

Exotic Plant Management through the Seasons at Great Smoky Mountains National Park

by Kristine Johnson

Introduction

The official mandate of the National Park Service (NPS) is “to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” When this guideline was set forth in the 1916 Organic Act that established the National Park Service, no one’s worst nightmares could have foretold the threats our national parks face in 2003: poor air quality, urban sprawl at the boundaries, and a tremendous influx of exotic species. Still, the earliest NPS policies provide protection for the biological diversity of native species (from genetic through community levels) and for the prevention and control of exotic species, which constitute a primary threat. Additional guidelines were established in 1999, when President Clinton issued Executive Order 13112 directing all federal agencies to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.

At Great Smoky Mountains National Park, some of the earliest exotic invaders included chestnut blight, European wild boar and rainbow trout (introduced in the first part of the past century), balsam woolly adelgid, dogwood anthracnose, beech bark disease, hemlock woolly adelgid, and butternut canker. There are also around 380 species of exotic plants that remain from old homesites or have invaded disturbed areas such as roadsides, wildland fires, or construction sites. The National Park Service manages only about 50 exotic plant species: those known to be invasive enough to displace native plant communities, hybridize with natives, or interfere with cultural landscapes.

The history of exotic plant management at the Smokies goes back to the 1940’s, when fire control aides spent some of their off-season time on eradication of kudzu at old homesites. This early work provided a good foundation for the expanded resource management program that began in the 1980’s to implement an integrated pest management program. A team of botanists from the University of Tennessee (Drs. Ed Clebsch, Richard Clements, and Gene Wofford) conducted a baseline inventory of invasive exotic plants. Strategies then were developed to control each plant based on the species biology.

Control methods include hand pulling, mechanical cutting, and selective use of herbicides. The latter are carefully chosen for minimal environmental impact and used as sparingly as possible. Currently nearly 800 exotic plant sites are documented in the

Park’s database. All treatments and monitoring activities are recorded, and the database is referenced to an Arcview Geographic Information System.

To every thing there is a season...

Timing is crucial in an effective Integrated Pest Management program. For example, seed dispersal must be prevented in many species; action must be taken against garlic mustard by the end of April, while privet and multiflora rose don’t have mature fruit until late summer. Impact on non-target plants can be greatly reduced if treatments can be made during the dormant season. And since Japanese barberry produces leaves much earlier in spring than most natives, the seedlings are easy to spot and pull in early April.

Each of the following plants is well documented as invasive in the Mid-Atlantic States and all are expanding their range in the Southern Appalachians.

Early Spring

Garlic mustard (*Alliaria petiolata*) is a biennial herb in the mustard family. First recorded in the U.S. around 1868 from Long Island, New York, it was introduced by European settlers as a medicinal herb. Its leaves have a garlic-like odor when crushed, and its white flowers develop into prolific tiny seeds



Garlic mustard
(*Alliaria petiolata*)

with very high germination rates and viability in soil for up to ten years. The Park has five established garlic mustard sites. Several other sites were discovered near trailheads (perhaps seeds came off hikers’ boots or vehicles) and the plants were removed before seeds were produced. Of the established sites, four probably started during construction projects when seeds were brought into the Park with straw, contaminated seed mix, or soil. In recent years, the Park has adopted more stringent standards for imported construction materials, since prevention is preferable to subsequent years of control efforts. The fifth site is a riparian area where seeds apparently washed in from a tributary outside the Park or from a nearby road. Since garlic mustard is not perennial, its root systems usually are not extensive or deep, and the goal is to prevent seed set. Plants can be hand-pulled any time prior to bloom, which is usually April in East Tennessee. An established site (where seed production has occurred for a year or more) must be monitored for at least ten years to insure that no plants germinate. Over the past eight years, Park workers have removed 78,652 garlic mustard plants from Big Creek Campground, 23,617 from Balsam Mountain Campground, 21,850 from Cosby Campground, 15,663 from the Maloney Point Overlook, and 10,610 from Caney Creek near the boundary at Pigeon Forge. These figures indicate the exponential potential expansion of garlic mustard, which easily out-competes native spring flora.

