



Canadian Food  
Inspection Agency

Agence canadienne  
d'inspection des aliments

## Canadian Food Inspection Agency



### **Our vision:**

To excel as a science-based regulator, trusted and respected by Canadians and the international community.

### **Our mission:**

Dedicated to safeguarding food, animals and plants, which enhances the health and well-being of Canada's people, environment and economy.

## ***The Canadian Food Inspection Agency Plant Health Research Program: overview and collaborations***

***Cheryl Dollard, M.Sc.***

***National Manager, Plant Research & Strategies  
Plant Health Science Directorate, CFIA***

Canada

# Overview

- **The Canadian Food Inspection Agency**

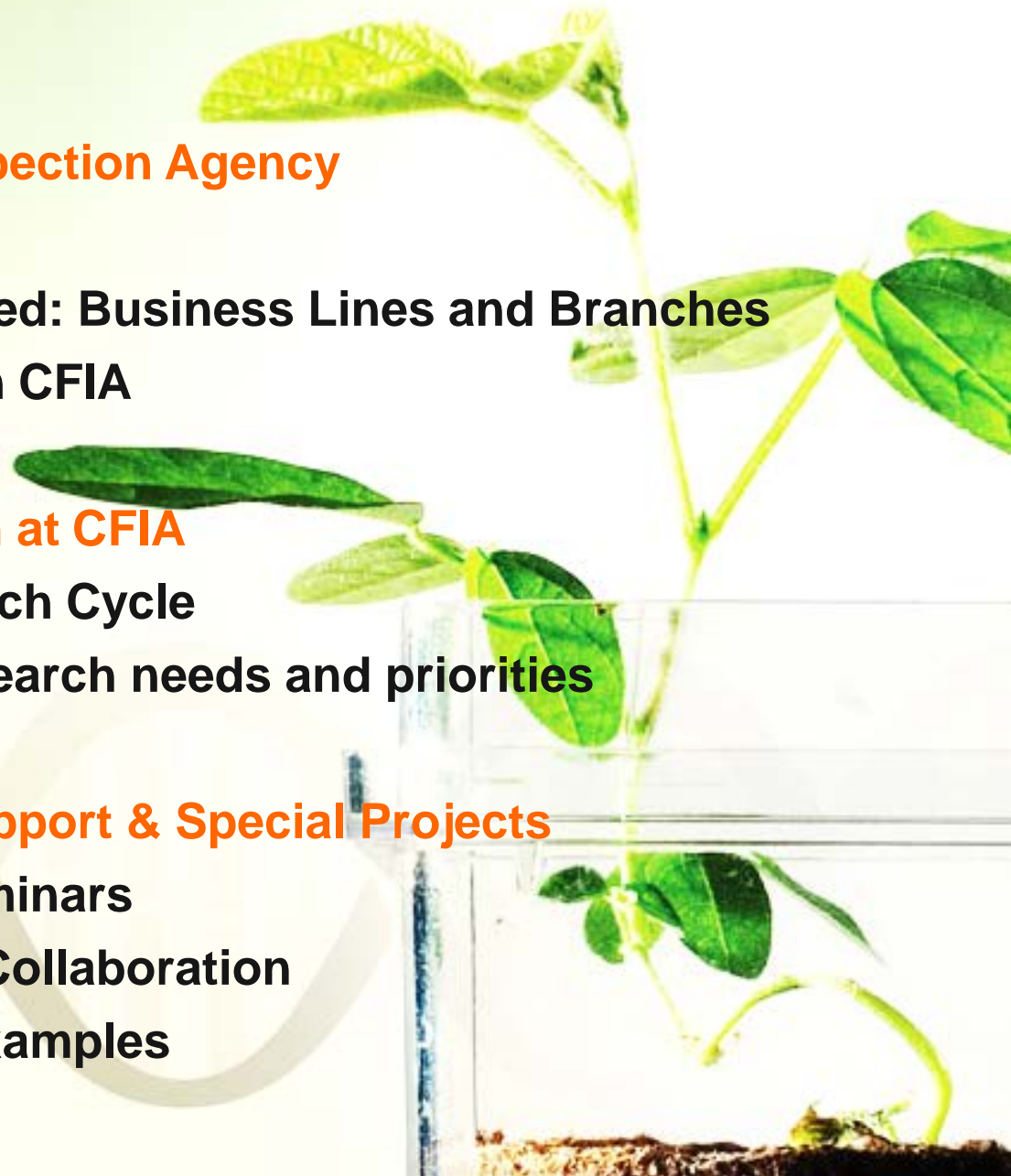
- Who we are
- How we are organized: Business Lines and Branches
- Plant Science within CFIA

- **Plant Research Program at CFIA**

- CFIA's Plant Research Cycle
- Identification of research needs and priorities

- **Outreach, Foresight, Support & Special Projects**

- Science Scan & Seminars
- External Research Collaboration
- Special Projects: Examples



# The Canadian Food Inspection Agency: Who we are:

- CFIA is Canada's largest science-based regulator
- Responsible for delivery of all federally mandated programs for food safety, plant and animal health.

