



Report #2

Assessment of Models for the Collation and Communication of Information on the Economic Impacts of Invasive Plants





Executive Summary

This report summarizes the benefits of improved awareness of economic impact information for invasive plants, provides examples of available economic impact information as well as its effective use around the world, and identifies gaps in the existing knowledge base for BC. It concludes with two key recommendations for the Invasive Plant Council of BC about the type of information required and how to access and communicate it.

This report's recommendations are divided into two main parts:

1. Collate economic impacts information

- a) Conduct a thorough review of all available data and information on the economic impacts of invasive plants and create a comprehensive reference list and document compendium.
- b) Develop a document that collates the most effective elements of the existing knowledge base into a summary document of 'facts and figures' that can be used by a wide variety of people and groups.
- c) Conduct an economic impact analysis of all currently available data in BC relevant to invasive plant management costs, lost production values for all sectors, environmental impacts, and social impacts to provide a more comprehensive summary of current economic implications for BC.
- d) Model the current and potential distributions, and current and potential management costs and loss of revenues, created by approximately six priority invasive plant species.

2. Communicate economic impacts information

- a) Commence a collaborative project between the provincial government and the Invasive Plant Council to develop an Invasive Plant Information Network for British Columbia that would provide, through a website:
 - i) the summary of economic 'facts and figures' with links to reference sources;
 - ii) the economic impacts reference list and document compendium;
 - iii) contact details for all invasive plants groups, organizations, and contact people in BC; and
 - iv) information on invasive plant training sessions, workshops and conferences, funding opportunities, legislative changes, media releases, new research, and publications.
- b) The Invasive Plant Information Network for British Columbia would be requested, as more information becomes available, to:
 - i) develop and distribute brochures and posters on the economic costs of invasive plants to BC;
 - ii) develop a steady supply of media releases focusing on the economic impacts of invasive plants in BC; and
 - iii) create and distribute a BC-wide invasive plant newsletter, with frequent reference to economic impacts, particularly by industry type.

The report also includes an extensive summary of relevant research for reader reference.

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Introduction

This report investigates potential methods to improve the way in which data and information on the economic impacts of invasive plants are accessed and used in British Columbia. Economic impacts can include agricultural, environmental, and societal costs directly attributable to invasive plants as a result of lost production values, management costs, and reduced environmental and amenity values. This report outlines the benefits of improving the way in which economic impact information is applied, investigates how this is done effectively elsewhere, provides examples of the type of economic impact information currently available, and identifies gaps in the existing knowledge base for BC. Finally, recommendations about the type of information required, and methods to access and effectively communicate it are provided.

The intent of this report is consistent with the objectives of the *Invasive Plant Strategy for British Columbia* (Fraser Basin Council 2004). Two of the eight objectives listed on page four of the strategy are to: (a) Help ensure secure, stable, and long-term funding, resources, and staffing for the coordination and implementation of invasive plant management in British Columbia; and (b) Increase public awareness of the impacts of invasive plants and management strategies for their prevention, detection and control. This report is designed to assist in meeting these objectives.

Why Do We Need This Information?

Invasive plants are often cited to be second only to land clearing and habitat destruction as the most threatening process to biodiversity. However, general understanding by the broader community and current investment levels by governments do not match this position. Successful management of invasive plants requires long-term strategic planning and an adequate level of investment.

Demonstrated examples have shown that improving the way in which the real cost of invasive plants to society are communicated is one of the most effective ways to increase the level of awareness and understanding by the broader community, influence decision-makers, and create change in the allocation of resources. This report was designed to assist in the building of a better 'business case' for investment in invasive plant management.

The objectives of this report are to:

- Outline the benefits of improving access to and use of data on the costs of invasive plants;
- Investigate effective models currently in use elsewhere;
- Provide examples and a reference list of Canadian and international information;
- Provide a baseline collection of available BC information;
- Identify gaps in the existing BC knowledge base; and
- Recommend an approach for information collation and communication.

The purposes of the Invasive Plant Council of British Columbia are to educate the public and professionals about invasive plants and their risk to the world's ecosystems, conduct research relating to invasive plants and make the results of this research available, and carry out other activities that support education and research.

Case Study

Salinity costs Australia \$200 million annually but receives substantial community recognition and annual expenditures of \$1.4 billion, more than ten times the expenditure on invasive plants. However, the annual cost of invasive plants to Australian agriculture alone has been estimated to exceed \$4 billion.