Because all but the Maloney Point site are in areas with rich native flora, we have chosen the very labor-intensive hand-pulling method over herbicide.

Coltsfoot (*Tussilago farfara*) also is found in disturbed areas. One site within the Park is a roadside at high elevation and the second is a wildland fire area several miles from the Park boundary. Seeds may have been introduced to the fire site on firefighters' clothing or tools, or may have blown in from a distance. Over 520 plants were pulled in the past two years from the Wedge Ridge fire site, which burned in 2000. Coltsfoot is a perennial in the Aster family and somewhat resembles a dandelion, with a yellow flower and light, wind-blown seeds. Like garlic mustard, it was brought to America by European settlers as a medicinal herb. Coltsfoot can be hand-pulled to prevent seed set, but it also spreads vegetatively and has an extensive root system. Park workers made an alarming discovery last year when root segments an inch or more in size were potted up and within a few weeks had grown into entire new plants!

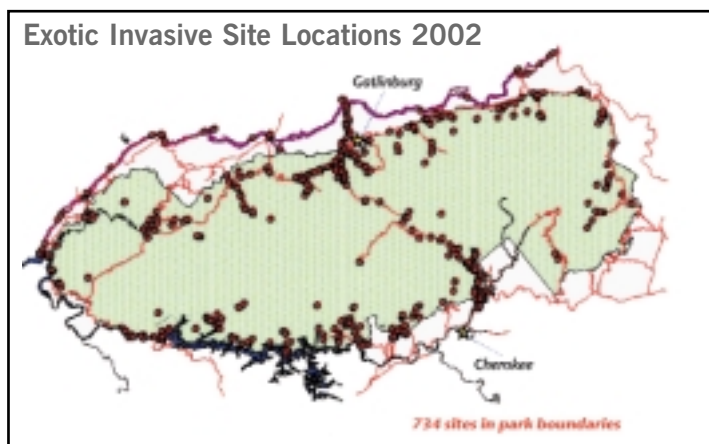
Japanese barberry (*Berberis thunbergii*) was introduced as an ornamental shrub in 1875 and is still widely used as a landscape plant. It spreads vegetatively but also produces prolific seeds that can be distributed for miles by birds and small mammals. It is shade tolerant and can form dense stands in a variety of habitats, from closed canopy forests to pastures. There are two barberry sites in the Park, and in both cases a few original shrubs have produced thousands of seedlings spread over several acres. At the Twin Creeks site, 1,048 seedlings were pulled in the past 8 years, originating from only one 'mother' shrub. At Elkmont, 2,839 seedlings have been pulled over the past 8 years, again originating from two large shrubs. The seedlings can be hand-pulled, and April is a good time to spot them because barberry produces new leaves earlier than most native deciduous plants. Larger shrubs are cut and stump-treated with glyphosate.

Late spring

Multiflora rose (*Rosa multiflora*) has leafed out by late April and early May, somewhat ahead of most native shrubs and thus easily visible. Small clumps of rose are easily treated by basal bark applications of triclopyr/oil in other seasons, but dense thickets of rose have been successfully treated with foliar applications of glyphosate. The Little Cataloochee section of the Park is a remote area where old homesites have been overgrown by multiflora rose that was planted in the 1930's as an erosion control (just prior to the Park's establishment). We estimate that by the late 1980's, when control was begun, over 12 contiguous acres of rose grew in thickets of various sizes throughout the Little Cataloochee area. Herbicide applications in this area are difficult due to the remote location (work crews must camp out) and the distance from water. In order to mix herbicide, water must be pumped up to holding tanks using equipment from wildland firefighting operations including portable pumps, fire hose and folding tanks. Now that native plants occupy many of the former rose sites, treatments are still performed in spring to reduce non-target impacts and for easier access.



Crew after a hard day of killing paulownia on the Blacksmith 500 acre fire site.