## ***Vision***

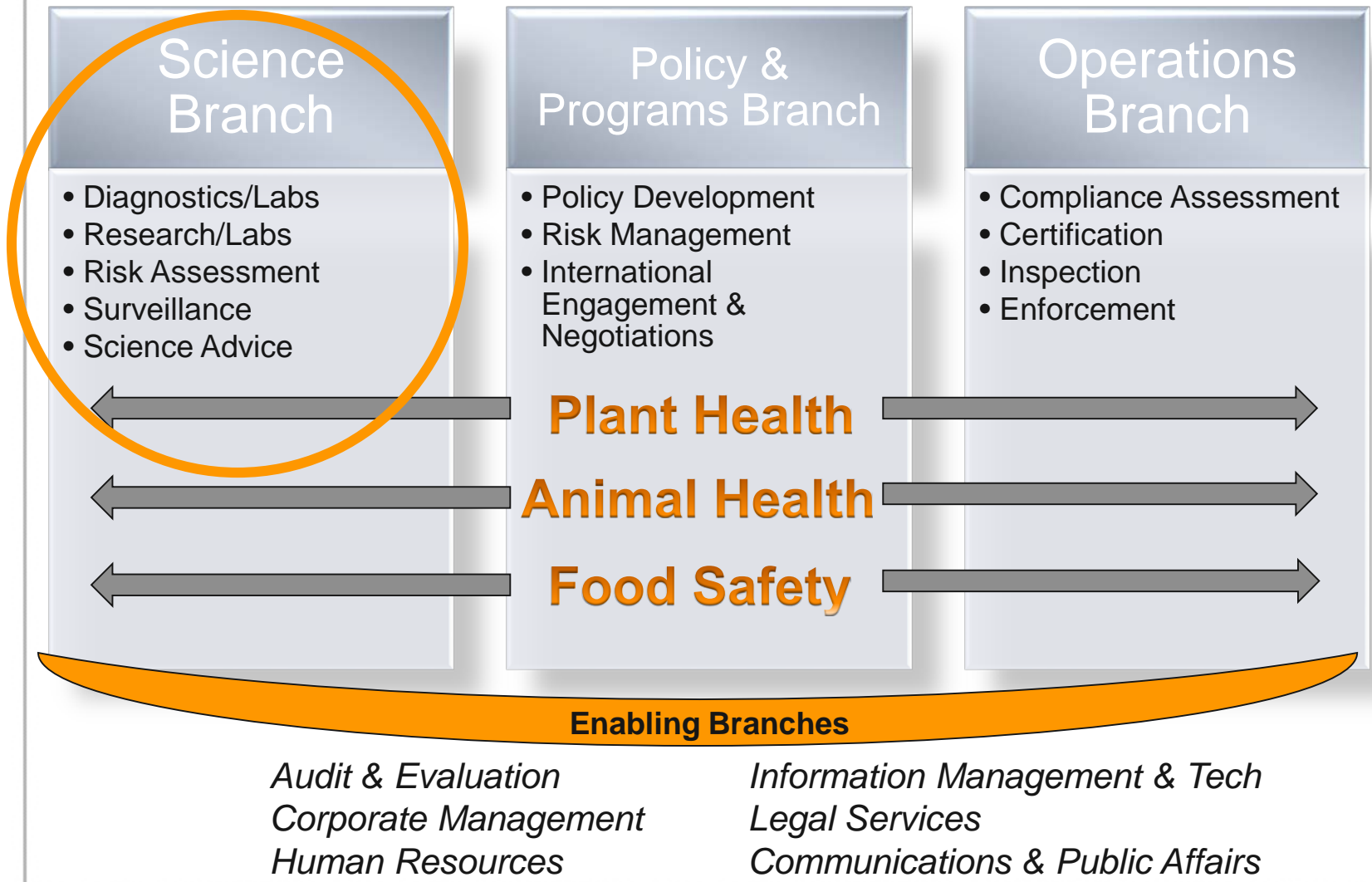
*To excel as a science-based regulator, trusted and respected by Canadians and the international community.*

## ***Mission***

*Dedicated to safeguarding food, animals and plants, which enhances the health and well-being of Canada's people, environment and economy.*



# Organization: Business Lines and Branches



# CFIA: Canada's National Plant Protection Organization (NPPO)

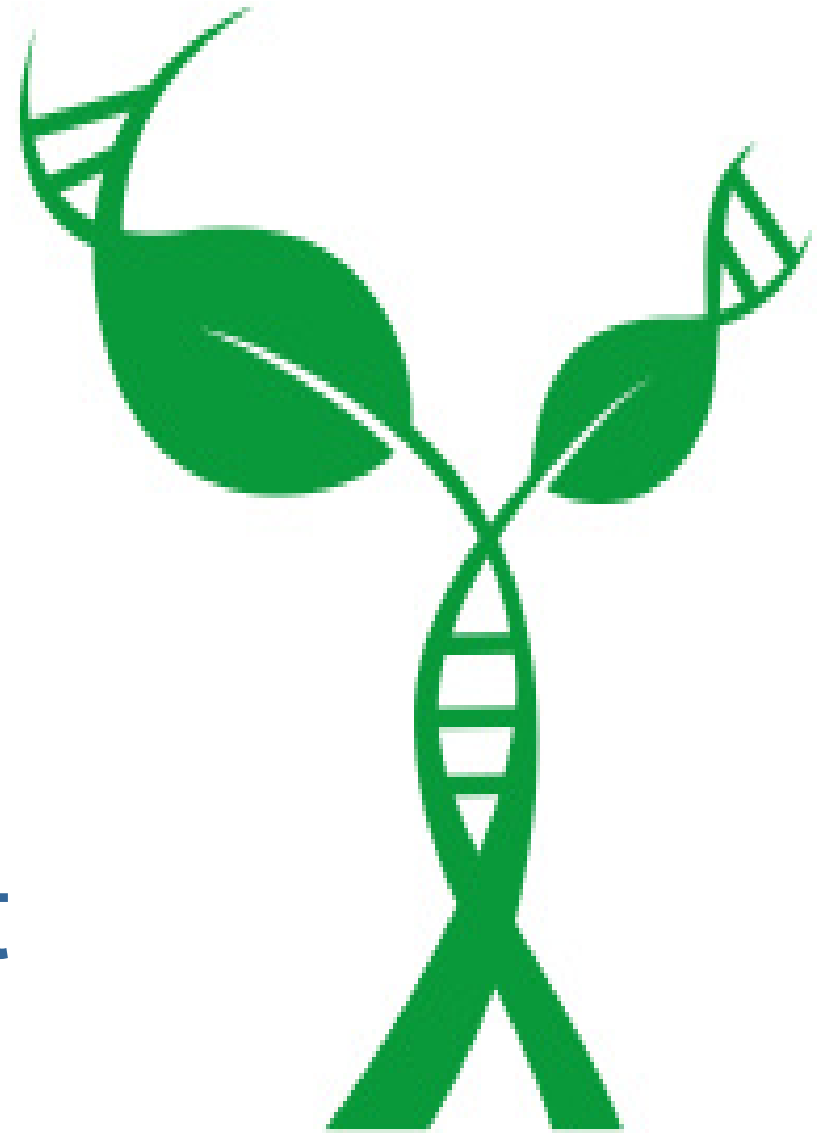


Canada is a contracting party to the International Plant Protection Convention (IPPC) under the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary measures (WTO-SPS).

