National Plant Science Network Workshop: The Report

GUELPH – NOVEMBER 2016
The National Plant Science Network will connect Experts within key pillars: Clean Plant, Surveillance and Diagnostic Subnets to support development, implementation of the PAS-EMF and to align priorities of Plant Science Community.

Outcomes:
- State of the art, interconnected network for Plant Science with innovative Centers of Excellence
- Rapid, effective emergency response informed through multi-jurisdictional partnerships
- Sustainable, world-class, science, technology and innovation to protect Canadians and enhances Canada’s prosperity.
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1 Introduction and Objectives of the Workshop

Since 2001, Canada has pursued development of an overarching “network of networks” to support collaborative emergency management response and address One Health threats to public safety and security. While integrated networks for public health, food safety, and animal health have been established, plant health remains without a fully integrated network for its science and research work.

The National Plant Science Network (NPSN) Workshop was held to engage stakeholders from Federal/Provincial/Territorial (FPT) governments, academia and industry in an initial conversation.

Objectives of the workshop were:
• To present and discuss the vision for a National Plant Science Network and the development and implementation of a Clean Plant initiative.
• To evaluate the possibility of a Network of Centres of Excellence application to support the National Plant Science Network.
• To present and discuss the pros and cons of the US National Clean Plant Network in the Canadian context.
• To present and discuss the roles and responsibilities of industry, government and academia within a Clean Plant initiative for Canada.
• To develop an action plan for establishment of a Clean Plant initiative in Canada.

Participants at the workshop included representatives from federal government departments (Canadian Food Inspection Agency, Agriculture and Agri-food Canada, Natural Resources Canada Forest Service), provincial governments, academia, industry and the United States government (US Department of Agriculture).

Funding for the workshop was provided by the Natural Sciences and Engineering Research Council (NSERC) through an NSERC Connect Grant to Dr. Robert Hanner from the University of Guelph. This funding was used for meeting facilities, food, communications, facilitation and reporting and to support travel and accommodation expenses for academic researchers to participate in the workshop. Government and industry participants provided their own funding for travel and accommodation.

2 Setting the Context

Opening Remarks
Opening remarks were provided by Dr. Malcolm Campbell, University of Guelph, Dr. Mario Thomas, Biodiversity Institute of Ontario, and Cameron Duff, CFIA.

Presentations
The following section provides brief overviews of presentations designed to provide context to the workshop discussions.

2.1 Developing a National Strategy to Safeguard Plant and Animal Health in Canada – Dr. Jaimie Schnell, CFIA

In July 2016, Canada’s federal, provincial and territorial (FPT) Ministers of Agriculture endorsed the Emergency Management Framework for Agriculture in Canada and agreed that development of a national plant and animal strategy is a key deliverable of the framework.
Given the potential economic losses and the dynamic risk landscape affecting Canadian plant and animal resources, prevention and mitigation provide the greatest return on investment for plant and animal health. A collaborative process is underway to engage all levels of government (federal, provincial/territorial, municipal and local), industry and producers, and other stakeholders (NGOs, academia, government-industry advisory boards) in the development of a Plant and Animal Health Strategy. The Strategy will be presented to the FPT Ministers of Agriculture for consideration at their annual conference in July 2017.

2.2 The US National Clean Plant Network (NCPN) – Dr. Erich S. Rudyj, United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS)

The USDA’s National Clean Plant Network (NCPN) is a network of clean plant centres located in US government agencies and universities with the mission of diagnosing plant pathogens in “mother” (nuclear stock) plants and in applying therapy to “clean” these plants in preparation for their use by industry. The network produces and distributes asexually propagated plant material free of targeted plant pathogens and pests to ensure the global competitiveness of specialty crop producers and protect the environment. Core activities include: networking and governance; plant introduction; diagnostics; therapeutics; foundation plantings; linkages to nursery initiatives; and education and outreach. Funding is provided jointly by government (25%) and industry (75%). The NCPN is an effective model that could be applied in the Canadian context.

