

When the Single Species Approach is not Enough: Using Buckthorn as a Target Species for an Ecosystem Approach to Combat Invasive Species

Josie Belter, College of Saint Benedict/ Saint John's University
 Environmental Studies Department
 Undergraduate Thesis, Advisor Troy Knight

Issue

Invasive species are non-native species that have negative effects on the ecosystems in which they invade; these negative effects are not only significant within natural systems, but can be seen in almost every activity where humans interact with the environment. Most noticeably, invasive species can negatively affect human health, recreational activities, and also agricultural sectors of our lives. Invasive species are most often managed and controlled using a single species approach, which focuses on one target invasive species without taking into consideration any interacting species and could cause unintentional effects, such as in the photos below. An ecosystem approach, though, is another way to view invasive species management. An ecosystem approach draws attention to not only the target invasive species but also to other species that the target invasive species may interact with. **Taking an ecosystem approach to combatting invasive species may be much more effective than the single species approach because an ecosystem approach considers how species interact with one another as well as how any management method will impact the entire ecosystem.**

The above photo on the right shows a plane spraying pesticides on a field.

http://www.greensolutionsmag.com/wp-content/uploads/2011/10/ft_cropduster2.jpg



The photo on the right shows algae blooms of a coastal area that were caused by the runoff of fertilizers and other chemicals applied to fields that make their way from agricultural fields to waterways.

http://www.noaanews.noaa.gov/stories2010/20101209_habs.html



Methods

To identify an ecosystem approach as an effective way to combat and manage invasive species, I used a combination of literary review and a case study focused on two invasive agricultural pests, oat crown rust and the Asian soybean aphid. In my case study I am identifying traditional management methods of these agricultural pests, which is primarily chemical and biological control. I am comparing the environmental impacts associated with traditional management methods to the impacts of a proposed method of removing the invasive shrub buckthorn around agricultural areas. Finally, I will weigh both management techniques and use successes from similar cases to support the proposal to remove buckthorn.

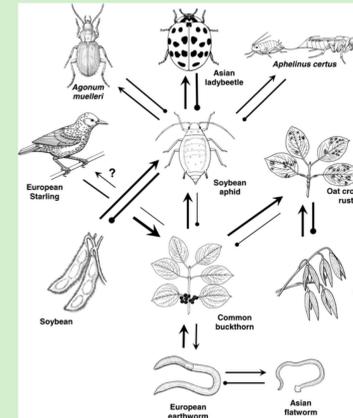


Figure 1. The figure to the left is an interaction web diagram from Heimpel et al. (2010) that shows several species interact with one another including oat crown rust, the Asian soybean aphid, buckthorn, European earthworms, and a number of other species. The Heimpel et al. (2010) diagram was the original interaction web that guided my own personal case study focusing on buckthorn as a solution to the agricultural pests oat crown rust and the Asian soybean aphid.



A: Oat Crown Rust

B: Oat Crown Rust on Buckthorn

C: Asian Soybean Aphids

D: Asian Soybean Aphids and Asian Lady Beetle

E: Buckthorn Thicket

F: Close-up of Buckthorn

Discussion and Results

Most agricultural organizations and groups recommend chemical application, genetically modified pest resistant crops, and biological control as the best options for eradicating oat crown rust and the Asian soybean aphid; however, by using an ecosystem approach, buckthorn can be identified as the proper target species. One study by Heimpel et al. (2010) used an interaction web, as seen in Figure 1, to summarize how invasive species can interact with one another and argued that invasive buckthorn is the link that connects these agricultural pests. By eliminating buckthorn then, there may be a decrease in these agricultural pests and a number of other invasive pests that also interact with buckthorn. Though there has not been much research and data collected on the effects of agricultural pests after removing buckthorn around farm fields, one study did find that when the invasive shrub buckthorn was removed that invasive European earthworms decreased by almost 50% for the subsequent years after the study was performed (Madritch, 2009). This success suggests that the same could be true by removing buckthorn around agricultural areas where pests including oat crown rust and the Asian soybean aphid are present.

References

If you would like to learn more about ecosystem approaches and invasive species:

- 1) Heimpel, G. E., L. E. Frelich, D. A. Landis, K. R. Hopper, K. A. Hoelmer, Z. Sezen, M. K. Asplen, and K. M. Wu. "European Buckthorn and Asian Soybean Aphid as Components of an Extensive Invasional Meltdown in North America." *Biological Invasions* 12, no. 9 (Sep 2010): 2913-31.
- 2) Kuebbing, S. E., M. A. Nunez, and D. Simberloff. "Current Mismatch between Research and Conservation Efforts: The Need to Study Co-Occurring Invasive Plant Species." *Biological Conservation* 160 (Apr 2013): 121-29.
- 3) Knight, K. S., J. S. Kurylo, A. G. Endress, J. R. Stewart, and P. B. Reich. "Ecology and Ecosystem Impacts of Common Buckthorn (*Rhamnus Cathartica*): A Review." *Biological Invasions* 9, no. 8 (Dec 2007): 925-37.

Photo Credits:

- A) Oat Crown Rust http://bulletin.ipm.illinois.edu/photos/oat_crown_rust.jpg
 B) Oat Crown Rust on Buckthorn http://bulletin.ipm.illinois.edu/photos/buckthorn_oat_rust.jpg
 C) Asian Soybean Aphids <http://extension.entm.purdue.edu/pestcrop/2006/issue24/images/fig4.jpg>
 D) Asian Lady Beetle and Aphids <http://www.ipm.iastate.edu/ipm/icm/files/images/lady%20beetle2.jpg>
 E) Buckthorn Thicket http://www.uwgb.edu/biodiversity/herbarium/invasive_species/rhafra_dense_stand01.jpg
 F) Close-up of Buckthorn http://www.nyis.info/user_uploads/files/1334004_buckthorn_foliage.jpg