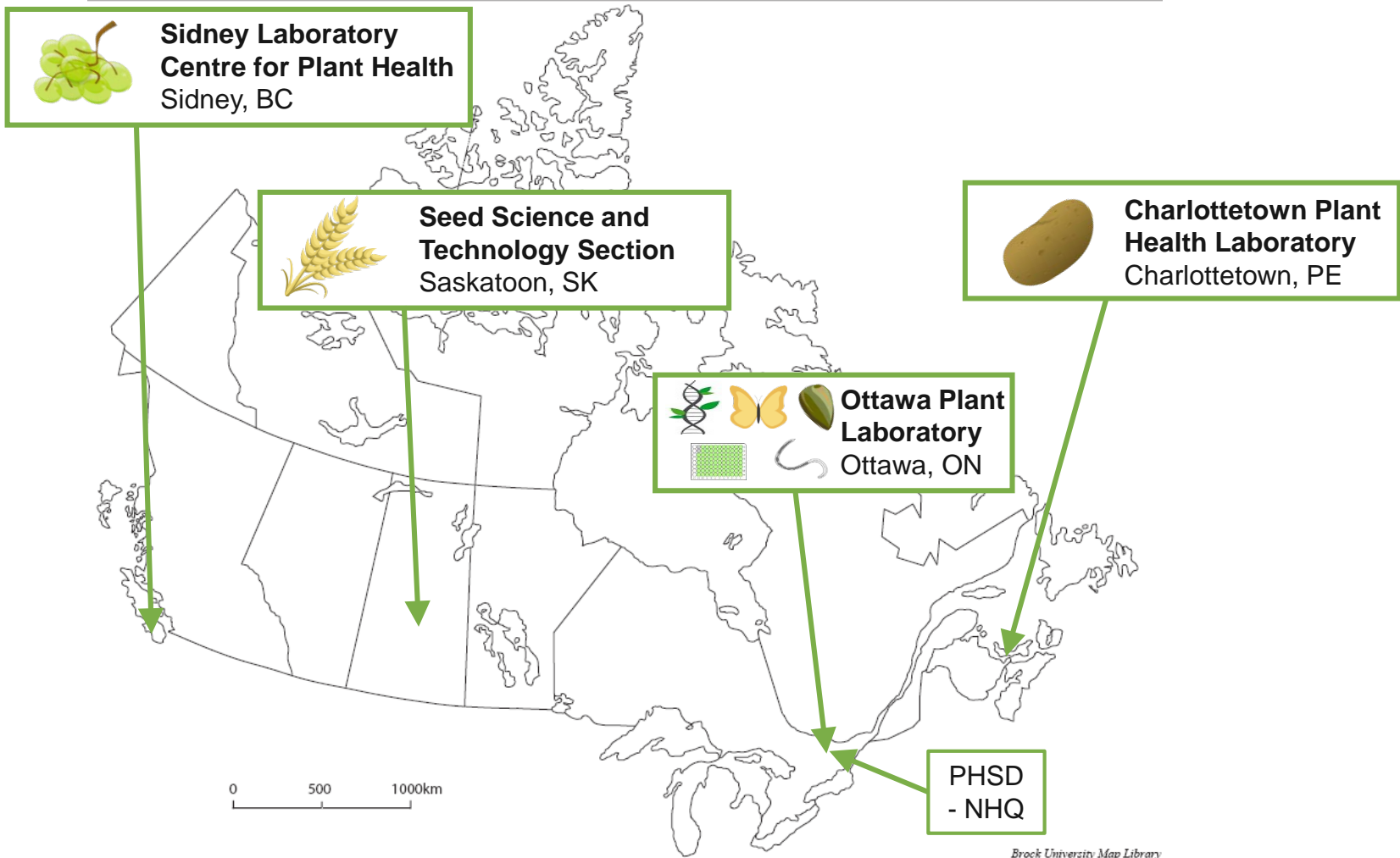
Under this agreement, CFIA is recognized as the National Plant Protection Organization (NPPO) for Canada with legislative authorities under the Plant Protection and Seeds Acts to implement Programs which:

- Prevent spread of plant pests
- Promote appropriate control measures
- Minimize trade impacts

CFIA's:  
Plant Health  
Science  
Directorate  
and  
National Plant  
Lab Network



# Science Branch: *Plant Health Science Directorate and Plant Health and Seed Lab Network*



Plant Health Science Directorate - National Headquarters (NHQ): Ottawa  
National Plant & Seed Labs in regions: Sidney, Saskatoon, Ottawa, Charlottetown

# Science Branch - Plant Health Science Directorate: *National Coordination*

*“The Directorate strives to provide plant science leadership and to be a valued source of scientific knowledge, analysis, advice and support within the CFIA and by key CFIA stakeholders.”*



## Goals include:

- ***Ensure the right science is available:*** at the right time to deliver on the Agency's mandate, now and into the future
- ***Manage of our resource base:*** efficiently, while being flexible, innovative and responsive to change
- ***International networking*** to seek and provide the best and timeliest advice using the most current and relevant science available in the world



# Science Branch - Plant Health Science Directorate: *National Coordination*

## Plant Health Science Division

Science to inform program  
design & policy

- Risk assessment
  - Early warning
  - Science advice
  - Science strategy
- International Standards



Plant Health Risk  
Assessment

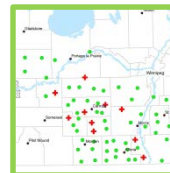
Plant and Biotechnology  
Risk Assessment



## Plant Health Science Services Division

Science to facilitate program  
delivery

- Plant Health surveys
- Diagnostic services
- Quality assurance
  - Science advice
  - Science strategy
- Research coordination



Plant Health Surveillance

Plant Health Laboratory  
Services



Plant Research and  
Strategies



# Science Branch: *Plant and Seed Lab Network*

**Expertise:** Research/Diagnostic: Entomology, Seed Science, Nematology, Genotyping, Botany, Biotechnology, Mycology, Bacteriology and Virology

**Technology:** Molecular, Morphological, Biochemical approaches to detection and identification of plants, seed, and plant pests, including: Genomics (NGS, Molecular Barcoding); Taxonomic/Systematic (Bioassay, microscopy, tissue culture); Surveillance (Biochemical lures, trapping)

**Plant Health and Seed testing:** Import/Domestic/Export Programs

## **Specializations:**

National Collections: Virus tested stock, seed and plant herbaria, mycological and bacterial cultures, registered plant varieties

Post-Entry Quarantine Facilities: Fruit-tree, small fruit and Grapevine, Potato



# Plant Research to meet our Obligations: Protecting our Plant Resource Base

In order to meet our obligations CFIA relies on sound science as the basis of its program design and regulatory decision-making, this includes:

- **Risk Assessments** to determine whether pests, commodities, weeds, and new novel or genetically modified crops could pose risks to Canada
- **Surveillance Programs** for foreign plants, pests, and diseases that could damage Canadian agriculture and forestry
- **Diagnostic Testing** to support import and export inspections and domestic control programs
- **Research and Technology Development** to detect plants and pests that threaten Canadian agriculture, forestry and biodiversity

