TERRESTRIAL INVASIVE PLANT SPECIES CONFERENCE

Understanding Plant Invasions in a Changing World

August 20-22, 2012

Delta Sault Ste. Marie Waterfront Hotel
Sault Ste. Marie, Ontario Canada
The Terrestrial Invasive Plant Species Conference is being funded by the Invasive Species Centre, and hosted in partnership with the following organizations.
# Conference at a Glance

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<td>Tour 1: Invasive Species Walkabout on Sault Ste. Marie’s Historic Whitefish Island</td>
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<td>Tour 2: Invasive Species Research at the Ontario Forest Research Institute</td>
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<td>Current State of Terrestrial Invasive Plants in Ontario</td>
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<td>Strategies for Development of Early Detection and Rapid Response (EDRR)</td>
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<td>Aggressive Control for Possible Eradication</td>
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Monday, August 20, 2012

08:45
Tour 1 participants to assemble in the hotel lobby for departure to Whitefish Island

09:00 to 11:00
Tour 1: Invasive Species Walkabout on Sault Ste. Marie’s Historic Whitefish Island

12:45
Tour 2 participants to assemble in the hotel lobby for departure to Ontario Forest Research Institute

13:00 to 15:00
Tour 2: Invasive Species Research at the Ontario Forest Research Institute

15:00 – 17:00
Algoma Foyer
Registration
Speaker A/V Check-in
Poster Session Set-up

Tuesday, August 21, 2012

07:00 – 08:00
Algoma Foyer
Poster Session Set-Up

07:00 – 17:00
Algoma Foyer
Registration
Speaker A/V Check-In

07:00 - 08:00
Algoma Foyer
Early AM Refreshments

08:00
Algoma Ballroom
Opening Plenary Session

Session Moderator: Dr. Pedro Antunes, Algoma University

08:00
Audience Seated

08:05
Welcoming Remarks
Robert G. Lambe, Conference Chair and Executive Director, Invasive Species Centre

08:20
Session Opening Remarks and Keynote Speaker Introduction
Pedro M. Antunes, Chair, Scientific Review Committee and Associate Professor, Department of Biology, Algoma University

08:30 – 9:30
Invasion Biology – Where did it Come from, Where is it Going, and Why Don’t Some People Like it?
Dr. Daniel Simberloff, University of Tennessee, Knoxville

9:30 – 9:50
Algoma Foyer
Networking Break

9:50 – 12:00
Algoma Ballroom

Current State of Terrestrial Invasive Plants in Ontario

Session Moderator: Dr. Dawn Bazely, York University

09:50
The Status of Invasive Plants in Ontario
Dawn Bazely, Department of Biology, York University

10:20
Review of Federal and Ontario Legislation of Terrestrial Invasive Plant Species
Andrea Smith, Department of Biology, York University

10:40
Regional Ranking Criteria for Priority Invasive Species in Ontario – Issues Related to Framework Development and Data Collection
Martha G. Scott1 and Pedro M. Antunes1, 2, 1Invasive Species Research Institute, Algoma University, 2Department of Biology, Algoma University

11:00
Giant Hogweed (Heracleum mantegazzianum): Surely We Saw that Coming?
Kim Cuddington, Wonho Lee, Stephi Sobek-Swant, Warren Stevenson and Samantha Shortall, University of Waterloo

11:20
Invasive Indicator Species Monitoring at TRCA Terrestrial Volunteer Monitoring Program Sites: 2009-2011 Results
Theresa McKenzie, Toronto and Region Conservation Authority

11:40
A Silent Invasion – Genetic Contamination by Pinus peuce May Increase Disease Susceptibility of Native White Pines
John A. McLaughlin, Pengxin Lu, Sylvia Greifenhagen and Richard Wilson, Ontario Ministry of Natural Resources

12:00 – 13:30
Algoma Ballroom
Luncheon
13:30 - 15:10
Algoma Ballroom

Programs, Prevention and Potential Threats

Session Moderator: Mr. Don Schmitz, Florida Fish and Wildlife Conservation Commission

13:30
Lessons from Florida’s Invasive Plant Management Program in Natural Areas and Why Invasive Plant Research and Outreach is Important
Don Schmitz, Florida Fish and Wildlife Conservation Commission

13:50
The Establishment of the North American Invasive Species Network (NAISN) to Enhance the Communication, Coordination and Cooperation of Invasive Species Management in an International Multi-jurisdictional Environment
Don Schmitz, Florida Fish and Wildlife Conservation Commission

14:10
Invasive Species in Mexico: Who Should Be on the List?
Patricia Koleff, Georgia Born-Schmidt, Ana Isabel González and Yolanda Barrios, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO)

14:30
An Overview of Invasive Plants as a Threat to Plant Species at Risk in Ontario
Eric Snyder and Darryl Mitchell, Ontario Ministry of Natural Resources

14:50
Setting Strategic Priorities for Invasive Plant Management in Ontario
Francine MacDonald¹, Donna Wales¹, Elizabeth Wright¹ and Hayley Anderson¹, ¹Ontario Ministry of Natural Resources, ²Ontario Invasive Plant Council

15:10 - 15:30
Algoma Foyer
Networking Break

15:30 - 17:00
Algoma Ballroom

Strategies for Development of Early Detection and Rapid Response (EDRR) Capacity in the States and Provinces across the U.S. and Canada

Session Moderator: Dr. Randy Westbrooks, Invasive Plant Control Inc.

15:30
Introduction to Early Detection and Rapid Response (EDRR) – An Effective Strategy for Management of New and Emerging Invasive Species
Randy Westbrooks, Invasive Plant Control Inc.

15:55
EDDMapS – Using Apps and Maps to Help Build Early Detection Networks for the Management of Invasive Species
Chuck Bargeron, Center for Invasive Species & Ecosystem Health, University of Georgia

16:20
Integrating Invasive Plant Inventory into VSP Protocol and VSP Field Campaigns
Danijela Puric-Mladenovic, Ontario Ministry of Natural Resources, Southern Science and Information Section

16:45
The Great Lakes Early Detection Network (GLEDN)
Mark Renz¹, Alycia Crall², Greg Newman², and Brendon Panke², ¹University of Wisconsin-Madison, ²Colorado State University

17:05
Adjourn
Tuesday, August 21, 2012

Poster Session

Does Emerald Ash Borer Infestation Facilitate Exotic Plant Species Invasion?
Idaline Laigle1, Isabelle Aubin1, Krista Ryall2 and Taylor Scarr2, 1Natural Resources Canada, Great Lakes Forestry Center, 2Ontario Ministry of Natural Resources

Spread of Non-Native Plants and Earthworms along Linear Feature Networks
Erin Cameron and Erin Bayne, University of Alberta

Temporal Changes in Arbuscular Mycorrhizal Communities on a Highly Invasive Plant, Vincetoxicum rossicum (Apocynaceae)
Nicola J. Day1,2, Pedro M. Antunes2,3 and Kari E. Dunfield1, 1School of Environmental Sciences, University of Guelph, 2Invasive Species Research Institute, 3Department of Biology, Algoma University

A Guide to the Identification and Control of Exotic Invasive Species in Ontario's Hardwood Forests
Lisa Derickx1, Pedro M. Antunes1,2, 1Invasive Species Research Institute, 2Department of Biology, Algoma University

Mapping Terrestrial Invasive Species Using Community Volunteers
Freyja Forsyth, Credit Valley Conservation

Impacts of Non-Native Plant and Animal Invaders on Gap Regeneration in a Protected Boreal Forest
Jessica M. Humber1,2, and Luise Hermanutz1, 1 Memorial University of Newfoundland, Department of Biology; 2 Government of Newfoundland and Labrador, Department of Environment & Conservation, Wildlife Division

The Effect of AMF Diversity on Plant Defense against a Root Pathogen
Thaddeus Lewandowski1,2, K.E. Dunfield2 and Pedro M. Antunes1, 1Invasive Species Research Institute, Algoma University, 2School of Environmental Sciences, University of Guelph

Evaluating a Large Scale Invasive Species Management Program in Northeastern Minnesota’s Superior National Forest
Michael P Lynch1 and Jack Greenlee2, 1Cook County Invasive Team, 2United States Department of Agriculture - Forest Service

Different, but Not So Different: Identifying High Risk Non-native Plants Using Three Risk Assessment Models
Allison Mastalerz and Theresa Culley, University of Cincinnati

Do Native Plant Mixtures Reduce Invasions along Roadsides in Wisconsin
Jaslyn Mink, Mark Renz and, John Stier, University of Wisconsin-Madison

The Exotic Invasive Plant Vincetoxicum rossicum is a Strong Competitor with Natives Even Outside its Current Climatic Range
Laura A. Sanderson1 and Pedro M. Antunes1,2, 1Invasive Species Research Institute, 2Department of Biology, Algoma University

The Invasiveness of the Grass Melinis minutiflora is Favoured by Fire and Displaces the Endemic Species in Brazil
Maria Rita Scotti1, Iuri Teles1, Ana Paula Teixeira1, Iara Freitas1, Bianca Ribeiro1, Nathalia Muguet1 and Elizabeth Uber-Bucek2, 1Federal University of Minas Gerais / Brazil, 2Uberada University of Minas Gerais / Brazil

Effectiveness of Alternative Herbicides for Control of Japanese Knotweed (Polygonum cuspidatum)
David J. Spiering, Buffalo Museum of Science

Re-Slicing the Pie: Modelling the Effects of Invasive Species that Have the Potential to Change the Distribution of Resources in a Community
Tanya L.M. Stemberger, Mike Boers and Bernard Roitberg, Simon Fraser University

Does Variation in Local Seed Rain Affect Invasion Success?
Jessica Wilson and Brandon Schamp, Algoma University

Setting Priorities for Invasive Alien Species Management
Silvia Ziller and Michele Dechoum, The Horus Institute for Environmental Conservation and Development, Brazil
Wednesday, August 22, 2012

07:00 - 17:00

**Algoma Foyer**
Registration
Speaker A/V Check-in

07:30

**Algoma Foyer**
Early AM Refreshments

08:30 - 10:10

**Algoma Ballroom**

## Aggressive Control for Possible Eradication

**Session Moderator:** Dr. Sandy Smith, Faculty of Forestry, University of Toronto

08:30

**Tipping the Balance: Is Aggressive Control of Invasive Plants Warranted?**
Sandy Smith, Faculty of Forestry, University of Toronto

08:50

**Classical Weed Biocontrol in Canada: How do New Agents Against Emerging Invasive Species Happen?**
Rosemarie De Clerck-Floate and Robert Bourchier, Agriculture and Agri-Food Canada

09:10

**Proposed Release of *Hypena opulenta*: A Potential Biocontrol Agent for Dog-Strangling Vine**
Rob Bourchier1, Aaron Weed2, Alexander Hazelhurst2, Lisa Tewksbury3, André Gassmann4, Sandy Smith5 and Richard Casagrande6
1Agriculture and Agri-Food Canada, Lethbridge Research Centre, 2Biological Sciences, Dartmouth College, 3Department of Plant Sciences and Entomology, University of Rhode Island, 4CABI Europe-Switzerland, 5Faculty of Forestry, University of Toronto

09:30

**Herbicide Use in Invasive Exotic Plant Management. A Review of Policy Regulations and Current Use, with a Focus on North America**
Viktoria Wagner1, Pedro M. Antunes2, Michael Irvine1
1Department of Ecosystem and Conservation Sciences, University of Montana, 2Algoma University, 3Ontario Ministry of Natural Resources

09:50

**Will Native Dogbane Beetles (*Chrysochus auratus*) Adapt to Dog-Strangling Vine (*Vincetoxicum* spp.)?**
Rhoda de Jonge1, Sandy Smith2 and Rob Bourchier3
1University of Toronto, 2Faculty of Forestry, University of Toronto, 3Agriculture and Agri-Food Canada, Lethbridge Research Centre

10:00 - 12:30

**Algoma Ballroom**

### Environmental and Ecological Impacts

**Session Moderator:** Dr. Stephen Murphy, University of Waterloo

10:30

**Ecological and Environmental Impacts of Invasives: Measuring Effect Size Can Reveal When Not to Act**
Stephen Murphy, Department of Environment and Resource Studies University of Waterloo

10:50

**Scorched Earth Strategy by Invasive Alien Plants**
John Klironomos, Department of Biology, UBC Okanagan Campus

11:10

**Invasion and Trait Distributions in Plant Communities**
Brandon Schamp, Algoma University

11:30

**Interaction Between Invasive Plants and their Natural Enemies at Range Margins**
Peter M. Kotanen and Dasvinder Kambo, Department of Ecology and Evolutionary Biology, University of Toronto, Mississauga

11:50

**Variation in Defensive Secondary Metabolites of Native and Non-native *Lonicera* Species Grown in the Common Garden: Responses to Nutrient Availability and Relationships with Herbivore Resistance**
Deah Lieurance1, Sourav Chakraborty2, Pierluigi Bonello2, Susan Whitehead1, Deane Bowers1 and Don Cipollini2
1Wright State University, 2Ohio State University, 3University of Colorado

12:10

**Plant Invasions and Extinction Debts**
Benjamin Gilbert1 and Jonathan Levine2
1Department of Ecology and Evolutionary Biology, University of Toronto, 2Institute for Integrative Biology, ETH Zurich

12:30 – 13:45

**Algoma Ballroom**

Luncheon
13:45 - 14:45
Algoma Ballroom

Ongoing Control and Restoration

Session Moderator: Dr. Michael Irvine, Ontario Ministry of Natural Resources

13:45
Ongoing Control of Invasive Plants and Habitat Restoration
Michael Irvine, Ontario Ministry of Natural Resources

14:05
Butternut Hybridity Testing in Ontario – A Simple Process with Unexpected Complications
John A. McLaughlin and Glenna Halicki Hayden, Ontario Ministry of Natural Resources

14:25
Non-target Effects of Herbicides on Native Plants and Soil Biota: The Current State of Knowledge
Cara R. Nelson¹, Viktoria Wagner² and Pedro Antunes³, ¹University of Montana, ²Algoma University

14:45 – 15:05
Algoma Foyer
Networking Break

15:05 - 16:15
Algoma Ballroom

Ongoing Control and Restoration (cont’d)

Session Moderator: Dr. Michael Irvine, Ontario Ministry of Natural Resources

15:05
A Decision Support System for Invasive Species Management
Edward Hanna, DSS Management Consultants Inc.