Summer

June and July are the best times to survey for paulownia or princess tree (*Paulownia tomentosa*), mimosa (*Albizia julibrissin*) and ailanthus or tree of heaven (*Ailanthus altissima*), since these invasive trees bloom during that time. Seedlings are hand-pulled, but larger stems must be cut and stump treated. One of our most difficult sites overall has been a 500 acre wildfire site that burned in the summer of 1999 and was subsequently invaded by paulownia, ailanthus and woolly or common mullein (*Verbascum thapsus*). Seeds of these plants blew in from large infestations just outside the Park boundary and quickly became established on the mineral soil left by the fire. Thousands of seedlings have been removed; some areas averaged 40 paulownia seedlings per acre. With no canopy left in many parts of the burned area, paulownia was in good position to become a dominant species. In November 2001 one of the largest fires in Park history burned 7000 acres on the North Carolina side of the Park. Unfortunately the southern boundary of the fire, just outside the Park, was an old municipal watershed area badly infested with paulownia and ailanthus. The Park received funds through fire rehabilitation to begin surveying and controlling exotics on this fire site.



Mimosa (*Albizia julibrissin*)

Chinese yam (*Dioscorea oppositifolia*) is treated prior to its summer production of bulbils. Glyphosate and triclopyr are both effective on yam.



Wisteria
(*Wisteria floribunda*)

By August, it's time to treat the few remaining kudzu (*Pueraria lobata*) and wisteria (*Wisteria floribunda*) sites left at old homesites. The

Park has documented 130 kudzu sites but, thanks to the hard work of those before us, only a few are still active. In recent years we have used the herbicides Transline in areas away from water and Accord near streams for control of both

kudzu and wisteria. Some of the sites are very remote now and require hiking several miles with equipment.

Our field trials for control of sericia lespedeza (*Lespedeza cuneata*) indicate best results from late summer treatments, which conveniently coincide with approaching fall frosts so that large brownout areas are not noticeable in treated fields. Our largest areas of lespedeza are in Cades Cove, where lespedeza and fescue were planted in the 1950s-1970s. Garlon 4 and Escort are the most effective herbicides for lespedeza.

Fall/Winter

Dormant season treatments can begin once frost has ended the growing season for all but the evergreens. Privet (*Ligustrum* sp.), Japanese honeysuckle (*Lonicera japonica*), vinca (*Vinca minor*), winter creeper (*Euonymus fortunei*) and English ivy (*Hedera helix*) can all be treated with minimal non-target impact. Foliar applications are possible on days when temperatures rise above 60°F. Garlon 4 and Accord are both effective on these plants, although Garlon appears to work more quickly. Basal bark and cut/stump methods also are used on privet, depending on the site.

Our biggest challenges are finding enough personnel (paid and volunteer) for the labor-intensive work, and preventing new invasions from sites outside Park boundaries. Recently we have made good progress in cooperating with Park maintenance and contractors to prevent introductions from using fill dirt, hydroseeding, and other construction activities. Straw is no longer used for mulch/erosion control because of the barnyard weeds that came with even 'clean' straw, and if fill dirt must be brought from outside the Park, the site of origin is inspected first for weeds. The Park has been able to persuade some neighboring landholders to control their own exotics (especially those that produce seeds carried by birds or wind), but many are unable or unwilling to cooperate. We hope that through the Exotic Pest Plant Councils and other educational programs, the general public will become more aware of the threats exotic plants pose to our natural areas, so that we may "leave them unimpaired for the enjoyment of future generations."

Kristine Johnson is Supervisory Forester at Great Smoky Mountain National Park and can be reached via e-mail at Kris_Johnson@nps.gov

More information can be found at:

- *Tennessee Exotic Pest Plant Council, www.tn-eppc.org*
- *Southeast Exotic Pest Plant Council, www.se-eppc.org*
- *University of Tennessee Botany Department, <http://tenn.bio.utk.edu>*

Park visitors who find any of these plants in the Park can notify the vegetation management section at 865-436-1707.

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