Ash Mortality" research);
- ash replacement protocols (an outreach and education tool for nurseries, communities) to facilitate reintroduction of ash and other species into communities. (This would build on www.emeraldashborer.info).

B: Outline for a Potential Lingering Ash Pilot Test Program:

- Identify potential sites (e.g., Detroit, Montreal)
- Identify nursery stakeholders
- Develop a cohesive plan
- Identify multiple screening sites (State- Province level)
- Develop a European ash die-back breeding program
- Keep decision makers informed
- Maintain communication between countries
- Establish a central research and data collection entity

4. Resources

What financial resources and expertise are available, or missing?

Available Resources:

- Professional expertise (genomics, pathologists, entomologists)
- Research funding (Genome Canada, US funding agencies, US & Canadian Forest Services)

Resource Gaps:

- Hi-tech expertise (AI, innovative problem-solving methods)
- Genetic resources required to initiate research
- Strong communication plan to reach the public, municipalities about forest health
- Federal funding for urban forest management, city programs
- Nurseries able to provide trees in type and at scale appropriate to current and future risks
- Approach to protect important species and individual trees
- Efficient resistant phenotype screening methods

Innovative Approaches:

- Consider the link between urban forests and public health (e.g. lowered health insurance costs)
- Apply citizen science to identify genetic resources (e.g. lingering ash)

5. The Moonshot

Are there broad areas emerging beyond ash that could bring us to the moonshot? What are the priorities in 12 – 18 months? In 3 – 5 years?

Emerging Beyond Ash: Research Actions

- Establish a Canada-US network to identify host-pest interactions in global trade
- Using commercial species, identify the pathways of greatest risk
- Establish resistant tree test plots in post-EAB urban areas
- Pursue genetic knowledge on diversity of host tree species – large-scale basic data gathering (including the tree genome database https://treegenesdb.org/)
- Increase visibility of tree breeding using flagship projects
- Employ tech solutions for early monitoring of trees and pests
- Engage the arboretum community as stakeholders
- Rebuild lost infrastructure based on agreed need
- Enhance and expand Sentinel Plant Network & American Public Garden efforts to identify potential pests offshore in common gardens
- Research Bt ash as a concept
- Research EAB population disruption (sterile males, pheromones, etc.)
- Codify a research-to-planting process for resistant and improved trees

- Focus on accelerating rapid phenotype ID, breeding and production as a technology challenge
- Employ "proven winner" strategy to ID and support universities with best relevant research departments

Related Actions (Prevention-focused)

- Focus on proactive and preventative approaches
- Improve the flow of scientific information with tree professionals in other countries
- Use commercial species to focus on pest introduction pathways
- Using CAPTURE, prioritize the top 10 to 20 commercial species in North America
- Using CAPTURE, prioritize the top 10 to 20 urban tree species
- Build a robust monitoring, prevention, and response program

Post-breakout Session Open Discussion and Feedback: What Was Said

The origins of this discussion extend from the Forest Health Initiative model and paradigm for addressing emerging forest health problems.

The question now is how to broaden the approach beyond a single species, such as was done with American chestnut? Forest.Health is the evolution of that concept, addressing forest health challenges by taking a host-centric approach, by providing a new future using methodologies and trees that will survive in emerging conditions.

The CAPTURE species evaluation exercise led to ash as a high-priority, and the US—Canada Forest Health and Innovation Summit theme brought us to the point we've now reached. Who to engage and where to obtain the funding required are the next steps, while we continue to evolve the community. The goals are to leverage biotech with a focus on host trees, to improve forest health, and to facilitate acceptance of forest biotech by the urban and rural public and NGOs.

Can we leverage biotech and other available tools to position forest health as a priority? Can we go beyond North America and build a global approach to forest health and invasive alien species, i.e.,

Moonshot: Build a global network of people who anticipate forest health issues at the speed of need.

We need to set a very high bar, to start with Canada and the United States, then expand to Europe, China, South America, etc., with the acknowledgement that forest health is a global issue. Ash is the perfect tree to bring to our community together, with ash as the rallying cry for the commercial species at risk as the potential next ash.

A tagline to describe Forest.Health in 20 words or less … *"Leveraging the power of science to ensure a healthy future for forests and people".*

The connection between ash and a global forest health network will require work and development of a convincing value proposition.

The ash work should be a subset of an overall global forest health network concept.

There are gaps to acknowledge, the federal infrastructures necessary to accomplish a high-impact outcome may be insufficient. We need to ask what can change at the Federal level to allow a more nimble response?

If the moonshot is to be a global network, there are other partners we should engage, on the Canadian side: the Public Health Agency of Canada, the CFIA, Global Affairs. To be able to articulate a value proposition on all levels is the key to success.

A global network would not be a huge funding investment, but we would need to consider how to allocate funds.

It would be effective to use some of the funding available to get the message right, so that it will resonate with the public and with decision makers.

Required is development of a communications strategy, a "common rallying point" around the benefits of forestry and of wood products, and working with appropriate partners.