The Australian Prime Minister's Science, Engineering and Innovation Council in May, 2002 stated that limiting the spread of pests, weeds, and imported diseases to be one of four areas of investment likely to return the greatest impact.



What Information Is Available?

An on-line literature review of North American material relevant to invasive plants reveals that there is a vast array of textual information available on the economic impacts of invasive plants. However, the majority of it (and particularly for Canada) is in the format of generalized information that contains references to economic impacts interspersed with other information, as opposed to specific documents dedicated to economic impacts.

Many documents refer to general impacts of invasive plants, such as:

- loss of animal habitat;
- decreased water quality and fish habitat;
- increased wildfire hazard;
- losses in crop quality and yield;
- costs of control (chemical, mechanical, biological, and other methods) in croplands, pastures, public spaces and natural areas;
- restoration of degraded areas following control;
- regulatory costs;
- cost of human and animal health treatment; and
- loss of revenue due to declining recreational values of water bodies or increased costs of maintaining quality of habitat.

Broad statements such as these, while an accurate reflection of the impacts of invasive plants, tend not to be as effective as specific statements, such as the loss of agricultural or forestry revenue, the management costs created by a particular species, or the expenditure saved by the effective bio-control of another species.

The following sections provide some examples of economic impact information that is available at an international level, in Canada and in British Columbia. It is not designed as an exhaustive list of available economic impacts information; it is a snapshot of the scope and nature of information that is currently available. A more detailed reference list is provided in Appendix 1. Most of the information from different parts of the world and in the reference list in Appendix 2 focuses on the economic impacts of invasive plants on agricultural or production values, and the management costs of invasive plants impacting these industry sectors. Far less data are available on the economic, social, and environmental impacts and management costs of invasive plants on social (amenity), recreational, health, or biodiversity values. It is acknowledged that it is far more difficult to place a dollar amount on values such as these, which will be reflected in the relative degree of difficulty of achieving some of the report's recommendations.

International Information

United States

The **National Invasive Species Information Center**, available on the US Department of Agriculture website (www.invasivespeciesinfo.gov/), provides information, including a section of Economic Impacts Spotlights, such as:

- Pimentel et al. (2005) estimated that the total costs of

invasive species in the United States amount to more than \$100 billion each year;

- Invasive species impact nearly half of the species currently listed as threatened or endangered under the US Federal Endangered Species Act (Pimentel et al. 2005); and
- Purple loosestrife can produce up to 2.7 million seeds per plant yearly and spreads across approximately 1 million additional acres of wetlands each year, with an economic impact of millions of dollars.

The US Office of Technology Assessment (1993) estimated that the total direct costs due to weeds in the United States are \$3.6 to \$5.4 billion annually; indirect costs related to environmental impacts, human health, regulatory, and other factors are perhaps an additional \$1 billion annually.

Australia

The **Cooperative Research Centre** (CRC) for Australian Weed Management often refers to invasive plant impact and cost 'facts and figures' in many of its general publications, such as:

- Biocontrol of rubber vine has provided a net value of \$232.5 million through a total investment of \$3.6 billion over 21 years, providing a benefit-cost ratio of 108:1 (*weedwatch* newsletter, March 2006);
- A review of 24 biocontrol programs over a 103 year period delivered a total average annual benefit of \$95 million, for an annual average investment of \$4 million, giving an overall average benefit-cost ratio of 23:1 (*weedwatch* newsletter, March 2006); and
- Weeds cost Australian farmers 14 percent of their income; a new report by the Weeds CRC confirms that weeds are causing a loss of \$1 in every \$7 of agricultural income (*weedwatch* newsletter, July 2004).

The CRC also produces a Technical Series of reports that focus on the economic impact of invasive plants (CRC Technical Reports: www.weeds.crc.org.au/publications/technical_series.html).

Information from Canada

The **Invasive Plants of Canada website** (www.plantsincanada.com/) is an initiative of the National Botanical Services and contains helpful links and reports, with a series of 14 fact sheets. Each fact sheet contains a section on environmental and economic impacts; for example:

- **Leafy spurge** has been recognized as a major alien pest on the Canadian prairies. Its persistence and difficulty in eradication makes control in areas of high infestation costly and difficult. In the United States, leafy spurge is considered a serious national pest of agricultural fields, rangelands, and pastures (Dunn 1979, Masters et al. 1994). In some cases, the cost of control may be greater than the original cost of the land (Lavigne 1984). The cost of annual losses of all kinds from leafy spurge in the United States was estimated at \$92 million (Thompson et al. 1990).



