AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Economics of controlling invasive species: optimal control and stability of ecological-economic system

Morteza Chalak[*,1] , Arjan Ruijs[2], Lia Hemerik[3], Wopke van der Werf[4], Ekko C. van Ierland[2]

[1]Centre of Environmental Economics and Policy, School of Agricultural and Resource Economics, University of Western Australia, Australia.
[2]Environmental Economics and Natural Resources group. Wageningen University, the Netherlands.
[3]Biometris, P.O. Box 100, 6700 AC Wageningen University, The Netherlands.
[4]Plant Sciences, Crop & Weed Ecology Group, P.O. Box 430, 6700 AK Wageningen University, The Netherlands

Poster prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012

Copyright 2012 by Morteza Chalak. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

***Corresponding author. Contact: morteza.chalak@uwa.edu.au**

Economics of controlling invasive species: optimal control and stability of ecological-economic system

Morteza Chalak[1], Arjan Ruijs[2], Hemerik, Lia[3], Wopke van der Werf[4], Ekko van Ierland[2]
[1]Centre of Environmental Economics and Policy, School of Agricultural and Resource Economics, University of Western Australia, Australia
[2]Environmental Economics and Natural Resources group. Wageningen University, the Netherlands
[3]Biometris, Wageningen University, [4]Plant Sciences, Crop & Weed Ecology Group, Wageningen University, the Netherlands

Introduction:

Biological control agents that are introduced to agriculture can spill over to the environment and cause negative externalities (e.g. Chalak et al. 2010).

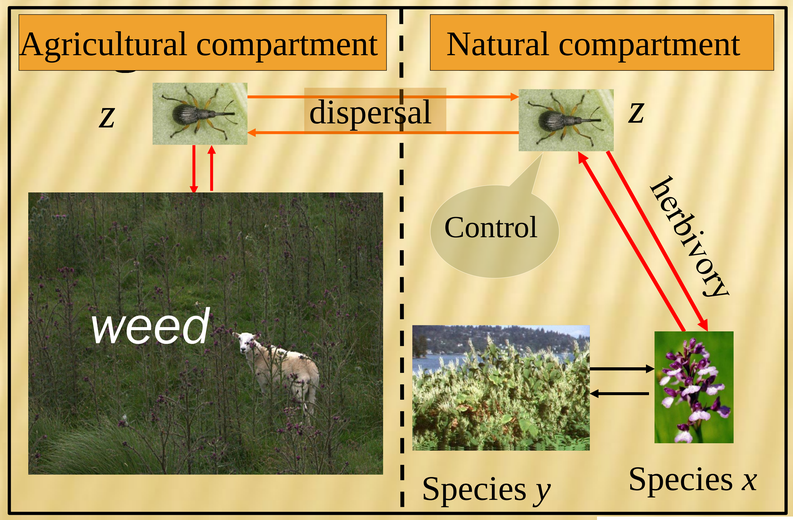
This study analyses a herbivore which:

- was introduced to agriculture to decrease weeds but…
- spilled over to the environment and attacked an endemic species.

System:

We consider a two-compartments ecosystem where:

- herbivore (z_m) is introduced to control weeds in agriculture,
- herbivore disperses to a neighbouring natural area,
- the herbivore attacks endemic species *x*.

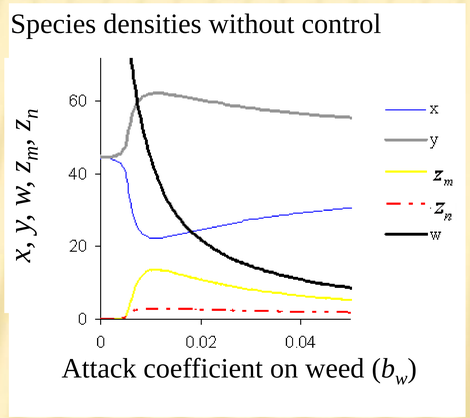


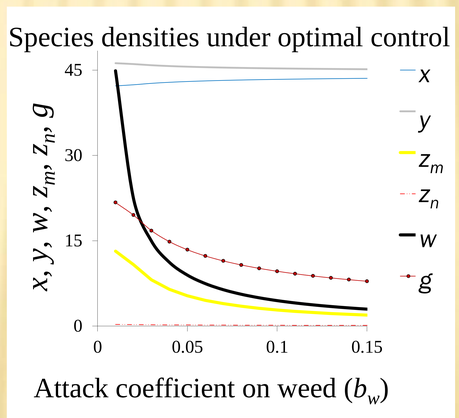
Research questions:

A) Under what conditions do introduced herbivore drive endemic species *x* to extinction?

B) What are optimal levels for control of the herbivore for different:

- species values,
- attack rates of the herbivore,
- densities of non-target species ,*x*?





Model:

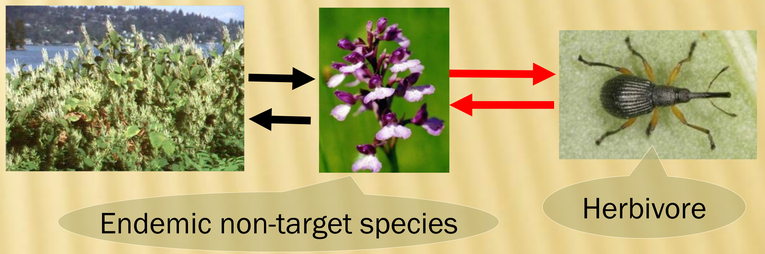
- A complex economic optimisation model is developed that includes processes such as: plant competition, dispersal, herbivory and control.
- Stability of the ecological economic system is tested to find conditions under which the system becomes unstable and endemic species *x* goes to extinction.

Results and conclusions

A) Extinction risks can be higher when the herbivore has a lower attack rate.

B) Control must increase when:

- the non-target host has a higher biodiversity value than does its competitor,
- the herbivore has a relatively low attack rate on the target species (i.e. the weed),
- the non-target species has a low density.



References:

Begon, M., Harper, J.L., Townsend, C.R., 1996. Ecology: individuals, populations and communities. Blackwell Scientific, Boston, Massachusetts, USA.

Chalak M, Hemerik, L., van der Werf, W., Ruijs, A., van Ierland, E.C., 2010. On the risk of extinction of a wild plant species through splillover of a biological control agent: analysis of an ecosystem compartment model. Ecological Modelling, 221, 1934-1943.

Agricultural & Applied Economics Association Annual Meeting, Seattle, Washington, August 12-14 , 2012.