# CFIA's Plant Research Program



# Plant Research & Strategies: 3 core activities

- Strategic Meetings
- Outreach
- Training
- Advice

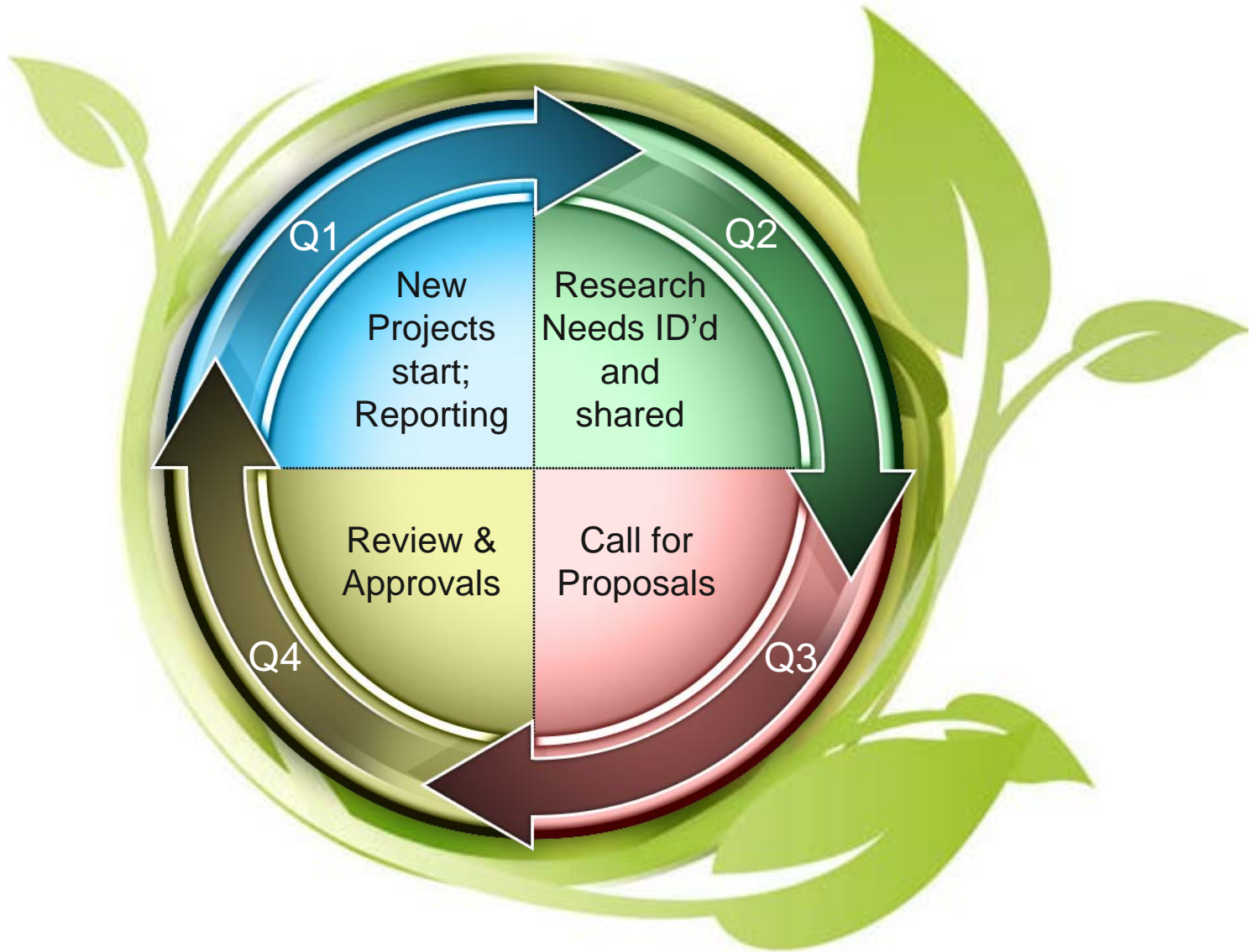


- Needs
- Reviews
- Funding
- Reporting

- Plant Research Seminars
- Plant Science Scan
- Social media

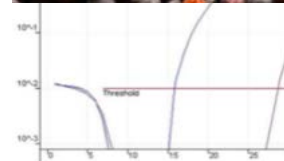


# CFIA's Annual Plant Research Cycle



# Identification of Plant Research Needs and Priorities:

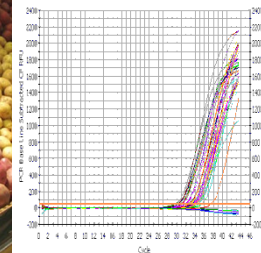
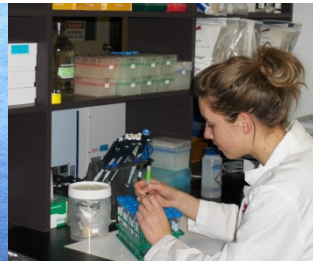
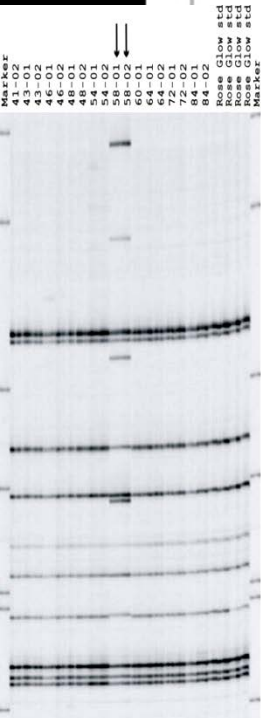
- Collaborative process
  - Commodity based working groups
  - All CFIA Branches represented
  - External experts
- 
- Needs lists are distributed with collaborating organizations:
    - Natural Resources Canada/Canadian Forest Service
    - Canadian Grain Commission
    - Agriculture and Agrifood Canada
    - Euphresco



# Identification of Plant Research Needs and Priorities (con't):

Needs are categorized by Commodity:

