REPORT

Developing Options For Community-Based Protocols To Detect Invasive Alien Plants And Insects In The Northwest Territories

For: The Department of Environment and Natural Resources, Wildlife Division
Government of the Northwest Territories
Reference Number: PM 006667

Cecilia Tagliavia (MSc, PhD)
Annette Dubreuil (BSc, MBA)
Milissa Elliott (BSc, MSc)
Tony Morris (BA, MES)
Dawn Bazely (BSc, MSc, DPhil)

Draft Submitted June 2009
Updated January 2011

CONTACT INFORMATION

DIRECTOR

Institute for Research and Innovation in Sustainability (IRIS)
Professor Dawn R. Bazely,
Biology Department,
York University, Toronto, Canada
dbazely@yorku.ca

DESIGNER

Niko Papadimitriou
niko@nikopapadimitriou.com

York University
349 York Lanes
4700 Keele St.
Toronto, Ontario
Canada M3J 1P3
Email: irisinfo@yorku.ca
Tel: +1 416 736 2100 ext. 33631 or ext. 20109
Fax: +1 416 736 5837
Website: www.irisyorku.ca

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Canadian Federal Alien Invasive Species Strategy calls for the territories and provinces to develop protocols for the early detection of newly arriving and spreading non-indigenous species. Citizen Science is increasingly seen as making an important contribution. The involvement of community members in these kinds of activities will be essential, especially in those areas of Canada with low population density, such as the Northwest Territories, Yukon and Nunvavut.

We reviewed existing community-based programs and protocols for the detection of plants and insects from North America and Europe, with an emphasis on northern USA and Canada. We also surveyed members of three communities in the Northwest Territories: Fort Good Hope, Fort Simpson and Inuvik, in Fall 2008, to ask about the experience of local people with non-indigenous plants and insects: whether they have found them, and attempted to report them, and what kind of reporting systems and supports for community-based detection of non-indigenous species, they would need to see put in place.

There are many existing community-based monitoring protocols, and a great deal of them are web-based. They range from requiring a fairly advanced level of expertise with species identification to those that provide description and identification for the existing invasive species of concern.

Most community members surveyed in Fort Good Hope, Fort Simpson and Inuvik had heard of the issue of invasive species and were willing to contribute to reporting. The Environment and Natural Resources Office, Elders and Renewable Resource Boards were most often identified as recipients of information. People surveyed often preferred to make the report in person, locally, although there was willingness to report through internet-based forms. **Therefore a protocol that uses multiple channels is recommended.** The importance of having reliable information on which plants and insects are indigenous was frequently cited along with the need for two-way flows of information exchange, with frequent reporting back to communities.

Note: URL webpage links were checked in 2011 and several (denoted by an asterisk * were found to be inactive). This finding highlights the importance of the need for stable URLs associated with reporting on invasive species.

Launching canoes on the Mackenzie River at Fort Simpson, during National Aboriginal Day 2008 celebrations (Photo: Paul Marmer).

1. INTRODUCTION

Siberian pea shrub, Caragana arborescens*, a non-indigenous species, in a Fort Simpson garden, 2008 (Photo: Dawn Bazely).*

Humans have moved species around, intentionally and unintentionally, for millennia (Myers and Bazely, 2003). The rate at which species have been transported among continents increased enormously post–1500, when Christopher Columbus arrived in the Americas (Myers and Bazely, 2003). Many introduced or non-native species that are moved between continents do not become established in the new habitat, and if and when they do establish, they often simply increase the species richness of an area, existing alongside native or indigenous species (Stohlgren et al., 2003). However, a small number of introduced or alien species become invasive and disrupt ecosystem functioning, often resulting in high economic costs for control (Myers and Bazely, 2003). Boreal and tundra biomes, which occur at higher latitudes, have fewer introduced species than more temperate and tropical biomes, for two main reasons: harsher environmental conditions that prevent the survival and establishment of species, and fewer transportation routes that provide access for introduction.

Beginning in the early 1990s, increasing global awareness of the risks and threats of invasive non-indigenous species has led to many countries and international agencies adopting legislation and policies to detect, prevent, and manage non-indigenous invasive species (Myers and Bazely, 2003; Genovesi and Shine, 2004). Article 8 of the United Nations Convention on Biological Diversity specifically addresses the issue of non-indigenous species (UNEP, 1992). In September 2004, the Canadian federal government along, with its provincial and territorial counterparts, introduced An Invasive Alien Species Strategy for Canada (Government of Canada, 2004). This strategy was developed over four years. Its goal is to reduce the risk of invasive alien species in order to conserve ecosystems. The strategy mandates the development of various tools for detecting, reporting and managing invasive species.

Increasing numbers of new species are expected to arrive in Canada's north for two reasons: (1) climate change, which will allow higher rates of species survival and establishment (Kimmel, 2009) and (2) economic development, which will provide increased routes for intentional and unintentional species introductions (Myers and Bazely, 2003). Climate change will affect the distribution of plant and insect species depending on the properties of the ecological niche of each species as well as its physiological characteristics (Mika et al., 2008), and the frequency of introductions (Myers and Bazely, 2008). In northern regions, such as the Northwest Territories, which are the focus of much resource and economic development activity, new pathways of entry are likely to emerge (NatureServe Canada, 2008) and the continued and possibly accelerated movement of new species northwards is expected to occur (Oldham, 2007).

Highway 1, Northwest Territories (Photo: Dawn Bazely).

In the Northwest Territories, as elsewhere, there have been and will continue to be both intentional and unintentional species introductions. There are many examples of accidental introductions (see Myers and Bazely, 2003), such as pond or aquarium species that are delivered to recipients by mail and which carry additional and unwanted introduced species (MNISC, 2008), or weed seeds that are by-products of other activities, such as *Lotus corniculatus* (Oldham, 2007). Two of the many reasons for deliberate introductions of plants in the Northwest Territories include (1) soil stabilization (e.g. *Caragana arborescens*, Siberian Pea Tree), and (2) aesthetic appearance, in the case of horticultural plants (e.g. *Viola tricolor*, Pansy) (Working Group on General Status of NWT Species, 2006).

Scientists, government officials, conservationists, and environmental managers face increasing pressure to address a diversity of problems caused directly and indirectly by Invasive Alien Species (IAS) or INIS (Invasive Non-Indigenous Species) (Hulme, 2006; Tanentzap et al., 2009). The limited body of resource management professionals, the need for extensive data collection in the field, the public desire for responsible management, as well as the public willingness to be involved in ecological data collection are the main drivers of local community-based projects to document the natural environment and the ways in which it is changing (Hulme, 2006). It is widely recognized by science professionals that community-based groups have a fundamental role to play in providing science-based information that can guide decisions about natural resources management (Yarnell and Gayton, 2003).

The management of Invasive Alien Species usually occurs through three successive steps: (1) prevention, (2) eradication, and/or (3) control (Williams, 1997). A large body of research indicates that early action on invasive species is the most cost-effective method of long-term control and impact management. However, there are enormous logistical challenges associated with early detection, rapid response and monitoring, which can also be very costly (Myers and Bazely, 2003; Hulme, 2006). Prevention includes building awareness and local stewardship (Herron, 2002). Eradication requires knowledge at the earliest possible time of the location where potentially invasive species first occur. Established and consistent protocols for early detection, rapid assessment and effective response are key both to gaining a better understanding of the manner in which various ecosystems respond to Invasive Alien Species and also for avoiding the often prohibitive costs of their control, once they have become established (Williams, 1997; Tagliavia and Hayes, 2009). One of the challenges of early detection and rapid response, arises during the early stages

of invasion, when Invasive Alien Species are rare, and detection rates are often compromised due to this low occurrence and the limited power to discern significant changes in abundance (Myers and Bazely, 2003; Hulme, 2006).

At this early stage, the optimum strategy for detection is to conduct fewer surveys at more sites (Hulme, 2006). Because of the additional costs associated with this approach, the mobilization of citizen scientists may play an important role in complementing regular monitoring by paid, trained staff (Hulme, 2006).

Community monitoring protocols that have been both developed and implemented, occur at varying levels of intensity, from simple, passive transmission of information from locals to professionals, to systems that create the possibility for developing independent initiatives (McCall and Minang, 2005). A community monitoring protocol will still require the involvement of professionals at some or many levels and stages. Scientists have been reluctant to accept citizen science in the past, due to a lack of accredited auditing that is required for determining the validity and acceptability of the data for academic and research purposes within peer-reviewed arenas. Within the scientific community, a heavily structured platform of methodology ensures the quality and validation of research initiatives, which can further complicate a monitoring program for those who lack a background in science (Boudreau and Yan, 2004). A community monitoring protocol requires scientists to provide the initial platform for determining the appropriate scientific and societal data to be collected, but scientists must have the ability to communicate the necessary information in a meaningful way (Delaney et al., 2008).

Both the local community and the scientific community must also learn how to communicate with each other. Many times, when a new monitoring protocol fails, the causes of the failure can be traced back to the scientists who assumed that members of the participating local community, formed a homogenous demographic group. However, there are usually differences in ethnicity, economic class, education, socio-economics, technology structures, and gender divisions, all of which affect the interactions between scientists and locals (McCall and Minang, 2005). Therefore, a key challenge for the local community is to be able to express adequately to scientists, the extent of their local knowledge as well as their concerns, and sometimes, to be able to use appropriately, the new technologies that may be brought into the community by scientists. Nevertheless, even if these challenges are not always overcome, community monitoring programs still have the potential for providing a wealth of information about population structure, behaviour, and distribution of

species and of assisting enormously in the conservation of native species of concern (Delaney et al., 2008) and with control of invasive alien species (R. Westbrooks, pers. com.). Furthermore, the development of simple pocket identification guides by other programs aimed at education about and control of invasive alien species has been shown to provide adequate education for participants to produce meaningful data (R. Westbrooks, pers. com.). The present state and impact of the field of what we currently term "citizen science", in which local community members, who may be amateur naturalists, participate in and contribute to formalized science data collection and analysis, continues to be the subject of lively debate. In fields such as astronomy, the contribution of amateurs has been consistently recognized (e.g. Bennett, 2004; Guzik et al. 2004; http://nasascience.nasa.gov/citizen-scientists), while in biology, the notion that dedicated amateurs may have a significant contribution to make to formal science has arguably waned since the early 1900s (Sheail, 1987), but has increased in the last 30-40 years in ecology, where the contribution of citizen scientists to long-term data sets and local observations of environmental indicators has been increasingly recognized (e.g. Vaughan et al., 2007).

The Canadian Community Monitoring Network (http://www.ccmn.ca/english/*) has developed a Model for Community Based Monitoring (CBM) using the lessons learned by the regional co-ordinators and their experiences testing CBM approaches in communities in Alberta, British Columbia, New Brunswick, Nova Scotia, Ontario, Saskatoon and Quebec. An important conclusion of their efforts was that, since communities are unique, any approach to Community Based Monitoring should be (1) appropriate for the local context, (2) a continually evolving process, and (3) flexible to change. Overall, CBM must be versatile, iterative and adaptive. This model for CBM involves four major interrelated phases: (1) Community Mapping, (2) Participation Assessment, (3) Capacity Building, and (4) Information Gathering and Delivery.

Mackenzie River, January 2011 (Photo: Dawn Bazely).

1.1 SCOPE OF WORK

Nearly 900 introduced plant taxa and over 100 insect taxa have been identified as posing a potential invasive threat to the ecosystems of the Northwest Territories (NatureServe Canada, 2008). From 2005 to 2010, the number of introduced plants increased from 94 to 116, while the number of introduced insects stood at 11 in 2010 (GNWT 2009). The NWT Biodiversity Action Plan (NWT Biodiversity Team, 2004) calls for improved tracking and monitoring of introduced, potentially invasive plant and insect species. The development of Community Monitoring Protocols that engage citizen scientists and local knowledge, can contribute to the territorial framework for addressing threats from Invasive Alien Species.

In order to determine how a Community Monitoring Framework could be achieved, we carried out a review of both peer-reviewed and grey literature, undertook local community consultations, and spoke with invasive species experts at three conferences in 2008. We then synthesized and analyzed this information to develop a single, proposed protocol for monitoring newly arriving and existing introduced species, which would be suitable for the Northwest Territories. The protocol was developed so as to provide a flexible approach to community monitoring that is founded upon a multi-channel communication network, which aims to meet the needs of the Government of the Northwest Territories, while reflecting the capacity and desire of local communities.

Highway 1 near Fort Simpson, January 2011 (Photo: Dawn Bazely).

2. METHODS OF INVESTIGATION

2.1 LITERATURE REVIEW

We carried out a literature review of management approaches, legislation and policies relating to Invasive Alien Species (IAS) based on Internet and university library research that examined the international, global situation. The documents included peer-reviewed, primary and secondary literature, on-line publications, and a range of government and other "grey" literature sources. We focused on North American examples of existing community-based protocols that are being used to detect, report and/or monitor invasive plants and insects. We also consulted with experts in Canada and the USA and collected information about community-based approaches and programs directed at monitoring and reporting on invasive species. Expert consultation was done through telephone calls and at three conferences on invasive species:

> (1) The Ontario Invasive Plant Council Annual General Meeting (Barrie, Ontario, November, 2008: http://www.ontarioinvasiveplants.ca/index.php/previous_ag_meetings).
>
> (2) The Minnesota Invasive Species Council Conference (Duluth, MN, USA, October, 2008: http://www.minnesotaswcs.org/Invasives.htm).
>
> (3) The Yukon Invasive Council Symposium (Whitehorse, Yukon, October, 2008: http://www.yukoninvasives.com/).

2.2 COMMUNITY CONSULTATION

Mackenzie River at Norman Wells (Photo: Annette Dubreuil).

In general, community-monitoring protocols are first developed by professional managers and/or scientists, and are presented to the target audience that will use the protocol afterwards: in this case, the local community. While this process does have some merit under specific circumstances, as a result of early brainstorming sessions in our group, after an initial review of community based interviews carried out by Milissa Elliott and Dawn Bazely in July and August 2008, the literature and conversations with Dr. Suzanne Carrière (ENR, GNWT), about her experiences, we concluded that this classic "top-down" approach to developing protocols was not especially likely to generate a successful community-monitoring protocol for communities in the Northwest Territories.

Additionally, a preliminary scan of the range of community-monitoring programs indicated that many of them required extensive completion of forms, often on-line, and assumed a fairly advanced level of knowledge of which species to be looking for. Our collective experience in doing fieldwork on the issue of invasive species in NWT, surveying students about climate change, on York University's campus, and developing sustainable-business models that might appeal to aboriginal communities, led us to conclude that very early local community input, via consultation, to the process of developing a protocol, would be essential. By conducting community consultations about monitoring of invasive species, we sought to incorporate a bottom-up approach in developing the protocol, in which community perspectives were incorporated at step zero. The consultation process would include a discussion about what information could be gathered, and an examination of how community members' could participate in developing a monitoring program. This was subsequently expanded into a survey with targeted questions, in the form of a questionnaire, aimed at identifying: (1) the willingness of local community members to participate, (2) the extent to which information would likely be shared, and under what circumstances, (3) the various types of communication that could be employed, and (4) what kind of response participating community members would like to receive from the program (Appendix B).

These surveys were carried out through community consultation exercises in three communities: Fort Simpson, Fort Good Hope, and Inuvik, in the Northwest Territories in October 2008. Members of our research team had previously visited all three communities during the summer of 2008 on a related project that sought to

determine whether local community members were aware of the issues of introduced and invasive species. The community consultations, which introduced the surveys, also included a PowerPoint presentation outlining the issues surrounding invasive species, and were followed by a discussion. As an incentive for individuals to participate in the survey and to assist in building and fostering relationships between the community and the researchers, a community dinner was held during each presentation, which was locally catered. Door prizes were also provided as an incentive to attend. Extensive canvassing was done throughout each community to gauge responses from youth, elders, community members, and professionals.