2.3 A National Plant Science Network for Canada – Cameron Duff, CFIA

The proposal for a National Plant Science Network in Canada focuses on connecting partners and stakeholders from industry, academia, and all levels of government. The NPSN would comprise a community of experts in plant research, diagnostics, risk assessment, programs, policy and operations under three key pillars or “subnets”: Clean Plant, Surveillance and Diagnostics. The vision for the Clean Plant subnet is, “An integrated evidence-based approach aimed at maintaining and distributing a consistent supply of disease-free plant materials to support Canada’s food supply, trade and economy.” The concept supports the development and implementation of the Plant and Animal Strategy and the priorities of the plant science community. It is also aligned with the government’s desire for integrated, enterprise-wide approaches to enhance the value of scientific efforts and infrastructure. The proposed CFIA Sidney Centre for Plant Health, for example, will optimize expertise, increase research capacity, create a collaborative, biosecure facility and enable a network of plant health laboratories connected by high-capacity IMIT. The Clean Plant initiative could be aligned and complementary to the Sidney Centre for Plant Health.

The Clean Plant initiative will:

- Provide opportunities for Canadian producers and growers to supply the domestic market with pathogen-free planting materials.
- Facilitate streamlined access to new and innovative material to industry without placing additional risks on the sector.
• Provide biosecurity for production systems, farms, nurseries, and orchards while promoting trade.
• Focus on research aimed at solving local, regional and national challenges related to pests and diseases.
• Develop talent and expertise through state-of-the-art science and technology development.

### 2.4 Plant Science Research Capacity – Dr. Della Johnston, Agriculture and Agri-Food Canada

The role of AAFC’s Science and Technology Branch is to provide science that enhances the sector’s resiliency, fosters new areas of opportunity for the sector and supports sector competitiveness. The Branch focuses on three areas: crop protection, crop improvement and biovigilance. Crop protection includes research on integrated pest management, plant pathology and weed management. Science related to crop improvement focuses on disease resistance, nutrient and abiotic stress, yield improvement and preferred attributes. Biovigilance is the study of the unintentional effects of climate change, pest movements, and farming practices on pest populations, plant health and ecological services (biodiversity).

It is long-term, forward-looking research approach that seeks to mitigate potential threats before they impact the agricultural sector and improve capacity for rapid, agile and effective response to new, emerging, old and latent crop pest problems. The biovigilance continuum includes: awareness of a threat; detection and identification of a threat; assessment and understanding of the situation; mitigation; and determination of unintended effects of mitigation and further threats. Biovigilance relies on the involvement of partners and collaborators across sectors and disciplines.

The Branch also maintains AAFC biological resources to support taxonomy and national identification services through its biodiversity collections.

### 2.5 Natural Resources Canada Forest Invasive Alien Species Research Plan – Dr. Anthony Hopkins, Canada Forest Service

The Canadian Forest Service provides science and policy expertise and advice on national forest sector issues. It conducts scientific research on Canada’s forests that is used to inform forest management planning and policy decisions and to assist the forest industry, the public and other scientists.

Research areas include forest fire monitoring, insect and disease identification, forest monitoring, climate change, biodiversity, conservation, protection, and industry innovation. The CFS works with the CFIA and other responsible parties, including provinces, to mitigate the impacts of established Forest Invasive Alien Species. Prevention is a key pillar of the National Forest Pest Strategy, along with a focus on development of national and international phytosanitary standards to reduce global movement of forest pests. Prevention activities include pathway and risk analysis (predictive models, host distribution, insect/disease ecology, etc.) and detection, identification and surveillance (genomics-based detection identification tools, trapping, sampling, etc.).
2.6 Industry Perspective – Nick Lemieux, Grape Growers of Ontario

The Canadian Grape and Wine Industry has an annual economic impact of $6.8B. Viruses and pests can lead to reduced quality and decreased returns for growers. Currently there is no guarantee that propagating material and planting material is disease free. Growers have no choice but to replace infected vines with plant material that cannot be verified as clean. The industry suggests three steps toward solving the problem: 1) Inhibit spread through best management practices in the vineyards; 2) Removal of infected material, identified through cost-effective testing; and 3) Planting of clean material, provided through a clean plant propagation program. The Canadian Grapevine Certification Network focuses on creating a system and protocols in Canada that will allow grapevines to be grown without the risk of carrying potentially devastating disease. Creating and maintaining a clean plant program requires ongoing collaboration with the federal government, CFIA and industry partners.

3 Focus on the Concept

Participants discussed the proposed concept for a National Plant Science Network in terms of:

- What elements most resonate with you?

- Are there any significant concerns or components/aspects missing?

- What are your suggestions for improving the concept?

What elements most resonate with you?

