Pacific Institute for Climate Solutions
Knowledge. Insight. Action.

Briefing Note 2011 – 1

5 January 2011

Policy instruments for managing the spread of invasive plants in BC

Produced in partnership with ISIS – A Research Centre, Sauder School of Business, UBC
Author: Dr. Rupananda Widanage, Research Assistant, School of Resource & Environmental Management, Simon Fraser University
Editors: Dr. Alison Shaw, Dr. Hisham Zerriffi, Ivan Watson

Issue

Climate change is likely to produce a proliferation of invasive plant species that will require government intervention using both market and non-market approaches to manage the impact on BC rangelands. Currently, there is little consensus as to which policy instruments will be the most effective for managing invasive plants. Some policy makers tend to advocate market-based tools such as taxes, tradable permits, and payment for ecosystem services[1]. Others prefer non-market policy instruments such as community-based management, establishment of property rights, and local awareness campaigns[2]. Clearly, a precautionary approach to invasive plant management in BC is necessary in order to anticipate and plan for changing conditions under climate change[3].

Building upon a previous Briefing Note, "Managing Invasive Plants in Rangelands in B.C. under Climate Change: Rationale for Government Intervention", this note elaborates on the benefits and trade-offs of selected market-based policy instruments - payment for ecosystem services and user fees - and examines their appropriateness in invasive plant management.

Background

Climate change is likely to create favourable conditions (i.e. increase in temperature and/or decreases in precipitation) that expand the geographic ranges of existing invasive plant species while allowing new species to become established in BC[4]. Invasion creates negative externalities in different economic sectors such as agriculture, livestock, tourism, and international trade. Research indicates that invasive plants account for losses of some $170 million/year to the agriculture and related industries in Canada, including declines in crop yields and grazing capacity and the costs of control.[5]

Ecosystem services are public goods and invasive plant species generate overall 'public good' losses through decline in forage productivity, biodiversity, and recreational potentials. In 2006 for example, diffused knapweed in BC created damage costs including forage, recreation, and biodiversity loss of $21.09 CDN per hectare.[6] Ecosystem services, such as rangeland

management, are non-rivalrous where individual benefits from invasive plant management depend on the actions of other land users[7] and are non-excludable where it is not possible to prevent access by people who have not paid for its management. Private ranchers or farmers, for instance, who receive the ecosystem benefits (i.e., forage, biodiversity, and soil fertility) from these lands without paying, will therefore be reluctant to control invasive plants on their range or agricultural lands without an appropriate incentive. Perversely, a rancher who increases his/her stocking rate (livestock) in order to earn a high profit margin may reduce the competitiveness of native grass species in rangelands, thus encouraging growth of invasive plant species and resulting biodiversity loss, with or without climate change. Markets driven by self interest are unable to manage goods in desired quantities in perpetuity, ultimately leading to market failures. There is therefore a case for either regulatory or market-based intervention through which the private rancher must be incentivized to appropriately manage and conserve ecosystem services.

Recommendations

Under changing climate conditions, it is prudent to anticipate the impacts of invasive plants and to identify approaches that ensure strategic and efficient resource allocations and promote overall integrity of ecosystems into the future. Toward this end, numerous policy instruments have been identified. Under conditions of accelerating biological invasion, government can take a regulatory approach in setting a quantity standard for harvesting ecosystem services such as number of daily grazing animals per hectare. However, establishing a regulatory body for monitoring these standards may generate a substantial administrative cost.[8] In contrast, empirical evidence indicates that a decentralized community-based resource management system achieves good results in managing, for example, forest, fishery, and local irrigation systems[9]. Setting regulatory standards and then working with community institutions and organizations to achieve them is thus a solid option for managing invasive plant species.

Recently, increasing attention has been paid to market-based instruments for the management of invasive species. Two broad approaches are germane: 1) incentivizing appropriate behaviour such as payment for ecosystem services; and/or 2) punishing consumptive behaviour through user fees.[10]

Payment for ecosystem services: Under this system, a government, through a natural resource agency like BC's Integrated Land Management Bureau, would provide financial or non-financial incentives for resource users (i.e. ranchers or farmers) to protect ecosystem services by managing invasive plant species on their lands.

