Ecological Effects and Management of Common Buckthorn (*Rhamnus Cathartica*), a Michigan Invasive

Seth Tartamella

Writer's Statement

I am Seth Tartamella, and am a first year applied ecology major in the College of Forest Resources and Environmental Science.I wrote this article because common buckthorn is one of the first invasive species I learned about in my vegetation of North America class and composition offered a perfect excuse to learn more about an invasive I was unfamiliar with. My goal with this article was to research the basics of common buckthorn's invasion and share what I found with the community of Michigan Tech while gaining experience writing in a scientific manner.

Introduction

The goal of this research is to make clear the situation surrounding an invasive species: common buckthorn (*Rhamnus Cathartica*). In order to understand the complex effects of a species invasion, we must ask an important question: "What species are considered invasive to the Upper Peninsula of Michigan?" This is an important question because it establishes whether or not a species is actually problematic. Many species that are introduced for ornamental, agricultural, or other reasons never escape cultivation. For a species to truly be considered invasive, it needs to have traits that make it a dominating force outcompeting native species. Another important aspect of that question is the clarification that we are interested foremost in species causing problems in the local area, such as common buckthorn. Anyone spending time in the beautiful Keweenaw Peninsula will notice the thickets of common buckthorn dominating forest understories. The importance of the threat invasives like common buckthorn pose is much harder to overlook when one can take a short walk along the MTU campus disc golf course and witness their effects first hand. Common buckthorn is producing drastic effects to local ecosystems and must be addressed to protect the beauty of the unique environment found only here.

Ecological Effects of Common Buckthorn

Common buckthorn is a woody shrub native to Eurasia (Archibold et al., 1997, p. 617). It has 2–3 inch long simple elliptical to oval leaves with fine serration arranged alternately, but may appear opposite or nearly so (Seiler et al., 2025; Barnes & Wagner jr., 2004, p. 184). Common buckthorn produces copious amounts of small black drupes that contain 2–4 seeds (Archibold et al., 1997, p. 617). The terminal bud is replaced by a thorn and is flanked by two lateral buds, resembling a buck's hoof. Common buckthorn was initially introduced to North America during the colonial period for medicinal purposes. Not enough research into the history of common buckthorn's spread has been done to say for sure, but it likely arrived around here at some point after 1800. It has since escaped cultivation and is naturalized across much of the United States, including in the Upper Peninsula. Its large invasion range is attributed mostly to human causes due to its popularity as a hedge plant (Kurylo & Endress, 2012, pp. 602–605).

The presence of common buckthorn in the Upper Peninsula is significant because it causes drastic changes to native ecology. Common buckthorn's presence here in our natural areas is actively altering their ability to perform natural functions by suppressing native species, altering the way soil forms, and reducing native species diversity. This matters because the organisms that make this area their home are a unique expression of nature and provide a

beauty unavailable anywhere else on Earth. In order to safeguard the things that contribute to this beauty we need to understand how common buckthorn is able to dominate and what that does to native ecology.

One trait that allows common buckthorn to change native biotic communities is its allelopathic habit. Allelopathy is the term used to describe a plant's ability to alter the soil around it to suppress the growth of competing species. This helps the allelopathic species ensure its domination of sites where it becomes established. In a study to assess the allelopathic capabilities of common buckthorn it was found to reduce the abundance of many types of nearby native plants by preventing germination (Warren II, et al. 2017, pp. 1236–1237). The researchers hypothesized that common buckthorn's allelopathic chemicals are so effective because they are completely foreign to native plants; they have not adapted alongside common buckthorn and therefore have no resistance to these chemicals. Common buckthorn uses this advantage to invade forest understories and form dense monotypic patches, something it is incapable of in its native range (Knight, 2005, p. 31).

Allelopathy is not the only way common buckthorn affects soil. Its leaves contain high levels of nitrogen, so after dropping they decay much faster than the leaves of native plants. These leaves are also attractive to invasive earthworms and result in an increased earthworm population (Heneghan, 2003, pp 28–30). These traits combine to cause leaf litter in invaded woodlands to decay much faster than it otherwise would (Heneghan et al., 2002, p. 110), changing an element important to native environments. Soil arthropod communities rely on substantial leaf litter density, so less leaves on forest floors mean there is less habitat available to this community, reducing species richness and affecting forest ecosystem functions. There is also a higher ratio of unmineralized nitrogen in soil surrounding common buckthorn, suggesting the microbial community is affected as well (Heneghan, 2005, pp. 44–48). Changes in soil formation could have persisting impacts to the land even after successful eradication of common buckthorn.