15:25
A Five Year Review of Buckthorn (Rhamnus cathartica, R. frangula) Management in London, Ontario
Bonnie M. Bergsma¹ and William J. De Young², ¹City of London, ²Bradwill Ecological Consulting

15:45
Invasive Phragmites (Phragmites australis): Habitat Preference, Impact on Native Plants and the Benefit of Stem Cutting to Control Spread
Prabir Roy, Parks Canada

16:05
Closing Remarks
Owen Williams, Chair, Ontario Invasive Plant Council

16:20
Conference Adjourns
Invasion Biology – Where did it Come from, Where is it Going, and Why Don’t Some People Like it?

Daniel Simberloff
University of Tennessee, Knoxville

Invasion biology is a very young field, though its antecedents stretch back to the 18th century. Contrary to popular belief, it did not begin with Elton’s 1958 monograph, but rather with the SCOPE project of the 1980s. Because invasion biology is so young, the SCOPE questions are still relevant: (1) Why are some species invasive? (2) Why are some habitats invasible? 3) How can knowledge about (1) and (2) aid management of troublesome invaders? Of course the questions have evolved, and we now know that questions (1) and (2) are inextricably linked, but the sorts of detailed, case-specific research that has led to this realization is still important, exactly because invasions are so idiosyncratic. Evolutionary research was not part of the SCOPE project, but it has increasingly become a prominent part of invasion biology. Ecosystem impacts were originally just a minor part of the field, and they have now become one of its leading edges, particularly as ecological research on aboveground-belowground interactions has proliferated. In the midst of this feverish research activity, critics have lambasted invasion biology and management on several grounds, most notably charging that the claimed harmful impacts are overblown, that many introduced species are beneficial, that the attempt to control invasions is futile, and that the entire enterprise is tainted with xenophobia. These arguments are largely misguided.
Canada’s Invasive Alien Species Strategy started to take shape in 2001, was released in 2004, and the provincial and territorial bodies mandated under the strategy for addressing the issue of non-indigenous species, stand at varying stages. As session moderator, I will frame the questions of “How many invasive species are there in Ontario?”, “What do we know about them?” and “How effective are management and policy responses?” in the context of the requirements of the federal strategy, and the progress made on evaluating the status of invasive plants in other Canadian and National jurisdictions. The challenges of effective knowledge mobilization regarding invasive species, from researchers to policy makers and on-the-ground managers will be explored.
Review of Federal and Ontario Legislation on Terrestrial Invasive Plant Species

Andrea Smith
Department of Biology, York University

Regulatory measures can play a key role in the prevention and control of invasive species. Legislation can regulate both intentional and unintentional introductions through risk assessment, border inspections, and pathway management. It can also facilitate early detection and rapid response to biological invasions, by regulating monitoring programs, quarantine capabilities, emergency response plans and eradication measures. Yet no legislation currently exists at the federal or provincial levels in Canada dedicated to invasive species. A review of existing laws and regulations relating to invasive species is an important first step toward strengthening our legislative response. I conducted a review of federal and Ontario legislation to determine coverage of invasive species prevention, early detection and rapid response issues. A total of 30 Acts were found that apply to invasive species, most on an incidental basis. Prevention is the main focus (87% of Acts), while early detection and rapid response are addressed less frequently (53% and 63% respectively). Less than a third of federal Acts, and less than half of Ontario Acts focus on terrestrial invasive plant species. Numerous gaps and barriers to an effective response were identified, including conflicting priorities of different government agencies, lengthy permitting and approval processes, limited scope, and lack of capacity to implement and enforce legislation. Additionally, few Acts address common pathways and vectors of introduction, such as the horticultural industry, and online or cross border shopping. The current piecemeal legislative framework needs significant changes to effectively address terrestrial invasive plant species threats.
One of the most important components of invasive species management is to determine which species represent a priority for prevention and control within a defined geographical region. However, a standard, regional-scale prioritization process is often difficult to design, test and implement. We reviewed existing criteria used to rank or ‘prioritize’ invasive species in North America and recommend an approach to ranking in Ontario based on biological attributes, new introductions via retail sales, and spatial factors such as proximity to human settlement, and presence of major transportation corridors. The proposed approach is being tested using invasive plant species that are already present within natural areas of Ontario, as determined through scans of vascular plant checklists. Historical occurrence data from a range of sources (published checklists and floral inventories, environmental impact analyses undertaken for municipal development, and point of sale data from the plant retail sector) are summarized for five regions of the province (Southwestern Ontario, the GTA, Central Ontario, Eastern Ontario and Muskoka/the Kawarthas) to determine whether regional differences exist in the distribution of invasive plant species. This information is then being used to test a prioritization framework for Ontario. The framework incorporates factors such as designated natural areas, locations of species at risk, areas of high human disturbance, major transportation arteries and biological attributes of species to identify priority areas/species for control and management. Two qualitative survey tools were also developed as part of this study to assess the impact of the gardening public and gardening practices on mechanisms of spread of invasive plant species in Ontario. Behaviors and consumer knowledge related to transport of horticultural species along major transportation arteries into “cottage country”, where the public maintains second homes, are being investigated and will be used to develop educational materials, and web-based best practices guidelines in collaboration with project stakeholders. The outcomes of this research will: improve decision-making support for policy makers and managers through the development of a prioritization framework; identify issues and knowledge gaps that are barriers to prioritizing IS in Ontario, and improve public awareness about the impact of transporting plants along transportation corridors.
Giant Hogweed (*Heracleum mantegazzianum*): Surely We Saw that Coming?

*Kim Cuddington*, Wonho Lee, Stephi Sobek-Swant, Warren Stevenson, Samantha Shortall

*University of Waterloo*

Giant hogweed (*Heracleum mantegazzianum*) is a recognized invasive plant species in the UK, Europe and the United States. Giant hogweed has been of great concern in Europe because of its fast spread, great tolerance of a wide variety of environmental conditions, but most importantly because of its human health and economic impact. Aside from impacts on native floral per se caused by dense stands, and increased riverbank erosion as native bank stabilizers are out-competed, the species can cause quite serious photodermatitis. In Canada, the species is formally documented in British Columbia, Ontario, Quebec, and New Brunswick. Giant Hogweed has been known to occur in Canada since the 1970s, however, in contrast to the United States, there has been little legislation in place to regulate the sale and spread of this species, which is not an agricultural pest. In 2009 and 2010, in Canada there was growing alarm over the occurrence of this species in urban centers, and possible impacts on health. Since there are no predictions regarding the potential range of *H. mantegazzianum* in North America, we use presence data from Europe and N. America and the maximum entropy techniques (i.e., MaxEnt) to demonstrate that Giant Hogweed has the potential to occupy a larger range than currently. We use occurrence data and literature life history data to produce predictions of possible rates of spread in North America. We conclude that, without widespread control, *H. mantegazzianum* will almost certainly rapidly expand its range and increase in density in Canada in areas of high population density such as southern Ontario, with the consequent negative impacts that have been previously noted in the UK and Europe.
Invasive Indicator Species Monitoring at TRCA Terrestrial Volunteer Monitoring Program Sites: 2009-2011 Results

Theresa McKenzie, Toronto and Region Conservation Authority

Since 2002, the Toronto and Region Conservation Authority’s Terrestrial Volunteer Monitoring Program (TVMP) has been collecting presence data for a suite of 50 native indicator species at 56 ten hectare sample sites distributed throughout its jurisdiction. Volunteers are recruited under the TVMP and trained to conduct long-term monitoring of assigned sites according to a standard protocol. Results from the first five years of the program have been used to describe the condition of the overall Toronto region terrestrial ecosystem on the basis of native indicator species richness, and to document the differences found between the urban and rural zones. In 2009, a new invasive species protocol was added to assess the severity of invasion by selected priority terrestrial invasive plant species on TVMP sites. A report on the results of the first three years of the invasive monitoring is in preparation for publication mid-2012. This presentation will outline the methods used to standardize observations of invading species and to score the severity of invasion by individual species and by the indicator suite. Highlights of the results for 2009-2011 include maps that illustrate the regional distribution of selected species and severity of invasion scores and overlay the results on urbanization zones. Results of the investigation into a statistical relationship between native indicator richness scores and invasive indicator severity of invasion scores over the same period, along with the challenges in interpreting them will be discussed.
A Silent Invasion – Genetic Contamination by *Pinus peuce* May Increase Disease Susceptibility of Native White Pines

John A. McLaughlin, Pengxin Lu, Sylvia Greifenhagen and Richard Wilson

*Ontario Ministry of Natural Resources*

Macedonian pine (*Pinus peuce*) is marketed in Canada and the United States as an ornamental pine species and even for pine nut cultivation. *Pinus peuce X Pinus strobus* (eastern white pine) and *Pinus peuce X Pinus monticola* (western white pine) hybrids have been included in a breeding program used to develop genetic resistance to white pine blister rust. In 2010, needle browning caused by *Lophophacidium dooksii*, a needle blight pathogen found in eastern North America, was observed on many trees in the five-needle pine genetic archive located at the arboretum of the Ontario Forest Research Institute in Sault Ste Marie, Ontario. A survey of the archive found several non-native five-needle pines and their hybrids with the native white pines exhibiting different levels of susceptibility to the disease. Macedonian pine and its hybrids were the most heavily infected. Because *P. peuce* is highly susceptible to the disease and readily hybridizes with native white pines, planting this species in North America increases the risk of contaminating the white pine gene pool with alleles more susceptible to *L. dooksii*. Transporting infected Macedonian pine to western North America could introduce this damaging needle blight to western white pine. Likewise, Europeans should be concerned about introduction of *L. dooksii* to the native range of Macedonian pine.
Lessons from Florida’s Invasive Plant Management Program in Natural Areas and Why Invasive Plant Research and Outreach is Important

Don C. Schmitz
Invasive Plant Management Section, Florida Fish and Wildlife Conservation Commission

During the past 400 years, Florida’s natural areas and waterways have been invaded by mostly tropical and subtropical non-native plants. These invasions increased during the twentieth century with the rise of the ornamental plant industry and through the unintentional contaminants of imported commodities. Because of these plant invasions, Florida has developed one of the most successful and largest public lands and waterways invasive plant management programs in the U.S. Its success is largely due to the establishment of a lead state agency that coordinates and funds two large invasive plant control programs. The process that led to the development of a lead Florida government agency began in 1899 after the U.S. Congress passed the Rivers and Harbor Act authorizing the U.S. Army Corps of Engineers to remove South American water hyacinth (Eichhornia crassipes) that was impeding navigation in the St. Johns River. For the next seventy years, water hyacinth removal, and beginning in the 1960s, hydrilla (Hydrilla verticillata) management, were generally piecemeal, uncoordinated, and often resulted in failure. In 1970, the Florida Legislature passed the Aquatic Weed Control Act creating a statewide Invasive Plant Management Program.

Within a few years, the lead state agency developed a standard management system with the goal of achieving maintenance control of invasive non-native plants in Florida’s waterways and wetlands, and eventually, in the upland environment too. Florida’s invasive plant management program consists of clear management objectives, yearly surveys, and statewide standardization (including a resource protection plan, a statewide distribution of available funds, and a statewide consistency in policy, goals, and control methods). It also requires extensive coordination and cooperation with federal, tribal, state, and local government agencies, universities, CISMAs, homeowners, and public groups.

Recognizing that research and public education are critical to environmentally and economically sound invasive plant management programs, Florida began funding invasive plant research and outreach in 1970. Since then, more than $22 million have been spent on more than two hundred scientific research and outreach projects to develop better cost effective methods of controlling invasive plant invasions and increasing public information about invasive plant management in Florida. A brief history of Florida’s invasive plant management research and outreach program will be presented.
The Establishment of the North American Invasive Species Network (NAISN) to Enhance the Communication, Coordination, Collaboration, and Cooperation of Invasive Species Management in an International Multi-Jurisdictional Environment

Don C. Schmitz
Invasive Plant Management Section, Florida Fish and Wildlife Conservation Commission

A number of invasive species centers, institutes, labs, and networks have been established in North America over the years to help meet the needs and demands of public conservation land and waterway resource managers. Two workshops were held in 2010 in the U.S. to determine how to integrate these centers, institutes, labs, and networks into a unified umbrella network. Scientists, policy makers, resource managers, NGOs, educators, and information specialists from Canada, Mexico, and the U.S. attended these workshops along with the directors or representatives from invasive species centers, institutes, labs, networks and others. As a result of these workshops, the North American Invasive Species Network (NAISN) was established in November 2010 as a non-profit international organization that will work to unify and connect existing invasive species regional efforts into a single network. NAISN will work to enhance better communication, coordination, collaboration, and cooperation in dealing with the multi-jurisdictional aspects of biological invasions in North America.

NAISN Membership is selective and limited to regional invasive species university centers, government institutions, and research labs (hubs and nodes) and individuals (affiliates) with invasive species interests and qualifications that are valuable to the organization’s mission. NAISN hubs are defined as regionally or internationally-based, thematic-based, and/or taxonomically-based coordinated invasive species management activities and services provided by university and/or government centers/institutes/labs that address common needs and pool resources in response to invasive species issues. NAISN Nodes are defined as specific single government agency, network, or another organizational entity that has a recognized role in providing invasive species management services. NAISN Affiliates are individuals with invasive species qualifications that are valuable to the NAISN mission and may be appointed to Advisory Boards or Committees by the NAISN Board of Directors.

Some examples of enhancement services that are planned by NAISN are: help compile national statistics in the Canada, Mexico, and the United States on natural area invaders, help coordinate surveillance activities, track invasive species range expansions, help coordinate early detection and rapid response throughout North America, maintain a taxonomic expertise database for all taxa, track research within Canada, Mexico, and the U.S., develop watch lists for each geographical region in North America, develop national standards and prevention and management guidelines, track invasive species expenditures at state, provincial, and local levels, promote and help establish CISMAs (Cooperative Invasive Species Management Areas) that reach out and collaborate with all stakeholders including private landowners, and establish a one-stop educational and outreach web outlet for the public, media, and policy makers.
Invasive Species in Mexico: Who Should Be on the List?