Pale Corydalis, Corydalis sempervirens*, along highway (Photo: Milissa Elliott).*

2.3.1 COMMUNITY SURVEY

Survey questions used a simple check box with an additional comment section to allow participants to express their thoughts and concerns (Appendix B). Check boxes were used in an effort to avoid a labour-intensive survey that required a large amount of the participants' time. Since all university-based research in Canada must comply with the ethical standards of the Government of Canada's Research Councils (Tri-Council Policy for Research involving humans: (http://www.nserc-crsng.gc.ca/NSERC-CRSNG/policies-politiques/tpsintegrity-picintegritie_eng.asp), the survey was approved by York University's Office of Research Ethics, and included a mandatory consent form. The survey, which constituted basic research, also required a scientific research license, which was granted by the Aurora Research Institute, Inuvik, NWT (Appendix C). During the surveying process in the three communities (Fort Simpson, Fort Good Hope, and Inuvik), the consent form allowed participants to choose the degree to which they wished to remain anonymous. Participants were able to contribute their name to the government agencies of the Northwest Territories, but could also provide survey information and remain completely anonymous if they so chose.

To provide a better foundation for administering the survey, a PowerPoint presentation was given by a team member to inform the audience about the basic premises of an alien invasive species, their possibilities, and what the overall project was about. All participants were made aware of all of the information about the project before being given the survey to make informed decisions about the questions posed to them.

Mackenzie River at Norman Wells, Fall 2008 (Photo: Annette Dubreuil).

3. RESULTS AND ANALYSIS

3.1 LITERATURE REVIEW

The following two sections describe past and existing groups and community-based programs related to the management of invasive plants and insects.

3.1.1 EXISTING COMMUNITY-BASED PROTOCOLS FOR DETECTING AND MONITORING INVASIVE PLANTS

CANADA

The Citizen Science Network (http://www.citizenscience.ca*) web site provides a directory of community-based monitoring and citizen science organizations from across Canada, as well as a rich tool-kit containing relevant resources, and an on-line listing of events. Citizen science monitoring groups are welcome to create a profile for the monitoring initiative on the site and join the list serve serving the community (see also http://www.ccmn.ca/english/*).

Nature Watch is a national program (http://www.naturewatch.ca/english/) that includes a series of volunteer monitoring programs designed to help identify ecological changes that may be affecting our environment. This is a joint venture between the Canadian Nature Federation and Environment Canada's Ecological Monitoring and Assessment Network Coordinating Office (EMANCO). As a volunteer you require a login and registration to submit your data. The Northwest Territories coordinator listed from the Yellowknife office was Jennifer Morin, Ecology North, 5013-51st Street, Yellowknife, NT X1A 1S5; ph: (867) 873-6019, fax: (867) 920-2986 nwtplantwatch@yahoo.ca, www.emannorth.ca/plantwatch. However, please note that the Northwest Territories web link is not active!

"NatureWatch" includes a **"Plant Watch"** http://www.naturewatch.ca/english/plantwatch and a planned butterfly watch. The Plant Watch website provides species descriptions by provinces or regions. A data sheet also called an observational form is available and can be printed. Registered users can view results and download data available on-line. The **NatureServe** website (http://www.natureserve.org/) is available for the USA, Canada, Latin America and the Caribbean. Although it is not a community-based program, there are links to local programs in different Canadian provinces (e.g. B.C conservation data centre; see below).

Church door, Fort Good Hope, Fall 2008 (Photo: Annette Dubreuil).

BRITISH COLUMBIA

The Invasive Plant Council of B.C. under the leadership of Executive Director Gail Wallin, is, arguably, Canada's most experienced and established Invasive Council (http://www.invasiveplantcouncilbc.ca/). The council has established regional committees and districts, created many resources, such as the T.I.P.S. (Targeted Invasive Plant Solutions sheets), and has developed a range of inclusive means by which local communities can become involved. For example, the Community Mapping Network Invasive Species Atlas, aims to "play a role of first detection and alert for subsequent agency action and [act as] a resource for NGOs to express awareness and concern and to coordinate local action." The current on-line status of this project is uncertain.

Raven at Fort Good Hope, Fall 2008 (Photo: Annette Dubreuil).

The demonstrated long-term sustainability of the B.C. Council is underlain by the depth and breadth of academic expertise about invasives available in the province, the extent to which this has been mobilized outside of universities and colleagues, the diversity of stakeholders who participate, the inclusive approach (see Memorandum of Support – membership is free - http://www.invasiveplantcouncilbc.ca/about-us/memorandum-of-support), and stable funding in the early stages.

The **WEEDS B.C.** (http://www.weedsbc.ca/index.html) website focuses on sending the message of prevention. The site provides information on weed identification including photos along with two downloadable documents: 1) "Guide to Weeds in B.C." and 2) "Seven Step to Managing Your Weeds" (http://www.weedsbc.ca/resources.html). Both documents are written in plain language. Additional information can be found at http://www.agf.gov.bc.ca/cropprot/weeds.htm where the "Invasive Plant Management in BC" document is available. This is a resource site with links to other sites, such as The BC Weed Control Act (RSBC 1996) (http://www.weedsbc.ca/legislation.html). Invasive species can be searched for by region and there are different pages with information on species identification, their habitats, damage quotient and pattern of spread.

The British Columbia Ministry of the Environment has a **B.C. Conservation Data Centre** website (http://www.env.gov.bc.ca/cdc/contribute.html). This site provides data forms for both plants and insects (non–invasive) but could be adapted and used in reporting invasive species.

The Ministry of Agriculture and Land has a **Non-Native and Invasive Plant Pests Fact Sheet** (http://www.agf.gov.bc.ca/cropprot/nonnative.pdf) on their website (http://www.agf.gov.bc.ca/cropprot/nonnativepests.htm). Here, one can find photos and descriptions of agricultural non-native and invasive pests.

Inuvik, Fall 2008 (Photo: Annette Dubreuil).

The Invasive Alien Plant Program (IAPP) application is the database for invasive plant data in BC. It is intended to co-ordinate and share information generated by various agencies and non-governmental organizations involved in invasive plant management. The application has been developed to allow for entry, edit and query of invasive plant information, including: site details; invasive plant inventory information; planning; treatment methods and data; and, monitoring data. The Invasive Alien Plant Program (IAPP) Application (http://www.for.gov.bc.ca/hra/Plants/application.htm) has three components: 1) the Data Entry module, which has restricted access with user ID and password requirements; 2) the Map Display module, which is accessible to the public; 3) the Report-A-Weed wizard. This program also has an invasive plant identification presentation on their website, (http://www.for.gov.bc.ca/hra/Publications/invasive_plants/IAPPplantID/North/aP_Lite_Flash/index.html).

YUKON

Environment Yukon, the Yukon Government agency responsible for the environment, (http://www.environmentyukon.gov.yk.ca/) has an Education and Youth section, that has environmental monitoring information, with links to various Nature-Watch programs and to GLOBECanada, an experiential science program for youth (http://environmentyukon.gov.yk.ca/educationyouth/monitoringprograms.php). The Wildlife and Biodiversity section includes information on invasive species, and the Yukon Invasive Species Committee (http://www.environmentyukon.gov.yk.ca/wildlifebiodiversity/invasivecommittee.php*). There is also a brochure available for download, *Yukon Invaders: Help Reduce the Spread of Invasive Plants in Yukon* (http://www.environmentyukon.gov.yk.ca/mapspublications/documents/YukonInvadersBrochure2007_web.pdf).

The non-profit Yukon Invasive Species Council is very active and hosts a resources page with various brochures and reports, including those listed previously (http://www.yukoninvasives.com/resources1.html).

NOVA SCOTIA

The Plant Patrol N.S. (http://www.plantpatrolns.ca/report/) volunteer monitoring project in Nova Scotia was initiated to gather baseline data on the spatial distribution and abundance of invasive alien plants in Nova Scotia's Annapolis Valley, and to make this data easily accessible. The web site has a simple on-line form for reporting an alien species, which may be previously listed or may represent an "other", new species. The program offers the possibility of becoming a trained volunteer, or

simply reporting a sighting of an invasive species. Trained volunteers are provided with an observer's manual that details the survey protocol, GPS methods, and how to complete the datasheet. The manual and datasheet are downloadable, with the former being easy to read. It is a very simple way to report map sightings of invasive species, on-line.

The "BioBlitz" program (http://www.stmarys.ca/bioblitz/welcome.html) is an annual event led by Saint Mary's University, in partnership with the Ecology Action Centre, the Discovery Centre, the Canadian Parks and Wilderness Society, the Museum of Natural History, the Nova Scotia Departments of Environment and Natural Resources, and many other environmentally minded community groups. A BioBlitz is a taxonomic survey to identify as many different groups of organisms as possible in a 24-hour period in any chosen area. This event brings elements of scientific research, education and competition together. The website provides a list of experts and their contact information. The intent is to sample all species present in the area, not just invasive species.

ONTARIO

The Ontario Federation of Anglers and Hunters (O.F.A.H.) in partnership with the Ontario Ministry of Natural Resources (O.M.N.R.) created the Invading Species Awareness Program in 1992 to actively promote: 1) legislative change to stop the introduction of exotic invading species and lessen the impact of those established in Ontario; 2) control, monitoring and prevention programs; 3) public participation, demonstrations, and education campaigns to raise awareness about the ecological impacts associated with exotic invading species. The program's "...ability to effectively track, monitor and control invading species rely directly on public participation and volunteer efforts. Without the concern, dedication and participation from the public, our program would not be the success it is today..." (http://www.invadingspecies.com/About.cfm?A=Page&PID=22). This program has a very simple on-line reporting form (http://www.invadingspecies.com/Report.cfm) and a Grade 4 curriculum kit. The website provides the "volunteer" with a detailed description of target invasive species (forest pests, and plants of interest for the purpose of this study). Under the same umbrella are different species-specific programs including the following: 1) Biological control of purple loosestrife, 2) Fanwort find, and 3) Invasive species watch (with a downloadable 2007 Invading Species Watch Report, instructional manual for volunteers, and sampling log sheet).
Currently, the O.F.A.H. hosts the co-ordinator for the newly emerged Ontario Invasive Plant Council (http://www.ofah.org/News/index.cfm?ID=3&A=GetDoc&DID=468).

The Monitoring the Moraine program has a web site with community resources, meetings, field days and workshops (http://www.monitoringthemoraine.ca/ProjectActivities/CommunityResources.htm).

The Observer Network (http://observernetwork.eomf.on.ca/default.aspx*) is a group of woodland owners participating in a biodiversity-monitoring network. This group has developed standard observation protocols; they are also training observers and are developing a regional database. Moreover, they are interested in building a database of information about habitat and species occurrences in eastern Ontario, as well as ecosystem threats, such as insects, diseases, invasive species, and natural disturbances. A username and password is required in order to upload new data, and the protocol is very detailed and technical.

Annette Dubreuil in Inuvik for community consultations, Fall 2008 (Photo: Milissa Elliott).

USA

The National Biological Information Infrastructure (NBII) is a broad, collaborative program that provides increased access to data and information on the nation's biological resources (http://www.nbii.gov/portal/server.pt). This web site provides a multitude of species information: 1) Identification, including opportunities for volunteer training, 2) Reporting, which includes a list of community outreach programs, list servers, on-line reporting forms, contact information, and a telephone hotline number, 3) Expertise (government agencies and councils), 4) Occurrence and Assessment, and 5) Planning and Response. Within this site, the US National Framework for Early Detection and Rapid Response (EDRR) to invasive species is also available (http://www.nbii.gov/portal/community/Communities/Ecological_Topics/Invasive_Species/Early Detection,_Rapid_Response_(EDRR)/*). Each component of the National ED/RA/RR Framework prototype describes an activity associated with addressing the invasive species issue and provides access to resources reported in the National EDRR Needs Assessment Survey initiated in 2006.

The North American Weed Management Association (http://www.nawma.org) is another agency with a mandate to address invasive species. Under the Mapping Standards link (http://www.nawma.org/Mappingpg.html) you can find downloadable documents such as the "Mapping Standards" "Main Document" and "Addendum to Mapping Standards (September 2007)", the "noxious weed inventory form", the "weed inventory field form", and the "weed survey field form".

The SAVEM--SAMAB's Southern Appalachian Volunteer Environmental Monitoring Program has also been active in the field. Before a volunteer begins monitoring, a program design team member trains the individual. Hands-on field training is

provided as to: 1) Identification of primary plants of concern, at minimum, 2) Operation of Global Positioning System, and 3) Recording observations on the Level I Data Sheet. This program focuses on recording observations on "Plants of Primary Concern", for which a list is given.(http://www.samab.org/Focus/Monitor/monitor.html).

The Aquatic Nuisance Species (ANS) Task Force is an intergovernmental organization dedicated to preventing and controlling aquatic nuisance species (http://www.anstaskforce.gov/default.php). The Task Force consists of 10 U.S. Federal agency representatives and 12 Ex-officio members, and is co-chaired by the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration. They clarify that the efforts required for prevention and control of ANS depend on the type of program on which one wishes to embark. An Early Detection -Awareness Program requires: 1) identification information through widely distributed materials (pamphlets, signage, etc.), 2) no formal training program, 3) a confirmation system to respond to suspect sites. This program can then provide: 1) building of awareness, 2) a high number of "volunteers", 3) early detection, and 4) a high possibility of false identification. An Awareness Brochure Approach requires staff to be responsible for: 1) developing, evaluating and distributing materials, 2) responding to potential infestation calls, and 3) providing ongoing educational outreach (optional). Volunteers are asked to look for ANS during their usual activities, with little effort and no training. They may have a lower rate of discovery per person (since ANS is not the focus), but the number of watchers compensates for the intensity of the monitoring activity.

MINNESOTA

(http://www.mda.state.mn.us/plants/pestmanagement/misac/profiles.htm*). This link is the information page for invasive aquatic plant and animals as well as terrestrial plants, animals, and pathogens. Some species contain only profiles, while others consist of identification cards. The cards are formatted in a very simple and easy to understand manner. They consist simply of pictures and species characteristics, while explaining how to report a sighting to the appropriate authority. Minnesota also has a dedicated hotline for reporting invasive aquatic species and a separate one for reporting invasive terrestrial species. The terrestrial number is cleverly called the "Arrest the Pest" hotline.

POLICIES AND LEGISLATION

(http://www.dnr.state.mn.us/eco/invasives/index.html). This link leads to informational posters produced by the State of Minnesota, and also provides access to the annual report on invasive species. This report provides information on how well the various policies, programs and legislation developed by the state have been implemented, with 2010 being the most recently posted. Annual reports are legislatively mandated in the state of Minnesota and must contain the following items: expenditures, progress, the effectiveness of management activities conducted in the state, including educational efforts and watercraft inspections, information on the participation of others in control efforts, and an assessment of future management needs. One of the main community–based management activities that is required by law in Minnesota is the watercraft inspection program and enforcement mandates.

In 2007, the State of Minnesota had fifty watercraft inspectors (mostly student interns) working from late- April to mid- October. These inspectors worked a total of 24,000 hours, inspecting 42,000 watercraft, and distributing 5,452 Invasive Species Alert Tags. This program also worked with eight lake associations and citizen groups to increase the locations and number of inspections. These groups provided funding for additional inspection areas, while the state program provided training, equipment and supervision. Funding for the program largely came from a surcharge on watercraft licenses and non-resident fishing licenses. Other money came from the general accounts of state and federal departments involved in the project.

Conservation officers in the state spent 3,222 hours enforcing invasive species laws. They issued, statewide, 39 civil citations, 5 summons, and 27 written warnings for violations. Alongside watercraft inspectors, they also distrubuted educational information to the public. Paid advertising and public service announcements were produced for television, radio and newspaper outlets, to inform the public of issues relating to invasive species.