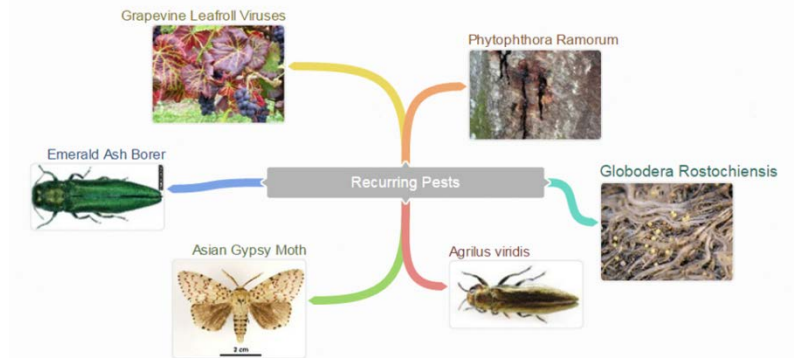
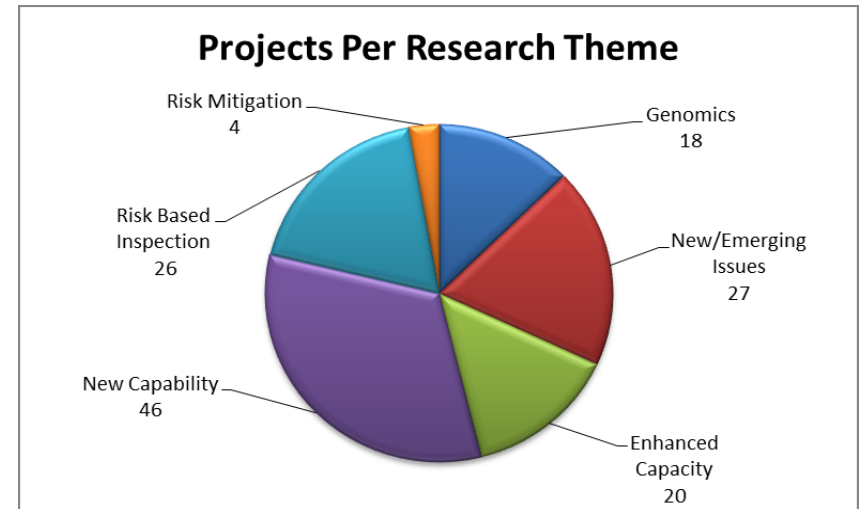
- *Biosafety*
- *Forestry*
- *Horticulture*
- *Grains & Oilseeds*
- *Seeds*
- *Potato*
- *Invasive Alien Species & Domestic Programs*





# Research Areas & Themes:

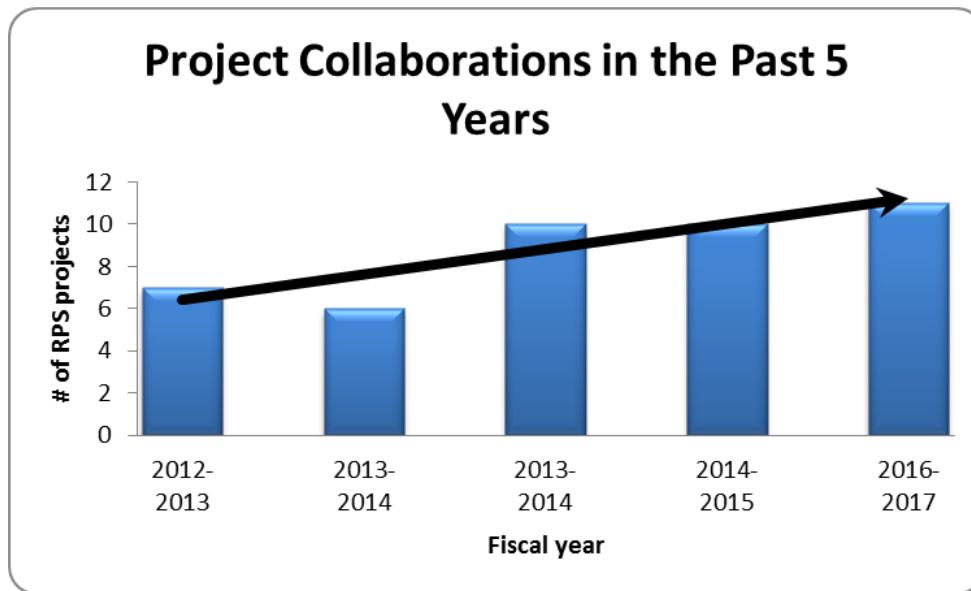
- *Biology/Taxonomy*
- *Detection/ID test methods*
- *Surveys, Lures, Traps*
- *Pathway analysis*
- *Biotechnology*
- *Controls/Alternatives to MeBr*
- *Pest specific topics (e.g. AGM, P. ramorum, PCN..)*



# Research proposals, review, approval

- Proposed research must align with 1 or more needs
- Projects must include a CFIA collaborator
- Review process:
  - corporate and scientific
  - internal and external
- Research Steering committee: Decisions

# External Collaborative work: Research Partnership Projects (RPS):



# plant Research Scientists in the Agency: 9

Currently more than 150 research needs have been identified

Increased focus on collaborative work with external partners to enhance capacity and delivery of science to support Programs

# Outreach, Support and Special Projects



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# Communications and Foresight Activities: Plant Research Seminar Series

- Established in 2012 to share and promote research outputs
- Live and virtual via webinar
- Average: 70 participants/viewers (up to 150)
- International audiences!!

*- Australian Chief Plant Protection Office  
- NZ Ministry for Primary Industries  
- Australian Dept of Ag and Water Resources  
- USDA Center for Plant Health and Science Technology*

**The Plant Research Seminar Series**  
Genomics R&D Initiative (GRDI) Series - part 2 of 3

The GRDI shared priorities project on Quarantine and Invasive Species (QIS)  
Nucleic acid and Invasive plant reference barcode collection

**Presented by:**  
Dr. Guillaume Bilodeau  
and Dr. Marie-José Côté  
Research Scientists  
Canadian Food Inspection Agency