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Invasive plant species are a major threat to Mexico’s biodiversity; nevertheless this threat just begins to be recognized by Mexican environmental legislation. While the legal and technical framework to manage pests and quarantine procedures for plants is well established, until recently the environmental legislation provided only general guidelines to regulate the problem of invasive alien species (IAS). However, the National Law for Environmental Protection and the General Law of Wildlife were modified as of April 2010 expanding some articles and adding the term invasive alien species for the first time. The modifications request the development of invasive species lists for Mexico to forbid the introduction of IAS or species that might carry IAS into the country. A thorough revision of pertinent literature on existing risk assessment protocols and prescreening schemes, which vary in scope and completeness, from Australia, the United States Canada and Mexico as well as several European countries made evident that none of these would be directly applicable to Mexico, due to the information requirements such as, for example, percentage of spatial coverage of IAS in the country. Therefore the National Commission for the Knowledge and Use of Biodiversity (CONABIO), an inter-ministerial commission and the lead organization at national level regarding invasive species, together with experts from other governmental institutions, NGOs and Universities is now taking on the task to develop a generic prescreening tool, which allows a preliminary identification of potentially high risk candidates for the official list. During a first workshop, a prototype was developed and is being tested on several taxonomic groups. Average assessment time is around an hour depending on the availability of information.
An Overview of Invasive Plants as a Threat to Plant Species at Risk in Ontario

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A number of studies have indicated that a high percent of the species at risk of extinction or extirpation in the United States, whether assessed by the federal Fish and Wildlife Service or by NatureServe program state conservation data centers, are at risk primarily because of the effects of invasive species. Other studies of species at risk in the United States, Canada or North America, with the species under consideration restricted either taxonomically or ecologically, suggest that not all groups of species at risk are subject to the same level of risk from biological invasions. This study is intended to characterize the risk posed by invasive plant species to plant species at risk in Ontario, i.e., to plant species listed under Ontario’s Endangered Species Act. Both mosses and vascular plant species at risk are included in the study. A number of comparisons are made amongst plant species at risk with respect to the threat posed to them by invasive plants. These comparisons concern whether the threat is assessed as the highest ranked risk to the species or lower ranked, and caused by direct competition (e.g. allelopathy, niche occupancy), indirect impacts (e.g. alterations to ecological communities or trophic relationships) or hybridization. The results of this analysis will be assessed in a theoretical context and implications for research, policy and program priorities will also be explored.
The Ontario Invasive Species Strategic Plan provides the framework for setting priorities for Ontario’s current and future actions on invasive plants. The Plan recognizes many of the complexities involved with addressing invasive plant issues, including leadership/coordination, legislation/policy, risk analysis, monitoring/research and public/agency communications. Effective solutions to this complex problem require the development of shared goals amongst all agencies and organizations involved in invasive plant management at all levels (national, provincial and regional/local). In the winter of 2012, the Ontario Ministry of Natural Resources, Canada/Ontario Invasive Species Centre and the Ontario Invasive Plant Council, engaged over 50 invasive plant experts and managers within Ontario to identify strategic priorities for invasive plant management in the province. The Delphi Technique, an approach to obtain expert opinion and formulate solutions to complex problems through a series of iterative and objective surveys and workshops was utilized. Respondents completed two on-line surveys; the first survey soliciting opinion on the key barriers, opportunities and solutions to invasive plant management in the categories of priority invasive plants, control techniques, legislation/policy, research, climate change and communications; the second survey shared the findings of the first survey and respondents provided their opinions on the proposed solutions. The results of the surveys were shared in a culminating workshop in March 2012, and experts were asked to confirm the identified priorities for invasive plant management. This presentation will provide an overview of the results of the Delphi and review the strategic priorities identified for invasive plant management in the province of Ontario.
Introduction to Early Detection and Rapid Response (EDRR) –
An Effective Strategy for Management of New
and Emerging Invasive Species

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Prevention, exclusion, early detection, assessment, and rapid response are the primary elements of an effective strategy for managing new invasive plants at different levels of the landscape – from the national level, to states and provinces, counties, municipalities, and other local land units. At all these levels, success in preventing the introduction, establishment, and spread of new invaders depends on a thorough knowledge about a species distribution in a particular geographical area. While prevention is the preferred strategy for managing new invaders, early detection and rapid response (EDRR) is the next best option, and perhaps the most practical, for a variety of reasons. First of all, EDRR does not restrict trade and movement of introduced species that may or may not become invasive. Secondly, EDRR addresses only invasive species that have established free living, self-perpetuating populations. Thirdly, EDRR has minimal and short term impacts on the invaded habitat. And finally, EDRR aims to restore the invaded habitat to a natural (in the case of natural area invaders) or managed (in the case of crop pests) balance.

This session will provide an overview of EDRR as an IVS management strategy, and provide guidelines for establishment of an EDRR Framework in the province of Ontario – including establishment of a Provincial EDRR Coordinating Committee, development of a Provincial EDRR Work Plan, and long term goals for development of a Provincial EDRR Network with trained volunteers and agency field personnel. The U-GA, Early Detection and Distribution Mapping System (EDDMapS) will be discussed as a good example of an online system for archival and analysis of field data from network partners. The session will also include presentations on historical and current EDRR initiatives in the province, as well as potential initiatives such as Slender False-brome (*Bracypodium sylvaticum*), a recently documented Eurasian woodland grass that could be tracked and addressed through this approach to IVS management.
EDDMapS – Using Apps and Maps to Help Build Early Detection Networks for the Management of Invasive Species

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Invasive plant species are increasingly becoming a priority in environmental monitoring programs due to the high economic and ecologic cost. EDDMapS’ primary goal is to discover the existing range and leading edge of invasive species while documenting vital information about the species and habitat using standardized data collection protocols. The National Invasive Species Council states that management and research should be directed towards prevention, early detection and rapid response, control and management, restoration, and organization collaboration. EDDMapS allows for data from many organizations and groups to be combined into one database to show a better map of the range of an invasive species. Goals of the current project include: identification and integration of existing state and regional datasets, increase search and filtering options on EDDMapS website, develop data dictionary, data collection standards and protocols, update NAWMA Invasive Plant Mapping Standards, and coordinate with local, state and regional organizations to develop early detection networks. After seven years of development of EDDMapS, it has become clear that these local organizations are key to developing a successful early detection and rapid response network.

EDDMapS continues to develop tools to help land managers better control invasive species through integrated pest management techniques.
Integrating Invasive Plant Inventory into VSP Protocol and VSP Field Campaigns

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Adaptive management and conservation actions, either tailored to detect, eradicate invasive species and/or reduce their negative impacts, need to be prioritized based on solid and sound inventory and monitoring information. In particular, it is critical that this information is standard across spatial and temporal scales, and yet cost-effective and robust enough to support timely, adaptive and informed decision making. As such, Vegetation Sampling Protocol (VSP) is an integrative, spatial and quantitative vegetation inventory and monitoring method developed and designed to support strategic, diverse and long-term vegetation inventory and monitoring applications in southern Ontario. This plot-based inventory protocol has a proven record with over 6,000 VSP spatially geo-referenced plots collected by a variety of resource management partners across southern Ontario. VSP integrates and captures a number of elements and information requirements relevant and applicable to invasive species inventory and monitoring. As such, VSP can be used to guide invasive species data collection and/or to integrate invasive species sampling with regular VSP inventory. Moreover, VSP provides capacity of collecting standard, cost-efficient invasive species data by encouraging collaboration of numerous organizations and groups, while they conduct field sampling to support other inventory needs.
Early detection and rapid response (EDRR) seeks to identify populations of invasive species early in their invasion history to improve the success of control or eradication efforts, but effective EDRR remains elusive due to financial and managerial constraints. Based on stakeholder’s feedback we have created an early detection network for the Great Lakes region. This network focuses on collecting and verifying sightings from casual observers and sharing these sightings with other networks. GLEDN also uses this shared information from all data providers to create an email alert of new sightings and maps of species distributions. With this network, we provide a cost-effective framework for online EDRR that integrates data and develops social capital through a virtual community. One of the many benefits from sharing species location information is the creation of habitat suitability models for invasive species that predict invasion potential across this region. We tested the accuracy of this concept by accumulating shared data throughout Wisconsin to create a habitat suitability model for spotted knapweed (Centaurea stoebe) and wild parsnip (Pastinaca sativa) in Wisconsin. We visited > 150 sites for each species along roadsides throughout Wisconsin. Sites were randomly selected from a pool of 1200 locations. Models accurately predicted the absence of the species >90% of the time. While presence was considerably less accurate (<60%) it is likely influenced by areas not being exposed to propagules from these invasive species, and may not reflect inaccuracy of the models. Results confirm that sharing data location information across networks allow for the development of a useful tool for predicting spread potential which can be useful for prioritizing areas for monitoring as well as regulation.
“Invasional meltdown hypothesis” (Simberloff & Von Holle 1999) has been suggested as a mechanism to explain facilitative interactions among exotic species. We study the potential for invasion by exotic plant species following emerald ash borer (EAB) (*Agrilus planipennis*) outbreaks. In Southwestern Ontario, this exotic wood-boring beetle has already killed several hundred thousand ash trees (*Fraxinus* spp.). A long-term monitoring study has been set up to evaluate a critical issue for forest management: the impact of understory vegetation response to the massive mortality of ash trees on forest ecosystem functions and services. One key aspect of this project is how landscape (urban and agricultural with different level of forest retention) and forest patch configuration (woodlot or riparian) affect the invasion potential of exotic plant species following EAB outbreak. EAB modify the habitat in a way that favours exotic plants. The use of a trait-based approach shows that exotic plant species possess different characteristics (i.e. trait values) according to the landscape and configuration of the forest. This variability, especially in traits related to competitiveness of the exotic species, may lead to different plant community responses following EAB outbreak. Because urban and riparian forests are more disturbed and more prone to exotic propagule pressure, they are expected to be more vulnerable to exotic plant species invasion. Understanding facilitative interactions between EAB outbreak and exotic plant responses are crucial information for managing and mitigating the loss of these foundation tree species.
Linear features often act as movement corridors for active or passive dispersal of non-native species. However, despite the importance of linear features in invasive spread, our understanding of the effects of network structure on spread is limited. We examined spread of non-native species along roads, pipelines, and seismic lines in northern Alberta and the Northwest Territories and tested whether campgrounds, well pads, and intersections (“nodes” within the linear feature network) could serve as key sources of invasive propagules due to the higher concentrations of human activity at these locations. We also investigated whether non-native plant and earthworm distributions were correlated, as it has been suggested that they can facilitate each other’s invasions. Non-native plants and earthworms were sampled in the ditch/on the line, in the forest edge, and in the forest interior at distances of 0 m, ~250 m, and ~600 m from the nodes. As expected, occurrence and species richness of non-native plants was significantly lower in the forest edge and interior than in ditches/on features. Earthworm occurrence was also lower in the forest interior than in edges and ditches. However, nodes appeared to have little effect on distribution of non-native species on roads and pipelines. On seismic lines, non-native plant occurrence was higher at intersections with roads, but little spread occurred along the lines away from the intersections. Thus, our study suggests that nodes do not act as foci for invasions in the boreal forest and earthworms and non-native plants do not facilitate each other’s invasions in this system.
Temporal Changes in Arbuscular Mycorrhizal Communities on a Highly Invasive Plant, *Vincetoxicum Rossicum* (Apocynaceae)

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Plant invasions, where a plant dominates the vegetation to the detriment of surrounding species, are a worldwide problem, impacting biodiversity, the economy and social aesthetic values of the landscape. The role of belowground biota in plant invasions has received increasing attention recently, particularly in terms of arbuscular mycorrhizal fungi (AMF). In this widespread obligate mutualism, plant hosts provide the AMF with carbon and AMF provide the plant with nutrients, increased water uptake and pathogen protection. Exotic plants that are highly mycorrhizal-dependent can alter belowground community composition to foster an AMF community that is beneficial for their own growth (i.e., positive feedback). The time scale at which changes in AMF communities occur in the presence of an invading plant species has not been investigated, but could potentially occur in a very short period of time if there is a fast turnover rate in AMF species upon plant invasion. Using molecular methods, we investigated changes in AMF communities colonizing a highly invasive plant species, *Vincetoxicum rossicum* (Apocynaceae), in southern Ontario, Canada. We documented the AMF species present in the roots at monthly intervals over the first six months of growth from seed. We will report whether we found a detectable sequence of colonization in AMF communities and evidence for positive feedback with the AMF community. This work is expected to provide greater insight into how exotic plant invasions may alter belowground biotic processes and the potential role that soil biota communities may play in plant invasions.
Terrestrial invasive species are increasingly prevalent in Ontario’s hardwood forests, thus posing a potential threat to a significant component of the Province’s economy. Invasive species may result in reductions to timber value and the quality and quantity of other forest-derived products. Considering the increasing number of exotic invasive species establishing in Ontario’s forests, there is a clear need for management guidelines that focus on those species that have the largest potential to be detrimental to hardwood stands. Currently no overview exists that encompasses the priority invasive plant species present in Ontario hardwood stands. Here we showcase a comprehensive guidebook that aims to be the go-to resource for fast identification and management of priority invasive species. Terrestrial invasive plant species were identified as priorities for management based on the economic, environmental and social risks they pose in relation to Ontario’s hardwood forests. The guide includes identification tools in the form of visual aids, easy to follow dichotomous keys and written descriptions. It describes the biology, success mechanisms, ecological impacts and pathways of introduction for each species. Essential strategies for management include prevention, early detection and control options. Biological invasions are dynamic and each case is unique. However, every woodlot owner or manager has the ability to take action regardless of their level of experience or available resources. Our guide is meant to help woodlot owners and managers make decisions on how to deal with invasive species.
Invasive species are a growing concern to many naturalists, conservationists and scientists. Engaging the public in environmental issues such as invasive species management increases public awareness and education, on the ground support for control and management, and overall improvement to ecosystem biodiversity. Starting in 2010 community volunteers were trained on invasive plant species identification, use of GPS units and an invasive species mapping methodology. The goal of this project is to gather information on the invasive species found at Terra Cotta Conservation Area, a property of Credit Valley Conservation (CVC), with the end result of developing an invasive species management plan to guide future land activities. A GPS based methodology was used for the mapping the invasive plant species. The property was overlaid by a 50 by 50 metre grid network, with each grid cell being given a unique identifier (ID number). These ID numbers were loaded as centroids onto GPS units and plotted on maps. The volunteers were provided with maps of grid cells to visit and scoured the cells for invasive species, recording species presence and abundance. Volunteer training workshops and workdays were held over the 2010-2011 field seasons and the data gathered is now being used in determining priority areas for invasive species management. This project while engaging the public and creating increased awareness of the issues of invasive plants is also benefiting CVC’s Invasive Species Program by gathering data in an area where staff resourcing would otherwise not have been able to. Over the 2 years of data collection a group of dedicated volunteers was formed who are now skilled in invasive species identification, have an interest in continuing their support in the Invasive Species Program through future volunteer workdays and have become stewards for invasive species management on other properties as well (including their own).
Impacts of Non-Native Plant and Animal Invaders on Gap Regeneration in a Protected Boreal Forest