Overall, participants were in favour of the concept and its components. The importance of clean sources for plants was highlighted, and therefore starting the NPSN concept with the Clean Plant initiative makes sense. A key point that especially resonated was the involvement of industry: participants saw this as vital to success. The concept’s focus on prevention was also considered critical. The network’s potential for increasing opportunities for information and expertise sharing among all players – governments, academia and industry – was considered very positive and will lead to increased efficiencies and improved economic benefits.

Are there any significant concerns or components/aspects missing?

Participants noted that the governance structure for the NPSN needs to be established. It was suggested to look to existing successful models, such as Canadian Food Safety Information Network and the Canadian Animal Health Surveillance Network. There is also a need to clearly articulate the funding requirements and sources to ensure sustainability going forward. Communication is another area for focus – the network raises opportunities for outreach and education that should be exploited.

Participants noted that clear definitions are needed, for example for “clean plant” (disease free versus disease resistant versus true-to-type) and “surveillance.” Participants also saw a need for greater emphasis on prevention.
Other areas of concern/missing aspects included:

• Biovigilance to be part of (or instead of) surveillance.
• Need a foresight component.
• Soil health and management – biodiversity, presence of pathogens.
• Greater focus on “One Health – healthy plants, healthy people, healthy economy.”
• IT backbone – communication, information sharing and data management (cloud based, how to keep current).
• Opportunity to use state-of-the-art science and technology.
• Need dedicated people/location – need a champion.

What are your suggestions for improving the concept?

• Define terms and scope, based on further discussion.
  ▪ Focus on prevention.
  ▪ Expand beyond only quarantine pests to also include issues of local/provincial concern and of concern to producers.
  ▪ Include a sub-element of foresight under surveillance and include biovigilance.
  ▪ Add notion of standard tool box and operating practices to be shared/deployed.
  ▪ Emphasize importance of proactive and sustainable approaches.
  ▪ Confirm vision.

• Determine governance; set out roles and responsibilities.

• Determine funding sources.

• Include a communication pillar.

4 Focus on Developing a Clean Plant subNet in Canada

Participants considered the objectives and common themes relevant to all impacted industry sectors and the key factors that need to be in place for a Clean Plant subNet to function effectively. The potential role and contribution of the academic community was also identified.

Common Themes and Objectives

Participants identified the following key objectives/themes:

Research, knowledge translation and knowledge transfer

▪ Development of a resource/repository of plants that are free of risks and other pests (regulated and unregulated) that have economic impact on the industry.
▪ Improved understanding of ecological vectors, modes of transmission, natural enemies, resistance.
▪ Improved efficiencies and rapid turnaround.
▪ Reduced timeline for new introductions.
▪ Education.

Economic impact

▪ Growers have access to clean plants and materials that give an economical advantage and provide a better chance of long-term profit.
▪ Cultivars based on characteristics that increase performance and give added value.
▪ Access to varieties from non-traditional sources.
▪ Increased export opportunities.
Quality assurance
- Nationally standardized certification programs.
- Standard operating procedures and best management practices.
- Assurance of true-to-type of materials.
- Incentive to remove disease material to prevent cross contamination of clean stock.

Sustainability
- Funding, governance.
- Ability to adapt to changing priorities.

Collaboration
- Across and within the commodity sectors.
- Data sharing on surveillance, diagnostics, therapeutics, pest management, foresight.

Key Considerations and Factors for Success
Participants noted that all stakeholders need to be involved and included, especially industry. Incentives for participation could be considered (e.g., start-up funds for industry organizations). Ongoing review and assessment (feedback loop) is important to demonstrate the value of participation.

It will be important to set standard definitions for terms (including “clean”) so that there is common understanding across all players. Participants suggested applying lessons learned from the USDA National Clean Plant Network. It was also noted that the creation of the Clean Plant subNet need not depend on implementation of the National Plant Science Network; it can be started on its own.

Other key factors or “enablers” include:
- Scope: clean plants imported; clean plants multiplied in Canada; clean plants for export market; regulated and unregulated pests and pathogens.
- Governance: leadership, resource allocation, roles and responsibilities, defined boundaries, strategic plan in place, policy framework to support infrastructure, economic impact assessment.
- Funding: multiple sources (government, industry, Genome Canada, NSERC), options (matched funding, co-funding); sustained, stable; financial support for downstream stakeholders.
- Capacity and expertise: diverse subject matter experts; multidisciplinary teams; clusters of specialized/advanced equipment and infrastructure; international connections; participation in Centres of Excellence/Network of Centres of Excellence.
- Transparency.
- Consistency and standardization.
- Communication and data sharing.
- Regulatory review and renewal.