The annual report also breaks down the budget and provides information on where money was spent. In 2007, about 73% of funds were spent directly on ground management efforts, including inspection, enforcement and educational efforts, emphasizing the state's reliance on direct, community-based management efforts. Remaining funds were allocated to research, administration and program direction.

Milissa Elliott in Inuvik for community consultations, Fall 2008 (Photo: Annette Dubreuil).

Minnesota places a strong emphasis on transparency and accountability, hence the legislative mandate for annual reports. An issue like invasive species needs to incorporate all segments of society, which the state clearly recognizes. There is also a strong emphasis on coordination and cooperation with other governmental and non-governmental partners, particularly community groups and NGOs.

Educational efforts in the state have expanded far beyond informational posters and advertising. Minnesota includes invasive species information in its issuance of fishing and boating licenses, erects billboards in key transit areas, and holds displays at state exhibits and fairs. The state also held a "Stop the Aquatic Hitchhikers" week, from June 23-30 (see also p. 26 in MNISC, 2008). Minnesota has also worked with zoos and aquariums to educate the public, and has even partnered with car wash stations near recreational lakes to offer washing of boats and trailers. Finally, the state has given presentations at universities, high schools, conferences, annual meetings, lake associations, and service and professional organizations.

In terms of measuring the effectiveness of their educational efforts, the state conducted surveys of boaters to gauge whether the information about invasive species was being absorbed. The survey was conducted in five states: Minnesota, Vermont, California, Kansas, and Ohio, on over 4,000 boaters. The results showed that the number of boaters that take personal action is proportional to the activity of the particular state's public awareness and outreach campaigns, with Minnesota having the highest percentage at around 90%. The survey was conducted by Minnesota Sea Grant (a non-governmental organization) and the University of Minnesota.

A series of factors have contributed to why Minnesota is a jurisdiction that appears to be leading the way in invasive species management. In 1999, President Clinton signed Executive Order 13112 requiring the creation of Councils of Invasive Species in each state jurisdiction. The Minnesota Invasive Species Advisory Council, or MISAC, was formed in 2001 in response to this Executive Order. The Council is co-chaired by the Minnesota Department of Agriculture and the Minnesota Department of Natural Resources. The remainder of council is made up of representatives from other state departments, several federal departments, universities, and non-governmental organizations, and totals thirty members. The purpose of MISAC is to review information concerning management of terrestrial and aquatic invasive species in the state, and to share strategies that will help to maximize resources for managing the issue. Information about MISAC can be found at http://www.mda.state.mn.us/plants/pestmanagement/misac/default.htm*.

There are other laws and regulations in Minnesota dealing with invasive species, but the following three are the main statutes that give rise to regulations and are the most comprehensive in nature.

These three statutes can be accessed at http://www.mda.state.mn.us/plants/pest-management/misac/regulations.aspx

The first is the Plant Protection and Invasive Species statute. The relevant section is 18G.12 Invasive Species Management and Investigation. This requires, by law, research into the introduction and spread of invasive species and the feasibility of various control programs. This section also requires a management plan for terrestrial invasive species, considering strategies for detection and prevention, disseminating information, coordinating control efforts, and participation by local authorities in local management efforts. Finally, it requires regional cooperation and that an annual report be published.

The second statute, Chapter 84D, is the primary invasive species law and the most comprehensive. This law consists of fifteen sections and covers both aquatic and terrestrial invasive species. This statute is so comprehensive and effective due to the detailed requirements that it sets out and its very definition of invasive species.

Section 84D.1 defines invasive species as:

> A non–native species that:
>
> (1) causes or may cause economic or environmental harm or harm to human health; or
>
> (2) threatens or may threaten natural resources or the use of natural resources in the state.

> (Note the use of the word may, invoking the precautionary principle and allowing for flexibility and discretion in determining whether a species is a hazard. This lowers the burden of proof and allows for value judgments.)

Under Section 84D.2 Invasive Species Management Program for Aquatic Plants and Wild Animals in Subd.4 there is a legislative requirement to train and authorize personnel to inspect watercraft for a minimum of 10,000 hours each boating season.

Fireweed, Chamerion latifolium*, an indigenous species along Mackenzie Highway (Photo: Milissa Elliott).*

Another unique feature of this statute is the classification process of non-native species. A species can be designated as either a prohibited invasive species, regulated invasive species, unlisted non-native species, or unregulated non-native species. The rules governing the management of these various lists are different. There is also a fair amount of discretion left to the department as to what criteria they may choose to use in evaluating a species.

The final, most useful section of this statute is 84D.13 Enforcement: Penalties. Under this statute, individuals found in violation of any other section of the statute may be found guilty and receive a variety of penalties, including charges of criminal misdemeanors. This section is fairly detailed in terms of instances of unlawful behaviour and the associated penalties. For example, failure to drain water from watercraft and equipment upon leaving infested waters brings a fine of $50. Refusal to submit to an inspection carries with it the suspension of a watercraft license.

The last statute from Minnesota worth examining is Chapter 6216, which receives its authority from Chapter 84D.12. This section of Chapter 84D allows the Commissioner (equivalent to a government minister in Canada) to adopt rules for the designation of species and the rules governing their management. Chapter 6216 allows for flexibility in the management of regulated or prohibited invasive species. The majority of the text of this statute consists of lists of individual species under these classifications.

These three statutes provide comprehensive coverage of the issue of invasive species. They are wide-ranging enough to include research into pathways of introduction and control measures, while focusing strongly on community education, local monitoring efforts, all while having enough legal power to allow for enforcement and penalties.

WISCONSIN

The River Alliance of Wisconsin and the Wisconsin DNR are partnering with local citizen groups to implement a pilot project that trains canoeists and kayakers to assist in the early detection of four invasive species (Japanese knotweed, common reed grass, Japanese hops, and purple loosestrife) along riverbanks throughout southern Wisconsin (MacFarland p. 98 in MINSC, 2008). http://www.wisconsinrivers.org/conservation-projects/invasive-species.

The Citizen Lake Monitoring Network (CLMN) (http://www.uwsp.edu/cnr/uwexlakes/clmn/) connects over 1000 citizen volunteers statewide with the Wisconsin Department of Natural Resources (DNR). Their goals are to collect high quality data, educate and empower volunteers, and share this data and knowledge. Training of volunteers is available via a series of workshops (http://www.uwsp.edu/cnr/uwexlakes/clmn/training.asp). Volunteers can: 1) measure water clarity (using the Secchi Disk method), 2) collect chemistry, temperature, and dissolved oxygen data, 3) identify and map native plants, and 4) identify and map aquatic invasive species (i.e. Eurasian Water Milfoil, Zebra Mussels, Curly Leaf Pondweed, Purple Loosestrife, Rusty Crayfish, etc.). DNR and University of Wisconsin-Extension staff provide volunteers with the necessary equipment and training. Volunteers then provide their time, expertise, energy and a willingness to share information with their lake association or other lake users. The information gathered by the volunteers is used by DNR lake biologists, fisheries experts and water regulation and zoning staff, as well as by UW-Extension, lake associations and other interested individuals or parties. An "AIS Monitoring Procedures - CLMN Training Manual" is available at, http://www.uwsp.edu/cnr/uwexlakes/clmn/publications.asp; however, this is very detailed and technical. In addition, a username and password are required to login and report data on-line.

POLICIES AND LEGISLATION

Like Minnesota, Wisconsin also has an Invasive Species Council that was developed as a result of Executive Order 13112. All of Wisconsin's invasive species information, including a description of the council, can be found at http://www.dnr.state.wi.us/invasives/iscouncil.htm. The Wisconsin council is structured a little differently than Minnesota's. In Wisconsin, the council consists of government representatives from six departments, and seven other members appointed by the Governor for five-year rotations, representing public and private interests concerned with invasive species. Like Minnesota, Wisconsin's council is legislatively mandated and is re-

quired to develop four subcommittees on the following topics: education, research, regulation, and interagency coordination. For the management of invasive species in Wisconsin, the government has taken a cost-sharing approach in that it awards grants to public or private entities for up to 50% of the cost of a control project.

Wisconsin also has three main policies and laws that relate to invasive species, accessible at http://www.dnr.state.wi.us/invasives/laws.htm. These three items consist of two state laws and one state management plan. The first law is the Invasive Species Statute 23.22. This Statute is very similar to Minnesota's, with more focus on the aforementioned cost-sharing arrangement. It also requires biennial reports, rather than annual. The second piece of legislation is the Invasive Fish Species Statute 23.225, which makes it illegal to transport, possess, release, sell, or store any fish species or its eggs that has been classified as invasive. The final, most significant policy is the Comprehensive State Management Plan. This Plan only addresses aquatic species. The plan contains goals, and strategies and associated actions required to achieve them. It is strategy A for Goal 2, which has the most relevance for this discussion, as it requires the development of a classification process. This has led to the Wisconsin DNR's Proposed Invasive Species Identification, Classification and Control Rule. The Proposed Rule is available at http://dnr.wi.gov/invasives/classification/. Currently, this rule is in the public hearing process and the final draft is not expected until December of 2008 . The rule also addresses both aquatic and terrestrial species. If all goes well, it will become law shortly, and following this, a classification system similar to Minnesota's will be introduced, with listings of "prohibited" or "restricted" species. "Prohibited" will refer to species not already in the state, and staff will work to prevent their introduction, while "restricted" will refer to species already established, and staff will work to eliminate them. [Update: The Proposed Invasive Species Identification, Classification and Control Rule was registered August 2009]

One of the local engagement projects underway in Wisconsin is the **Invasive Plants of the Future Project**, available at http://www.dnr.state.wi.us/invasives/futureplants/index.htm. This project aims to identify, control, and monitor invasive species. Collecting and reporting guidelines can be found at http://www.dnr.state.wi.us/invasives/futureplants/reporting.htm and the Invasive Plant Report Form can be found at http://www.dnr.state.wi.us/invasives/futureplants/pdfs/ReportForm.pdf. Wisconsin also has a volunteer **Weed Watcher Program**. Anyone can register through the DNR to become a Wisconsin Weed Watcher, which means you can take care of a nearby area and watch for invasive species.

Poppy, Papaver *spp. (Photo: Milissa Elliott).*

The DNR will keep you informed of sites with target plants, invasive species websites, information resources, tips for collection, eradication, and other relevant topics. The Wisconsin Weed Watcher registration form can be found at http://www.dnr.state.wi.us/invasives/futureplants/pdfs/WeedWatchers_reg.pdf.

Wisconsin does not have the same focus on education as Minnesota. Without the education outreach component, there is a decreased likelihood that members of the public will learn about invasive species and engage in voluntary programs such as the Weed Watcher. While voluntary identification and control programs, such as this may be effective, there needs to be accompanying education and information mobilization on the level of that in Minnesota to increase awareness and encourage participation.

ALASKA

Alaska has developed one of the most extensive mapping and database inventories for invasive plants. The **AKEPIC Plant Mapping Project** has an inventory field data sheet available on-line (http://akweeds.uaa.alaska.edu). The program website provides a downloadable manual and training on invasive plant identification in the form of downloadable PowerPoint presentations. This is a comprehensive and well-maintained website.

The support for action on invasive plant species in Alaska is high and reflects the large amount of government funding relative to Canada. There are extensive resources to aid in plant identification, and Weed Identification Workshops can be requested.

3.1.2 EXISTING COMMUNITY-BASED PROTOCOLS FOR INVASIVE INSECTS

CANADA

The **B.C. Conservation Data Centre** provides forms for reporting rare butterflies and dragonflies (and plants) that can be adapted for invasive/ new species moving into the NWT (http://www.env.gov.bc.ca/cdc/contribute.html). For methods, see the Nature Serve Natural Heritage methodology website (http://www.natureserve.org/prodServices/heritagemethodology.jsp). We found this site to be quite challenging to navigate as there are numerous links to follow and we did not think that it was particularly accessible for a volunteer.

We consulted Dr. Corey Sheffield, a post-doctoral fellow in Prof. Laurence Packer's laboratory (Biology Department, York University), who suggested a very simple way to collect insects by using colorful plates intended to mimic flowers and attract insect. These are filled with salted water and left in a location for days to a week. The insects are then collected, stored in alcohol, and sent to experts for identification. We also consulted Prof. Andrew Donini (Biology Department, York University), who carries out research in comparative physiology and endocrinology of insects. He suggested that insects of concern could be placed in small vials and allowed to dry naturally before being sent to an expert.

UNITED KINGDOM

The **Harlequin Ladybird Survey** (http://www.harlequin-survey.org/recording.htm) provides a very simple recording form.

3.1.3 ANALYSIS OF EXISTING COMMUNITY-BASED MONITORING PROGRAMS

We found very few community-based programs targeted at detecting and monitoring invasive insects in comparison to the wide range of programs aimed at detecting and monitoring invasive plants. This is probably due to the challenges associated with monitoring the appearance and spread of introduced insects compared to plants. Plants are sessile and are more easily sampled and identified to genus and species, whereas insect identification to the genus or species level is much more difficult for a lay person, or even a biologist, who is not an entomologist by training or a specialist for a particular taxonomic group. None of the programs that we found and looked at were designed for early detection (finding, identifying) of species newly spreading into an area, be they invasive, non-native etc. Rather, we found that most programs were designed to identify sightings of previously identified invasive alien species, and that these programs are typically designed to be carried out by citizens who have some training, or at the very least might be dedicated field-naturalists. Furthermore, many programs required an on-line registration (including user name and password), were not particularly user-friendly and were not suitable for people who may wish to remain anonymous.

If the intent of a community-based program is to monitor the invasive species in the area that are already known, then a detailed information sheet must be made available for identification and little or no initial training (on-line or in person) of volunteers is required. However, if the intent is to detect newly arriving species, then based on our review, experts would need to be available to carry out taxonomic identification, either directly in the field, or from a remote location, most likely at a university or government laboratory, and that some initial training (either on-line or in person) would by necessary for volunteers. This is essential for avoiding over-sampling, or erroneous sampling and avoiding any further damage to the local native plant and insect populations. One possibility is that the Bioblitz programs could be used as a means of confirming species that turn up as a result of early detection programmes.

3.2 SURVEY OF COMMUNITIES

In total 60 survey responses were received (14, Fort Good Hope; 26, Fort Simpson; and 20, Inuvik). The comprehensive survey results are given in Appendix D. The results are charted for each question and a complete listing of the comments, including discussion points from the community dinners, are included.

Overall, the survey found that there was moderate knowledge and awareness of terms used in the invasive species field, and that the Environment and Natural Resources Department (ENR) was identified as the best place to get information about these species. The ENR was also the most likely organization that community members would notify if they saw a new species, and similarly, community members felt that the ENR was also the best group to pass on this information up the chain. Response was very strong (over 90%) that community members would be willing to report an introduced species if they found one. Although 60-80% of respondents were willing to provide information on habitat, location, a photo or description, fewer felt comfortable providing their name and contact information (48.3%), and even fewer were willing to providing GPS points (31.7%). Overall, 16.7% of respondents indicated that they would like an alternative language than English for reporting, though this response was as high as 35.7% in Fort Good Hope. Most community members had access to the Internet (83%), generally at home (70%).

The preferred method for reporting was generally "in person", though Inuvik respondents had a marginal preference for website reporting. However, in Fort Simpson and Fort Good Hope, reaching an expert directly and communicating by email were more popular choices than reporting using websites. Finally, respondents were willing to look for plants and insects (88.3%), and community members were divided about whether incentives should be provided (48.3% in favour and 45.0% not in favour).