The carrying capacity of infested areas may be reduced by up to 75 percent since wildlife and cattle will not graze there (Lacey et al. 1984). Infested sites have been shown to be used less by native ungulates such as bison, elk, and deer (Trammell and Butler 1995). Farm equipment coated with the milky sap is difficult to clean, and the sap has also been known to cause severe blistering and hair loss on the feet of horses (Muenscher 1935). Horses and cattle normally do not eat leafy spurge when other forage is available (Montgomery et al. 1956); however, reports of cattle that have done so indicate that they develop scours and weakness (Muenscher 1960).

Leafy spurge can become dominant in mixed-grass prairies and change the abundance and diversity of native grasses and legumes through its superior competitive advantage arising from its rapid growth and allelopathic effects on other species (Steenhagen and Zimdahl 1979, Belcher and Wilson 1989). It has also been reported as a serious threat to endangered species due to its aggressiveness with most herbaceous vegetation (Evans et al. 1991).

- The proliferation of **purple loosestrife** leads to a variety of environmental and economic impacts. The formation of dense stands of purple loosestrife results in the loss of wetland habitat for the establishment and spread of native aquatic vegetation. On some sites, purple loosestrife is a threat to species designated nationally at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This is the case with swamp rose mallow, *Hibiscus moscheutos*, a species designated as vulnerable by COSEWIC. The proliferation of purple loosestrife in wetlands also changes the composition and cover values of plants that may serve as food sources for waterfowl and furbearers or as habitat for other aquatic life.

The spread of purple loosestrife also has a direct economic impact when plants clog irrigation or drainage ditches on farmlands or cause degradation and loss of forage value of lowland pastures (*Invasive Exotic Plants of Canada Fact Sheet No. 4*).

- The major negative impact of **Scotch broom** on the west coast of BC is the threat to biodiversity in sensitive ecosystems, especially the Garry oak meadow ecosystem. The Garry oak meadows once covered much of what is now Greater Victoria. This ecosystem is arguably the smallest and most endangered in Canada. Broom is now well established in the Garry oak meadows around Victoria; it successfully out-competes almost all of the wildflowers, threatening an already fragile and greatly reduced plant community. Economically, the BC Ministry of Forests and Range reports that broom is invading the coastal Douglas-fir forests, and is interfering with reforestation following harvest (Carson 1998). Furthermore, the net economic value of Scotch broom in Oregon is estimated at over \$14 million with even a small reduction of only 10 percent producing a gain of \$1.4 million in net value (The Research Group 2000).

An Invasive Alien Species Strategy for Canada

discusses the economic threats of invasive plants, including the following points:

- A preliminary review of the economic costs of invasive alien species (heretofore referred to as 'invasive') in Canada provides insight into the magnitude of the problem. Examining just 16 species for which published information is available, a conservative estimate of their cumulative annual costs was between \$13.3 and \$34.5 billion. These estimates are known to be incomplete, and it is widely estimated that the damage resulting from past introductions of harmful invasive plant pests on agricultural crops and forestry is \$7.5 billion annually. Manitoba alone estimates its economic losses from Dutch Elm disease at roughly \$30 million, and a single invasive thistle species impacting a single crop, canola, carries an annual cost of \$320 million on the prairies.
- Many significant pests affecting agriculture are not native to Canada—for example, 80 percent of agricultural weeds are invasive—and many crops cannot be grown without protection from invasive species, which results in significant losses in crop yields, direct control costs, indirect environmental costs of chemical control, and potential devaluation and market losses from commodity contamination.
- It is widely estimated that the damage resulting from past introductions of harmful invasive plant pests on agricultural crops and forestry is \$7.5 billion annually.