**Date:** May 14, 2014  
**Time:** 13:00-14:00 EST

**Live Location @**  
Ottawa: Skyline Complex  
1341 Baseline Rd  
T5-1-353

**Virtual Locations @**  
Charlottetown: 93 Mount Edward Road  
Conference Room

Ottawa: Camelot, 59 Camelot Dr.  
2E-102

Saskatoon: 421 Downey Rd  
3<sup>rd</sup> Floor Training Room

Sidney: 8801 East Saanich Road  
Conference Room

This presentation will be offered as a webinar

For further information contact: amy.kehoe@inspection.gc.ca

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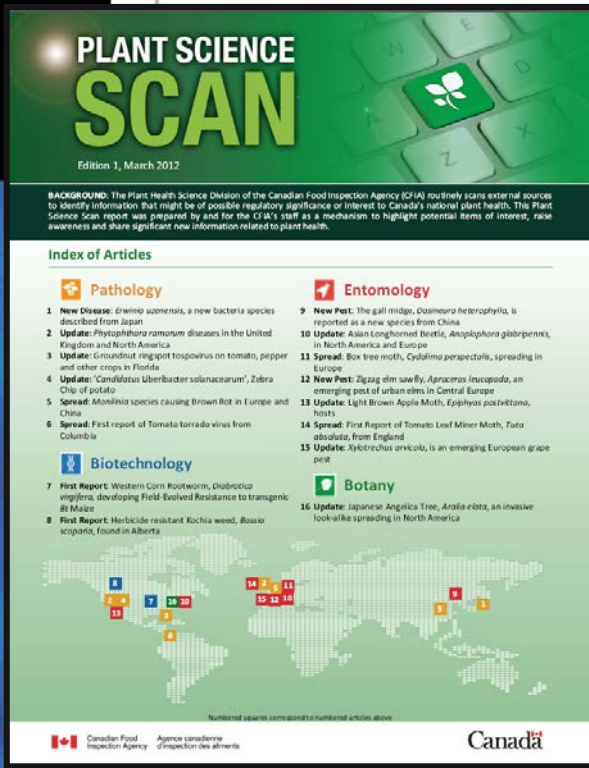
**Abstract:**  
The goals and deliverables of the GRDI QIS project are the protection of Canadian biodiversity and trade from the impacts of global change through improved ability to monitor invasive alien and quarantine species. This will be accomplished by the development of reference databases and the use of new technologies such as sequencing for metagenomic analysis from field and bulk materials. Dr. Bilodeau and Dr. Côté are two of the CFIA scientists involved in this multidisciplinary project (AAFC, NRCC, DFO, NRC and PHAC).  
Dr. Bilodeau is leading the subproject 1: "Nucleic acid extraction", which includes DNA extraction from reference collections and DNA extraction improvement from bulk and field samples. This subproject is linking to three of the subprojects of this GRDI project where the ultimate goal is the production of standard operating procedures (SOPs) for obtaining the highest yield and quality of DNA material for sequencing from marine organisms, terrestrial organisms and direct detection. For example, DNA extraction improvements were validated by real-time PCR assays developed by the group. Moreover, magnetic beads, internal controls (IC) were developed to evaluate PCR inhibition, and compared different kits and methods. Within this project, DNA extraction improvements from viruses and from insect traps for metagenomics were also evaluated. Furthermore, microfluidic chips developed by NRC were also tested in CFIA lab. The use of microfluidic chips for sample preparation would facilitate DNA extraction for a larger volume of material more representative of a good sampling method. Some DNA extraction procedures (SOPs) developed from Sub-Project 1 have been already transferred and are currently used by different diagnostic laboratories such as for invasive plants and for food and bulk samples for metagenomic analysis with next generation sequencing.  
Sub-project 3 involves the development of new data repositories by barcoding quarantine and invasive species in the terrestrial ecosystems including viruses, fungi, nematodes, insects, plants and their native relatives. Dr. Côté is the principal investigator of the sub-project 3 theme 5: invasive plants. Thirty nine plant species are targeted for the Plant sub-theme of this project. Collection of material representative of the targeted plant species and their relatives identified for sampling according to their distribution and availability is ongoing at the National Vascular Plant Herbarium (AAFC), the Canadian Museum of Nature and other North American herbaria. Barcoding is targeting 4 plant genome areas. Databasing of specimen records and sequence data is addressed at the project wide level, since Bioinformatics is one of the main sub-projects (Sub-project 5) of the QIS project. Ultimately, barcodes of 4 genome areas, sequenced from 5 to 10 specimens of some 39 targeted invasive plant species and some 195 specimens of related species, will be available for use as a reference for diagnostic analysis or for the establishment of novel procedures such as environmental sample analysis.

*If you would like to receive notifications of upcoming seminars: send an e.mail to:*

[PlantResearchSeminar-SeminaireRechercheVegetaux@inspection.gc.ca](mailto:PlantResearchSeminar-SeminaireRechercheVegetaux@inspection.gc.ca)

# Communications and Foresight Activities: Plant Science Scan

- Quarterly publication;
- Publically available information on issues of potential regulatory significance to the CFIA's Plant Program.



- E.mail distribution = broad reach:
  - OGDs - Parks Canada, NRCan, AAFC, etc.
  - Ontario Ministry of Ag and Food
  - Manitoba Conservation & Water Stewardship
  - Australian Chief Plant Protection Office
  - NZ Ministry for Primary Industries
  - Australian Dept. of Ag. and Water Resources
  - USDA Center for Plant Health & Science Tech.

To Subscribe: [PSS-SSV@inspection.gc.ca](mailto:PSS-SSV@inspection.gc.ca) ;

archived issues: Publications Canada Catalogue: <http://publications.gc.ca/site/eng/9.802674/publication.html>

# Plant Research & Strategies: Supporting External Collaboration:



- Liaise/coordinate/support for our plant science community working on externally funded/coordinated projects to:
- Advise on scientific questions posed by Project Coordinators/Managers/Leads
- Connect scientists to enhance collaboration and efficiencies for research in common areas of interest
- Support decision making based on the most up-to-date information from policy-makers, clients, collaborators and trade partners
- Provide input when developing projects to have outputs supporting evidence based decisions for development of departmental policies.

## External Collaborations: *Genomic R&D Initiative (GRDI)*

### Quarantine Invasive Species (QIS) Project

- **Goal:** establish baseline sequence data/barcodes for long term monitoring of native & invasive species by establishing new data repositories & data analysis tools for developing detection and control methods for invasive species
- **Collaborators:** CFIA , Agriculture and Agrifood Canada, Environment Canada, Dept. of Fisheries & Oceans, Natural Resources Canada and National Research Council
- **Status:** Completing in 2016

- ***Impacts:***

*This project directly assisted the response to a WTO challenge by Malaysia regarding requirement for soybean exports to be free of Downy mildew by demonstrating that species was not present in Canadian exports but was found on grain being imported from a neighbouring country.*



# Genomics Applied Partnership Program (GAPP): Protecting Canada's forests against invasive alien species by next generation bio-surveillance

**Goal:** To develop and validate DNA detection arrays based on targeted genome signatures in regulated pests for use by CFIA diagnostic labs to allow accurate ID of these species and putative origins.