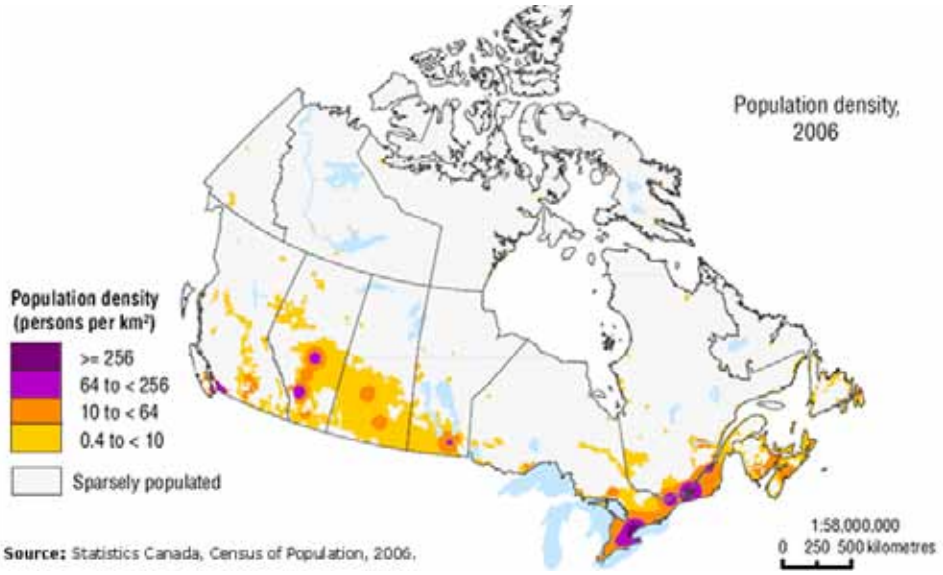
Fort Good Hope, Summer 2008 (Photo: Milissa Elliott).

4. DISCUSSION AND RECOMMENDATIONS

4.1 CITIZEN SCIENCE IN THE NORTHWEST TERRITORIES

Relative to nearby territories, provinces and states, current levels of local community-based activity relating to invasive species are limited. Most Canadians live within 100 km of the US-Canada border. This means that in the north, where there is lower population density (Statistics Canada, Figure 1), every pair of eyes is important when it comes to noticing the arrival of new species. Therefore, there is a higher need for citizen science in the north, relative to the south where increased densities allow for more experts and naturalists to undertake invasive species sightings work.

Figure 1. Density of Persons/km² in Canada in 2006. (Statistics Canada).



At the Yukon Invasive Species Symposium (http://www.yukoninvasives.com/), Yukon-based colleagues expressed a strong desire to see the level of community-based activity and engagement around the issue of invasives in the Yukon, reach that of British Columbia and Alaska. On the other hand, Dawn Bazely pointed out that, relative to the Northwest Territories, public engagement and outreach activities in the Yukon were at a more advanced stage, than many other provinces and territories! The length of time since program establishment, the capacity for local training, and the availability of expert knowledge all play important roles in determining the extent of community input to and support for mapping the appearance and spread of introduced species of both plants and insects. There are many successful community engagement activities and models from the Yukon, B.C. and Alaska, including those that partner with First Nations. For example, Ms. Merci Hillis, gave a presentation at the Yukon Invasives Symposium about her experiences (http://www.yukoninvasives.com/html/speakers.html*; See http://www.environmentyukon.

gov.yk.ca/wildlifebiodiversity/YukonInvasiveSpeciesSymposium.htm). "Merci is a member of the Gitxsan First Nation in the Fireweed Clan out of the Wiigyet House. She has worked on the Gitxsan Invasive Plant Program: Weeding Out the Invaders as the invasive plant identification technician since 2005. She has received training in invasive species identification, Invasive Alien Plant Program, IAPP, data management and inventory system and is certified as a Pesticide Applicator."

Many of the speakers at the Yukon Symposium expressed an interest in forming a regional invasives group. This approach would be beneficial for the NWT for two main reasons:

1. It was evident from symposium talks, that many of the invasive plant species of concern are similar across the region, e.g. sweet white clover (*Melilotus alba*).

2. The process of getting to where BC currently stands with its Invasive Plant Council, has taken many years. Therefore, it would make a lot of sense and have a lot of benefits for NWT to be part of a regional group addressing invasive species, so that NWT could benefit directly from the experience of nearby regions. Whether such a regional council deals with only plants or more taxa is immaterial – insects and others will be incorporated as they arrive, in the business of these and related groups.

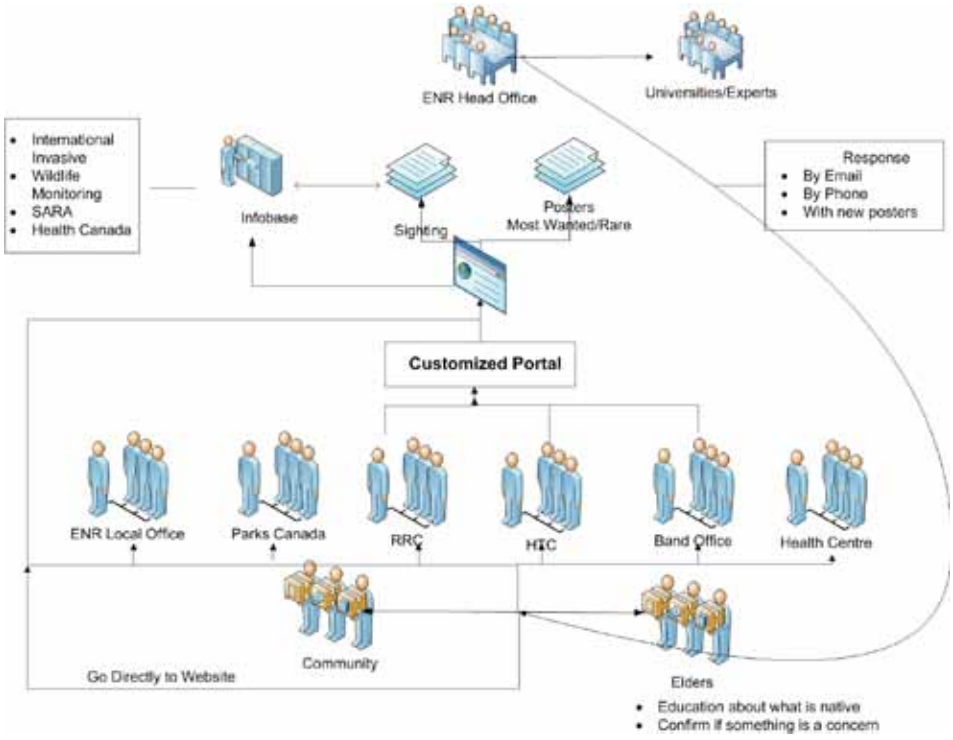
Local communities in the NWT are clearly interested in this issue. Capacity building will be required as well as clear reporting options, which are flexible enough to meet the needs of different local communities.

4.2 SUGGESTED PROTOCOL (TRAINING/EDUCATION, DATA ENTRY SHEETS, WEBSITE, INSTRUCTIONS)

The proposed data entry sheet for the suggested protocol is given in Appendix E. While the ENR was looking for a protocol for invasive plant and insect species, the researchers uncovered through community consultations that there is a desire by community members to have an outlet to share all changes being seen, and have these recorded – this includes sightings of invasive species and reports of changes to native ones. Presently, while large animal sightings are recorded by the ENR, there is no such outlet for native plants, small animals and fish, for example.

Therefore, the proposed protocol has flexibility built into it to ensure that all changes sighted by community members can be recorded in one place, and that no sighting will be turned away for lack of information. This is important when engaging with citizens who won't have much, if any, training working with protocols, since the proposed protocol is designed to not require training, so that truly anyone can use it. The process must not get frustrating or overly complicated. The traditional knowledge that is held by community members necessitates that the protocol record items such as traditional names, as well as provide an opportunity to highlight the changes being seen in native species. By ensuring ease of use, the protocol is designed to get maximum sightings recorded.

Based on the feedback received during the community consultations, the following is a flow chart of how the information gathered via a protocol for the Northwest Territories might make its way to the ENR.



First, it is important that there be multiple channels through which the information can be reported. Some community members preferred the option of filling out a form at home, on the Internet. Others will need the support of local offices, namely the ENR. Therefore, while we recommend that the protocol be one that is housed online, we recommend that paper worksheets also be created and that citizens have the option of visiting a local office to report their findings and observations. Since in some communities, the location of the ENR office is not accessible, creating a protocol with support from other offices, such as the RRCs is also advisable, since it will increase the chances of getting better uptake with citizens who prefer to report "in person". Similarly, it would be very useful to ensure that staff in other offices (i.e. the Band Office, Health Centre) are aware of the program. This will be important, because the protocol will rely to a high degree on citizen science, with participants generally likely to have little or no formal science training (in contrast to citizen science programs in other jurisdictions), and will ensure that staff can advise citizens appropriately. In this way, there will be increased assurance that when a sighting is discussed, someone will know to direct it to the ENR office or that ultimately the information will be recorded in the web portal.

There is a real desire by communities to hear back about the information that they provide to the ENR. Suggestions about how to undertake this in the community, are presented in section 4.4. However, community members also have good access to the Internet (70% have access at home) and so would be able to look at information for themselves. We therefore recommend that the protocol be tied to the NWT Species Monitoring Infobase. This database could be expanded to include the sightings/ protocol. In this way, citizens could look up species and view where other sightings have occurred. Tying the two systems together will serve numerous objectives. First, it will provide access to the Infobase that already houses information about which species are native or indigenous (information that was requested by community members, especially ones that are not local, are more web-savvy, and possibly educated). Second, it will allow citizens to see what others are reporting in neighboring communities, providing them with more information. Benefits of this would include local organizations and schools having access to what is happening in their community.

Finally, the protocol acknowledges that the ENR staff will not always be able to identify the species found by citizens. As such, building a network of university professors and research laboratories that can be contacted for identification and other supports, will be essential for ensuring the accuracy of information, and keeping

Training is not required to use the protocol and report a sighting. However, it is recommended in order to ensure that the maximum number of sightings get reported. While a high number of people would be happy to participate (based on the community consultations), this number would undoubtedly decrease with the inclusion of a requirement for training. Furthermore, creating training to use the protocol might deter participation, as citizens may feel unprepared. Instead, we recommend a protocol that allows for individuals to report at the scientific level that they feel comfortable with. Rather than suggesting exactly what training courses should be provided, we recommend that the program operate for one year, and identify where the gaps seem to be, and that appropriate programs then be developed to fill them. For example, to address a lack of insect sightings, a training program could be developed specifically for insects. Or programs might be targeted at communities with low participation rates. This said, training will be needed for ENR staff to be able to assist citizens when they come into the local ENR office (or equivalent) to report their sighting. The staff will need to be very familiar with the questions and the web portal to record the sighting.

Since the protocol has been designed to encourage the participation of all citizens, the main effort required will be to make citizens aware of the program and to get them engaged. As a result, numerous marketing strategies and tactics will be required. Depending on budgets, this could include commercials on radio and television, stories on local television news, in newspapers, as well as online outreach. Catchy posters will be helpful as well, including "most wanted" to educate the public about new invasives that they should be on the lookout for.

Another way to increase participation is for the ENR to provide action boxes for the communities. These boxes would contain items such as digital cameras, nets, vials for collecting samples, information pamphlets, etc. The equipment could be borrowed and used by participants to support and strengthen the data collection process.

4.3 QUALITY CONTROL (EVALUATION CRITERIA)

We propose the use of the following Evaluation Criteria for assessing existing community-based programs in other jurisdictions, that may be considered for inclusion in NWT community-based programs relating to invasive species, and for assessing newly developed protocols (see Table 1).

A) Does it have plain language instructions?

B) Method for reporting invasive (e.g. by mail, phone, on-line)?

C) Is training required? How much training (hours/weeks)?

D) Is equipment needed?

E) Effort required (time spent collecting – reporting: low, medium or high)?

F) Does it require Internet access?

G) Delivery procedure: are data sheets available?

H) Is the program contact information available – i.e. a specific person?

I) Are data publicly accessible?

In Section 3 we provided a brief description of each program that we examined. For ease of comparison of all programs on the basis of the above Evaluation Criteria, each program's characteristics are listed in Appendix A: Table 2.

4.4 REPORTING BACK TO COMMUNITIES

In our surveys, the sentiment expressed in every community was that it is essential to create and maintain a two-way flow of information between experts (Elders, scientists and ENR staff) and members of the community, in order to act on this issue (Appendix D). We therefore recommend that each sighting be given a Confirmation Number, so that accountability is built into the system. In this way, if a community member doesn't hear back about their sighting, they can follow up with ENR.

Other ideas for reporting back to communities include using the GPS information from the sightings to create maps for the communities. This could be done by the local ENR staff person and be used both as an awareness tool and as a way to further engage active citizen scientists. As Internet bandwidth improves in NWT, the ENR could consider making these maps interactive and available to the public.

Meeting the challenge of effective communication will be a large part of the successful implementation of an early detection and rapid response community-based protocol. However, the lessons learned about knowledge mobilization and reporting back to communities during the International Polar Year programme have improved the capacity of university-based scientists and various government agencies in this area.

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APPENDIX A – LITERATURE REVIEW

Table 1: Community-based programs and related websites

Forestry/ Wildlife	Location	Program Name	URL
All	Ontario, Canada	O.H.F.A. invasive species awareness program	*http://www.invadingspecies.com/Report.cfm*
All	Ontario, Canada	Observer Network	*http://observernetwork.eomf.on.ca/default.aspx**
All	B.C, Canada	NatureServe	*http://www.natureserve.org/prodServices/obsStandard.jsp*
All	North America	EMAN	*ttp://www.eman-rese.ca/eman/ecotools/protocols/terrestrial/exotics/intro.html**
All	North America	Nature Watch	*http://www.naturewatch.ca/english/plantwatch/*
All	Wisconsin, USA	The Citizen Lake Monitoring Network (CLMN)	*(http://www.uwsp.edu/cnr/uwexlakes/clmn/)*
Weeds	North America	The North American Weed Management Association	*http://www.nawma.org*
All	Minnesota, USA	Species ID Profiles	*http://www.mda.state.mn.us/plants/pestmanagement/misac/profiles.htm**
Weeds	Wisconsin, USA	Weed Watcher	*http://www.dnr.state.wi.us/invasives/futureplants/pdfs/WeedWatchers_reg.pdf*
Plants	B.C, Canada	Weeds BC	*http://www.weedsbc.ca/index.html*
Plants	N.S, Canada	Plant patrol NS	*http://www.plantpatrolns.ca/report/*
Plants	Wisconsin, USA	Invasive Plants of the Future	*http://www.dnr.state.wi.us/invasives/futureplants*
Plants	Ontario, Canada	Monitoring the Moraine	*http://www.monitoringthemoraine.ca/ProjectActivities/CommunityResources.htm*
Plants	Alaska, USA	AKEPIC mapping project	*http://akweeds.uaa.alaska.edu*
Insects	United Kingdom	Ladybird survey	*http://www.harlequin-survey.org/recording.htm*
Insects	B.C, Canada	BC Conservation data centre	*http://www.env.gov.bc.ca/cdc/contribute.html*
All	Yukon	Yukon Invasive Species Committee	*http://environmentyukon.gov.yk.ca/wildlifebiodiversity/invasivehelp.php*

URL checked in 2011 and link found to be broken

Table 2: Community-based programs Evaluation Criteria continued.