The **Saskatchewan Agriculture and Food** webpage titled "Preventing the Introduction of New Weeds: New weeds cost money" (www.agr.gov.sk.ca/Crops/Integrated_Pest_Management.asp?firstPick=Crops&secondpick=Integrated%) includes the following information:

- Once established, a new weed can be more difficult to control, and any available control options are more costly. For example, allowing the introduction of a weed like scentless chamomile into a new area could cost an additional \$7.50 to \$20.00 per hectare to control with herbicides in cereals and oilseeds, while there are no registered options for pulse crops.
- Leafy spurge is very competitive with range and pasture resources in Saskatchewan. When it comprises 80 per cent of the vegetation cover, all grazing by cattle is eliminated because leafy spurge has replaced the grass cover. Cattle cannot eat leafy spurge due to the irritating and, on rare occasions, toxic sap that circulates through the entire leafy spurge plant. Eradicating the initial patch of leafy spurge is much more cost-effective and requires less time and effort than trying to control an infestation once it is well established.
- Crop losses in Canada from weeds are estimated at \$984 million, with \$612 million of this loss in Western Canada (of which 84 percent is in field crops) for 58 field crops and fruit and vegetables (Swanton et al. 1993).



Much of the available information is specific to a relatively small group of species, including the following key invasive species:

Purple loosestrife

- An estimated 190,000 hectares of wetlands, marshes, pastures, and riparian meadows are affected in North America each year, with an economic impact of millions of dollars (Ontario Federation of Anglers and Hunters, date unknown).

Leafy spurge

- The economic loss from direct and secondary impacts in Manitoba alone is estimated at \$19 million per year (Brandon University 2000).

Diffuse and spotted knapweeds

- Economic losses in western Canada total \$58 million annually (Harris and Cranston 1979); and
- BC spends \$1 million for knapweed control on rangelands (Harding and Alder 1999).

Canada thistle

- Wheat losses in Saskatchewan have been estimated at \$3.6 million annually (Agriculture Canada 2000); and
- Yield and control losses to prairie canola producers are \$320 million per year (Canola Council of Canada 2001, quoted on IPCAN website)

Eurasian water milfoil

- About \$4 million has been spent in BC over about 15 years for control, research, and development. Control of milfoil in places such as Osoyoos Lake is done through mechanical removal by special harvesting barges to improve swimming and boating conditions (www.plantsinCanada.com/).

Information from British Columbia

Ministry of Agriculture and Lands

- The webpage “Knapweed - Its Cost to British Columbia” (www.agf.gov.bc.ca/cropprot/knapweed.htm) notes that knapweed is highly competitive and capable of invading grassland sites to the exclusion of native vegetation. Domestic animals and wildlife, such as elk, rely on these range grasses and herbs for up to 80 percent of their diet. Knapweed encroachment can destroy the forage base and would result in a significant decline in deer and elk numbers. Over 40,000 hectares in BC are knapweed infested, reducing forage potential by up to 90 percent. There is a potential in BC for spread to 1 million hectares of grassland range and undetermined areas of fringe forest. If it spreads to its ecological limit, knapweed could infest up to 8 to 10 million hectares in western Canada. To date, knapweed has resulted in an economic loss of over \$400,000 annually in equivalent hay production in BC, which could increase to over \$13 million annually.

- The “Weeds BC” webpage (www.weeds-bc.ca/) includes an impacts page with a list of general impacts and “10 Destructive Weeds of BC.” This webpage provides a link to the on-line version of A Guide to Weeds in British Columbia, which provides a general Impacts section, for example:

Agricultural: Spotted knapweed reduces or displaces desirable forage plant species and reduces carrying capacity for livestock and wildlife (Sheley and Jacobs 1997).

Ecological: Spotted knapweed is a highly competitive weed that invades disturbed areas and degrades desirable plant communities, forming monocultures in some areas of western North America. Although spotted knapweed is usually found in disturbed areas, it may invade adjacent areas that are relatively undisturbed (Rutledge and McLendon, Undated).

Human: Spotted knapweed can cause skin irritation. Hands and exposed skin should be washed with soap and water following contact with this plant.

Ministry of Environment

- The webpage entitled “Alien Species in British Columbia: What are the Economic Costs?” (www.env.gov.bc.ca/wld/aliensp/aliens_ecohuman.html) notes that alien (i.e., invasive) species can have significant economic impacts because many aspects of our human economy rely on services and functions provided by nature. Natural resource-based sectors most affected by invasive species include forestry, agriculture, fisheries and aquaculture, and tourism and outdoor recreation.