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In balsam fir (Abies balsamea) -dominated boreal forests of Gros Morne National Park, Newfoundland (Canada), non-native Cirsium arvense (Field or Canada thistle) has invaded forest gaps. Its management is complicated by the lack of viable control techniques and an overarching issue of gap regeneration failure attributed to browsing by non-native moose (Alces americanus). This study identifies the impacts of thistle invasion on balsam fir regeneration and explores protocols to re-establish fir in gaps invaded by thistle and moose. Fir seeds were planted into ten gaps (five natural; five anthropogenic) and the emergence, growth, herbivory damage, and survival of fir was determined for two years amongst five treatments (n=50 plots; 32 seeds/plot): 1) thistle monocultures in gaps; 2) where aboveground thistle biomass was removed; 3) where above- and below-ground thistle biomass was removed; 4) non-invaded areas in gaps; and, 5) adjacent uninvaded forest edges. In addition, 432 fir seedlings (aged 15 months) were transplanted into four forest gaps within the above treatments and followed for one year. Results indicate that invasion of C. arvense negatively affects fir emergence and early survival, and may further contribute to continued balsam fir regeneration failure independent of future moose densities. However, older fir seedlings transplanted into thistle monocultures experienced a positive facilitative effect due to the protection thistle provided against small mammal herbivory. Restoration actions that combine moose density reductions with the planting of fir seedlings offers the most viable long-term strategy to re-establish the native forest canopy in thistle-invaded gaps and would likely lead to the eventual decline of shade-intolerant C. arvense.
The Effect of AMF Diversity on Plant Defense Against a Root Pathogen

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Arbuscular mycorrhizal fungi (AMF) are widespread soil dwelling microorganisms that enter into symbiotic relationships with plants. This symbiosis is considered a mutualism in which AMF gain carbon from their plant host in exchange for mineral nutrients. Increased AMF diversity is known to correlate positively with aboveground plant productivity as a result of improved nutrient uptake. Additionally, recent data have shown that pathogen protection is another benefit conferred by AMF to their hosts. However, a relationship between AMF diversity and pathogen protection is unknown. A growth chamber study was designed to determine whether AMF diversity is positively associated with pathogen protection. All combinations of three species of AMF from three different clades were introduced to Leucanthemum vulgare, an Ontario invasive species, either in presence or absence of the plant root pathogen Rhizoctonia solani. Data on plant biomass and root architecture will be presented as response variables to quantify AMF-mediated pathogen protection. Diverse communities of AMF that confer the greatest protection against soil pathogens could facilitate terrestrial invaders.
Evaluating a Large Scale Invasive Species Management Program in Northeastern Minnesota’s Superior National Forest

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In areas with high human population density and/or limited public land, invasive species control programs are often limited to small isolated patches of natural habitat. Here we describe a large scale invasive species control program in a sparsely populated northeastern Minnesota county (Cook). This area lies between Lake Superior and Ontario, Canada and is dominated by publicly owned land managed by the United States Forest Service. In 2002, a systematic inventory of non-native invasive plants was initiated in the Superior National Forest and annual herbicide treatment began in 2006. Data on the spatial distribution and density of invasive species populations has been collected continually throughout the treatment program and the current study uses temporal comparisons to evaluate the effectiveness of this program. Due to the continued expansion of this program, new invasive species locations were identified each year, however, the relative health of individual populations was greatly reduced in the years following treatment and ‘site visited no observation’ was recorded for many populations after two or more years of treatment. Overall, large scale invasive species programs can be effective, however, they require sustained funding, a consistent management plan across property ownership and initiation before the species becomes too widespread. Ultimately large scale invasive species control may only be feasible though biological methods but for certain areas, and species lacking bio-control agents, a coordinated herbicide program can reduce invasive species populations.
Managing invasive plant species at the beginning stages of the invasion process is an efficient way to reduce impacts of invasive species on natural areas. Unfortunately, most plants are not considered invasive at the beginning of the invasion process, and are therefore more likely to progress to a stage where they become harder, if not impossible, to manage. Risk assessment schemes are useful in determining which nonnative plants are at high risk of becoming invasive, contributing to land managers ability to prioritize action. Analysis of 29 prominent hypotheses in invasive plant ecology has led to the conclusion that the interactions between propagule pressure, abiotic characteristics, and biotic characteristics, and the how humans impact those interactions, are core questions to understanding invasive plant ecology. Risk assessment schemes frequently use these four categories when attempting to predict a species ability to become invasive, but often in different ways. Three weed risk assessment models were used to analyze nonnative plant species detected while surveying five forests in Southwestern Ohio: the Australian weed risk assessment system, the U.S. weed-ranking model, and the Ohio invasive plant assessment protocol. The Australian weed risk assessment system is one of the leading risk assessment schemes used throughout the world today. The U.S. weed-ranking system was developed to rank groups of plant species for the entire country. The Ohio invasive plant assessment protocol is a recently compiled protocol intended to streamline the risk assessment process. It is hypothesized that while each model varies in how much importance is given to different interactions, the models will provide parallel results. The results of this study are intended to help determine which nonnative plant species occurring in Southwestern Ohio forests should be given management priority, while also establishing the convergence of various risk assessment models in determining high risk plant species invasions.
Do Native Plant Mixtures Reduce Invasions along Roadsides in Wisconsin?

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Roadsides are important plant corridors vulnerable to the establishment of invasive plant species. This study evaluated factors affecting successful revegetation of roadsides using native and Eurasian seed mixes. There were several Native seed mixes used, and most of them consisted of warm season grasses, and forbs such as Aster novae-angliae, Dalea purpurea, and Solidago speciosa. In contrast, the several different Eurasian seed mixes all consisted of cool season grasses, such as Poa pratensis, Festuca brevipila, and Lolium perenne. We wanted to test whether roadsides revegetated with native or Eurasian plant species differed in invasibility. State and county highway roadsides across the state were selected, and vegetative surveys were conducted at 27 sites to determine plant species composition and cover. Additional information regarding revegetation efforts for a specific roadside was found in corresponding construction records. This included what species of plants were seeded at each site and the year that the seeding efforts occurred. Results indicated higher invasive plant richness, but similar invasive plant cover at the sites revegetated with native species compared to Eurasian species. However, native species sites had lower cover of planted species than sites revegetated with Eurasian species. Current analyses are being done to determine how plant establishment over time influences these variables. Future analyses will also evaluate environmental and physical factors responsible for invasion, in addition to effects of roadside management efforts. Initial results suggest that either planting mixture behaves similar in invasibility, but suggests that Eurasian mixes are more effective at reducing invasive plant cover. This suggests that native species mixtures currently used could benefit from inclusion of other species that are similar in function to Eurasian species.
The Exotic Invasive Plant *Vincetoxicum rossicum* is a Strong Competitor with Natives Even Outside its Current Climatic Range

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Dog-strangling vine (*Vincetoxicum rossicum*) is an aggressive invasive plant originating from Central and Eastern Europe that is becoming increasingly invasive in southern Ontario. Once established, it successfully displaces local native plant species but mechanisms behind this plant’s high competitive ability are not fully understood. It is unknown whether cooler temperatures will limit the range expansion of *V. rossicum*, which has demonstrated high phenotypic plasticity for other habitat variables such as light and soil moisture. Furthermore, if *V. rossicum* can establish outside its current climatic limit it is unknown whether competition with native species can significantly contribute to reduce fitness and slow down invasion. We conducted an experiment to test the potential of *V. rossicum* to spread into northern areas of Ontario (Canada) using a set of growth chambers to simulate southern or northern Ontario climatic temperature regimes. We also tested plant-plant competition by growing *V. rossicum* in pots with an aggressive native species, *Solidago canadensis*, and comparing growth responses to plants grown alone. We found that the fitness of *V. rossicum* was not affected by the cooler climate despite a delay in reproductive phenology. Growing *V. rossicum* with *S. canadensis* caused a significant reduction in seedpod biomass of *V. rossicum* and we did not detect a temperature x competition interaction. We conclude that the spread of *V. rossicum* north is unlikely to be limited by climatic temperature and its control can benefit from using an aggressive native species as a competitor.
The Invasiveness of the Grass *Melinis minutiflora* is Favoured by Fire and Displaces the Endemic Species in Brazil

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One of the most important parks in Minas Gerais State, Brazil, is the Serra do Rola Moça State Park (PERSM) that was created for the preservation of the endemic vegetation of “Campo rupestre” over hematite rocks outcrops. The PERSM vegetation is composed by both the Cerrado vegetation and the endemic Campo Rupestre plants. In the latter, the dominant families are Leguminosae, Orquidaceae, Velloziaceae, Poaceae and Lichens. However, some antropogenic factors such as a highway that crosses the park and massive fires have severely disturbed this endemic vegetation and changed its composition. These factors favoured the growth of *Melinis minutiflora*, an invasive grass, which is displacing the endangered native species. This invasive species was not found in the preserved native area of Cerrado or “campo rupestre” but an occupation index of 60%/m² was recorded in the disturbed areas of the park. In the dry season, the grass leaves are found very dried and the straw becomes a powerful fuel for fire spread. Besides, after the fire, the carbon and nitrogen content was significantly increased favouring the growth and invasiveness of *Melinis minutiflora*. In addition, this invasive plant showed an inhibitory allelopathic effect against lettuce seed germination as well as over the native plants germination. Our data show that the invasive plant *Melinis minutiflora* is favoured by antropogenic factors and have inhibited the sprouting of native plants in the endangered Campo rupestre vegetation after fires.
Effectiveness of Alternative Herbicides for Control of Japanese Knotweed 
(*Polygonum cuspidatum*)

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Japanese knotweed (*Polygonum cuspidatum*) is a non-native invasive plant that can establish large monotypic stands and have negative impacts on native species and ecosystems. Due to an extensive system of rhizomes it is difficult to control with hand pulling or mechanical cutting and herbicides are often used for control, either alone or in combination with other techniques. Two years of data on potted Japanese knotweed plants was used to compare the effectiveness of control by two alternative herbicides (EcoSMART®, Phydura®) compared to the widely used conventional chemical herbicide (Roundup PROMAX®). Glyphosate is the active ingredient in Roundup PROMAX® and both alternative herbicides contain essential plant oils as active ingredients and claim to be less toxic. All herbicides reduced the number of leaves per plant compared to control plants, but only EcoSMART® caused reductions similar to Roundup PROMAX®. Only Roundup PROMAX® also reduced the number of stems per pot. The alternative herbicides did show the ability to suppress Japanese knotweed flowering which could reduce spread of the plant in sexually reproducing populations. Despite the two alternative herbicides not controlling Japanese knotweed as effectively as a conventional herbicide, the use of such products should be considered in sensitive environments, such as wetlands, or in high public use areas, such as schools and playgrounds. These products are also less costly and require less permitting or applicator certification for use. Alternative herbicides should be added to toolbox of techniques for control of Japanese knotweed and other terrestrial invasive plants.
Re-Slicing the Pie: Modelling the Effects of Invasive Species that Have the Potential to Change the Distribution of Resources in a Community

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Species introductions can have positive and negative effects on communities, and in many cases introduced species do not appear to immediately threaten native species. By remaining in lag phase they increase biodiversity with their presence, and may even facilitate growth and reproduction of native species by providing habitats or food sources. Alternatively they may drive down species richness in their new communities, which would be particularly detrimental if endangered, threatened, or economically important native species were involved. Declines in native species richness are especially likely if the invader is a generalist and occupies a higher trophic level. Invaders can also affect fundamental properties of their invaded ecosystems by changing the quality or quantity of essential biotic interactions (e.g. by removing keystone species), the landscape, disturbance regime, or nutrient cycling. The spotted winged drosophila (SWD or Drosophila suzukii) is an invasive pest that despite occupying a lower trophic level, may have large effects on its invaded community by causing a shift in resource availability. Unlike other Drosophila species, female SWD preferentially oviposit in ripe or ripening fruit over rotting fruit. As larvae begin to develop, the fruit prematurely softens and rots, rendering it unmarketable thus there is an economic cost to this invasion. As a result of SWD activity, availability of the fruit resource appears to shift from frugivores to detritivores and other Drosophila that require rotting fruit. We developed a theoretical model that explores the strength of various parameters on the effects of a SWD-like pest on the dynamics of rot (resource) in a frugivore-detritivore system.
Invasive species have been an important research topic in ecology for many years, due to their negative impacts on biological diversity and ecosystem services, such as industry, human health and agriculture. Because of this, it is important to understand the effects of invasion of non-resident species on plant communities, as well as the characteristics defining a successful invader. Propagule pressure has been shown to be a strong predictor in determining the success of an invader; however, it is not known whether residents that produce a greater seed rain yearly will be more resistant to invasion. This study explored whether the native seed production, here experimentally manipulated, influenced the propensity for our study community to be invaded by non-residents. We set up an experimental grid with 75 circular vegetation plots (3 meter diameter) in a natural old-field plant community. In order to restrict local seed rain, flowers were clipped in 25 of the plots during the first growing season and non-local invaders were added at the end of this season. In 25 separate plots, non-local and local invaders were added at the end of the first growing season. We used the remaining 25 plots as control plots, where we only added non-local invaders at the end of the growing season. During the first growing season, species richness data were collected. In the second growing season, both species richness data and species abundance data were collected for each plot. When comparing the number of individual invaders and ramets per plot with the treatments a significant relationship was not found. Results are still being analyzed.
Setting Priorities for Invasive Alien Species Management

Sílvia Ziller and Michele Dechoum
The Horus Institute for Environmental Conservation and Development, Brazil

The success of a non-native species introduction in a new area depends on environmental conditions (invasibility) as well as on species characteristics (invasiveness) and on the intensity and frequency of propagule pressure. Consequently, species tend to differ in abundance and distribution in different areas and these differences can be as variable as landscape heterogeneity. In natural areas, and especially in protected areas, it is essential to carry out a local assessment of species occurrences in order to define management priorities, focusing on a preventative approach for the control of individuals or populations and for actions aimed at eradication. A planning tool for priority actions towards the eradication or control of invasive species in natural areas is presented based on species occurrences. In order to define priorities, species occurrences are mapped and qualitatively classified using the following parameters: invasion status (contained, introduced, established, invasive), local density (low, medium or high) and local level of risk (low, medium or high). With a simple mathematic equation, priorities are established for management efforts, allowing anyone to use the tool without any sophisticated requirements. As a result, using the preventative approach, small populations of species posing high risk come out as higher priority than larger populations; populations whose eradication is more feasible receive higher priority than those requiring long-term control; and non-indigenous as well as opportunistic species receive lower priorities because they are not prone to cause environmental damage. Priorities are then slightly rearranged to optimize movement in the area and consider other important issues such as the presence of restricted, fragile habitats, endemic or threatened species. The operational sequence of the prioritization exercise should respect the priorities as much as possible but must also optimize transit cost and time.
Tipping the Balance: Is Aggressive Control of Invasive Plants Warranted?