- Collaborators:** CFIA (Ottawa), Natural Resources Canada – *Academia:* U. of British Columbia, Laval
- Focus:**  
Sudden Oak Death, *Phytophthora ramorum*  
Asian Gypsy Moth, *Lymantria dispar asiatica*
- 14 CFIA Scientists**
- Project Value:** 2.43M\$ over 3 years
- Status:** Y2/3 in progress



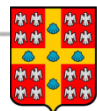
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GenomeCanada



Genome  
British Columbia



GenomeQuébec

# International Collaborations: PH QUADS Scientific Collaboration Working Group



Quadrilateral engagement group similar to NAPPO – like minded countries work together to develop strategies to influence the work of the IPPC and share key information.



SCWG is a sub-group that focused on addressing on technical questions of interest to all countries:



Diagnostics  
Digital Id Tools  
Barcoding  
Lures, Surveillance, Traps  
others...





# Euphresco - The European Phytosanitary Research Coordination Project

- The CFIA applied for membership and was accepted in 2015.
- In 2016, the Agency renewed membership for another 5 years.
- Currently, CFIA is participating in projects via “in kind” contribution
- In 2016, CFIA has facilitated participation from a National perspective coordinating interest in project themes with scientists at Natural Resources Canada and Agriculture and Agrifood Canada

# 2015 Euphresco Topics for which CFIA was interested to collaborate

<b>Eurphresco Projects:</b>	<b>Plant participant</b>	<b>Status</b>
<b>Tree Borers: risk assessment, risk management and preparedness for Emerald Ash Borer and Bronze Birch Borer</b>	PH Science Services - Survey Unit (T. Kimoto)	In Progress
<b>MULTIPLEX – multi-lure and multi-trap surveillance for invasive tree pests.</b>	PH Science Services - Survey Unit (T. Kimoto)	In Progress
<b>The biology and epidemiology of Candidatus Liberibacter solanacearum and potato phytoplasmas and their contribution to risk management in potato and other crops.</b>	Charlottetown Laboratory (Dr. Sean Li)	In Progress
<b>Diagnostic tools for the detection and identification of Ralstonia solanacearum directly on plant tissues.</b>	Charlottetown Laboratory (Dr. Sean Li)	In Progress
<b>Assessment of Dickeya and Pectobacterium spp. on vegetables and ornamentals</b>	Charlottetown Laboratory (Dr. Sean Li)	In Progress
<b>The application of Next-Generation Sequencing technology for the detection and diagnosis of Non-Culturable Organism: Viruses and Viroids.</b>	Sidney Laboratory (Dr. Mike Rott)	In Progress



# Collaborative study on Barcoding of plant pests and invasive plants - 2015

- Euphresco facilitated project: Evaluation of a EU method for barcoding of regulated Arthropods, Bacteria, Fungi, Invasive Plants, Nematodes, and Phytoplasmas of phytosanitary importance.
- 23 participants from 14 countries, including Canada
- Scientists from the Ottawa Plant Laboratory Molecular Identification Research Lab participated
  - Dr. M.J. Côté – Molecular Identification Research Lab (invasive plants)
  - Dr. Guillaume Bilodeau – Pathogen Identification Research Lab (fungi)
- Final report published: Spring 2016
- **Benefit:** *Results will be useful to help develop internationally harmonized approach to use in regulatory setting.*



# 2016 Euphresco Topics for which Canada has indicated interest:

Topic Area	Topic code	Focus of study
Forestry	2016-F-211	phytoplasmas
Forestry	2016-C-227	Chalara
Potato	2016-F-218	Epitrix II
Vine	2016-F-196	Flavescence dorée (Candidatus Phytoplasma vitis)
Other	2016-A-188	Presence of harmful organisms in soil samples
Other	2016-I-193	Phytosanitary research projects database
Other	2016-A-215	Improvement of diagnostic methods for Quarantine pathogens by droplet digital PCR
Other	2016-I-224	International Plant Sentinel Network 2



# CFIA Special Project: Plant Network of Experts

- **Goal:** Create a mechanism for linkage and info sharing among Canada's Plant Health experts to resolve collective challenges concerning plant health issues
- **Outcome:** Integrated network for Plant Health.