	Program Name/ Evaluation Criteria	A) Plain Language Instructions	B) Method for reporting (in person/on-line/email/mail/ phone/fax)	C) Training offered/ required	D) Equipments needed?	E) * Effort required (low, medium, high)	F) Does require internet access?	H) Delivery procedure/ data sheet?	I) Contacts of Program coordinators	J) Are data publicly accessible?
ALL TAXA										
	Nature Watch	Yes	On-line	No	No	Low	Yes	Yes	Yes	Yes
	Plant Watch	Yes	Mail/On-line	No	No	Low	Yes	Yes	Yes	Yes
	NAWMA	Yes	Email/Mail	No		Low	Yes	Yes	Yes	N/A
	BioBlitz	N/A	No	No	No	Low	Yes	No	Yes	N/A
	Observer Network	No	N/A	Yes	No	Medium	Yes	N/A	Yes	N/A
	CLMN	No	In person/ On-line	Yes	Yes	High	Yes	Yes	Yes	N/A
	BC Conservation data centre	Yes	Mail/Fax	N/A	Yes (GPS)	Medium	Yes	Yes	Yes	Yes (online)
PLANTS										
	AKEPIC Mapping project	Yes	Mail	Yes	Yes	Medium	Yes	Yes	Yes	Yes (online)
	Invasive plants of the Future WI	Yes	Mail	Yes	Yes	Low	Yes	Yes	Yes	N/A
	O.F.A.H. Invasive Species Awareness	Yes	On-line/Phone /Mail	No	No	Low	Yes	Yes (purple loostnife form)	Yes	Yes (online)
	Plant patrol NS	Yes	On-line	Yes	Yes (GPS)	Low	Yes	Yes	Yes (email)	Yes (map)
	Weed watcher, WI	Yes	Mail	Yes	Yes	Low	Yes	Yes	Yes	N/A
INSECTS										
	UK ladybird survey	Yes	Mail/On-line	Yes (online)	No	Low	Yes	Yes (online)	Yes	Yes (online)

***Effort required categories: High (more than 75 hours per year) intermediate (10-75 hours per year) Low (less than 10 hour per year) (EMAN, http://www.eman-rese.ca/eman/ecotools/protocols/matrix/intro.htm*).**

APPENDIX B – SURVEY QUESTIONNAIRE USED IN NWT

The government of the Northwest Territories has a Biodiversity Action Plan. As part of this plan they would like to increase their awareness of new species moving into the NWT. The government recognizes that members of local communities are in the best position to see changes and to understand them as they occur. The need for local communities to be involved is widely recognized around the world. The public desire for better management is growing and community members are often interested in helping to collect information. Furthermore, the body of professionals, however large, is limited in its ability to do this work.

For all questions, please check all that apply.

1. Which of these terms have you heard of?

- ☐ Invasive Species
- ☐ Non-Native Species
- ☐ Non-Indegenous Species
- ☐ Introduced Species

2. Where should you be able to go to get information about these species?

- ☐ Elders
- ☐ Band Office
- ☐ The Local Newspaper
- ☐ The Library
- ☐ Postings at The Northern Store or The North Mart
- ☐ The Local Environment & Natural Resources (ENR) office
- ☐ The Renewable Resources Council (RRC)
- ☐ Parks Canada
- ☐ The Health Centre
- ☐ The Internet
- Other_____

3. If you see a plant or animal that you have never seen before, who would you be most likely to tell or ask about it?

- ☐ Elder
- ☐ Teacher
- ☐ Someone at the community garden or greenhouse
- ☐ Environment and Natural Resources person (ENR)
- ☐ Renewable Resources Council person (RRC)
- ☐ Parks Canada person
- ☐ Someone at the Band Office
- ☐ RCMP
- ☐ Someone at the Northern Store
- ☐ Someone at the Health Centre

4. Would you be willing to report an introduced species if you found one?

☐ Yes ☐ No

5. Who do you think is the best person or group to pass on your information about the presence of introduced species to a program?

☐ Yourself, if there is an internet reporting form
☐ Elder
☐ Teacher
☐ Someone at the community garden
☐ Environment and Natural Resources person (ENR)
☐ Renewable Resources Council person (RRC)
☐ Parks Canada
☐ Someone at the Band Office
☐ RCMP
☐ Someone at the Northern Store
☐ Someone at the health centre

6. Which of the following information would you be willing to report?

☐ A description of the plant or insect
☐ Your Name and contact information for follow-up questions
☐ Photo
☐ Location
☐ GPS Point
☐ Habitat (i.e. lake, swamp, river, forest, tundra)

7. What language would you want to report the find:

Your own Language_____

☐ English

8. Do you have access to the Internet to report?

☐ Yes ☐ No

9. Where do you have access to the Internet?

☐ Home ☐ Library
☐ School ☐ Friendship/Welless Centre

10. What is your preferred option for reporting a new invasive species:

- ☐ Website
- ☐ In Person
- ☐ Email
- ☐ Guiding an expert to the location

11. Would you be willing to look for introduced species when you are out on the land?

- ☐ Yes
- ☐ No

12. Would you be willing to collect a sample of an introduced species if you find one?

- ☐ Yes
- ☐ No

13. Would you feel more comfortable or more inclined to participate in such a program if an incentive was offered? (i.e. t-shirt, baseball cap, toque, etc.)

- ☐ Yes
- ☐ No

14. Do you have any comments?

APPENDIX C – ARI LICENSE

SCIENTIFIC RESEARCH LICENCE
Licence # 14428N
File # 12 402 819

ISSUED BY: **Aurora Research Institute - Aurora College**
Inuvik, Northwest Territories

ISSUED TO: Dr. Dawn Bazely
York University
4700 Keele Street
Toronto, ON M3J 1P3
Tel: (416) 736-5784

ON: 10-Oct-08

TEAM MEMBERS: Milissa Elliot, Annette Dubreuil, Cecilia Tagliavia, Tony MOrris, Andrea Smith, ENR employee

AFFILIATION: York University

FUNDING: IPY (GAPS), ENR, GNWT

TITLE: Developing Options for Community-based Protocols to Detect Invasive Alien Plants and Insects in the Northwest Territories

OBJECTIVES OF RESEARCH:
The main objectives of this project are 1) to consult with communities about their views of community-based protocols for monitoring and reporting the presence and spread of introduced plant and insect species to the territorial government; 2) to determine community interest in developing or expanding local agricultural opportunities.

DATA COLLECTION IN THE NWT:
DATE(S): October 10 to October 23, 2008
LOCATION: Inuvik, Fort Good Hope and Fort Simpson

Licence Number 14428 expires on 31-Dec-2008
Issued in the Town of Inuvik on 10-Oct-08

Andrew Applejohn
Director, Aurora Research Institute

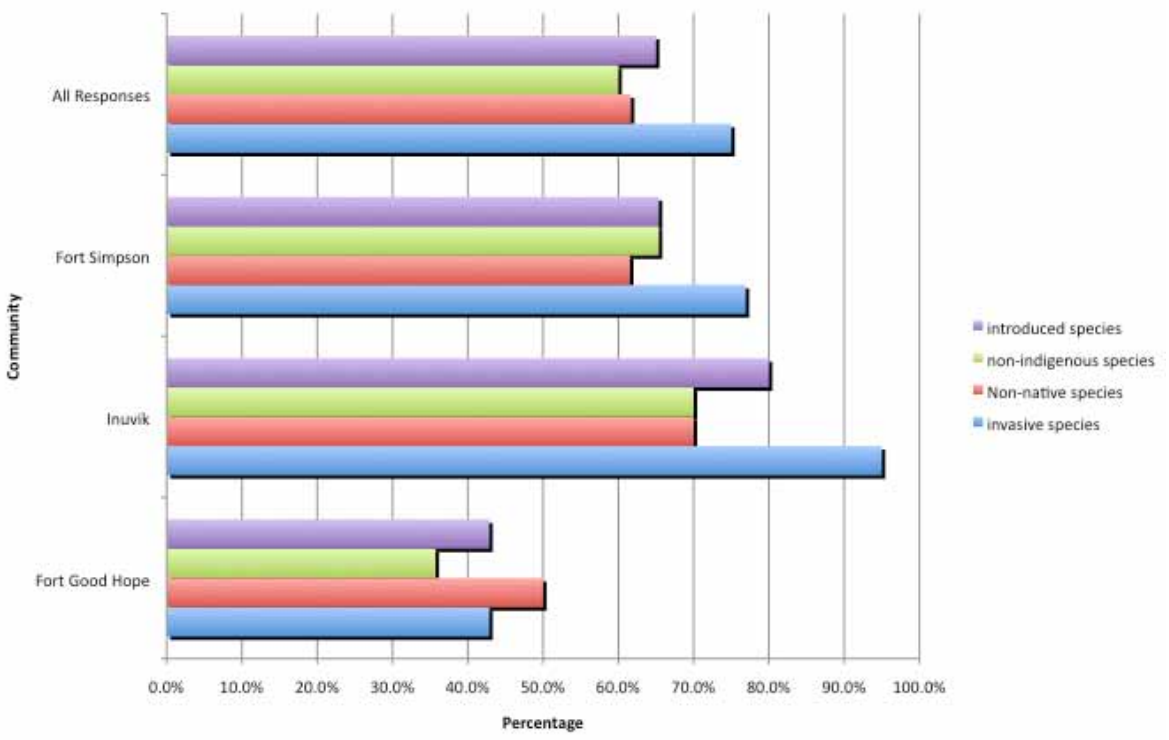
APPENDIX D – RAW DATA TABLES, CHARTS AND COMMENTS

Community Protocol Survey Results

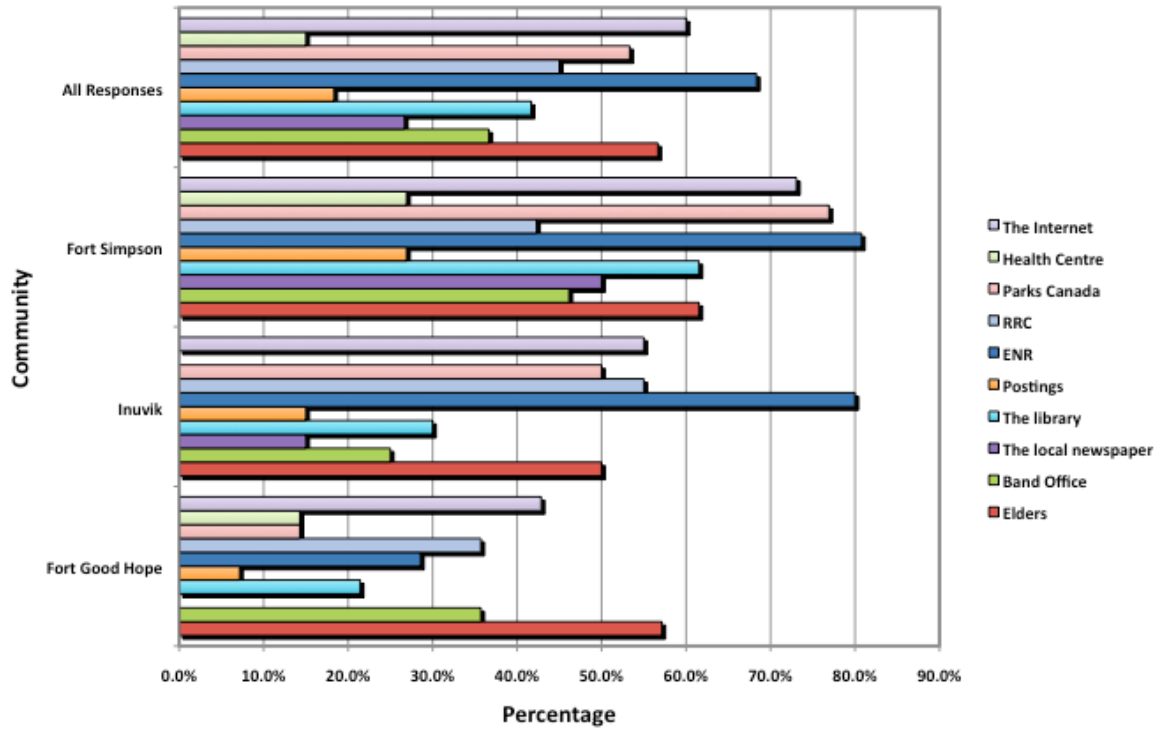
	Community Responses			Overall Results		
	Fort Good Hope	**Inuvik**	**Fort Simpson**	**All Responses**	**Median**	**Average**
#1 - Terms heard of						
invasive species	42.9%	95.0%	76.9%	75.0%	76.9%	71.6%
Non-native species	50.0%	70.0%	61.5%	61.7%	61.5%	60.5%
non-indigenous species	35.7%	70.0%	65.4%	60.0%	65.4%	57.0%
introduced species	42.9%	80.0%	65.4%	65.0%	65.4%	62.7%
#2 - Get information						
Elders	57.1%	50.0%	61.5%	56.7%	57.1%	56.2%
Band Office	35.7%	25.0%	46.2%	36.7%	35.7%	35.6%
The local newspaper	0.0%	15.0%	50.0%	26.7%	15.0%	21.7%
The library	21.4%	30.0%	61.5%	41.7%	30.0%	37.7%
Postings	7.1%	15.0%	26.9%	18.3%	15.0%	16.4%
ENR	28.6%	80.0%	80.8%	68.3%	80.0%	63.1%
RRC	35.7%	55.0%	42.3%	45.0%	42.3%	44.3%
Parks Canada	14.3%	50.0%	76.9%	53.3%	50.0%	47.1%
Health Centre	14.3%	0.0%	26.9%	15.0%	14.3%	13.7%
The Internet	42.9%	55.0%	73.1%	60.0%	55.0%	57.0%
#3 - Most likely to tell						
Elders	50.0%	45.0%	42.3%	45.0%	45.0%	45.8%
Teacher	0.0%	35.0%	11.5%	16.7%	11.5%	15.5%
Someone at the greenhouse	14.3%	25.0%	23.1%	21.7%	23.1%	20.8%
ENR	35.7%	90.0%	73.1%	70.0%	73.1%	66.3%
RRC	64.3%	40.0%	42.3%	46.7%	42.3%	48.9%
Parks Canada	14.3%	45.0%	57.7%	43.3%	45.0%	39.0%
Band Office	21.4%	5.0%	11.5%	11.7%	11.5%	12.7%
RCMP	7.1%	0.0%	3.8%	3.3%	3.8%	3.7%
Northern Store	0.0%	5.0%	3.8%	3.3%	3.8%	2.9%
Health Centre	14.3%	0.0%	3.8%	5.0%	3.8%	6.0%
#4 - Willing to report an introduced species?						
Yes	92.9%	95.0%	96.2%	95.0%	95.0%	94.7%
No	0.0%	5.0%	0.0%	1.7%	0.0%	1.7%
#5 - Best person to pass on information						
Yourself	50.0%	70.0%	46.2%	55.0%	50.0%	55.4%
Elders	50.0%	35.0%	23.1%	33.3%	35.0%	36.0%
Teacher	21.4%	30.0%	26.9%	26.7%	26.9%	26.1%
Someone at the greenhouse	14.3%	15.0%	7.7%	11.7%	14.3%	12.3%
ENR	35.7%	75.0%	76.9%	66.7%	75.0%	62.5%
RRC	57.1%	45.0%	38.5%	45.0%	45.0%	46.9%
Parks Canada	14.3%	45.0%	50.0%	40.0%	45.0%	36.4%
Band Office	21.4%	10.0%	15.4%	15.0%	15.4%	15.6%
RCMP	14.3%	0.0%	3.8%	5.0%	3.8%	6.0%
Northern Store	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Health Centre	14.3%	0.0%	3.8%	5.0%	3.8%	6.0%
#6 - Information willing to report?						
Description	71.4%	95.0%	76.9%	81.7%	76.9%	81.1%
Name and contact	28.6%	60.0%	50.0%	48.3%	50.0%	46.2%
Photo	35.7%	70.0%	69.2%	61.7%	69.2%	58.3%
Location	35.7%	65.0%	69.2%	60.0%	65.0%	56.6%
GPS Point	7.1%	45.0%	34.6%	31.7%	34.6%	28.9%
Habitat	42.9%	65.0%	61.5%	58.3%	61.5%	56.5%
#7 - Language						
Own	35.7%	0.0%	19.2%	16.7%	19.2%	18.3%
English	92.9%	100.0%	96.2%	96.7%	96.2%	96.3%
#8 - Internet						
Yes	64.3%	95.0%	84.6%	83.3%	84.6%	81.3%
No	35.7%	5.0%	11.5%	15.0%	11.5%	17.4%
#9 - Where						
Other (Work)	0.0%	15.0%	11.5%	10.0%	11.5%	8.8%
Friendship/Wellness Centre	14.3%	5.0%	7.7%	8.3%	7.7%	9.0%
School	42.9%	40.0%	11.5%	28.3%	40.0%	31.5%
Library	7.1%	30.0%	34.6%	26.7%	30.0%	23.9%
Home	50.0%	75.0%	76.9%	70.0%	75.0%	67.3%
#10 - Preferred option for reporting?						
Website	14.3%	50.0%	26.9%	31.7%	26.9%	30.4%
Email	21.4%	45.0%	50.0%	41.7%	45.0%	38.8%
In person	64.3%	45.0%	50.0%	51.7%	50.0%	53.1%
Guiding expert	50.0%	30.0%	42.3%	40.0%	42.3%	40.8%
#11 - Willing to look?						
Yes	85.7%	85.0%	92.3%	88.3%	85.7%	87.7%
No	14.3%	10.0%	7.7%	10.0%	10.0%	10.7%
#12 - Willing to collect a sample?						
Yes	100.0%	75.0%	92.3%	88.3%	92.3%	89.1%
No	0.0%	20.0%	0.0%	6.7%	0.0%	6.7%
#13 - Incentive						
Yes	78.6%	40.0%	38.5%	48.3%	40.0%	52.3%
No	21.4%	50.0%	53.8%	45.0%	50.0%	41.8%