Sandy M. Smith  
Faculty of Forestry, University of Toronto

As moderator, I will explore the question of long-term population stability or regulation versus temporary suppression and control for invasive plants in order to set the stage for further discussion. The argument that invasive plants lack natural enemies (enemy release hypothesis) necessitating classical biological control introductions as opposed to the effect of contributing factors espoused by the facilitation hypothesis will be explored. Discussion will center on whether aggressive control for managing invasive plants is warranted and if so, what strategies might be available for successful implementation. I will draw upon our current understanding of the contributing ecological processes such as genomic and phenotypic plasticity, temporal and spatial fluctuations in population dynamics, and biodiversity and stability within community ecology to develop one perspective on aggressive invasive species management.
Classical Weed Biocontrol in Canada: How do New Agents Against Emerging Invasive Plants Happen?

Rosemarie De Clerck-Floate and Robert Bourchier
Agriculture and Agri-Food Canada, Lethbridge Research Centre

Although classical weed biocontrol has had a long and successful history in Canada, the procedures for its development and safe use are relatively unknown to land managers. The aim of classical biocontrol is re-establishment of the ecological relationship between a pest organism and its host-specific natural enemies through targeted introductions of the latter. In general, the release process cannot be reversed, thus careful consideration is given to the ecological ramifications associated with these purposeful introductions into new environments. In Canada, the process of classical weed biocontrol is regulated by the Canadian Food Inspection Agency, and begins with development of a test plant list used to identify phylogenetically related, non-target plants that could be affected by the foreign agent if introduced. The potential host-range of the candidate agent is then extensively investigated experimentally using the test plant list species. After completion of the host-range testing, a petition that reviews host-range data along with current biosystematic, biological, and ecological knowledge for the target plant and the proposed agent is submitted for regulatory review. Most important are the results of the host-specificity testing that has been conducted to ensure the safety of the biocontrol agent. The data in the petition are peer-reviewed by expert panels in Canada and the USA, who weigh the potential environmental and economic risks of the proposed biocontrol introduction versus expected benefits due to the suppression of the invasive plant. As with any scientific process, the practice and science of biocontrol is advancing with new knowledge. Current research in Canada addresses host-range testing for new insect agents, development of propagation and release strategies for potential agents, and assessment of ecological impact and interactions of existing agents. Of interest to Ontario, current new targets for biocontrol include; swallow-worts, Japanese knotweed, garlic mustard, yellow toadflax and invasive hawkweeds.
Two species of European swallow-wort, *Vincetoxicum nigrum* and *Vincetoxicum rossicum*, have become invasive in North America, where there are no effective natural enemies available to suppress populations and deter further spread. Swallow-worts are superior competitors for resources with native plants and often form dense monocultures, commonly in old fields or the forest understory. Conventional control methods have been largely unsuccessful for managing established infestations, and biological control is a promising option. *Hypena opulenta* is a multivoltine leaf-feeding moth and one of five European insects that are being considered as potential biocontrol agents for swallow-worts.

Host-range testing on a test-plant list of 76 potential host plants using no-choice larval development showed that the larvae of *H. opulenta* are monophagous on *Vincetoxicum* spp. There are no-native *Vincetoxicum* in NA and *H. opulenta* does not present a risk to any native NA plant species or any other species of economic importance. In containment studies, *H. opulenta* caused extensive defoliation of both *Vincetoxicum* species and we expect that it will adversely affect plants under field conditions through repeated defoliation and in the presence of competing plant species.

A petition for the release of *H. opulenta* in the eastern US and in southern Ontario was submitted to regulatory authorities in December 2011. Pre-release monitoring of *Vincetoxicum* population densities at proposed release sites is underway to enable assessment of the impacts of the biocontrol agent, if its release is approved. Contrasting the known ecological and economic risks of the continued spread and impact of *Vincetoxicum* spp. in NA, with the potential risks/benefits of the release of *H. opulenta*, we are proposing the release of this moth. The insect is specific to the target *Vincetoxicum* species and has potential to have a significant impact on the spread, seed production and biomass of these invasive plants.
Invasive non-native plants can cause considerable environmental damage by replacing native species and altering ecosystem processes. Managers frequently respond to this threat by spraying herbicides, which is relatively inexpensive and requires less human labor than other control options. However, concerns among the public over non-target toxic effects cause growing conflict between practitioners and the public in invasive non-native plant management (INPM). Transparent management procedures and quantitative information are indispensable to create trust and a baseline for objective discussions among all stakeholders involved.

We reviewed current herbicide usage in INPM in North America (Canada, United States) by surveying more than 50 governmental offices (both at the federal and provincial level) and commercial agro-statistic companies. Specifically, we asked whether 1) quantitative information is available for herbicide usage in INPM, and if so 2) whether data existed on the type of herbicides used (active ingredients), amounts applied and areas treated. Our study revealed that data is available only for the four biggest land managing agencies in the U.S. (Bureau of Land Management, Fish and Wildlife Service, Forest Service, National Park Service) – although this information is not easily accessible to the public. Based on data that these agencies shared, our preliminary analysis showed that at least 300,000 ha are sprayed each year. In order to allow for objective discussions with the public, we recommend a more rigorous and transparent documentation of herbicide use in INPM.
Will Native Dogbane Beetles (*Chrysochus auratus*) Adapt to Dog-Strangling Vine (*Vincetoxicum* spp.)?

*Rhoda deJonge*¹, Sandy Smith² and Rob Bourchier³

¹University of Toronto  
²Faculty of Forestry at the University of Toronto  
³Agriculture and Agri-Food Canada, Lethbridge Research Centre

The methods for controlling invasive dog strangling vine (*Vincetoxicum nigrum* and *V. rossicum*) are currently inefficient and unreliable. In the past, we have been limited to three simple choices: physical removal, chemical treatment, and classical biological control. Instead, I propose using an ecosystem-based approach; recruiting native insects assist as controlling agents for this invasive plant. I have identified eastern North America’s dogbane beetle (*Chrysochus auratus*) as a potential native biological control agent for dog strangling vine. This common iridescent beetle is an excellent candidate due to it’s shared genetic history with the European beetle that controls dog strangling vine in its home range, and because of the familial relationship between the dogbane beetles’ natural host, dog bane (*Apocynum androsaemifolium* and *Ap. Cannibinum*), and dog-strangling vine. I aim to identify the key factors that determine the host-range of *C. auratus* using current-accepted methods of host-range testing, commonly used in classical biological control. If dog strangling vine is included in the beetle’s host-range, future research could be done to identify, and potentially select for the factors that affect the beetle’s herbivory and/or development on dog strangling vine. If we can successfully show that a native herbivore has the potential to become a biological control agent for this invasive plant through accelerated adaptation, it may cause a shift in biological control research and provide a new tool for controlling invasive plant species.
Ecological and Environmental Impacts of Invasives: Measuring Effect Size Can Reveal When Not to Act

*Stephen D. Murphy*
*Department of Environment and Resource Studies, University of Waterloo*

As moderator, I propose to present on how we can measure effect size to gauge ecological and environmental impacts of invasives. Controversially, some authors have suggested that it may be fruitless to concern ourselves over the inevitable whereas other reject that notion and prefer to act on any perceived impacts. The eternal problems include lack of data (or lack of data at a large enough scale) and the issue over problems with predictive modelling. I will discuss how one tries to be pragmatic in such decisions under uncertainty but my aim will not be to settle the issue but to open up the session to some advanced discussion.
Scorched Earth Strategy by Invasive Alien Plants

John Klironomos
Department of Biology, University of British Columbia, Okanagan

A major goal in ecology is to better understand the factors that determine the success of invasive alien species within native communities. A number of mechanisms have been shown to contribute to invasion, including increased competitive ability and escape from natural enemies. Here, I will present evidence for a novel mechanism - where invasive plants degrade beneficial microbes in the soil (mycorrhizal fungi) that are useful to native plants (for the uptake of nutrient resources and protection from pathogens), and as a result render the environment less favourable to the growth of natives and more favourable to the growth of invasives. This strategy further promotes invasion meltdown, making these invaded ecosystems prone to even further invasion by alien species.
Invasion and Trait Distributions in Plant Communities

Brandon Schamp
Algoma University

Natural variation in the potential for a natural community to be invaded offers hope that managers could one day augment systems in a way that reduces the probability of invasion. However, despite persistent efforts, researchers have generally been unable to find evidence of general factors that contribute to making natural communities more or less susceptible to invasion by non-resident species. One reason may be that there simply are no general factors that apply across communities and invasibility is influenced by different factors in different places. Another possibility is that a general principle may not yet have been identified or sufficiently studied. Finally, a third option, explored here, is that the probability of invasion is a function of the characteristics of resident species in relation to those of potential invaders. This notion has been poorly studied and represents a potentially unifying factor influencing community-level variation invasibility. Specifically, it has been predicted that invasion will be most successful when invaders are sufficiently different from resident species with respect to traits related to resource requirements. Thus, species with very different traits from resident species will be able to successfully invade, whereas a potential invader that is similar to resident species in growth-form and hence, resource requirements, may be less successful at invading. I tested this prediction using three sets of field data, all three of which recorded composition of vegetation plots over two years, and two of which were subject to the addition of seeds from non-resident species. I will report on whether my tests produced support for this theoretical prediction.
Interactions Between Invasive Plants and their Natural Enemies at Range Margins

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Department of Ecology and Evolutionary Biology, University of Toronto, Mississauga

Invasive plants often lose natural enemies (herbivores and pathogens) while invading new geographic regions, as predicted by the Enemy Release Hypothesis. However, a similar reduction in attack may occur at a much more local scale within a species’ range: isolated individuals may escape enemies that fail to find them or cannot maintain local populations. For instance, in Canada, most invasive plants occur primarily in the south; do isolated populations near the northern edge of an invader’s range escape the enemies present in more southern populations? We have investigated this issue using the non-native plant, common burdock (Arctium minus), as a model species. In southern Ontario, this plant is attacked by a wide range of insect herbivores, including generalist leaf chewers as well as specialists such as leaf-mining flies (Liriomyza arctii, Calycomyza flavinotum) and the very abundant lepidopteran seed predator Metzneria lappella. Surveys over an 850 km transect (Newmarket to Moosonee, Ontario) indicate that damage by all of these enemies declines sharply with latitude, while plants in more northern areas are larger and more fecund. These results suggest that marginal populations may gain a benefit by escaping their usual enemies. This may help burdock to extend its range northwards, and may accelerate further spread, including migration in response to climate change.
Variation in Defensive Secondary Metabolites of Native and Non-native Lonicera Species Grown in the Common Garden: Responses to Nutrient Availability and Relationships with Herbivore Resistance

Deah Lieurance¹, Sourav Chakraborty² Pierluigi Bonello³, Susan Whitehead⁴, Deane Bowers³ and Don Cipollini⁵

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The genus Lonicera (Caprifoliaceae) includes approximately 200 species worldwide, with 18 native and 16 introduced species in North America. Several Asiatic Lonicera species have become established and often dominate the landscape (e.g., L. japonica, L. tatarica, and L. maackii), while native Lonicera species, (e.g., L. reticulata, L. dioica, and L. flava), are relatively uncommon across their native range. Several phenolic metabolites and iridoids produced by Lonicera species exhibit allelopathic and anti-herbivore effects. In an effort to characterize differences in chemical profiles by species, we examined the phenolic and iridoid glycoside profiles for 5 native and 5 non-native Lonicera species grown in a field common garden experiment. Extracts were made from leaf material collected from fertilized and unfertilized treatments for each species (August 2012) and samples were analyzed using HPLC for phenolics and GC-MS for iridoids. We also compared the laboratory performance of the generalist caterpillar (Spodoptera frugiperda) feeding on native and exotic Lonicera species (2 native, 3 non-native). The non-native Lonicera species were characterized by having higher concentrations of phenolic compounds (chlorogenic acid, luteolin, luteolin-7-glucoside, and apigenin), variable responses to fertilization, and reduced total iridoid glycoside content and number of identified iridoid glycosides. Total iridoid glycoside content and the number of identified iridoid glycosides were higher in native, fertilized Lonicera species with the highest values found in L. flava. Fitness of S. frugiperda larvae was lowest on unfertilized plants, which correlated with increases in some metabolites, and with 0% survivorship on unfertilized L. maackii, L. reticulata, and L. sempervirens. Relative growth rates were highest for larvae feeding on non-native L. tatarica and L. fragrantissima. Continuing analysis will include multivariate approaches to separate defense profiles by species, the presence of unique compounds within species, relationships between defense metabolites and herbivore performance and whether variation in chemical defense traits may contribute to the overall success of non-native Lonicera species in North America.
Plant invasions and Extinction Debts

Benjamin Gilbert and Jonathan Levine

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Whether invasive plants pose a major threat to biodiversity is hotly debated. Much of this debate is fueled by recent findings that competition from introduced organisms has driven remarkably few plant species to extinction. Instead, native plant species in invaded ecosystems are often found in refugia – patchy, marginal habitats unsuitable to their non-native competitors. However, whether the colonization and extinction dynamics of these refugia allow long term native persistence is uncertain. We examined how invader impacts on landscape structure influence native plant persistence by combining recently developed quantitative techniques for evaluating metapopulation persistence with field measurements of an invaded plant community. We found that European grass invasion of an edaphically heterogeneous California landscape has greatly decreased the likelihood of the persistence of native metapopulations. It does so via two main processes: (1) decreasing the size of native refugia, which reduces seed production and increases local extinction, and (2) eroding the dispersal permeability of the matrix between refugia, which reduces their connectivity. These processes are common to many plant invasions, suggesting that our findings are relevant to a broad range of heavily-invaded ecosystems. Even when native plant extinction is the deterministic outcome of invasion, the time to extinction can be on the order of hundreds of years. Our results indicate that the relatively short time since invasion in many parts of the world is insufficient to observe the full impact of plant invasions on native biodiversity.
Control of Invasive Plants and Habitat Restoration

Michael Irvine
Forest Health and Silviculture Section, Ontario Ministry of Natural Resources

This session will focus on the theory and practice of successful control programs. We will be guided by the principles of integrated vegetation management (IVM) IVM is a knowledge-based approach; control programs are built upon a thorough understanding of the underlying biological system, and of the environmental, social and biological context in which the system is embedded. Because all control methods are considered in developing an IVM strategy, this session will welcome presentations discussing biological, herbicide and other methods of weed control. In addition, and related to this, we will look at restoration of the ecological function of habitats after the successful control of invasive plants.
Butternut Hybridity Testing in Ontario – A Simple Process with Unexpected Complications!