Financial costs are also incurred when invasive species damage infrastructure. Most intentional introductions of invasive species are based on economic motivations, yet they are seldom preceded by a careful cost-benefit analysis that includes societal and ecological consequences. Rarely do those responsible for introducing an alien species, either intentionally or accidentally, pay for resulting damages. Instead, consumers, other resource users, and taxpayers bear most of the burden.

The Canadian Food Inspection Agency classifies 94 alien species (plants and animals) as agricultural or forest pests and estimates that these regulated species cost the Canadian economy \$7.5 billion annually. That figure excludes costs that arise from regulated pests on natural ecosystems or the impacts of unregulated alien species. In the United States, the total cost of preventative measures, control programs, and lost production from alien species is estimated to exceed \$137 billion annually.

The Ministry of Environment document *Invasive Alien Species Framework for BC: Identifying and Addressing Threats to Biodiversity: A working document to address issues associated with biodiversity in British Columbia* outlines “Threats to BC’s Economy”:

- Invasive alien plant species inflict a heavy toll on agriculture, reducing forage potential and collectively infesting hundreds of thousands of hectares of crop and rangeland in British Columbia. Invasive alien plants



reduce crop yields by an average of 10-15 percent but the effect of some species can be much higher. North American forests are particularly vulnerable to invasions of European and Asian insects, which often out-compete their native counterparts with dramatic effects on forests—losses caused by alien forest pests in the United States are estimated to exceed \$2 billion (US) per year. Invasive species can also threaten human health, as illustrated by increased public health concerns surrounding emerging infectious diseases such as the introduced West Nile virus.

Miller and Wikeem (2005) state the following about economic threats in *Invasive Plants in British Columbia Protected Lands: A Gap Analysis for Developing a Five-Year Invasive Plant Management Strategy*:

Although few comprehensive studies have been conducted that evaluate the economic impacts of invasive plants, many economists and policy makers are aware that invasive species are having serious economic impacts (Sheley 2005). For example, Radtke and Davis of The Research Group (2000) estimated that tansy ragwort invasion in Oregon caused annual losses of US \$6 million to the state. Similarly, three knapweed species in Montana, North Dakota, and South Dakota are estimated to cause US \$42 million in direct losses per year (Hirsch and Leitch 1996).

Models for the Collation and Communication of Economic Impact Information

Several models effectively use a combination of media to collate, present, and distribute information on the economic impacts of invasive plants. Some examples are provided below.

The National Invasive Species Information Center

The National Invasive Species Information Center is a gateway to invasive species information, covering federal, state, local, and international sources. The site is hosted by the US Department of Agriculture through the National Agriculture Library (www.invasivespeciesinfo.gov/) and provides access to a broad array of information, including:

- Economic Impacts Spotlights, an easily locatable summary of pertinent economic impact facts and reports;
- a comprehensive reference list of economic impact reports and links to relevant documents, at the international, national, state, and local levels; and
- relevant media releases, invasive species education resources, a calendar of related conferences, funding opportunities, workshops and invasive species bills.

Research projects are competitively awarded by the Program of Research on the Economics of Invasive Species Management (PREISM), administered by the USDA's Economic

Research Service (Appendix 2). PREISM studies will provide analytically based principles, guidelines, and criteria for invasive species policy and program decision making, as well as the economic information, modeling systems, or other tools that support decision making. More information about these projects is available at www.ers.usda.gov/briefing/invasivespecies.

The Cooperative Research Centre for Australian Weed Management

The Cooperative Research Centre (CRC) for Australian Weed Management is one of dozens of CRCs that have been created in Australia over the last decade to improve the way in which scientists, policy makers, and extension workers collaborate on a broad range of sustainability issues. The CRCs are a funding partnership among national and state governments, tertiary institutions, and private organizations. The CRC for Australian Weed Management has successfully completed and presented research in a format that is widely distributed, easily accessed, and easily understood.

