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Managing Invasive Plants in Rangelands in B.C. under Climate Change: Rationale for Government Intervention

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Issue

Millennium Ecosystem Assessment (2005)[1] has identified invasive alien species as a major threat to the resilience of ecosystems in the presence of climate change. According to some researchers, invasive plant species may create an "invisible tax" on natural and environmental resources (Colautti, et al., 2006)[2]. Biological invasion created by invasive plant species has adverse impacts on economically productive resources and other environmental values. In Canada, invasive plant species have generated increased economic losses both through market impacts (e.g. reduction in crop yield) and non-market impacts (e.g. reduction in biodiversity) in last few decades (RNT, 2002; Colautti, et al., 2006)[3]. Given the substantial environmental and economic costs associated with the risk of biological invasion, policy makers in the Federal, Provincial, and Municipal governments should pay considerable attention to the management of invasive plant species in formulating environmental and natural resource policy, especially under projected climate change scenarios.

Background

Agriculture, livestock, tourism, international trade, recreation, and biodiversity are some of the major sectors that are affected by invasive plant species in Canada. Invasive plants resulted in a $170 CDN million cost to agriculture and related industries and $9.6 CDN billion cost to Canada's forest industry (Colautti, et al., 2006). Some researchers have shown that invasive plant species in rangelands in B.C. have already generated considerable economic losses to the province. For example, hawkweed (*Hieracium pratense* Tausch*)*, diffused knapweed (*Centaurea diffusa* Lam), and cheat grass *(Bromus tectorum* L.) resulted in approximately Can $165, 21.09, and 20.09 worth of economic damages per hectare respectively (Fried, et

al., 2008)[4]. In addition, invasive plant species in rangelands such as yellow starthistle (*Centaurea soltitialis)*, leafy spurge (*Euphobia esula* L.), and dalmatian toadflax (*Linaria dalmatica (*L.*)* P.Mill*)* have created adverse impacts on livestock production, recreation, biodiversity, water tables, and soil fertility (Duncan and Clark, 2005)[5]. Thus, economic losses from invasive plant species in BC consist of direct and indirect as well as market and non-market costs.

These cost estimates were based on benefit transfer methods from other contexts, which do not internalize all potential damage from biological invasion. In many instances, cost estimates related to invasive plant species in Canada only include direct and market losses. However, as noted above, there are substantial associated non-market costs that are harder to translate into a dollar value. Thus, the actual losses generated by invasive plants are greater than those quantified in the above cost estimates. Substantial economic losses and reduction in profits from various economic sectors such as agriculture, livestock, international trade, and tourism indicate that invasive species must be considered in strategies that promote long-term economic growth and resilience to climate change.

Climate change is expected to increase the number of invasive plants in rangelands. Studies in the United States indicate that climate change has and will continue to create favourable conditions for invasive plants in rangelands of the western US (Finnoff, et al., 2008)[6]. Based on these findings and personal communications with experts, there appears to be a high probability that in BC, new invasive plants or current invasive plants species will increase in rangelands under the influence of climate change[1]. Invasion creates competition between invasive plant species and native grass species in rangelands, leading to a decline in forage productivity. A reduction in forage productivity reduces forage crops available for cattle's consumption and leads to a decline in weight gain of animals. To maintain the same stock density and avoid a decline in weight gain of animals, ranchers have to purchase residual feed in the open market.

According to farm budget analyses of livestock enterprises in the southern interior (Malmberg and Peterson 2006)[7] and subsequent interviews with ranchers (pers. comm. 2008)[2], ranching enterprises in BC. operate at a low profit margin. Increases in input prices combined with decreases in beef export competitiveness due to the appreciation of Canadian dollar relative to US dollar has adversely affected the profit margin. A decline in forage productivity under the presence of climate change will further deteriorate economic profits of ranching enterprises, potentially causing a decline in private profits for ranching enterprises and export revenue for the country. Significant economic losses to Canadian ranching enterprises and the Canadian economy provide a strong rationale for federal and provincial interventions to mitigate the adverse impacts of invasive plant species.

Recommendations

[1] 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 & Land, British Columbia.

[2] Personal communication with ranchers in Okanagan, summer 2008.

The adverse impacts of invasive plant species in the presence of climate change can be identified as a negative externality to ranching enterprises in BC. Since market mechanisms do not capture externalities, the individual rancher is unable to internalize damages from invasive plants species when climate change is present, making invasive plants a market failure shouldered by ranchers. As a result, profit-oriented policy decisions may not lead to the optimal allocation of resources in the economy. An appropriate government intervention is necessary to correct for these market failures, most likely at the sectoral scale, in order to provide incentives that account for and remove negative externalities.

Rangelands in BC provide non-market benefits such as recreation, biodiversity, prevention of soil erosion, and protection of ground water tables. Invading invasive plants in rangelands in the presence of climate change reduces the value of these ecosystem services. Ecosystem services have characteristics associated with the public goods such as non-excludability and non-rival consumption. Due to non-excludability, the private land owner or rancher cannot prevent the people living in adjoining lands from receiving benefits of controlling invasive plant species in the private rangeland. This promotes a situation where there are no incentives to preserve these benefits. Private landowners or ranchers require incentives to control invasive plants in order to protect these social benefits; a rationale for government intervention to control invasive plants in rangelands.

Conclusions

This analysis shows that biological invasion in rangeland in the presence of climate change reduces economic welfare at both the regional and national scale. The Province, through the Ministry of Forests and Rangelands, could raise awareness of the economic losses associated with invasive species. More refined cost estimates, similar to those noted above, could, with appropriate incentives, catalyze support among ranchers to be active participants in minimizing invasive species. In addition, the Canadian government could finance research in this area. The loss of potential non-market benefits (e.g. biodiversity, recreation, and prevention of soil erosion) due to biological invasion in rangelands can be identified as the loss of a public good. Given these conditions, there is a strong rationale for government intervention to correct for market failure.

Sources

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[1] Millennium Ecosystem Assessment, 2005. Ecosystems and human well-being: multiscale assessments, 4: OisLAND press, London.

[2] Colautti, R.I. Bailey, S.A. Van Overdijk, C.D.A. Amundsen, K. & Maclassac, H.J. 2006. Characteristics and projected costs of non-indigenous species in Canada. *Biological Invasions,* 8: 45-59.

[3] RNT, Consulting Inc. March, 2002. Environmental and economic costs of alien species in Canada.Ontario, Picton.

[4] Frid, L., Knowler, D., Meyers, M., Scott, L., 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

[5] Duncan, L. and Clark, J.K. 2005. Invasive plants of range and wild lands and their environmental, economic and societal impacts. USA: WSSA.

[6] Finnoff, D., Strong, A., and Tschirhart, J., 2008. Bioeconomic model of cattle stocking on rangeland threantened by invasive plants and nitrogen deposition. *American Journal of Agricultural Economics.* 90(4): 1074-1090.

[7] Malmberg, M., and Peterson, T., 2006. Final Report: a project to develop baseline data on a typical ranch in BC.

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