John A. McLaughlin and Glenna Halicki Hayden
Ontario Ministry of Natural Resources

Butternut (Juglans cinerea) has been listed as an endangered species in Canada since 2005, and is protected under the federal Species At Risk Act (SARA 2003) and the Ontario provincial Endangered Species Act (ESA 2007). The Butternut Recovery Program mandated under SARA includes selection of putatively disease-resistant pure butternut for further testing and breeding. Butternut readily hybridizes with non-native Juglans species such as Japanese walnut (J. ailantifolia), and hybrids are not uncommon across southern Ontario’s settled landscape. Determination of hybridity is also a concern because the Ontario provincial Endangered Species Act (ESA 2007) stipulates that only reasonably healthy (a.k.a. retainable) butternut, but not hybrids, are protected, a seemingly simple distinction which has more complex implications when such trees lie on lands under development. In the field, hybrids are distinguished from true butternut by assessment of a variety of morphological and phenological characteristics. When this on-site assessment is inconclusive, tissue samples are sent to the Forest Pathology Laboratory at the Ontario Forest Research Institute, where DNA testing is conducted in order to detect hybridity. This presentation outlines the development and implementation of the molecular hybridity detection techniques and the unexpected issues that arise when applied science meets legislation.
Although initially developed for weed control in agriculture, herbicides are now widely employed to suppress invasive plants in natural ecosystems. Despite their widespread use, surprisingly little is known about the non-target impacts of commonly used herbicides on native plant communities, including on the fitness of desired native plant populations (growth, survival, and fecundity) and the soil biota that support them. In order to summarize the state of knowledge about impacts of herbicides on native plants and soil biota, we carried out an extensive literature search, using data bases for peer reviewed publications, including ISI Web of Science and Agricola. For each article, we recorded information on 50 variables related to the study objectives, methods, and results, including the types of response and independent variables tested. The majority of studies (over 90%) quantified effects on native plants at the community level and assessed plant response based solely on abundance measures (such as canopy cover, frequency, biomass, or density), which provided limited information on overall effects on plant populations. Only two studies assessed the effects of herbicides on any measure of species fitness; both focused on a single species of native forb and found significant declines in fecundity. In one case, declines persisted for five years. In addition, most investigations (ca 80%) focused on a single herbicide application rather than the effects of repeat spraying. Finally, most existing studies were done on older generations of herbicides (e.g., picloram and clopyralid). The extent to which results transfer to newly available herbicides (e.g., aminopyralid) is unknown. Findings suggest the need for expanding the types of native plant responses studied in order to more directly understand the consequences of herbicide application for both the viability of native plants and the overall resilience of their communities.
A Decision Support System for Invasive Species Management

Edward Hanna
DSS Management Consultants Inc.

Invasive species management involves major investments of public money under highly uncertain and complex conditions. Invasive species managers are faced with allocating scarce funds among a great many competing priorities. As well, new unexpected events and scientific findings require re-assessment of past allocation decisions periodically and sometimes under considerable public pressure and scrutiny. These circumstances demand that invasive species management decisions are not only rigorous from an economic efficiency perspective but also can be shown to be based on the best available scientific understanding. As well, the analysis of allocation/management alternatives must be comprehensive, systematic, coherent and efficient to cope with the complexity and number of management alternatives that need to be considered. An invasive species management decision support system (ISM_DSS) was designed and assessed for two alien invasive plant species (i.e., diffuse knapweed (*Centaurea diffusa*) and Eurasian water milfoil (*Myriophyllum spicatum*). This paper explains the design of ISM_DSS and the findings for the two case study applications.
In 2004 the City of London initiated buckthorn management experiments in municipal parks with woodlands. Early efforts lead us to hypothesize that buckthorn (*Rhamnus cathartica, R. frangula*) could be managed by mechanical techniques within a three year program: Year One to remove all seed-bearing stems; Year Two to remove any stem above the knee; and Year Three to remove any stem above the ankle. Management units were mapped according to three criteria: 1. ecological integrity of woodlands, 2. proximity to trails for aesthetic enjoyment, 3. recognition that buckthorn is a century-old weed burden that cannot be resolved by short-term decisions. In 2006 crews of youth led by university students began extracting buckthorn with shovels, Weed Wrench®, mini-excavator and muscle. By the end of 2010, 25 project sites had been managed to provide 89 hectares of control. Areas where buckthorn was controlled were naturalized by community group planting or were planted with “Rhamnus Replacements” selected for their ability to occupy the shrub understorey niche and for their provision of wildlife features (food, suitable bird nest stem architecture). Funding from the City of London was leveraged 2.8-fold from Federal, Provincial and local government and non-governmental organizations. The education and empowerment of youth and community volunteers was an eye-opening extra dividend to the buckthorn management program. For each park, the activity and progress were tracked in a database annually and areas of containment were mapped. Site reports documented hours of effort, area contained, replacement plants installed, field notes, observations, measurements, and recommendations for follow-up monitoring and management needs. From the initial observations to the five year review follow-up monitoring we have documented successful intervention and changed the trajectory of impenetrable walls of buckthorn to open-edged woodland mantles and vistas with buckthorn reduced to less than 5% of the understorey.
Invasive Phragmites (*Phragmites australis*): Habitat Preference, Impact on Native Plants and the Benefit of Stem Cutting to Control Spread

Prabir Roy  
Parks Canada

Over the past 10 years, the rapid spread of the invasive phragmites plant *Phragmites australis*, has become an ecological threat to the shorelines and wetlands of Southern Georgian Bay. It is now gradually covering the shoreline ecosystem and serving as a barrier to the beautiful waterfront. In the near future, this invasive phragmites may negatively interfere with visitor experience opportunities in the cottage country area of Southern Georgian Bay. Like other neighbour’s land, Georgian Bay Islands National Park does not exist in isolation; invasive phragmites are directly influencing the park’s native biodiversity. The park is intensively monitoring to both prevent and minimize the impacts of invasive phragmites. To develop a functional phragmites management strategy, the park conducted 3 different experiments with the objectives to: (1) understand the environmental factors responsible for the invasion and expansion phragmites in southern Georgian Bay, (2) assess the impact of phragmites on native plants and (3) evaluate the impact of cutting phragmites stems on patch growth. The results show that wet organic disturbed soil is the most favorable habitat for invasive phragmites invasion. Near-shore Southern Georgian Bay, where the forest changes into the shoreline with the large wetland areas, where water can enter seasonally because of small changes in Great Lake’s water depth but the landscape has the ability to retain the water instead of completely draining the whole area, is more susceptible for rapid colonization. Gradual decreases of Great Lakes water levels and the phragmites ability to outcompete native plants are two major contributors to quick establishment of invasive phragmites in this region. Invasive phragmites negatively impact native species by replacing wetland macrophytes: sedges, bull rushes and Canada Blue-joint grass on the shoreline. Stem cutting inhibits the further increase of phragmites patch size and significantly reduces phragmites growth and density. These findings have important implications for understanding the phragmites impact, control measures and, thereby, the development of a management plan based at a landscape or ecosystem level.
Pedro Antunes, B.Sc., Ph.D.
Research Chair in Invasive Species Biology and Associate Professor, Department of Biology, Algoma University

Pedro Antunes is a Research Chair in Invasive Species Biology (funded by the Ontario Ministry of Natural Resources) and Associate Professor (Department of Biology, Algoma University) since 2010. Currently, he is also the Research Director of the Invasive Species Research Institute at Algoma University, Chair of the North American Invasive Species Network and editor of the international journal Symbiosis. He began his academic studies in Biology at the University of Evora, Portugal (1999). He then undertook his doctoral research in Soil Science at the University of Guelph (2005) followed by post-doctoral research in Molecular Microbial Ecology (2005-07). In 2008, he moved to Berlin, Germany, to assume a Research Assistant Professor position in Ecology at the Freie Universität. His interdisciplinary research in ecology, soil microbiology and metagenomics focuses on the roles that soil microorganisms play in controlling plant productivity and community structure.

Chuck Bargeron, M.S.
Technology Director, Center for Invasive Species & Ecosystem Health and Department of Entomology, University of Georgia

Chuck is the Technology Director for the Center for Invasive Species & Ecosystem Health and has a Public Service Faculty appointment in the Department of Entomology at the University of Georgia. A native of Tifton, GA, he graduated from Abraham Baldwin Agricultural College in 1997 with an Associate Degree in Computer Science and received a B.S in Computer Science in 1999, from Georgia Southern University. In 2004, he received an M.S. in Computer Science from Georgia Southwestern State University. He has been with the University of Georgia for 16 years where he has developed web applications, interactive CD-ROMs, databases and outreach publications. Websites that Chuck has designed for the University of Georgia have been featured twice in Science Magazine, received regional awards for content and design, and have received over 1 billion hits in the last 10 years.

Chuck was the Florida Exotic Pest Plant Council Advocate of the Year in 2008 and received the Mid-Atlantic Exotic Pest Plant Council Award in 2009. He is the current President of the National Association of Exotic Pest Plant Councils. He is also an active member of the Florida Invasive Species Partnership, Everglades Cooperative Invasive Species Management Area Steering Committee and the North American Invasive Species Network.

Yolanda Barrios, M.Sc.
Invasive Species Analyst, National Commission for the Knowledge and Use of Biodiversity (CONABIO)

Ms. Barrios is an analyst for the National System of Information of Invasive Species in Mexico in CONABIO. She is in charge of updating the system with information on new invasive species detected in the country or those that are considered a threat, as well as including new information arising from publications and projects financed by CONABIO. She has recently participated in the development of a system to determine the species to be listed under Mexican law. She previously worked in the International Agreements area in CONABIO where she followed up on Mexico’s commitments to agreements such as the CDB. Ms. Barrios worked at Fauna and Flora International in Cambridge, UK and has a Master’s in Conservation Biology from the University of Kent, Canterbury.
**Professor Dawn Bazely D.Phil. (Oxon)**
Department of Biology and Director of IRIS, the Institute for Research and Innovation in Sustainability, York University, Toronto, Canada

Dawn Bazely’s research publications number over 70 journal articles, chapters, and books, including *Ecology and Control of Introduced Plants: Evaluating and responding to invasive plants*, 2003 (Cambridge University Press monograph with Judith Myers), and the forthcoming, *Environmental Change and Human Security in the Arctic* (Earthscan Press).

Dawn and her students study plant-animal interactions, from temperate to arctic regions, along with associated research areas, including invasive species, climate change impacts, forest dynamics, fungal endophytes of grasses, environmental security, sustainability and science policy.

Most recently, Dawn spent 2011-12 on sabbatical as a Bullard Fellow at Harvard Forest, Harvard University, and as Visiting Researcher in the Biodiversity Institute, Oxford University, where she worked on a book examining conservation issues in Southern Ontario, Canada from scientific, policy and political perspectives. She presents the most heavily populated, industrialized and farmed area of Canada, as a case study for evaluating what might lie ahead for other parts of the temperate forest region, extending south and east into the Northeastern USA. She also completed research for the Oxford University Press Annotated Bibliography on Grazing Ecology, one of a new series of Ecology bibliographies.

http://www.irisyorku.ca/about/our-people/core-faculty/dawn-bazely/

**Bonnie Bergsma, M.Sc.**
Ecologist Planner, City of London Planning Division, Parks Planning and Design

Bonnie Bergsma holds a Master of Science degree in Botany from the University of Toronto where she completed her field research at Ellesmere Island in the high Arctic and as a visiting scientist at the International Potato Center in the Peruvian Andes. After graduation, she conducted several life science inventories and gap analysis in north-central Ontario and the District of Muskoka to identify and recommend natural areas for protection. Bonnie has been the City of London’s Ecologist Planner since 1996 where she is responsible for providing expert scientific advice regarding land development applications that may affect the natural heritage system. She has been instrumental in the development of policy, procedures, standards and guidelines supported by Official Plan policies and tested at the Ontario Municipal Board and the Supreme Court of Canada. On a daily basis she applies science-based evidence to assist planners and developers in the implementation of Official Plan environmental policies and the recognition and protection of significant natural heritage features in the unique Carolinian Canada ecosystems in and around London.

**Rob Bourchier, Ph.D.**
Research Scientist, Agriculture and Agri-Food Canada, Lethbridge Research Centre

Rob is a research scientist in insect ecology and biological control with Agriculture and Agri-Food Canada (AAFC) in Lethbridge. Prior to working with AAFC, Rob worked for the Canadian Forest Service on the biological control of forest pests. Specific research interests include: host-plant insect interactions; population dynamics of biological control agents and their hosts; influence of habitat and climate on the impact and dispersal of biocontrol agents; and risk assessment of biological control. He is currently Canadian lead for collaborative projects developing new biological control agents for several invasive plants, including knotweeds and swallow-worts. Other projects with collaborators and graduate students have included work to estimate the impact and efficacy of established biocontrol agents, at a variety of spatial scales, for leafy spurge and knapweeds and toadflax.
Kim Cuddington, Ph.D.
Assistant Professor, University of Waterloo

Dr. Cuddington has co-edited a book, “Ecosystem engineers” (with J. Byers, W. Wilson and A. Hastings), coauthored a Department of Fisheries and Oceans publication concerning invasion risk of Asian Carps in the Great Lakes, and coauthored several publications about the theory of both extinction and invasion risk, as well as the application of these ideas to species such as emerald ash borer. In 2011, she organized a symposium at the Ecological Society of America that dealt with invasive species which cross the US-Canada border.

She is currently examining the extinction risk for Hine’s emerald dragonfly in Canada in light of their relationship with engineering digger crayfish, investigating the spread of giant hogweed, and developing potential range maps for emerald ash borer.

Rose De Clerck-Floate, Ph.D.
Research Scientist, Classical Weed Biological Control, Agriculture and Agri-Food Canada

Dr. De Clerck-Floate has researched the use of introduced biological control agents for invasive plant control for 20 years in her position with Agriculture and Agri-Food Canada (AAFC). Trained as an Insect-Plant Ecologist, she obtained a M.Sc. in Biology at the University of Saskatchewan (1987), a Ph.D. in Botany from Northern Arizona University (1991), and maintains an active involvement with the entomological community; currently as Vice President of the Entomological Society of Canada. Together with her graduate students and colleagues, she strives to increase the efficacy and environmental safety of new biocontrol agents through pre- and post-release studies. Two of her projects (rangeland weeds, houndstongue and Dalmatian toadflax), are showing success in sustained control by the host-specific insects tested and released 15-20 years ago in western Canada.

