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Department of Horticultural Science
University of Minnesota, St.Paul, MN

Overview of Vol.6, No.5 - Invasive Woody Plants

Stefanie Miklovic

Introduction of non-indigenous floral species into new habitats is not a recent phenomenon and can result from a variety of pathways. As transportation networks developed, connecting cities and people around the world, barriers which had previously prevented dispersal of species into new areas were removed. Some introductions are completely inadvertent. Other introductions are purposely performed by humans because the species of interest has economic, aesthetic, or habitat management value (though subsequent invasion into native floral areas may be inadvertent). The species described in this chapter fit the latter description. Whether or not the introduced species can survive, and possibly become invasive, depends upon the species individual characteristics and its interactions with the new ecosystem. The papers that follow this overview (Rabie, Mehta, Gale, and Rich) describe the effect of introduced woody species on native ecosystems and the efforts required to lessen their impact. In essence, these papers exemplify the importance of understanding how a species behaves and functions in its native habitat and of evaluating the potential threat its introduction has to a new ecosystem before the introduction occurs.

The species described in this chapter were introduced for the purpose of providing a service. *Rhamnus cathartica* and *Lonicera* spp. were introduced into the Midwest states of North America for horticultural use and for improving wildlife habitat, *Pinus* spp. was introduced to South Africa for its forestry value, and *Acacia saligna* was introduced into South Africa to stabilize disturbed fynbos. Characteristics which made these species attractive for introduction were those that reduced the human resources and effort required to establish the species, and enabled the species to provide the needed service in a short amount of time. Such characteristics include short juvenile periods, high seed production, long seed viability, quick germination, and high biomass production, and, when combined with seed dispersal mechanisms, are also those which enable the species to invade and establish native floral areas.

Several negative repercussions have resulted from these invasions. All of the invasions have been correlated with reduced competition by native species, leading to a loss of floral diversity and altered community structure, though the mechanisms for these impacts varies. In the case of *A. saligna*, the large amount of above-ground biomass that is produced, as well as nitrogen that is fixed by the plant, results in increased mineral enrichment and organic matter input of the soil (Mehta). Fynbos typically has poor soil and native fynbos species are not adapted to utilizing extra nutrients. As a result, only *A. saligna* benefits from the enriched soil. *R. cathartica* employs a different strategy for reducing competition. It produces allelopathic chemicals in its fruit and leaf structures which act as germination and growth inhibitors to native plants (Gale). As a result, understory and ground-level species are replaced by *R. cathartica* seedlings.

Other impacts on native fauna, local hydrology, and the invasive species themselves have also been documented. Rich reports that mortality of *Turdus migratorius* (American Robin) nests in *Lonicera* spp. and *R. cathartica* is greater than that in native species, and competition dynamics between robins and wood thrushes are altered when *Lonicera* spp. are present. Mehta and Rabie

report that both *Pinus* spp. and *A. saligna* greatly reduce water yields from catchments in South African fynbos, converting permanent streams to intermittent streams. Rich also reports that the co-existence of two introduced *Lonicera* species, *L. morrowii* and *L. tatarica*, has resulted in introgression, creating the most aggressive *Lonicera* spp., *L. xbella*.

Invasion of these species has degraded native systems to the point where control measures must be taken to restore the integrity of the system. Effective control requires employing a combination of techniques based on knowledge of the species phenology and natural system characteristics, utilizing different management strategies under different situations, performing follow-up monitoring and control, and coordinating efforts between owners of adjacent lands.

Mehta presents an example of effective control resulting from a specific combination of techniques based on characteristics of the system and invasive species. This "integrated control" approach seeks to remediate each level of *A. saligna* impact on the fynbos ecosystem. A harvest of large *A. saligna* trees and branches from a site for firewood is first performed, followed by a prescribed burning. The firewood can be sold, alleviating the high cost of the harvest, and the reduction in fuel creates a low-intensity fire more characteristic of a natural fire in an undisturbed fynbos ecosystem. Low-intensity fire stimulates germination of native seeds and volatilizes excess nutrients in the soil. Fire also encourages germination of *A. saligna* seeds in the seedbank, which are then innoculated with a fungus. Control by the fungus is slow but complete, preventing the seedlings from reaching maturity and spreading to other *A. saligna* seedlings that emerge from the seedbank. Eventually, *A. saligna* will be depleted from the seedbank and the excess nutrients will be leached from the soil, returning the fynbos to conditions similar to its pre-invasion state.

Different situations may require different approaches to achieve satisfactory control. *Lonicera* spp. can invade both open areas and woodlands. Control for each situation differs, however, as described by Rich. *Lonicera* spp. seeds are short-lived, and thus repeated treatments may be effective in exhausting their seedbank. In forest systems, repeated cuttings can exhaust root reserves, leading to death. Repeated cuttings made in open areas may not achieve the same results as *Lonicera* spp. production is higher in full-sunlight areas. Herbicide treatments following repeated cuttings or burnings are more effective alternatives for this situation. Another example describing the need for different approaches for different situations was presented by Rabie for *Pinus* spp. control in fynbos. The "fell and burn" technique, which comprises a manual cutting of *Pinus* trees 18 months before a prescribed burn, was reported as an effective control. If used in locations co-invaded by *A. saligna*, however, this technique will favor the growth of *A. saligna* seedlings.

Follow-up monitoring and control is emphasized by all of the papers in this chapter. Incomplete control of the techniques, as well as the extensive nature of the invasions (which contribute a continual flow of propagules to the site), the large seedbank that each species can create, and the few number of individuals needed to reestablish a site necessitate such action if control efforts are to be sustainable. If follow-up monitoring and control is not performed, reestablishment of the site by the invasive species will be quick and efforts to restore the site will have been wasted. Rich and Gale also stress the need for a regional removal strategy to coordinate control efforts

and reduce the flow of propagules, as continual control will be required until seed sources are eliminated.

The woody invasive plants described in this chapter exemplify the negative impacts that exotic invasive species can have on natural systems and the enormous efforts and resources required to alleviate such impacts. Completely inadvertent introductions will likely continue in the future as the source of the introduction is hard to identify and prevent. Intentional introductions that serve human purposes, however, can be reduced in the future if steps are taken to evaluate the behavior and functioning of the species in its native environment and assess its invasive potential in other ecosystems. Control of invasive species and restoration of degraded ecosystems is a difficult, costly process, and one that is still poorly understood. The best strategy for alleviating problems associated with invasive species is, therefore, to prevent them.