Contribution of the Academic Community
The academic community can undertake a wider range of research activities than the federal government, including broad research and basic science. This discovery role includes development of new diagnostic tools and new tissue culture methods, development and improvement of virus elimination methods, and breeding of disease resistant cultivars. The community can further contribute research infrastructure, expertise (capacity, capability, centres of excellence) and support through co-funding arrangements (Genome Canada, NSERC) and funding streams that are unique to the community.
Knowledge translation and transfer (KTT) is another area where the academic community can contribute to the Clean Plant subNet, by utilizing its international networks and connections with other agricultural disciplines such as climate change prediction and soil and root health. The academic community can also provide a forum for communication, education and outreach.

The community has an important role in training the next generation of clean plant researchers and highly qualified personnel (HQP).

Given the broad scope of areas where the academic community can contribute, participants noted that it should be engaged and involved in the governance structure of the Clean Plant subNet.

5 Focus on the Preferred Future and How to Get There

Participants discussed the preferred future five years from now (what would success look like?) and suggested actions and strategies that need to be undertaken over both the short term (6 to 12 months) and longer term (2 to 3 years) to achieve the Clean Plant subNet.

Prefered Future
Participants envision a fully functioning, state of the art, interconnected Clean Plant subNet serving key commodity groups (grapes, tree fruits, berries). It has the active involvement of all stakeholders (federal and provincial governments, researchers, academia, industry). A strong governance structure (governing board and working groups) supports evidence-based decision making and dedicated funding from multiple sources ensures sustainability.

There is a certification program in place as well as tools, standard operating procedures and best management practices that are openly shared and deployed. Targeted research, multidisciplinary approaches, collaboration and open data sharing support knowledge generation, transfer and translation. Because the Clean Plant subNet exists, there is rapid, agile, and effective emergency response to threats, improved protection for Canadians, and increased profits for industry.

Next Steps and Action Plan
Participants suggested that a step-wise approach be taken, with one or two commodities being introduced initially.

Activities over the next 6 to 12 months

Governance Structure
- Identify leads and create working groups (by commodity/by technology).
- Create formal steering committee.
- Review governance options/models; leading to selection of most appropriate governance structure.
- Develop strategic plan and business case for funding and engagement.

Funding
- Proposal preparation and submissions.
  - Develop a proposal to NSERC for Clean Plant/Plant Science to be part of the Networks of Centres of Excellence (aim for proposal to be submitted to the Spring 2017 competition).
- Secure start-up funds to support industry participation.
Program Scope
- Create list of pests (RSPM 35 to be revised).
- Identify existing facilities for retrofitting/repurposing (Sidney Lab, Summerland, Harrow, VRIC).
- Mobilize bioinformatics capacity – open data, cloud storage, expertise.
- Develop certification program.

Communication and Outreach
- Information out to stakeholders and gather feedback.
- Engage commodity groups at their meetings.
- Develop champions/ambassador groups.
- Website and social media development.

Activities over the next 2 to 3 years

Governance Structure
- Confirm governance structure, including working groups.
- Draft terms of reference (roles and responsibilities).
- Hold first annual meeting.

Funding
- Review and assessment to determine benefits and impact (ROI).
- Move to have the network part of Growing Forward 3.

Program Scope
- Identify best practices to apply to new commodities.
- Bring in additional commodities (at least 2 more).
- Define “clean” characteristics for commodities.
- Link provincial labs.
- Develop audit/inspection processes.

- Operationalize the network: hire HQP, identify and implement research priorities, start testing, bulk up production of clean material.
- Initiate licensing agreements for patented materials.
- Alignment with other subnets.

Communications and Outreach
- Continue engagement with commodity groups.
- Document and disseminate best management practices.
- Communicate results of impact assessment, including success stories.

Focus on prevention.
- Expand beyond only quarantine regulated pests to also include issues of local/provincial concern and of concern to producers.
- Include a sub-element of foresight under surveillance and include biovigilance.
- Add notion of standard tool box and operating practices to be shared/deployed.
- Emphasize importance of proactive and sustainable approaches.
- Confirm vision.
## APPENDIX: Participant List

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