Dr. De Clerck-Floate also is an expert on biocontainment, having served as the user representative in the recent design and construction of the Insect-Microbial Containment Facility, AAFC, Lethbridge, which houses biocontrol agents. She also contributed to the Canadian Food Inspection Agency’s (CFIA’s), “Containment Standards for Facilities Handling Plant Pests” (2007), has been an advisor on international containment projects, and currently is a member of the AAFC, National Containment Biosafety and Biosecurity Committee.

Rhoda B. deJonge, B.Sc.
Faculty of Forestry – University of Toronto

Rhoda deJonge is a graduate student studying insect interactions with dog strangling vine (Vincetoxicum spp.) under the supervisory of Sandy M. Smith at the Faculty of Forestry at the University of Toronto.

Rhoda’s background is in environmental non-profit organizations. For over five years she conserved high-quality natural lands in Michigan with a regional land trust. In Ontario, Rhoda worked for two years on water quality issues in her hometown of Hamilton and chaired the Landowner Relations Committee for the Bruce Trail. She has also taught Science and English in Seoul, South Korea.

Benjamin Gilbert, Ph.D.
Assistant Professor. Department of Ecology and Evolutionary Biology, University of Toronto

Dr. Gilbert’s research tests basic ecological principles, and uses the results from this research to understand and predict the effects of global changes. His previous research on invasion has focused on several goals: i) understanding the role of soil organisms in limiting new species, ii) determining how environmental gradients influence native and exotic species diversity, iii) testing the effects of native species loss on invasion rates, and iv) using coexistence theory to predict the success and impact of invasion. His most recent research explores how the long-term impacts of invasion can lead to extinction even when short-term trends suggest that native species will persist.
**Ed Hanna, B.Sc.(Hons), M.Eng.**
DSS Management Consultants Inc.

Ed Hanna is a private consultant specialising in natural resource management and environmental policy analysis. Ed is a principal with DSS Management Consultants Inc. He has received Honours Science and Masters of Environmental Engineering degrees from the University of Toronto. Ed has worked throughout North America and in Africa and Asia dealing with natural resource management issues relating to air, water, forests, fisheries, biodiversity and energy. He has authored numerous major technical reports over the last 40 years for federal and provincial governments, private industry and public organizations.

The focus of much of Ed’s work is on environmental and resource management decisions involving complex ecological and socio-economic issues. Relevant to this conference, he undertook a study for the Canadian Food Inspection Agency involving the economic damages of invasive species. The goal was to prioritise the deployment of resources to achieve the greatest likelihood in reducing the risk of future damages at the least cost. The decision analysis framework that was designed involved a combination of ecological, economic and management elements. This framework allows decision-makers to analyse which invasive species pose the greatest risk and which management alternatives would likely yield the greatest return. This work is the focus of his presentation today.

**Michael Irvine, Ph.D.**
Vegetation Management Specialist, Ontario Ministry of Natural Resources

Michael’s research at the University of Guelph developed an integrated weed management strategy for eastern white pine nurseries. As a provincial specialist he works to ensure that vegetation management programs are conducted to a high standard in Ontario’s public forests, by working with industry, the MNR field organization and other stakeholders. He has been with the Ontario Invasive Plant Council since its inception, and is currently an advisor to the OIPC board. He is also active on the board of the Ontario Vegetation Management Association. He is interested in finding integrated solutions to vegetation problems, including herbicides where appropriate. Michael is the forestry minor use pesticide coordinator for Canada.

**John Klironomos, Ph.D.**
Professor of Biology, University of British Columbia (Okanagan campus)

Dr. John Klironomos is a Professor of Biology at the University of British Columbia (Okanagan campus). His research is focused on understanding the causes and consequences of plant and microbial diversity in terrestrial ecosystems. Specific projects in his research group include determining feedback mechanisms between plant and soil microbial populations and communities, the use of soil microbes in landscape restoration, the functional consequences of changes in the structure of soil food-webs, the effects of climate change on microbial diversity and functioning, and the determinants of co-existence within plant and microbial communities. A major emphasis currently is on invasion biology. He received his training at Concordia University (BSc), the University of Waterloo (PhD), and San Diego State University (PDF). He then joined the faculty at the University of Guelph (1996-2009), and then relocated to the University of British Columbia (Okanagan campus). He has trained 47 graduate students and post-doctoral fellows, and has published 121 peer-reviewed papers. He was recently President of the International Soil Ecology Society, and is an Associate Editor for the journals *Ecology*, and *Ecology Letters*, and is on the editorial board of numerous others. He has received a number of fellowships and awards for his research in plant and soil ecology, including the Harvard Bullard Fellowship (USA), Humboldt Research Fellowship (Germany), NSERC Steacie Fellowship (Canada), and a Canada Research Chair in Soil Biodiversity.
**Professor Peter M. Kotanen, Ph.D.**  
Department of Ecology and Evolutionary Biology, University of Toronto, Mississauga  

Prof. Kotanen studies the ecology of plant populations and communities, with particular emphases on biological invasions, seed biology, and herbivory by vertebrates and invertebrates. Recent projects focus on the question of whether escape from natural enemies (diseases, insect herbivores) promotes the survival and spread of exotic plants. Model systems include common ragweed (Ambrosia artemisiifolia), common burdock (Arctium minus), and Canada thistle (Cirsium arvense), as well as numerous other plant species. Most of his work currently is in Ontario, Canada, but he also has worked extensively in the central Canadian Arctic and Subarctic on herbivory by geese. He and his students have published numerous papers on invasions and herbivory, and he is a member of the US-NSF Global Invasions Network. He holds a Ph.D. from the University of California, Berkeley.  
Web page: http://www.utm.utoronto.ca/~w3pkota/

**Robert G. Lambe, MBA**  
Executive Director, Invasive Species Centre  

Bob Lambe was appointed Executive Director of the Canada-Ontario Invasive Species Centre in January 2012. Previously, he held the position of Regional Director General of Central and Arctic Region at the Canadian federal Department of Fisheries and Oceans. Bob is currently Chair of the Great Lakes Fishery Commission and one of four Canadian commissioners appointed by the Governor in Council.  

Throughout his federal public service career, Bob held various management and professional positions in Transport Canada and Industry Canada prior to moving to Fisheries and Oceans. He also worked in the telecommunications and industrial electronics industries within the private sector.  

Bob holds a Masters of Business Administration degree from the Ivey School of Business at University of Western Ontario and is an electronic engineering technology graduate from the Cabot Institute of Applied Arts and Technology in St. John’s, Newfoundland and Labrador.

**Deah Lieurance**  
Environmental Sciences Ph.D. Program, Wright State University  

Deah Lieurance is a 4th year doctoral candidate at Wright State University in Dayton, Ohio. Under the direction of Don Cipollini, she is currently exploring the mechanisms contributing to the successful invasion of *Lonicera maackii* (Amur honeysuckle) in North America. Specifically she is investigating the “Enemy Release Hypothesis” and the chemical ecology of both native and non-native Lonicera species. She received her Master’s in Environmental Science from Ohio University in 2004 completing her thesis exploring the physiology and biomass allocation of *L. maackii* in contrasting light environments. And she hopes to continue her work with this prominent invasive by including observations of the plant in its native range in China.  

Ms. Lieurance spent four years working at the USDA-ARS Invasive Plant Research Laboratory in Fort Lauderdale, Florida where she conducted research to assess the impact of biological control agents on *Melaleuca quinquenervia* while also gaining experience with *Schinus terebinthifolius* (Brazilian Pepper) and many other invasive species in Florida. Additionally she has published research on the biomass allocation and defoliation following hurricane-force winds of the invasive earleaf acacia (*Acacia auriculiformis*) and co-authored a paper investigating the expression and costs of induced defense traits in garlic mustard.
Francine MacDonald  
Senior Invasive Species Biologist, Ontario Ministry of Natural Resources

Francine MacDonald is a Senior Invasive Species Biologist with the Ontario Ministry of Natural Resources’ Biodiversity Policy Section. Prior to her work with the MNR, she worked with the Ontario Federation of Anglers and Hunters and coordinated a variety of provincial invasive species outreach, and citizen science initiatives in Ontario. She is a founding member of the Ontario Invasive Plant Council, and has served on the OIPC’s executive, as well as chair of their Communications Committee. Ms. MacDonald is also a member of a number of additional bi-national and federal invasive species working groups including the U.S. Great Lakes Panel on Aquatic Nuisance Species.

Theresa McKenzie, B.Sc. (Hons)  
Terrestrial Volunteer Coordinator, Ecology Division, Toronto & Region Conservation Authority

Theresa McKenzie hold an honours B.Sc. degree from the University of Guelph and is a biologist with the Toronto and Region Conservation Authority in Toronto, Ontario. She manages a terrestrial monitoring program that engages and trains volunteers to conduct monitoring surveys on 10 hectare fixed sites distributed throughout the region. As a consequence of growing local concern over invasive species and their impacts, she developed a set of protocols to monitor priority terrestrial invasive plants under the existing program, and implemented them beginning in 2009. She is now engaged in analyzing, interpreting and communicating the initial results.

John A. McLaughlin, Ph.D.
Forest Research Pathologist, Ontario Forest Research Institute

Dr. McLaughlin studied forestry (BSc & MSc) at Lakehead University (Thunder Bay, ON). He received his doctorate in Environmental Biology from the University of Guelph. He has worked as a forest pathologist in Latvia, British Columbia, and since 1998 with the Ontario Ministry of Natural Resources. His research increasingly focuses on tree diseases caused by invasive, non-native agents; most recently butternut canker and beech bark disease. In addition to investigating genetic diversity of the pathogen (Ophiognomonia clavigignenti-juglandacearum) and host (Juglans cinerea) of the butternut canker pathosystem, and methods for disease resistance screening, his lab at the Ontario Forest Research Institute performs butternut hybridity testing supporting compliance with Ontario’s Endangered Species Act (2007) and recovery efforts aimed at saving this endangered species.

His beech bark disease research includes a plot network studying disease development as it spreads across Ontario, as well as its impacts, management options and disease resistance. Along with other OMNR collaborators he has recently published a beech bark disease research note to assist landowners and forest managers in dealing with beech bark disease, and presents workshops on beech bark disease for forest managers.

Stephen D. Murphy, B.Sc. Hons., Ph.D.
Professor and Chair, Department of Environment and Resource Studies, University of Waterloo

Stephen Murphy is a Professor and Chair of the Department of Environment and Resource Studies (ERS), University of Waterloo. He is also Chair, Centre for Ecosystem Resilience & Adaptation (ERA), Chair, Centre for Applied Science in ON Protected Areas (CASIOPA), Past-Chair, Society for Ecological Restoration Ontario (SERO), A Member of the Board & Past-Chair of Research/Control Committee, Ontario Invasive Plant Council, A Member of the Multi-Stakeholder Advisory Committee, Office of the Environment Commissioner of Ontario, and holds Associate Editor positions with Restoration Ecology and Weed Science. As a Professor at the University of Waterloo, he has mentored and trained over 200 students one-to-one and over 4000 students in classes in assessing invasive species, ecological integrity, ecological modeling, ecological restoration, wildlife conservation, ecological indicators, experimental design, and management plans for private and public lands. This has translated into several hundred peer reviewed journal articles, books/book chapters, conference papers and technical reports.
Cara R. Nelson, Ph.D.
Director, Wildlands Restoration Program & Assistant Professor of Restoration Ecology
Department of Ecosystem and Conservation Sciences, University of Montana

Dr. Cara Nelson directs an undergraduate degree program in ecological restoration (Minor and BS in Wildland Restoration) at the University of Montana’s College of Forestry and Conservation. Cara’s research focuses on four primary areas: 1) effects of large-scale disturbance on understory plants and trees, 2) conceptual basis for ecological restoration, 3) efficacy and ecological impacts of restoration treatments, and 4) sampling methods for detecting changes in understory plant abundance. These topics are being explored at landscape, population, and organism scales, through field experiments, retrospective studies, and meta-analyses. Cara and her students are particularly interested in projects that both contribute to basic knowledge of plant and restoration ecology and provide managers with timely information about the ecological effects of management interventions. In addition to her teaching and research, Cara currently serves as Vice-chair of the Society for Ecological Restoration.

Prior to joining the faculty at the University of Montana, Cara received Master of Science degrees in Forestry and in Conservation Biology and Sustainable Development from the University of Wisconsin and a Doctorate in Forest Ecosystem Analysis from the College of Forest Resources at the University of Washington.

Danijela Puric-Madenovic, M.Sc., Ph.D.
Senior Analyst, Settled Landscapes, Ontario Ministry of Natural Resources

Danijela Puric-Mladenovic, holds forestry degrees from the University of Belgrade and from the University of Toronto. She works as a Senior Analyst for Settled Landscapes with Southern Ontario Science and Information Section, OMNR. She is also an adjunct professor/ research associate with the Faculty of Forestry, University of Toronto.

A central theme throughout her work is the bridging of science with application to support conservation, restoration and long-term strategic planning and management of forests and vegetation in settled, developed and urbanized landscapes. Her work also has an emphasis on spatial and vegetation analysis; predictive modeling and mapping of present, past and future vegetation and species distributions; developing integrative and broad-scale sampling and vegetation inventory protocols that support efficient collection of field data for various modeling, mapping, reporting and inventory needs; urban forest inventories and urban forest planning. Besides her science practice, Danijela possesses academic, teaching and practical experience, and works closely with stakeholders, partners and community groups engaged in land and natural resources conservation, protection, management and planning.

Mark Renz, Ph.D.
Assistant Professor, University of Wisconsin-Madison

Mark Renz (Ph.D.) is an assistant professor and extension weed specialist with the University of Wisconsin-Madison. Dr. Renz researches and extends information about the biology and management of invasive plants. Research goals in Dr. Renz’s lab are centered on developing information that will improve management by improving the knowledge and understanding of invasive plant biology. Dr. Renz has over 15 years of experience with management of invasive plants throughout the United States in a wide range of habitats including riparian zones, roadsides, floodplains, prairies, wetlands, and forests. Education efforts focus on providing technical information and educational opportunities for agency staff, consultants, companies, and citizens concerned about invasive plants.
**Prabir Roy, Ph.D.**  
Ecosystem Scientist, Parks Canada

Dr. Roy, a former research scientist of The Bangladesh Fisheries Research Institute, has completed his PhD in the field of biology from Dalhousie University, Halifax. He has also completed his postdoctoral studies at Cornell University, Ithaca, New York. In Bangladesh, his research focused on sustainable shrimp farming in the inter-tidal zone of the Sundarban’s Mangrove Forest and unsustainable deforestation of the Sundarban’s National Park.