CHARTS OF SURVEY RESULTS

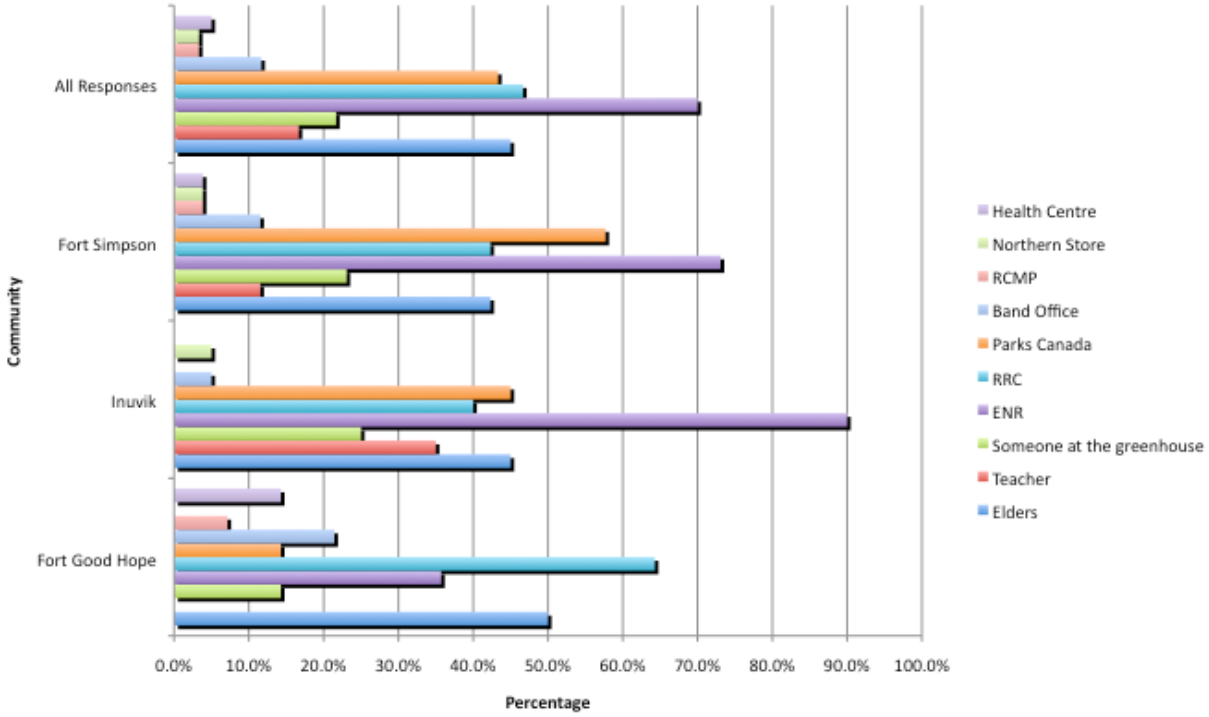
1. Which Of These Terms Have You Heard Of?



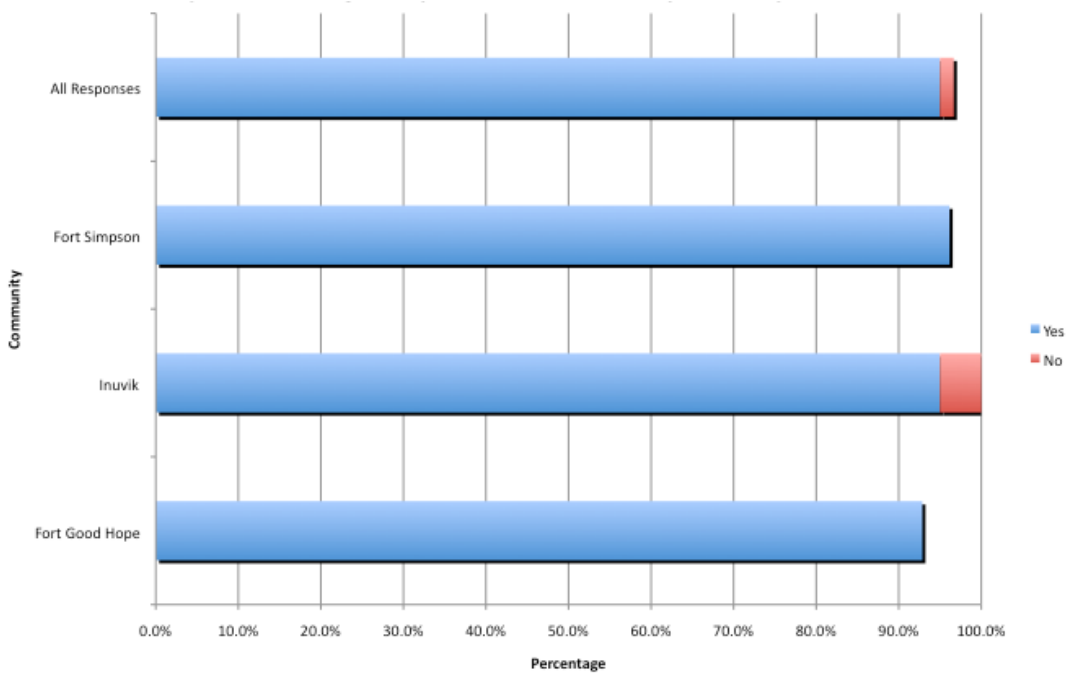
2. Where Sould You Be Able To Go Get Information About These Species?



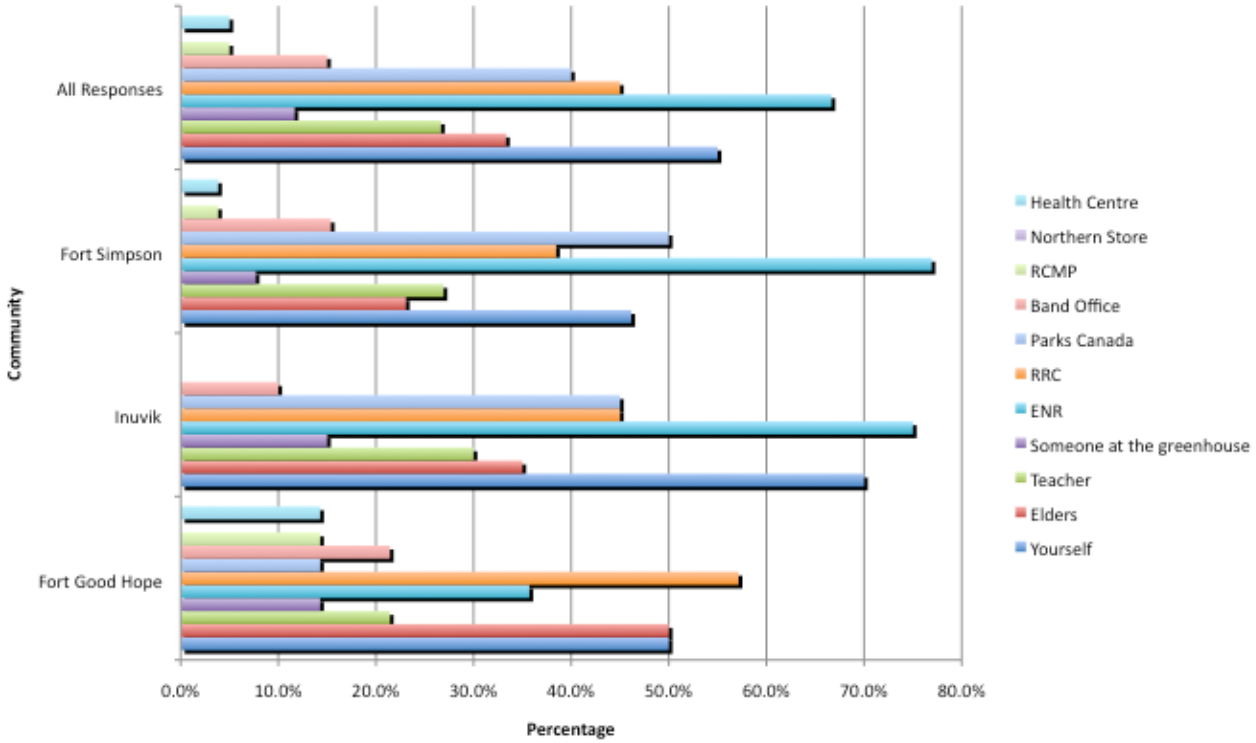
3. If You See A Plant Or Animal That You Have Never Seen Before Who Would You Be Most Likely To Tell Or Ask About It?



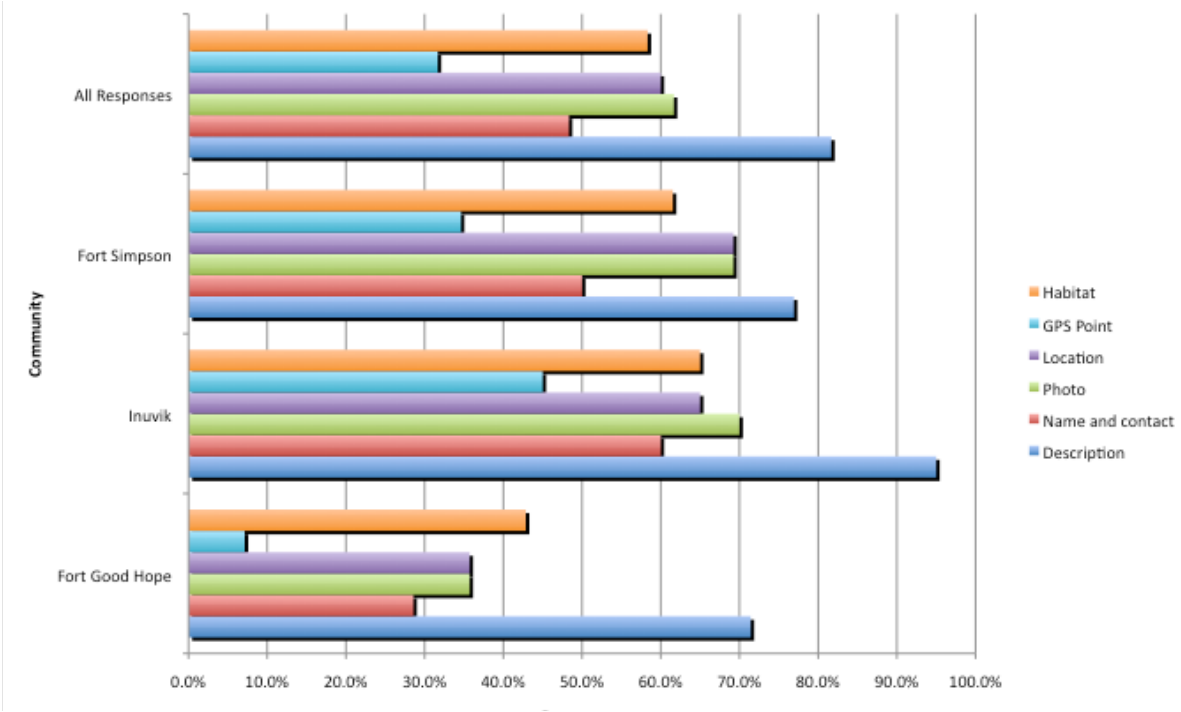
4. Would You Be Willing To Report An Introduced Species If You Found One?



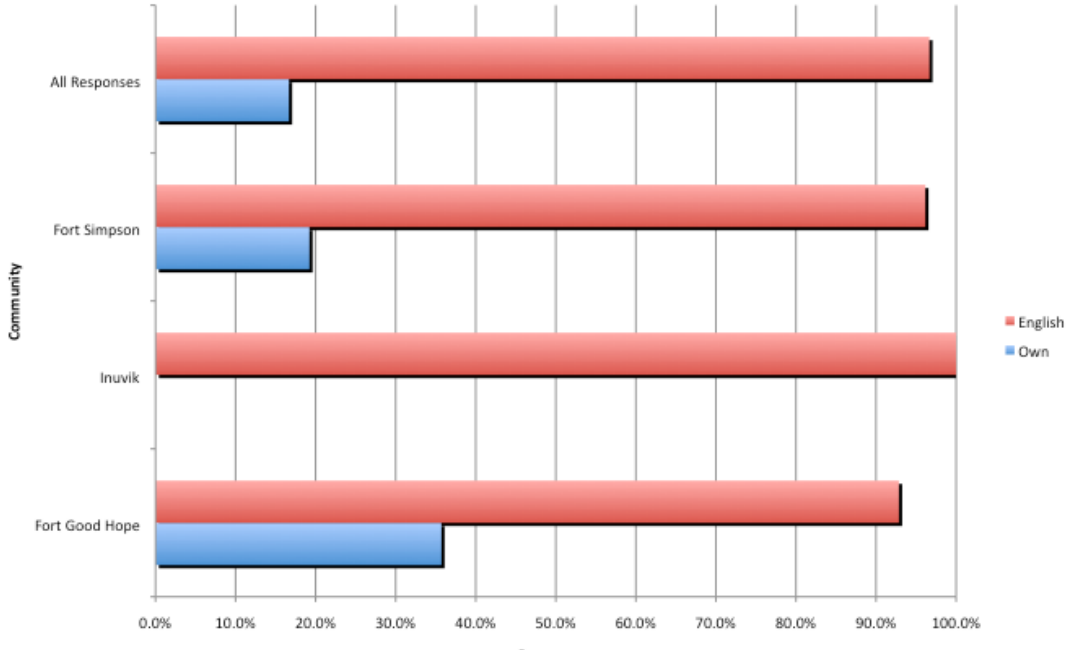
5. Who Do You Think Is The Best Person Or Group To Pass On Your Information



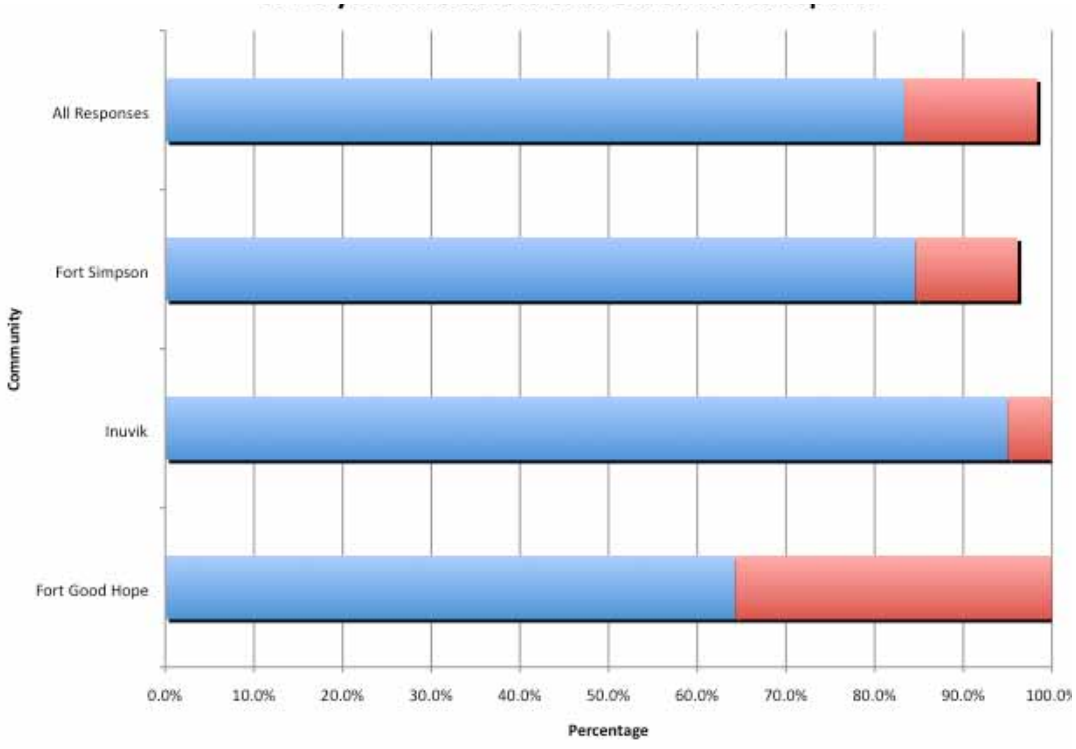
6. Which Of The Following Would You Be Willing To Report?



