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Overview of Vol.6, No.4 - Invasive Species of the Forest Ground Plane

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As one small person in the midst of countless grand trees of an old-growth forest, pondering the awesome changes that have occurred in the world during the lives of these ancient trees, it is easy to be overwhelmed. It is not difficult to feel a bit of mystery in the thick, still air under their thick canopy that provides a dark, damp, cool environment. Trying to recreate these forest understory conditions and the community that lives there, or even one remotely comparable, is therefore understandably daunting for restoration ecologists.

Typically, the primary concern in forest restoration is the reestablishment of tree cover. The larger the saplings planted, the quicker the forest will develop. However, it will still be many years until the environment present below the treetops resembles a forest understory. Depending on the specific forest system, the ground plane may support a thick litter layer, some coarse woody debris, and large populations of arthropods, microbes, and fungi. Forest ground plane vegetation depends on the special environment provided by woody cover, which is difficult to simulate. Nonetheless, if a restoration ecologist is concerned with establishing an understory plant community prior to canopy development, providing shade and mulch may aid in the survival of vegetation of the ground plane.

Generally though, little attention is given to planting understory species. It is, therefore, common to depend on natural recolonization. This is particularly true in forest systems managed for timber production. Although modern foresters are including concepts about ecosystem health into their management plans, priorities generally still lie with optimizing harvests. Foresters and managers need to carefully specify their objectives. For example, although many United States national forests are marked by 'land of many uses' signs, it seems counterintuitive to think that a forest can be managed equally well for resource production and conservation. Currently, a main focus of conservationists is the maintenance of biodiversity. Simberloff (1999) points out that "preserving biodiversity requires us to see a forest as a community of species rather than a wood factory." In order to do this, attention must be given to all forest species, even those herbaceous plants that may not provide direct financial gain.

Despite their lack of use in the building and paper making industries, forest understory plants are of great value to humans. Collecting herbs for medicinal and culinary purposes traces back to man's hunter and gatherer days. Pharmaceutical companies continue to invest large amounts of capital into researching plants for disease treatment. Hikers and children often enjoy their time in the forest while stopping for a closer look, a smell, or to pick wildflowers. Bird watchers and hunters would lose many creatures of interest to them if understory plants disappeared because most forest animals depend on the ground layer vegetation for food and cover.

In addition to the direct value of restoring ground plane vegetation, it is also important as a guard against further degradation. Lack of native vegetation on the forest floor and disturbed soil conditions leave the understory susceptible to invasion by exotic plants. Even mature, relatively stable forests are vulnerable to certain invasive species, such as *Alliaria petiolata* (McCarthy 1997). In this section of Volume 6 of Restoration and Reclamation Review, the biology and management of three invasive species of the forest ground plane, *A. petiolata* (garlic mustard), *Heracleum mantegazzianum* (giant hogweed), and *Hedera helix* (English ivy), are discussed. Alien invasive species are exotic species that become established in natural or semi-natural areas, are agents of change, and threaten native biodiversity (Species Survival Commission 2000). Therefore, it follows that a main impact shared by the species Susan Wilkins, Anne

Okerman, and LaRessa Mayer describe in their papers is a loss of biodiversity. Native plants suffer a reduction in abundance where invasive species occur, usually due to lower resource availability.

Typically, alien invaders have a competitive advantage over native species that allows them to advance into dominant positions in the ecosystem or habitat. A longer growing season relative to many native species in the areas they are invading has helped *A. petiolata*, *H. mantegazzianum*, and *H. helix* to acquire additional space, nutrients, and water. Another advantage exotic plant species have in the new habitat is a lack of specialized herbivores and other pests. Within native ranges, insects and disease often control plant populations, preventing many species that are invasive elsewhere from reaching high abundances. For instance, Susan Wilkins explains that over 30 insect species directly impact *A. petiolata* in Eurasia, which probably helps to reveal why its populations are smaller and more isolated there than in the United States.

Unique growth habits that influence competition for light, often characterized as aggressive or adaptable, also play an enormous role in allowing a species to invade. *H. mantegazzianum* is very aggressive because of its enormous size. As LaRessa Mayer points out, it is the largest forb in Europe. Reaching heights of 5.5 m and with leaves nearly 3 m wide; it is apparent how ordinary understory plants are easily out-competed. *H. helix* does not grow massive leaves, however, because it is a vine, it has the ability to reach greater heights than most understory plants and grow into already occupied spaces. Additionally, having two distinct growth forms, juvenile and adult, with different light requirements allows *H. helix* to thrive in a variety of conditions.