In 2007, Dr. Roy started his new career with Parks Canada. His studies concentrated on forecasting ecological change, the impact of invasive species and ecological restoration. In Georgian Bay Islands National Park, he is currently researching invasive plants, with the objectives to prevent and minimize their harmful impact. He is able to develop a ‘multi-approach functional phragmites management strategy’, which is based on site specific environmental factors. His ultimate goal is to develop a strategy to limit invasion or control their impact on native flora and fauna. He wrote more than 20 scientific articles in peer-reviewed journals.

**Brandon S. Schamp, Ph.D.**  
Assistant Professor of Biology, Algoma University

Dr. Schamp’s research centres on understanding existing patterns of biodiversity, with a specific focus on understanding how differences among species contribute to competition, and community assembly. Dr. Schamp has published several papers examining the assembly of both plant and animal communities that examine the role of species-level trait variation, predominantly using a null model approach. Dr. Schamp has also been interested in how trait variation among species may contribute to the invasion of plant communities, and published a paper in 2010 examining how monocultures of different sized plant species vary with respect to their ability to defend against invasion.

**Don C. Schmitz, M.S.**  
Research Program Manager, Florida Fish and Wildlife Conservation Commission

Mr. Schmitz has co-edited a book, “Strangers in Paradise: Impact and Management of Nonindigenous Species in Florida (with D. Simberloff and T. C. Brown),” coauthored several publications concerning U.S. national policy towards invasive species, and coauthored numerous publications and book chapters about the ecological impact of invasive non-native plant species in Florida. He initiated and organized the process that led to a U.S. Presidential Executive Order creating the country’s first National Invasive Species Management Plan and National Invasive Species Council, was a member of the U.S. Congress’s Office of Technology Assessment Panel on Harmful Non-indigenous Species, is a former chair of the Florida Exotic Pest Plant Council and former Co-Chair of the Florida Invasive Animal Task Team.

In 2010, Mr. Schmitz initiated and organized workshops that resulted in the establishment of the North American Invasive Species Network, an international non-profit organization. He currently manages ~30 university and/or government research and outreach projects a year for the Invasive Plant Management Section at the Florida Fish and Wildlife Conservation Commission and holds a Master’s Degree in Biological Science from the University of Central Florida.
Daniel Simberloff, Ph.D.
Nancy Gore Hunger Professor of Environmental Studies, University of Tennessee

Daniel Simberloff is the Nancy Gore Hunger Professor of Environmental Studies at the University of Tennessee. He received his A.B. (1964) and Ph.D. (1968) from Harvard University and was a faculty member at Florida State University from 1968 through 1997, when he joined the Department of Ecology and Evolutionary Biology at the University of Tennessee. His publications number ca. 500 and center on ecology, biogeography, evolution, and conservation biology; much of his research focuses on causes and consequences of biological invasions. His research projects are on insects, plants, fungi, birds, and mammals. At the University of Tennessee he directs the Institute for Biological Invasions (http://invasions.bio.utk.edu/resources/index.html). He is editor-in-chief of Biological Invasions, senior editor of the Encyclopedia of Biological Invasions, is a member of the editorial board for several other journals. He served on the United States National Science Board 2000-2006. In 2006 he was named Eminent Ecologist by the Ecological Society of America, and in 2012 he was elected to the U.S. National Academy of Sciences.

Andrea Smith, M.Sc., Ph.D.
Post-doctoral Researcher, Biology Department, York University

Andrea Smith is a post-doctoral researcher in the Biology Department at York University, where she investigates Canada’s preparedness to deal with the inter-disciplinary threats of invasive species. Her work to date has focused on how effectively education and legislation address the challenges of invasive species, and on the interactions between invasive species and climate change. Andrea obtained her M.Sc. in conservation biology and her Ph.D. in evolutionary ecology, both at Queen’s University. Before coming to York, she worked for several years at Ontario Nature, first as a regional coordinator, and then as a policy analyst, investigating natural heritage policy in Ontario. Andrea has also written status reports for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Most recently, Andrea completed a review of invasive species legislation federally and in Ontario for the Ontario Ministry of Natural Resources.

Professor Sandy Smith
Dean and Professor, Faculty of Forestry, University of Toronto

Eric Snyder, Ph.D.
Plant Species at Risk Specialist, Ontario Ministry of Natural Resources

Dr. Snyder has contributed to invasive plant research in the National Vascular Plant Herbarium, Agriculture and Agri-Food Canada, and as a botanist risk assessor in the Science Advice Division of the Canadian Food Inspection Agency. In the latter position, he developed a categorization tool for quarantine pest plants which was applied to complete hundreds of screening level risk assessments. He also served on the Invasive Species Panel of the North American Plant Protection Organization where he participated in the development of North American standards for weed risk assessment and invasive species pathways analysis. He has conducted an invasive species pathways analysis for the Northwest Territories Department of Environment and Natural Resources, and produced a national screening level risk assessment protocol for aquatic invasive species in Canada for the Canadian Department of Fisheries and Oceans. As an invasive species biologist at the Ontario Ministry of Natural Resources he co-authored the Ontario Invasive Species Strategic Plan and coordinated efforts to respond to invasive plants recently established in the province.

In 2010, Dr. Snyder accepted a position in the Species at Risk Branch of the Ontario Ministry of Natural Resources where he currently works as a plant species at risk specialist. He provides science advice concerning the status, protection and recovery of plant species at risk in Ontario.
Viktoria Wagner, Ph.D.
Postdoctoral Fellow, University of Montana, College of Forestry and Conservation

Viktoria Wagner is a plant ecologist with a diverse research background, including vegetation science and population ecology. In 2011, she has obtained a PhD degree in plant ecology at the University of Halle, in Germany. In order to gain more experience abroad and to tie her work more closely with land management practice, she has joined the restoration ecology lab of Dr. Cara Nelson, at the University of Montana, as a post-doctoral fellow. In her current projects, she is evaluating the effects of herbicides on native grassland communities, in exotic invasive plant management.

Randy Westbrooks, Ph.D.
Invasive Plant Control, Inc.

Randy Westbrooks, a native of Gaffney, South Carolina, received his B.S. and M.S. degrees in biology from the University of South Carolina in 1976 and 1978. He received a Ph.D. in botany and weed science from North Carolina State University in 1989. From 1979-2012, Dr. Westbrooks served as a Federal Invasive Species Prevention Specialist with the U.S. Department of Agriculture (APHIS PPQ - 1979-2000), and more recently the Department of the Interior (U.S. Geological Survey - 2000-2012). He is now an Associate with Invasive Plant Control, Inc. (IPC), a Nashville, TN, based company that is working to control invasive species worldwide.

Over the past 15 years, Dr. Westbrooks has been working with agencies and interagency groups to develop new capacity for early detection and rapid response (EDRR) to new invasive plants at the state and provincial level across the U.S. and Canada – ultimately, a National EDRR System for Invasive Plants in each country. The effort now is focused on development of EDRR capacity at all levels of the landscape. This includes individual public and private land units, watersheds and eco-regions, municipalities, counties, and states/provinces.
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Optional Pre-Conference Tours

Two pre-conference tours are being offered to Conference participants on Monday, August 20, 2012.

Tour 1: Invasive Species Walkabout on Sault Ste. Marie’s Historic Whitefish Island
Tour 2: Invasive species Research at the Ontario Forest Research Institute

Tour 1: Invasive Species Walkabout on Sault Ste. Marie’s Historic Whitefish Island

Time: 9:00 am to 11:00 am
Tour cost: $15.00/person (includes transportation and refreshments)
Participation: This tour is limited to 30 people, so early booking is recommended. This tour is not accessible for those with mobility challenges.
Registration: Pre-registration is required.
Transportation: Tour participants are to meet in the lobby of the Delta Sault Ste. Marie Waterfront Hotel at 8:40 am to board the shuttle to Whitefish Island.
Attire: As this is a walking tour over uneven terrain, hiking boots are strongly recommended. The tour will proceed rain or shine, so dress appropriately. Hats and sunscreen are also recommended.

Our recent surveys have documented a surprisingly large and diverse flora on Whitefish and adjacent St. Mary’s Island, with over 325 species recorded so far. The presence of a several native calciphiles reflect the basic composition of the soil; these include false mermaid weed (Floerkea proserpinacoides), brook lobelia (Lobelia kalmii), fen orchid (Liparis loeselii), water avens (Geum rivale), golden sedge (Carex aurea), porcupine sedge (C. hysterica), and greenish sedge (C. viridula). Another important feature of the flora of Whitefish Island is the presence of several exotic shrub species that now dominate much of the shrub layer. These species, introduced with European settlements, include European buckthorn (Rhamnus cathartica), glossy buckthorn (Frangula alnus), February daphne (Daphne mezereum), several exotic honeysuckles (including Lonicera tatarica, L. xylosteum, and L. morrowii), western snowberry (Symphoricarpos occidentalis), and wayfaring viburnum (Viburnum lantana). Although the city of Sault Ste. Marie is in close proximity, these potentially invasive shrubs are largely confined to Whitefish and St. Mary's Islands. Also interesting to note is the absence of many of our common boreal species, typical of acidic soils, including blueberries (Vaccinium spp.), bunchberry (Cornus canadensis), starflower (Trientalis borealis), and yellow clintonia (Clintonia borealis).

The tour brings us across St. Mary’s Island to the southern portion of

Tour 1: Invasive Species Walkabout on Sault Ste. Marie’s Historic Whitefish Island

Whitefish Island is a 1 km x 0.5 km island located along the north shore of the St. Mary’s River, which connects Lake Superior to Lake Huron. Historical records dating back to the early 1600s describe Whitefish Island as an important First Nations site for harvesting whitefish, while other early users and occupants of the island include the Hudson Bay Company, the Northwest Fur Company, military encampments during World Wars I & II, and engineers and craftsmen involved in the building of the locks (Sault Ste. Marie Canal). Geologically, Whitefish Island can be described as a low boulder field of glacial till overlying acidic bedrock (Jacobsville sandstone), and covered by a thin layer of basic soil deposited by fluvial action and the buildup of organic matter associated with centuries of fish harvesting.

Whitefish Island, where large colonies of cow parsnip (Heracleum maximum) dominates a recently cleared portion of the island. Different branches of the trail system lead across the boulder-strewn riverbanks, under a canopy of buckthorns, or along the marsh, each trail offering a variety of plant species. St. Mary’s Island has fewer buckthorn, but many more colonies of introduced honeysuckles,
daphne, wayfaring viburnum, and western snowberry. Purple loosestrife is found in a few places around the channel separating the two islands, as well as along the eastern end of the island.

Tour Leader – Susan J. Meades
Susan J. Meades is a botanist with over 30 years of field experience. She has worked as a consultant in Newfoundland and Labrador since 1978, conducting plant surveys for projects such as the Newfoundland Peatland surveys, the Trans Labrador Highway, and the Lower Churchill Hydroelectric project. Sue is also a botanical illustrator (Ringius & Sims, 1997. Indicator Plant Species in Canadian Forests) and senior author of the Annotated Checklist of Vascular Plants of Newfoundland and Labrador. Since moving to Sault Ste. Marie with her family in 1995, Sue taught as an adjunct professor at Algoma University (1997-2006) and created the Northern Ontario Plant Database and website. In addition to maintaining this database, Sue updates the nomenclature of the Canada Plant Hardiness Zone database and manages the Corridors for Life project, working with local power companies to improve vegetation management techniques in rights-of-way. Sue has been documenting the flora of Whitefish Island for Batchewana First Nation since April of 2010.

Tour 2: Invasive Species Research at the Ontario Forest Research Institute

Time: 1:00 pm to 3:00 pm
Tour cost: $15.00/person (includes transportation and refreshments)
Participation: This tour is limited to 30 people, so early booking is recommended.
Registration: Pre-registration is required.
Transportation: Tour participants are to meet in the lobby of the Delta Sault Ste. Marie Waterfront Hotel at 12:40 pm to board the shuttle to OFRI.
Attire: Closed-toe shoes are required.

Visit Ontario’s 9,000 square-metre provincial forest research institute to learn about invasive species-related research conducted by OFRI staff and researchers with Algoma University’s Invasive Species Research Institute. The tour will include an overview of OFRI, and visits to OFRI’s growth facilities, forest genetics, and forest pathology laboratories with feature presentations about:

- what OFRI researchers are doing to understand and manage the effects of invasive tree diseases, such as white pine blister rust, butternut canker, and beech bark disease
- how researchers with Algoma University’s Invasive Species Research Institute are studying the potential for invasive plants such as dogstrangling vine to invade and survive in northern Ontario and the effects of fungal endophytes (fungi that live in plants) on plant invasions.
- how climate change could affect the spread of invasive plant species

OFRI is the main forest research unit of the Ministry of Natural Resources, the agency responsible for resource management in Ontario. Our researchers conduct applied research to support the sustainable management of Ontario’s forests, building on a 60-year history of forest research excellence. Our research areas include biodiversity, climate change, silviculture, soils and hydrology, the bioeconomy, and more.

To learn more about OFRI visit http://ontario.ca/ofri
LOOK BEFORE YOU LEAVE!
Invasive species may be joining you on your trip.

You could unknowingly be carrying stowaways (invasive species) to your favourite natural area.

You can help!

1. **Watercraft** – Inspect and clean your boat and motor before moving to a new waterbody
2. **Pets** – Remove seeds and mud from your pets
3. **Firewood** – Buy firewood where you burn it
4. **Boots** – Clean seeds and mud from your boots
5. **ATVs/Vehicles** – Clean vehicles thoroughly before transport

Invading Species Hotline 1-800-563-7711
ontarioinvasiveplants.ca invadingspecies.com

ontario.ca/invasivespecies

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Photo credits: Key image: Ontario Federation of Anglers and Hunters, Asian Long Horned Beetle: D. Copplestone
For further information about the Science Transfer at Work materials please contact the Ontario Invasive Plant Council info@ontarioinvasiveplants.ca or the Invasive Species Centre info@invasivespeciescentre.ca
This is a beautiful non-invasive plant for your garden.

It will not invade nearby natural areas.

Pick up a Grow Me Instead guide for more information.