Another invasive trait *R. cathartica* demonstrates is its method of seed dispersal. It produces a fleshy fruit which appears attractive to birds as a food source, but birds are unable to digest its seeds, so they unwittingly disperse them far and wide. This mode of dispersal is evident by the large clumps of *R. cathartica* that tend to form under perching trees and along fencerows; places that birds frequent (Archibold et al., 1997, p. 617). Bird dispersal allows common buckthorn to move over vast distances and expand its range of invasion quickly.

Unfortunately, seed dispersal is not the only interaction between common buckthorn and birds. The research done by Knight et al. (2007, p. 934) states: "Apfelbaum and Haney (1987) claim that bird species diversity declines as invasion of *R. cathartica* progresses." They go on to reference another source by Schmidt and Whelan (1999, pp. 1504–1505), to clarify that this is due to the increased predation birds face when nesting in non-native shrubs. Similarly to the soil arthropod community, these birds are not adapted to survive alongside common buckthorn.

Common buckthorn also increases deer herbivory of nearby native plant species. White-tailed deer avoid eating *R. cathartica*, instead preferring native plants they are familiar with. Research by Warren II et al. (2025, p. 4) stated: "Our results demonstrate a synergistic negative interaction between overabundant deer and *R. cathartica* [common buckthorn] invasion, whereby the combined presence of both stressors amplified herbivory damage to native woody plants more than either factor alone." Increased deer herbivory caused by common buckthorn presence suppresses nearby native plants while the near complete lack of predation allows common buckthorn to grow uncontested. This competitive advantage allows it to quickly dominate areas with high deer populations where it becomes a dense thicket of pure buckthorn.

Common Buckthorn Management

It is easy enough to see that if common buckthorn is left unchecked it will drastically alter the native landscape and affect the integrity of natural ecosystem functions. Fortunately it is widely recognized that this issue needs a solution, so many researchers are working to develop effective management solutions. These strategies fall under four main categories: mechanical, chemical, biological, and burning.

Mechanical management involves physically removing or cutting common buckthorn. Unfortunately, it is often not that simple because common buckthorn is a vigorous stump sprouter; Once the main stem is cut it will send up more shoots from the remaining stump, becoming a dense bush. Simply cutting the trunk is not sufficient because it leaves the root systems intact, allowing the plant to resprout vigorously. In addition to that, if the buckthorn had been around for long enough to produce fruit there will be seeds banked in the soil, which will pop up to resume the dominance of their parent bush. Using this strategy on its own is possible, but highly impractical (Moriarty, 2005, p. 53).

Mechanical removal is often paired with herbicides for just that reason. Once the buckthorn is cut or girdled, the stump is sprayed with herbicide to fully kill the plant and prevent vegetative reproduction (Moriarty, 2005, p. 53). Herbicide is an effective way to deal with large amounts of buckthorn, but application of herbicides requires permitting and training because it can affect native plant regeneration if used improperly.

An alternative to chemical controls is the use of biological controls, such as fungi. The master's thesis of Michigan Tech student Lindsey Dolinski (2021, p. 19) discussed her findings in applying a fungal culture to common buckthorn stems after cutting, which was effective in colonizing the buckthorn and preventing regeneration. This fungus is native and has little chance of affecting nearby trees because it needs an open wound to infect its host. Using this fungus is also much safer than herbicides and has a lower ecological impact, so it is a promising alternative.

The other technique usable after mechanical removal is prescribed burning. Common buckthorn is not adapted to survive in areas disturbed by wildfire, so the reintroduction of fire to currently suppressed areas could help hinder buckthorn's ability to regenerate and dull its competitive edge. Fire becomes even more effective when there are fine fuels to help it spread. Research by Schuster et al. (2024) found that seeding in grasses after mechanical buckthorn removal is advantageous because it provides fuel in areas that otherwise would have been bare ground. Fire can then spread into areas previously dominated by buckthorn, which will suppress its regeneration and allow native fire adapted species to resume dominance.

Conclusion

Buckthorn is a problematic invasive present in much of North America, including the Upper Peninsula. Previous studies on common buckthorn have made it clear that the species causes a plethora of problems for native ecosystems through its allelopathic capability, influence on soil formation, and effects on native species. These problems result in changes to ecosystem functions. Ecosystems are delicate things that may take time to recover, but the situation is far from hopeless. Management practices are being developed to restore areas affected by this invasive back to their natural state. With more interest and funding, this invasive could certainly be eradicated, allowing affected areas to begin the restoration process.