Interactions between multiple invasive species may have an even greater effect on the ecosystem than one alone. When a species that did not evolve within a region invades, it may interact with the environment differently than the native dominant species, thus creating novel conditions conducive to further invasion. Anne Okerman comments that scientists are observing an increase in the establishment of other exotic plants in areas invaded by *H. helix*. Another example of interactions between invasive species is found in midwestern forests of the United States where European earthworms are invading the forest floor. They consume leaf litter, and possibly live roots and seeds, thereby drastically altering the environment and community of the forest ground plane. The effects of their invasion have not been studied intensively thus far, but, as Susan Wilkins describes, less litter reduces the shade for germinating plants, which may consequently favor some exotics, such as *A. petiolata*, over native species that are adapted for growth under a thick litter layer.

Considering the complex of problems resulting from invasive species, it seems important to examine the cause. Most exotic plants were initially introduced to the regions where they have become invasive. Managed deciduous woodlands contain many understory plants, which were planted for amenity or cover for game species, that have since spread outside of their intended range (Crawley 1987). All three of the species focused on in this section were planted purposefully, *H. helix* and *H. mantegazzianum* as ornamentals and *A. petiolata* for culinary and medicinal harvest.

When such exotic plants are contained to gardens, they pose little threat. Unfortunately, accidental spread by animals and contaminated vehicles and clothing can launch populations in new areas. As the human population grows and development increases, there will be more traffic through natural areas and, therefore, alien invasions are likely to rise in frequency. More development will also translate into further fragmentation of forests. As the length of forest edge increases relative to the area of forest interior, the successful passage of exotic propagules into understory communities is expected to become more common.

Even as forested land becomes more rare, certain areas, such as riparian forests will be maintained. Managing riparian forests for their protection of water resources is a logical objective but it will be difficult to preserve their biodiversity. Just as water is important for transport of goods, wildlife, and humans, it also serves as a dispersal mode for invasive species. LaRessa Mayer explains how *H. mantegazzianum* has been dependent on river channels and riparian forests for expanding its range. Similarly, Susan Wilkins describes the spread of *A. petiolata* through floodplains and even storm water paths.

How can the spread of invasive species of the forest ground plane be stopped? Even if it was possible to discontinue the sale of non-native species, prevent travel within forested areas, halt all land development, and create enormous buffer zones around river and stream channels, exotic species would still populate new areas. The dispersion of plants and animals is a natural process. Without humans, dispersal would occur differently and slower, but it is illogical to attempt to stop it.

Responsible management actions can, however, serve to decelerate species invasions and control them. Gardening and landscaping with native species instead of exotics, particularly near natural areas like forests, reduces the odds of invasion. As Anne Okerman discusses, *H. helix* is commonly sold by nurseries outside of its native Europe, even though it has already become naturalized on 3 other continents. Cleaning clothing and vehicles that travel within forests, and lessening such traffic, also decreases the spread of exotic propagules. Continual monitoring can allow managers to detect and remove potential invaders before they become problematic (Reichard 1997).

After large populations are established, managers employ a variety of methods to combat the invaders. Chemical treatment is effective for all the species described in this section. Depending on the other management goals of a site, *A. petiolata* can be eradicated with prescribed burns, although it is likely to be less feasible if earthworm invasions have drastically reduced the litter layer. Mechanical techniques are quite successful for removing small populations of *A. petiolata* and *H. helix*, but physical removal of *H. mantegazzianum* must be executed with caution since its sap causes rashes. Biological control methods have yet to be developed for the species in this section, thus, research into them may be useful.

Prospects of future research into control methods and the growing awareness of invasive species lends hope that efforts to restore and preserve forests will be increasingly successful. Similarly, the global action for conservation of biodiversity is having an impact on management goals of systems ranging from timber production areas to national preserves. As the topics of invasive species and biological diversity merge within scientific and policy-making organizations, great leaps can made for safeguarding forested ecosystems. By integrating a variety of methods and concerns, managers will be able to formulate appropriate plans to protect the world's forests.

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SSC Invasive Species Specialist Group, IUCN Guidelines for the prevention of biodiversity loss caused by alien invasive species. Approved at the 51st meeting of the IUCN Council, February 2000, Gland Switzerland.