This approach offers several advantages. First, incentives are easy to establish from the administrative point of view. Second, payment reduces undesirable behaviour. Third, payment may lead to innovation because firms or individuals tend to find new alternatives for the use of ecosystem services.[11] This option is administratively desirable because it does not leave responsibilities to change user's behaviour with administrators; instead it provides flexibility, letting beneficiaries decide how best to respond to financial or non-financial incentives in light of local and variable circumstances.

There is also a disadvantage: there can be a moral hazard associated with inability to monitor effectively, and/or in obtaining accurate information that will allow correct payments to be set for ecosystem services.

User fee: Under this policy option, the government imposes a price on the use of particular ecosystem services. This price may be considered a financial penalty that is intended to discourage the consumption of such services. This option is also desirable for administrators because it does not hold them accountable for user's behaviour. A disadvantage of this approach lies in the difficulty of finding appropriate information on which to base the tariff. The correct user fee should be equal to the marginal cost of damage to the ecosystem services due to a particular economic activity. In addition, during the process of experimentation leading to the setting of a correct fee, resources may be misallocated.[12]

Conclusions

Climate change is likely to accelerate the spread of invasive plant species[13]. Biological invasion with or without climate change creates numerous distortions in the economy and adversely affects efficient allocation of productive resources. Following the status quo may lead to aggravated negative effects from biological invasion. Therefore, the government should intervene now to manage anticipated plant invasions from climate change and other causes. Application of market-based policy instruments that consider social, economic, and institutional factors in assessing the value of ecosystem services is likely the best approach to follow.

Acknowledgment

Duncan Knowler, Associate Professor, School of Resources and Environmental Management, Simon Fraser University.

Sources

[1] Sterner, T., 2003.*Policy Instruments for Environmental and Natural Resource Management*. RFF Press, Resource for the Future, Washington, D.C.

[2] Yaffee, S.L., and Wondolleck, J.M., 2003.Colloborative ecosystem planning process in the United States:Evaluation and Challenges, *Environment,* 3(12):232-245.

[3] Aslan, C.E., Hufford, M.B., Epanchin-Niell, R.S., Port, J.D., Sexton, J.P., and Waring, T.M., 2009. Practical challenges in private stewardship of rangeland ecosystems: Yellow starthistle control in Sierra Nevadan Foothills, *Rangeland Ecology and Management,* 62(1): 28-37.

[4] E-mail communication with Judith Meyer, Professor, Dept. of Zoology, University of British Columbia and Linda Wilson Manager, Invasive Plant Management Program, Ministry of Agriculture and Land, British Columbia.

[5] Colautti, R.I., Bailey, S.A., van Overdijk, C.D.A., Amundsen, K., and MacIsaac, H.J., 2006. Characterised and projected costs of non-indigenous species in Canada. *Biological Invasion,* 8:45-59.

[6] Frid, L., Knowler, D., Meyers, M., Scott, I., and Widanage, R., 2008. Estimation of area dispersal and economic damage curves for six invasive plants in British Columbia, Draft Report, British Columbia: Invasive Plant Council

[7] Grimsrad, K., et al., 2008. A two agent dynamic model with invasive weed diffusion externality: An application to Yellow Starthistle *(Centaurea Solstitialis L.)*, in New Mexico, *Journal of Environmental Management,* 80:322-335.

[8] Goulder, L.H., and Parray, I.W.H., 2008. Instrument choice in environmental economic policy. *Review of Environmental Economics and Policy*.2(2):152-174.

[9] Acheson, J.M., 2008. Institutional failure in resource management. *Annual Review of Anthropology,* 35:117-134.

[10] Perrings, C., Mooney, H., and Williamson, M., 2010. *Bioinvasions and Globalization: Ecology, Economics, Management and Policy*, Oxford, New York, Oxford University Press.

[11] Howlett, M., and Ramesh, M., 2003. *Studying Public Policy, Policy Cycles and Policy Subsystems*, Oxford University Press, London.

[12] Hanley, N., and Spash, C.I., 2003. Cost-benefit analysis and environment, USA: Edward Elgar.
[13] Bradley, B.A., 2009. Regional analysis of the impacts of climate change on cheatgrass invasion shows potential risk and opportunity. *Global Change Biology,* (15): 196-208.