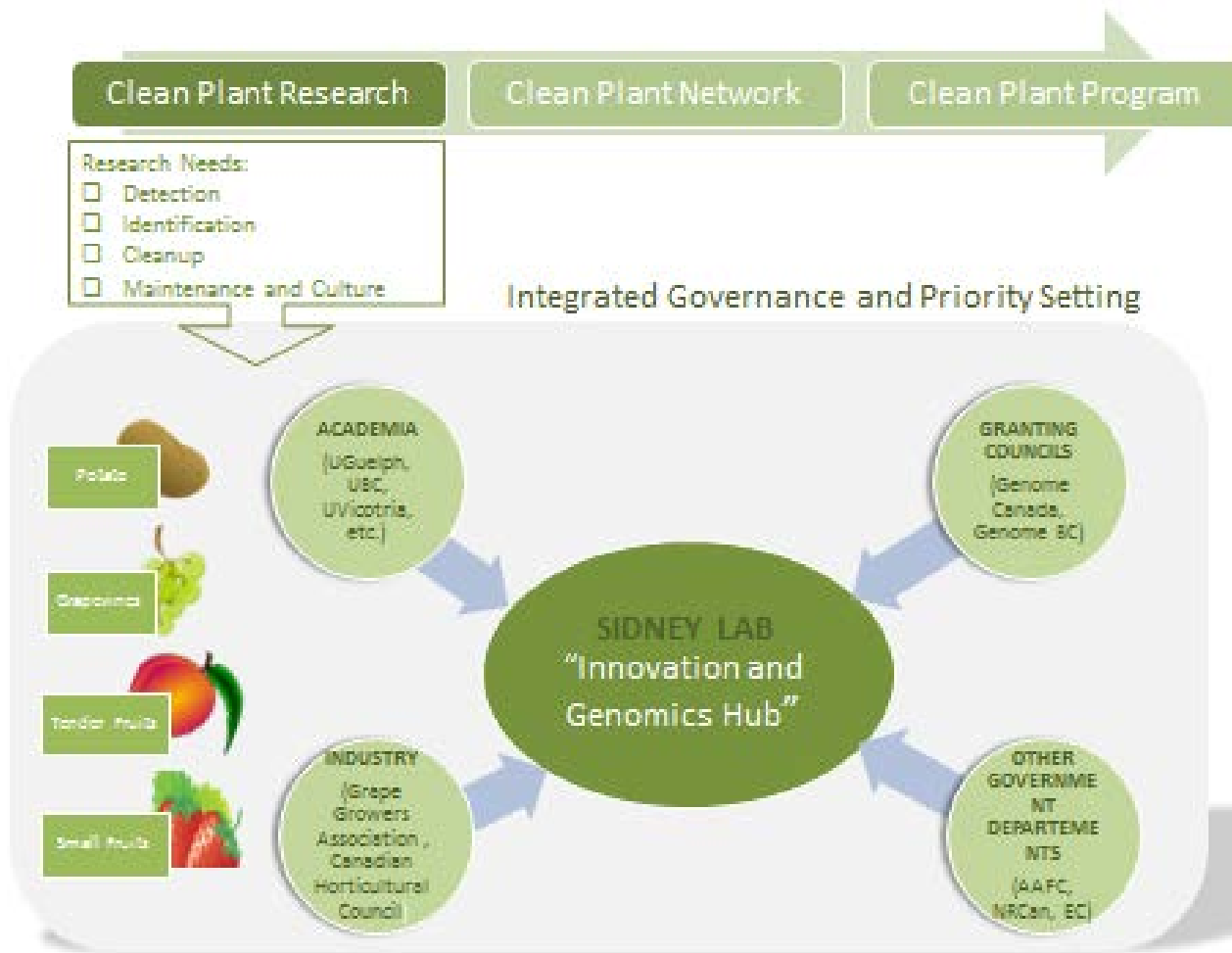


## Current status:

- A proposal to develop the network within Canada is currently under review – hoped to be able to initiate formally by 2017.
- **Connection to Euphresco** – will connect Canadian Plant Health Scientists with International Community

# National Clean Plant Network- Sidney Lab

**Aim:** to foster partnerships and collaborative genomics research projects focused on Next Generation Sequencing and metagenomics tools to help modernize post entry quarantine programs.



Connection to Euphresco:  
Dr. Mike Rott is working together with Euphresco scientists on project topic: *2015-F-172 'The application of Next-Generation Sequencing technology for the detection and diagnosis of non-culturable organisms: viruses and viroids'*



# Current project with the Biodiversity Institute of Ontario

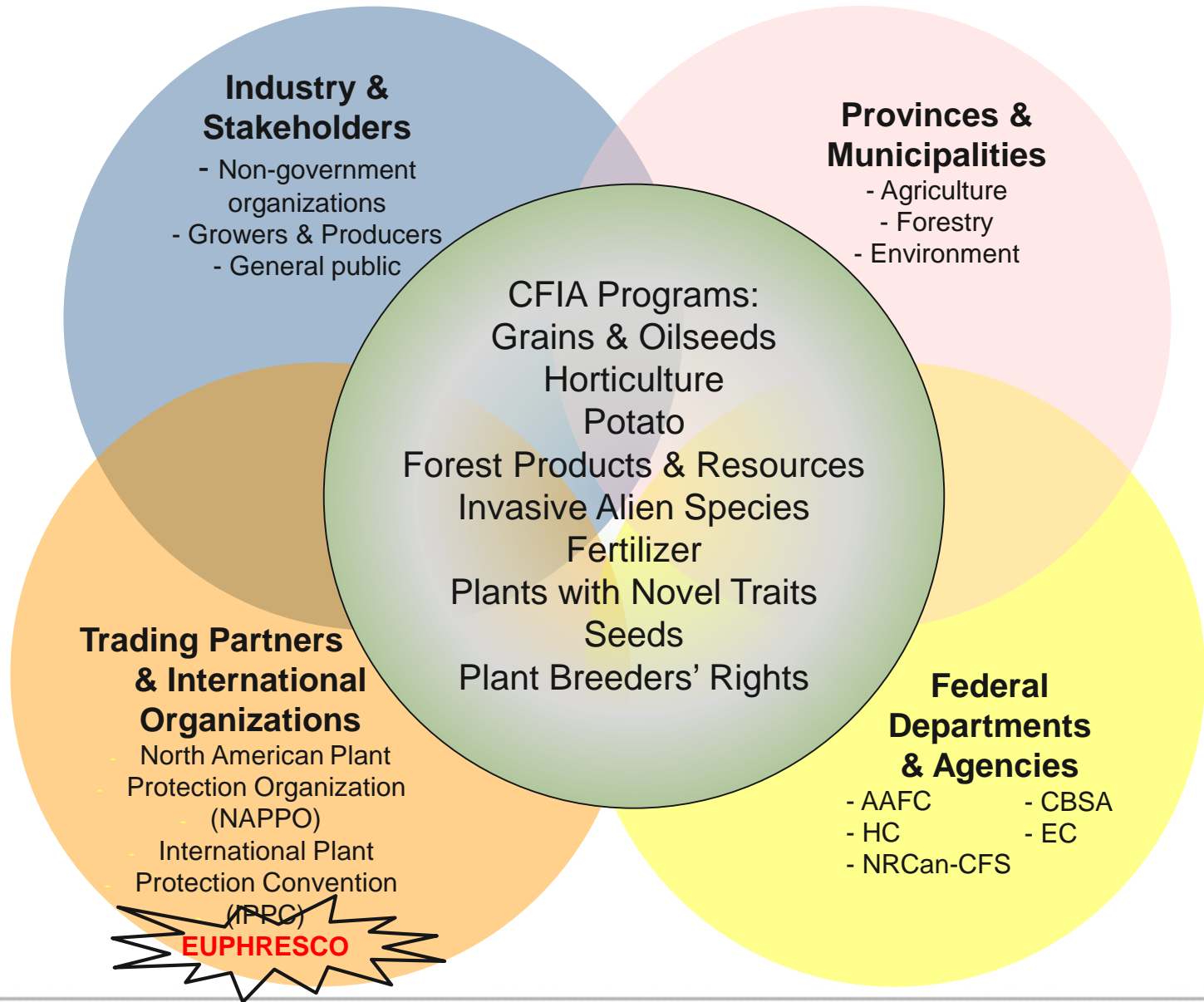


The Biodiversity Institute of Ontario at the University of Guelph (BIO) is an institute dedicated to the study of biodiversity with particular emphasis placed upon the study of biodiversity at the species level and use of molecular approaches such as Barcoding

CFIA is engaged in collaboration with BIO in key areas linked to Euphresco research topics:

1. Develop Training Modules supporting species identification using molecular Barcoding to be used part of continuing education, university curriculum  
*Euphresco topic: 2016-A-217 Use of Barcoding, from theory to practice*
2. Increase capacity for research and diagnostic tools to support development of the Clean Plant Network  
*Euphresco topic: 2015-F-172 'The application of Next-Generation Sequencing technology for the detection and diagnosis of non-culturable organisms: viruses and viroids*

# Our Partners and Stakeholders



Canada