Workshop Summary

Next Steps and Wrap-up: Monica Lear, USDA Forest Service, Lise Caron, Canadian Forest Service

Lise and Monica asked participants to consider first that we all work for people, and that forests are about people. Ash is a method for us to develop ways to work together and it is good to note that the United States and Canada are complementary in the ways we conduct research. Our work going forward, the idea to work towards a moonshot project, will require accomplishments on the ground. The timing, actions and moonshot results should be promoted using citizen engagement.

As a next step, it was noted that the Workshop Steering Committee would meet to refine the moonshot idea further, consider the final outcomes of the meeting, and seek to move the moonshot idea quickly to the Canada-US Forest Health and Innovation Initiative Committee.

Subsequent discussion by the Workshop Steering Committee on workshop outcomes, means to support the moonshot concept, and generate quick wins identified the following potential actions:

- Develop, or adapt an existing EAB portal
- Use the Canada – US link as a first step (with a focus on lingering ash)
- Install resistant ash tree demonstration plantings on the ground in a number of cities, reclamation plots, or other locations that add value
- Include focus on the westward movement of EAB in North America
- Establish links to EAB and ash protection research (including genomics work) in Europe
- Plan a scientist (CAN-US) meeting as early as January (purpose to encourage joint-work, quick development of a proposal for research).

APPENDIX

Participant List

Charles Barber
Director, Forest Legality Initiative, Forests Program
World Resources Institute

Mike Born
Director of Wood Technology
Fender Musical Instrument Corp.

Doug Burkett, PhD
Environmental Biologist
Armed Forces Pest Management Board
Office of the Assistant Secretary of Defense
US Army Garrison Forest Glen

Lise Caron, PhD
Director General
Canadian Wood Fibre Centre
Canadian Forest Service-NRCan

Rick Cooksey, PhD
Acting Director
Forest Health Protection
USDA Forest Service

Adam Costanza
Senior Research Scientist
NCASI

John Davis, PhD
Associate Dean for Research
University of Florida

Daniel Doucet, PhD
Research Scientist, Molecular Insect Biology
Great Lake Forestry Centre
Canadian Forest Service-NRCan

Ken Farr
Manager – Science Integration
Science Policy Integration Branch
Canadian Forest Service-NRCan

Tom Fox, PhD
Vice President, Research, Productivity and Sustainability
Rayonier Inc.

Rory Gilsenan
Director General
Science Policy Integration Branch
Canadian Forest Service-NRCan

Leigh Greenwood
Forest Health Program Director
The Nature Conservancy, North America Region

Michael Goergen
Vice President-Innovation
Director, P3Nano
U.S. Endowment for Forestry and Communities

Thomas Hall, PhD
Plant Pathologist/Forest Pathologist
Department of Conservation and Natural Resources
Bureau of Forestry, Division of Forest Health
Commonwealth of Pennsylvania

Subray Hegde, PhD
Branch Chief, Plants Branch
Biotechnology Risk Analysis Programs
Biotechnology Regulatory Services, APHIS/USDA

Jason Holiday, PhD
Associate Professor
Department of Forest Resources
and Environmental Conservation
Virginia Tech

Jennifer Koch, PhD
Research Biologist
USDA Forest Service, Northern Research Center

John Kough, PhD
Senior Scientist
EPA

Nathalie Isabel, PhD
Research Scientist, Forest and Environmental Genomics
Laurentian Forestry Centre
Canadian Forest Service-NRCan

Monica Lear, PhD
Deputy Associate Chief, Research and Development
USDA Forest Service

Jacinthe Leclerc
General Director
Laurentian Forestry Centre
Canadian Forest Service-NRCan

Brian LeCouteur
Principal Environmental Planner
Urban Forester / Agricultural Programs Manager
Metropolitan Washington Council of Governments

Patrick Lenz, PhD
Research Scientist, Quantitative Genetics
Canadian Wood Fibre Centre
Canadian Forest Service-NRCan

Anna Leon, PhD
Forest Pathologist
Weyerhaeuser Company

Susan McCord
Interim President
Institute of Forest Biosciences

Ali Mohamed, PhD
Division Director
Division of Environmental Systems
Institute of Bioenergy, Climate, and Environment
USDA NIFA

Dana Nelson, PhD
Research Geneticist and Project Leader
USDA Forest Service, Southern Research Station

Jack Okamuro, PhD
National Program Leader, Plant Biology
Acting Deputy Administrator, Crop Production and Protection
USDA - ARS

Carlton Owen
President & CEO
U.S. Endowment for Forestry and Communities

Meaghan Parker
Science Officer, Forest Legality Initiative
World Resources Institute

Carrie Pike, PhD
Adjunct Assistant Professor, Purdue University
USDA Forest Service, Northeastern Area State and Private Forestry

Kevin Potter, PhD
Research Associate Professor
Department of Forestry and Environmental Resources
North Carolina State University
Eastern Forest Environmental Threat Assessment Center
USDA Forest Service, Southern Research Station

Michael Rosen
President, Tree Canada

Rocco Saracina
Manager, Conservation Partnerships
Sustainable Forestry Initiative

Armand Séguin, PhD
Research Scientist, Forest Genomics
Laurentian Forestry Centre
Canadian Forest Service-NRCan