References

Apfelbaum, S. L., & Haney, A. (1987). Management of degraded oak savanna remnants in the Upper Midwest: preliminary results from three years of study. In J. Ebinger (Ed.) Proceedings of the Oak Woods management workshop [workshop] Peoria, IL, United States.

Archibold, O. W., Brooks D., & Delanoy L. (1997). *An investigation of the invasive shrub European Buckthorn, Rhamnus cathartica L., near Saskatoon, Saskatchewan. Canadian Field–Naturalist, 111*(4), 617–621. https://doi.org/10.5962/p.358266

Barnes, B. V., & Wagner jr., W. H. (2004). *Michigan trees: A guide to the trees of the great lakes region* (9th ed.). University of Michigan Press.

Dolinski, L. F. (2021). *Assessing the Utility of a Native Wood–Decomposing Fungus as a Biocontrol Alternative to Herbicides on Invasive Buckthorns in Forests of the Keweenaw Peninsula of Michigan* (Publication No. 1328) [Master thesis, Michigan Technological University]. MTU Digital Commons.

Heneghan, L. (2003). *And when they got together… impacts of Eurasian earthworm and invasive shrubs on Chicago woodland ecosystems. Chicago Wilderness Journal*, 1(1), 27–31.

Heneghan, L. (2005, September). *Impact of Rhamnus cathartica (European Buckthorn) on Midwestern Woodland Ecosystems and the Implications for Restoration Management. In L. C. Skinner (chair),* Biological Control. *[Symposium]. Proceedings: Symposium on the Biology, Ecology, and Management of Garlic Mustard (Alliaria petiolata) and European Buckthorn (Rhamnus cathartica)*. St. Paul, Minnesota, USA.

Heneghan, L., Clay, C., & Brundage, C. (2002, June). Rapid Decomposition of Buckthorn Litter May Change Soil Nutrient Levels. *Ecological Restoration, 20*(2), 108–111.

Knight, K. S. (2005, September). Buckthorn Biology and Invasion History. In L. C. Skinner (chair), *Biological Control.* [Symposium]. Proceedings: Symposium on the Biology, Ecology, and Management of Garlic Mustard (*Alliaria petiolata*) and European Buckthorn (*Rhamnus cathartica*). St. Paul, Minnesota, USA.

Knight, K. S., et. al. (2007). *Ecology and ecosystem impacts of common buckthorn (Rhamnus cathartica): a review. Biological Invasions*, 9(8), 925–937. https://doi.org/10.1007/s10530-007-9091-3

Kurylo, J., & Endress, A. G. (2012) *Rhamnus cathartica*: Notes on its Early History in North America. *Northeastern Naturalist, 19*(4), 601–610. https://doi.org/10.1656/045.019.0405

Moriarty, J. (2005, September). Conventional Management of Buckthorn Species. In L. C. Skinner (chair), *Biological Control.* [Symposium]. Proceedings: Symposium on the Biology, Ecology, and Management of Garlic Mustard (*Alliaria petiolata*) and European Buckthorn (*Rhamnus cathartica*). St. Paul, Minnesota, USA.

Schmidt, K. A., & Whelan, C. J. (1999). Effects of Exotic *Lonicera* and *Rhamnus* on Songbird Nest Predation. *Conservation Biology, 13*(6), 1502–1506. https://doi.org/10.1046/j.1523-1739.1999.99050.x

Schuster, M. J., et. al. (2024). Understory Revegetation Enhances Efficacy of Prescribed Burning after Common Buckthorn (*Rhamnus cathartica*) Management. *Natural Areas Journal, 44*(4), 206–214. https://doi.org/10.3375/2162-4399-44.4.206

Seiler, J., Jensen, E., Niemiera A., & Peterson, J. (2025). *Common buckthorn.* Virginia Tech Dendrology. https://dendro.cnre.vt.edu/dendrology/syllabus/factsheet.cfm?ID=559

Warren II, R. J., et. al. (2017). Allelopathic invasive tree (*Rhamnus cathartica*) alters native plant communities. *Plant Ecology, 218*(10), 1233–1241. https://doi.org/10.1007/s11258-017-0766-2

Warren II, R. J., et. al. (2025). Common buckthorn (*Rhamnus cathartica*) invasion exacerbates white–tailed deer (Odocoileus virginianus) browsing on native woody plants. *Invasive Plant Sci. Manag, 18*(23): 1–6. https://doi.org/10.1017/inp.2025.10023