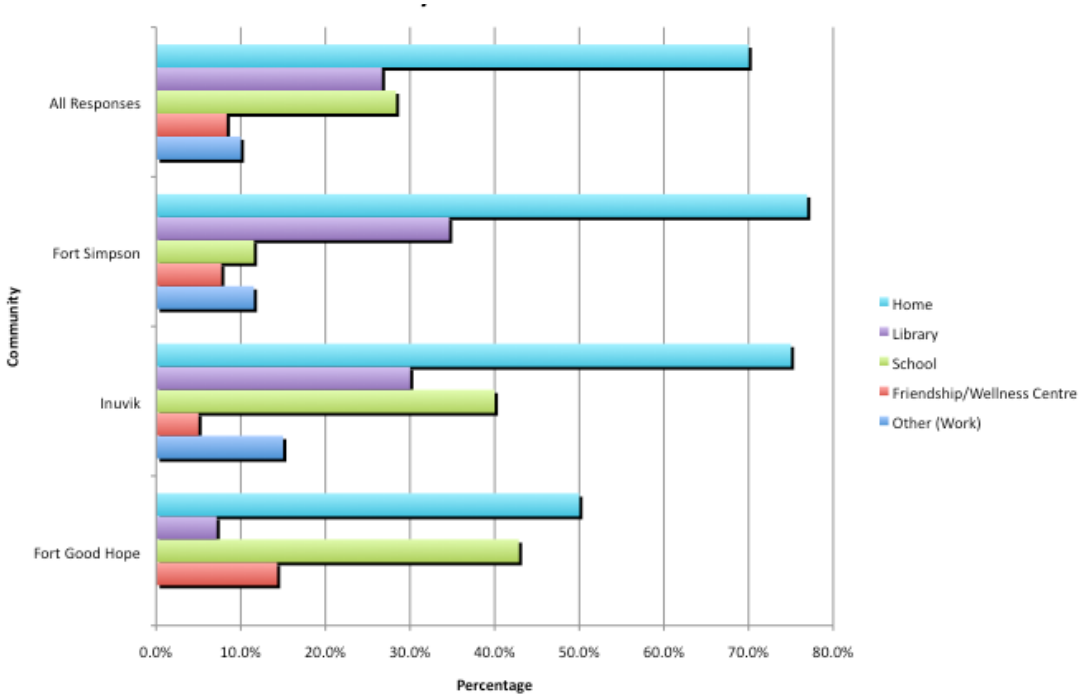
7. What language would you want to repost the find:



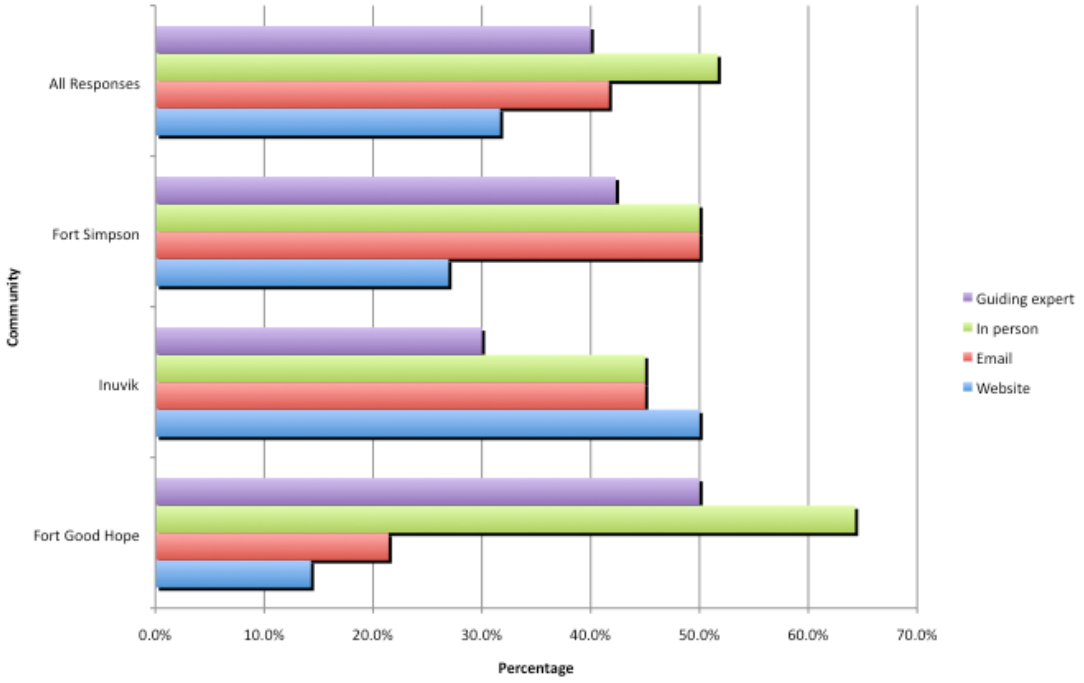
8. Do you have access to the internet to report?



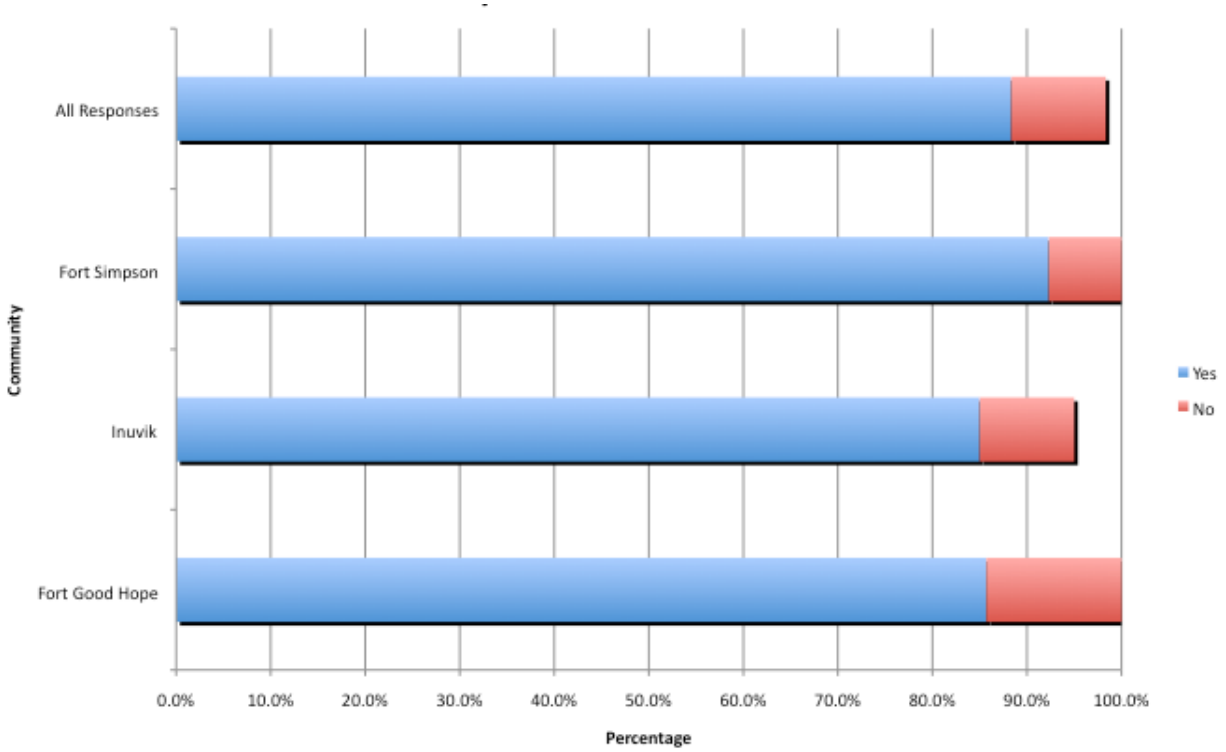
9. Where do you have access to the inetrnet?



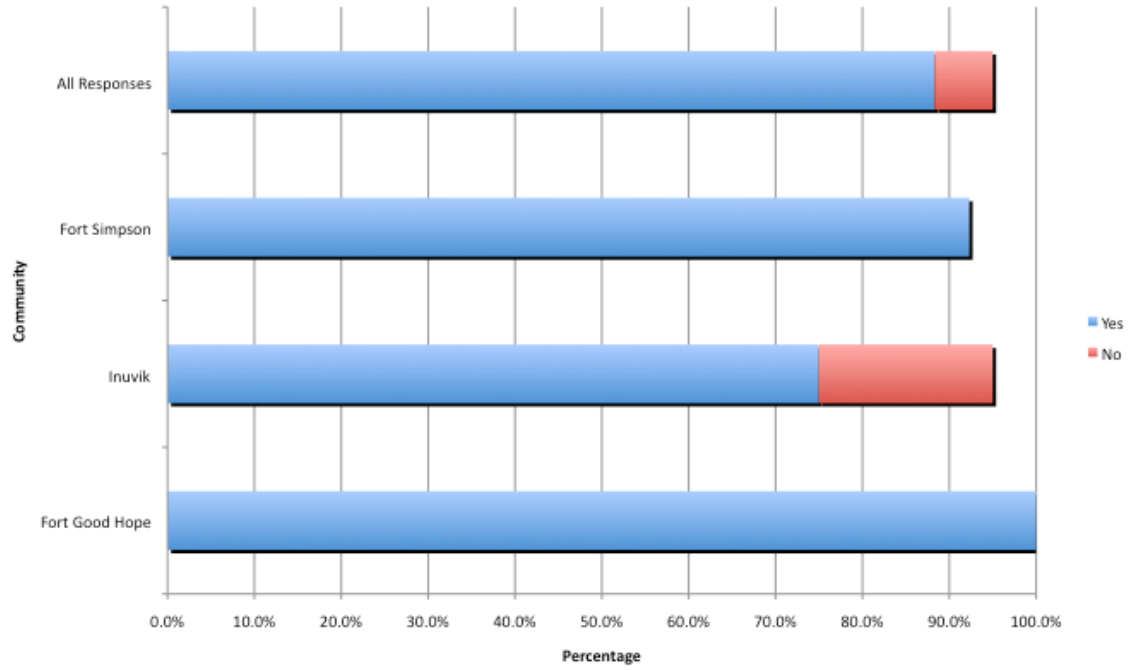
10. What is your preffered option for reporting a new invasive species



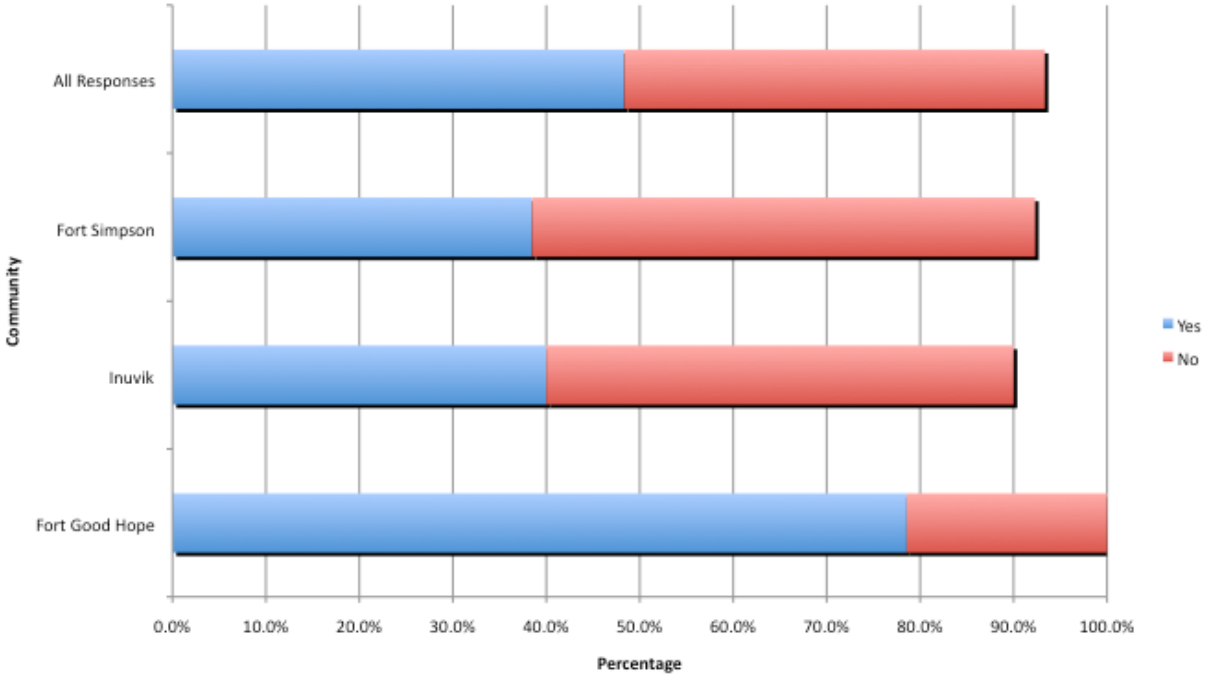
11. Would you be willing to look for introduced species when you are cut on the land?



12. would you be willing to collect a sample of an introduced species if you find one?



13. Would you feel more comfortable or more inclined to participate in such a program if an incentive was offered? (i.e t-shirt, baseball cap, toque, etc.)



COMMUNITY PROTOCOLS SURVEY COMMENTS

2. Where should you be able to go to get information about these species?

- Face-to-face with community members
- Radio (x2)
- College presentations
- Visitor Centre – summer
- Regional Wildlife Boards
- Hunters & Trappers (x2)
- Aurora Research Inst. (x2)
- Inuvik Comm. Greenhouse
- IRC
- TV
- Word of Mouth
- Other community bulletin boards
- Health centre if it affects health

3. If you see a plant or animal that you have never seen before, who would you be most likely to tell or ask about it?

- Aurora Research Institute

5. Who do you think is the best person or group to pass on your information about the presence of introduced species to a program?