The CRC is an excellent model for sharing knowledge, creating change and facilitating science-based decision making. Information is distributed to the research community, weed management stakeholders, and the broader community through a variety of media, including:

- CRC website (www.weeds.crc.org.au): a widely recognized and utilized website that brings together a large amount of information on the impacts and management of invasive plants. The website is well structured and easy to use, and provides a “one-stop-shop” source of information for many invasive plant initiatives across Australia.
- Technical Series: an ongoing series of research papers that are widely recognized regarding their scientific vigour in a user-friendly format. The 11 papers in the Technical Series strongly focus on the economic impacts of invasive plants.
- *Weedwatch* newsletter: published three times per year and has a broad target audience including scientists, policy makers, land managers, and the public. It also often focuses on economic impacts of invasive plants.
- Media releases: the CRC regularly produces media releases on current topics and research recently completed. This has helped to increase media reporting on invasive plant management. An overarching message communicated by the CRC is that research conducted clearly demonstrates that available control measures for invasive plants are cost-effective and can save society substantial amounts in lost production and management costs.

The CRC also produces scientific research papers and weed management guides, and helps users access community and scientific workshops.

The CRC is responsible for an increased interest in invasive plant issues by the Australian media, a better understanding by the broader community of invasive plant issues, and a vastly improved network of knowledge and communication



within the network of people and organizations involved in invasive plant management. The CRC has found a sound balance between agricultural, environmental, and educational programs, and the economic impacts caused by invasive plants.

Gaps in the Knowledge Base for British Columbia

As shown in the reference list in Appendix 1, many relevant reports and publications have been prepared on the economic impacts of invasive plants but no comprehensive approach is available. Further investigation would probably produce many more. From the information that is readily available from Canada and British Columbia, in particular, a number of points become apparent:

- Most data on invasive plant economic impacts are lost within lengthy textual discussion – data tend not to be presented in impact-creating statements that are easily accessible;
- Data tend to be presented in documents that will only be viewed by individuals already working in the field of invasive plant management; economic impacts data are not readily apparent in media seen by the broader community;
- Data are often outdated, particularly for British Columbia;
- A lot of information refers to generalized data, mostly from the United States, e.g. “In the United States, the total cost of preventative measures, control programs and lost production due to alien species is estimated to exceed \$137 billion a year” (www.env.gov.bc.ca/wld/aliensp/alien_ecohuman.html); and
- Information often refers to invasive species generally and not specifically to invasive plants.

Furthermore, regarding the format in which the available information is presented:

- It did not appear possible to find a single BC source (either government or non-government) that provides a comprehensive, easily digestible summary of facts and figures related to invasive plant economic costs and impacts (and potential savings) that can provide quick reference for a variety of users;
- There is no evident link between the availability of this type of information and how it is made available—or distributed wider than just a webpage, for example. This point refers to the creation of a ‘network’ of information, coordinated through the one medium, including ‘facts and figures’ summaries, reference lists, report compendiums, media releases, contact lists, newsletters, educational and workshop calendars, funding opportunities, and technical guides; and
- There is little evidence in BC of a collaborative approach between the provincial government and academic institutions on research on this topic, as can be seen in both the United States (NISIC and PREISM) and Australia (Weeds CRC).

Relatively little information on the economic impacts of invasive plants was available on either the BC provincial government websites or that of a coordinating group such as the Invasive Plant Council of BC. Of the available information rel-

evant to BC, it tended to be scattered in small references throughout many different documents, produced at both a federal and provincial level. Collating this information and then drawing out specific aspects to be presented in a more targeted manner would be beneficial.

The most obvious gap for BC is the limited available information that:

- Covers the economic costs and losses of invasive plants by industry type;
- Addresses priority species (other than knapweed) on current and potential distribution, key production, environmental and social impacts, and current and potential economic costs and losses;
- Was produced within the last ten years;
- Would create an impact for people outside of the field of invasive species management; and
- Compares the economic impacts of invasive plants to other industry sector types or societal costs.

A Proposed Approach for British Columbia

Many references state that the current estimates for economic impacts are incomplete, exclusive of additional components (e.g., natural ecosystems or the impacts of unregulated invasive species), or are unknown factors. Numerous documented precedents state the importance of better determining and communicating the economic costs of invasive plants, including:

- **Invasive Alien Species Framework for BC: Identifying and Addressing Threats to Biodiversity**, Guiding Principle #1: Base action on clear direction and the best available scientific and socioeconomic information. Efforts to manage invasive species are most effective when they: (1) have goals and objectives that are clearly defined and prioritized; (2) are proactive rather than reactive; (3) are based on current biological, social and economic information; (4) are applied rapidly, even when a reasonable degree of uncertainty is present; and (5) benefit a diversity of stakeholders (page 31);
- **The East Kootenay Invasive Plant Pilot Project**, Component 2: Education and awareness of the public on the economic and ecological impact of invasive plants to the East Kootenay region (The East Kootenay Invasive Plant Pilot Project); and
- **An Invasive Alien Species Strategy for Canada**: Continue to build and strengthen understanding of the environmental, economic, and social impacts of invasive alien species in Canada, including understanding of their impacts on aboriginal peoples.