- IRC
- Comment – Not the RCMP's mandate

6. Which of the following information would you be willing to report?

- GPS point, make sure you ask for datum of GPS points!

7. What language would you want to report the find:

- Would be good to have native/aboriginal language translated info brochures
- Gwich'in (x3)
- Inuvialuktun
- South Slavey
- Aboriginal dialects should be available
- French
- Slavey

9. Where do you have access to the Internet?

- Work (x6)

11. Would you be willing to look for introduced species when you are out on the land?

- Just for moose

12. Would you be willing to collect a sample of an introduced species if you find one?

- Maybe - depending what it is and how to preserve

13. Would you feel more comfortable or more inclined to participate in such a program if an incentive was offered? (i.e. t-shirt, baseball cap, toque, etc.)

- No answer, other than "not necessarily"
- Yes and "anything"

14. Do you have any comments?

- It would be very good to have a website where you can report anything new that you have not seen before.

- I think that this program is very important, because our livelihoods depends on the research done. It is also important that the research be done, because of the exploration work that is happening, on our land.

- It would be great to have some means of reporting back to people that i.e. 5 hummingbird moths have been spotted in 2007 or so people would like to know what is being spotted and how often. There has to be feedback - if the program is to be successful

- I don't think we should encourage people to pick/remove unknown species in case they are not invasive but rare. It's good to point out that invasive non-native wildlife species may follow these non-native plant/insects as people up north are really concerned about their wildlife. RRCs are not working at full capacity and ENR is busy but there are regional co-management boards that work directly with RRCs and can help with reports of invasive species. Handout of common invasive species would be good for communities. Where will the "invasive kits" be located?, and any training to use GPS. Any school/youth programs/presentations? Any ENR regulations?

- I have a degree in Environmental Science, therefore I am comfortable with vegetation ID, collecting samples, etc. I like the idea of the card with invasive and rare species. The ENR person in each community will be a VERY important part of your communication chain in putting out information on what to do when you find a rare species, and in teaching them ho to upload things to a website.

- Offering suggestion of who to report to needs to be only to agencies or groups who have this mandate. The RCMP have a mandate of dealing with crime. They have neither the time, nor the inclination to deal with issues that do not fit within their mandate. Seeing the RCMP on the list may lead community people to believe that they should report there. You could loose the information when the RCMP send them away. Have one reporting site for plants, insects, animals, etc. People then only have to go to one site or agency to make a report.

- liz.gordon@irc.inuvialuit.com
- I believe this project is very good for us and our land and I would be willing to help in any way I can
- Would not feel inclined unless they were fatal to someone or wildlife
- What is the best reseeding mixture for our location in the ISR or GSA and where can we get that info?

- I believe this is a good initiative, but I'm skeptical that a lot of information will be collected. I have experience in trying to get reports of unusual species and find a very low response rate. Also, many reports of unusual things turn out to be relatively common species that had just not been noticed before. It is my experience that the most knowledgeable local people are not likely to use a web-based system. Talking one on one is usually a much better approach when possible.

- Protecting the environment/land should not need any incentive

- Finding new species must be reported - public knowledge; Let the public be aware of where they can report such sightings

- In order to know what is introduced, we would need to know what is indigenous

- How can I identify a new specie if I am new in this area and don't completely know what is the natural habitat. Do you have a reference book showing the original plants? We need more tools to be able to help in searching.

- Enjoyed the presentation! It is a good idea to include members of the community to help out with this ongoing project. Hope we can make a difference.

COMMUNITY PROTOCOL SURVEY DISCUSSION COMMENTS

FORT GOOD HOPE

- People should go straight to ENR or the RRC
- We've seen magpie birds
- Should be able to upload information on a website
- Should be able to both use a website or see somebody in person
- We need to be educated, so that we know what we are looking for
- The program needs to be centered in the community – i.e. training for what
- to do with the information. Maybe we should send people to get training.
- There should be books or a book at the library
- What effects is the exploration work having?
- Could use "wanted" posters
- Reclamation – seeds are being brought in from outside the territory
- A few years ago there were a lot of caterpillar larvae on plants, and the birds weren't eating them
- Elders need education to know what questions to ask
- Need berry pickers, fishermen and hunters on board
- Need to exchange information with other communities – some sort of alert system
- Should use the radio
- Flyers are a good idea
- Must have transparency – to get answers back

INUVIK

- Strange tree spotted on the side of the road
- Would be good to have some sort of action kit, which you could lend out from RRC or ENR and would come with a digital camera, vials or envelopes for samples, GPS, nets for collecting insects, tags for identifying samples, etc.
- GRRB
- The Infobase is buried in the ENR website – very difficult to find.
- Skill set of staff is not being fully used – they have greater capacity than what their job allows for them to do – i.e. biologists could be supporting education and reporting about new species that might be invasive

FORT SIMPSON

- Need to know what the native species (plants and insects) are seeing lots of new animal species – deer, cougars
- Steve Gooderham
- ENR Ft. Simpson has ideas on how to support the development of a native seed mix in Ft. Simpson
- Have a system for allowing individuals who want to report something new, but do not want to reveal the exact location.
- This could include giving kilometer markers from the highway and latitude and longitude of an area rather than a specific point. The other option is a map that can be clicked on to identify the eco-zone using a website.
- The Ft. Simpson ENR office has the skills to identify most species, but is also willing to contact other to indentify unknowns.
- There are existing programs available through ENR to involve local school children in forestry activities (e.g. management, identification, and forest health).

APPENDIX E – SUGGESTED DATA ENTRY

***Must be filled out. Yellow highlighted text indicates what could be included as a thread/forum on the database.**

Who are you? – Contact Information

1. *Do you want to be contacted with the identity of the species? **YES OR NO**
2. *Can we contact you to obtain more information that might help us identify the species?

YES OR NO

If you answered Yes to one of these questions, please supply us with your name and how you'd like us to contact you. If your contact information is for work, please provide us with the organization.

Name _____

Organization _____

How should we contact you?

Mail _____

Phone/Fax _____

Email _____

What did you see? – Species Information

*Group (Flower, Tree, Shrub, Weed, Grass, Insect, Bird, Fish, Mammal...)

Common Name

Traditional Name

Scientific Name

Picture (Upload button)

Description

Sample being sent in

When was it sighted? – Date

*Date (month minimum)

Where was it sighted? – Sighting Location

*Region

Community

KM Posts - GPS Point / Range (identified in person at ENR office)

Description of the Location (i.e. traditional location name)

EcoRegion or Ecozones (Button with further information)

Why were you concerned?

New to NWT – I've never seen this before

Moving in NWT – I've seen this in other places, but never here

Rare Species Sighting (if the form were to be used for rare species sightings)

Changing OR Causing Problems (allowing monitoring of change, i.e. with large species)

strange looking ... it is changing from how it looked in the past (maybe it is sick)

changing habitat (i.e. taking over blueberry patch)

I'm seeing less/more

Making me sick

Ugly/Unsightly (may affect tourism)

How many did you see? – Population Information (To calculate approximate density)

Number of Individuals (<5, 5-10, 10-100, too many to count)

Size of Area (where the species was seen)

Percentage Cover

Enter –> Confirmation Number

(which can be used to access the status of the inquiry, i.e. "In transit", "Under Review by ENR", "Under Review by an Expert", "Identified")

APPENDIX F – LIST OF EXPERTS CONSULTED FOR THIS REPORTSHEET

Mr. Bruce Bennett
Wildlife Viewing Biologist
Yukon Department of Environment
Wildlife Viewing Program V5A
Box 2703
Whitehorse, Yukon, Y1A 2C6
Bruce.Bennett@gov.yk.ca

Dr. Andrew Donini
Biology Department
York University
4700 Keele Street
Toronto, Ontario M3J 1P3
adonini@yorku.ca

Mr. Bob Drinkwater
Invasive Plant Specialist
British Columbia Ministry of Forests and
Range: Range Branch
1st Floor, 1011-4th Avenue
Prince George, British Columbia V2L 3H9
Bob.Drinkwater@gov.bc.ca

Dr. David A. Galbraith
Head of Science
Royal Botanical Gardens
Hamilton & Burlington, Ontario
dgalbraith@rbg.ca

Ms. Sonja Leverkus
Range Agrologist / Tenures Forester
BC Forest Service
British Columbia Ministry of Forests and
Range
6100 Alaska Highway
Fort Nelson, British Columbia V0C 1R0
Sonia.Leverkus@gov.bc.ca

Dr. Cory Lindgren
Senior Program Specialist, Invasive Plants
Invasive Alien Species Section
Plant Health Division
613-269 Main Street
Winnipeg, Manitoba R3C 1B2
lindgrenc@inspection.gc.ca

Dr. Steven Seefeldt
Research Agronomist
United States Department of Agriculture
Agricultural Research Service
Subarctic Agricultural Research Unit
355 O'Neill Boulevard UAF
905 Koyukuk
P.O. Box 757200
Fairbanks, Alaska 99775-7200
sseefeldt@pw.ars.usda.gov

Dr. Corey Sheffield
Post-doctoral Fellow
Biology Department
York University
4700 Keele Street
Toronto, Ontario M3J 1P3

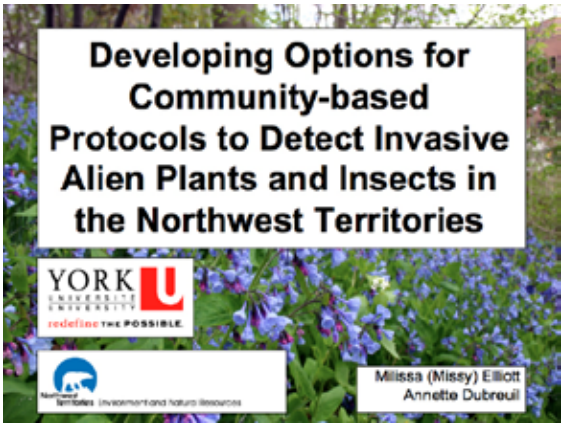
Dr. Andrea Smith
Post-doctoral Fellow
Institute for Research and Innovation in
Sustainability
349 York Lanes, York University
4700 Keele Street
Toronto, Ontario M3J 1P3

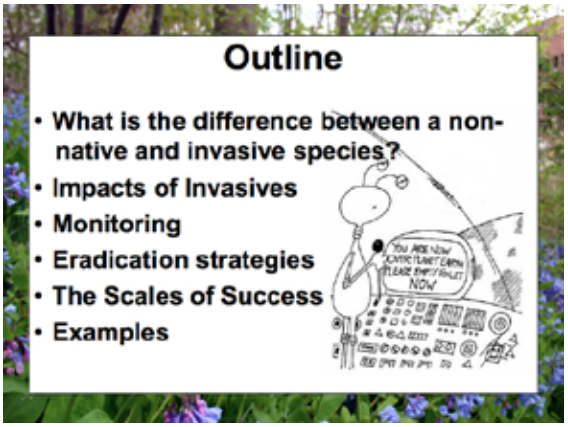
Ms. Gail Wallin
Executive Director
Invasive Plants Council of British Columbia
#104 - 197 North Second Avenue
Williams Lake, BC V2G 1Z5
info@invasiveplantcouncilbc.ca

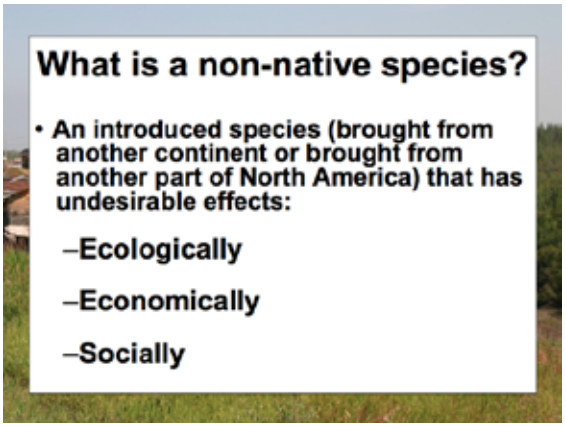
Dr. Randy Westbrooks
Invasive Species Prevention Specialist
National Wetlands Research Center
U.S. Geological Survey
Biological Resources Discipline
233 Border Belt Drive - P.O. Box 279
Whiteville, North Carolina 28472 USA
rwestbrooks@usgs.gov

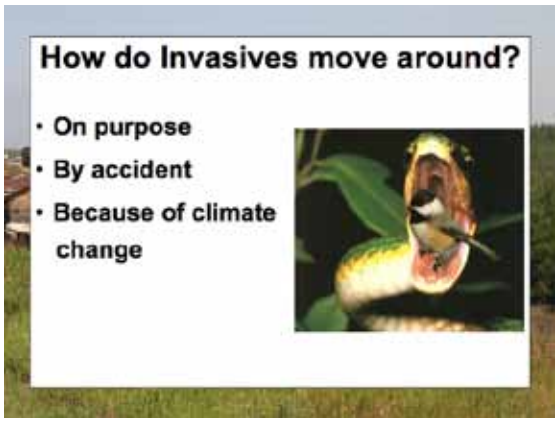
Dr. Tricia Wurtz
Ecologist
USDA Forest Service, State and Private
Forestry
Forest Health Protection, Fairbanks Unit
3700 Airport Way,
Fairbanks, Alaska 99709
twurtz@fs.fed.us

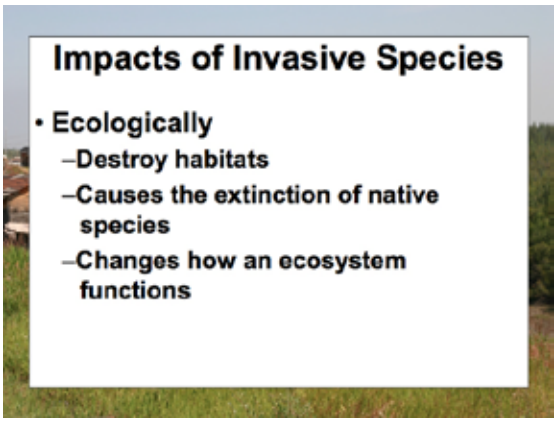
APPENDIX G – TEXT OF POWERPOINT PRESENTATION SHOWN AT COMMUNITY CONSULTATIONS











Impacts of Invasive Species

- Economic Costs
  - –Canada
    - Between $13.3 and $34.5 billion dollars spent controlling introduced species per year
  - –USA
    - ~$138 billion dollars spent per year

Impacts of Invasive Species

- Possible Social Impacts
  - –Could affect the food we eat (moose, caribou, fish)
  - –Impacts on our health in relation to Climate Change (e.g. West Nile)
  - –Lost incomes and reduced land values
  - –Loss of traditional medicinal plants

Introduced species in NWT

- Total of 107 species non-native species, some of which
  - –3 Birds
  - –1 Fish (Rainbow Trout)
  - –1 Butterfly (Cabbage White)
  - –102 Plants

Government of the Northwest Territories. NWT Species Monitoring – Infobase. Resources, Wildlife and Economic Development, GNWT, Yellowknife, NT.

AN INVASIVE ALIEN SPECIES STRATEGY FOR CANADA

- Integrating environmental considerations into decision-making
- Respond more rapidly to new invasions and pathways of invasion
- Strengthening programs to protect natural resources
- Maximizing collaboration between adhoc and regional/issue specific efforts

Eradication

- The removal of every individual and propagule of an invasive so that only reintroduction could allow its return.
- To date the only successful eradications have occurred on isolated islands.

Eradication Strategies

- Prevention
- Early Detection
- Rapid Response
- Control and Management
- Restoration and Rehabilitation

The Scales of Success

- Ecosystem
  - Aquatic or terrestrial
- Biome
  - Political boundaries
- Global
    - The majority of successful eradication are not published

IRIS
INSTITUTE FOR RESEARCH AND INNOVATION IN SUSTAINABILITY

Northwest Territories Environment and Natural Resources