Furthermore, the **Invasive Species of Canada Survey 2002: An Assessment of Resources and Needs** (Haber 2002) recommends establishing a coordination office, funded through a consortium of federal departments, to oversee the operations of a biodiversity information distribution network with an initial role to:

- establish an invasive species information website (“portal”) based on broad collaboration with information



- providers, including provincial and territorial partners, academic institutions, and others;
- link existing web materials available nationally and internationally on invasive species into an organized and broadly indexed framework that would include, among others, such highly requested information as fact sheets, distributional data, maps, images, and control options that are of particular value in the Canadian context;
 - facilitate development of Canadian invasive species lists and alert lists accessible on a geographical basis;
 - establish a bibliographic database of published Canadian work on invasive species for internet access; and
 - promote the establishment of standardized protocols for data entry and information exchange for all biological information in collaboration with international partners.

- ii) develop a steady supply of media releases focusing on the economic impacts of invasive plants in BC; and
- iii) create and distribute a BC-wide invasive plant newsletter, with frequent reference to economic impacts, particularly by industry type.

Recommendation 1(a) is an extension of the work presented in this report and should not be difficult to achieve. Recommendations 1(a) and 1(b) are a priority for completion before most of the Part 2 actions could proceed. Recommendations 1(c) and (d) are also a priority; however, they are larger, more time-consuming tasks. Further discussions are required regarding the most appropriate participant skills and backgrounds required to complete each of the recommended tasks, or groupings of tasks.

Recommendations

This report's recommendations are divided into two main parts:

1. Collate economic impacts information

- a) Conduct a thorough review of all available data and information on the economic impacts of invasive plants and create a comprehensive reference list and document compendium.
- b) Develop a document that collates the most effective elements of the existing knowledge base into a summary document of 'facts and figures' that can be used by a wide variety of people and groups.
- c) Conduct an economic impact analysis of all currently available data in BC relevant to invasive plant management costs, lost production values for all sectors, environmental impacts, and social impacts to provide a more comprehensive summary of current economic implications for BC.
- d) Model the current and potential distributions, and current and potential management costs and loss of revenues, created by approximately six priority invasive plant species.

2. Communicate economic impacts information

- a) Commence a collaborative project between the provincial government and the Invasive Plant Council to develop an Invasive Plant Information Network for British Columbia that would provide, through a website:
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 - iii) contact details for all invasive plant groups, organizations, and contact people in BC; and
 - iv) information on invasive plant training sessions, workshops and conferences, funding opportunities, legislative changes, media releases, new research, and publications.
- b) The Invasive Plant Information Network for British Columbia would be requested, as more information becomes available, to:
 - i) develop and distribute brochures and posters on the economic costs of invasive plants to BC;

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Appendix 2. Program of Research on the Economics of Invasive Species Management (PREISM)

www.ers.usda.gov/Briefing/InvasiveSpecies/preism.htm

Under the Program of Research on the Economics of Invasive Species Management (PREISM), the Economic Research Service conducts intramural research and funds extramural research to support the economic basis of decisionmaking concerning invasive species issues, policies, and programs. PREISM focuses on economic issues related to invasive species of agricultural significance or other pests that fall under USDA programs. These include exotic pests of crop, forest, and range land (such as insects, weeds, and disease-causing pathogens), and foreign livestock, poultry, and zoonotic diseases (transmittable between animals and humans), but also exotic pests and foreign diseases affecting public lands, ecosystems, and urban systems. USDA programs that address invasive species relate to exclusion, detection, monitoring, eradication, control, and restoration, and their domestic and international components.

The Economic Research Service has funded extramural research through the PREISM competitive award program since 2003. The program funded 12 projects in 2003, and seven projects annually from 2004–2006. Program themes include international dimensions of invasive species prevention and management; development and application of methods to analyze important invasive species issues, policies, and programs; and analysis of economic, institutional, and behavioral factors affecting decisions to prevent or manage invasive species.