13

forest WISDOM

forest guild national publication / spring 2009

in this issue:

Dave Ellum

Forest Guild member Dave Ellum is assistant professor of sustainable forestry at Warren Wilson College in Asheville, North Carolina. His current interest is in silviculture prescriptions that maintain floristic diversity in the understories of managed forests. He holds a BS in Wildlife Biology from North Carolina State University and an MF and PhD in Forestry from Yale University.

PROACTIVE COEVOLUTION: *Staying Ahead of Invasive Species in the Face of Climate Change and Uncertainty*

by Dave Ellum

The next generation of foresters, silviculturists, and forest managers will have to be far more imaginative than my own in predicting management outcomes. Until recently, our profession has had the luxury of basing management prescriptions on the ecological response of well-defined forest communities under relatively stable regional climates. With climate change, successfully predicting the outcomes of long-term management prescriptions will be far more elusive than it was for our predecessors.

Facing an uncertain future

For example, where I live–in the southeastern United States–a warmer, drier climate could have profound effects on the forest communities under management. As plant species ranges shift north or contract, competition dynamics could become fundamentally altered and standard regeneration methods could produce limited success. Shifts in species ranges could also provide opportunities for unique species mixtures, leading to the development of novel forest communities unseen during recent times.

The uncertainties brought about by climate change are especially relevant to managing future threats of invasive plant species to our native forest ecosystems. To meet this challenge, we will have to develop proactive approaches that focus on identifying future invasive species, promote management strategies that reduce the opportunity for invasion, and prioritize our efforts in combating these species.

continued on page 3

forest **WISDOM**

issue thirteen / spring 2009

forest **GUILD**
P.O. Box 519
Santa Fe, NM 87504
505-983-8992
505-986-0798 F

*forest***GUILD**

ON EXCELLENT FORESTRY AND INVASIVES

Dear Forest Guild members and friends,

What poses the greatest threat to the ecological and ecosystem services values of our forests during the coming decades? Invasive Species—even the threats of climate change and land conversion may have a smaller impact in the near term. The effects of climate change may take center stage in the latter half of this century, but invasive species will amplify those impacts as Dave Ellum (page 1) discusses. Similarly, the number of acres of forest affected by development or fragmentation will be multiplied by the spread of invasive species.

Invasive species are usually exotic or alien species that have gained a foothold in a new environment and are flourishing there—at the expense of native species and ecosystem function. Unfortunately, humans facilitate most of the movement of exotic species, often intentionally. For example, the shrubby lespedeza (*Lespedeza bicolor*) Bruce White mentions (page 11) was originally planted for quail habitat. Both plants and animals can become invasive, and they need not come from a distant continent. However, with changing local environmental constraints, species from nearby ecoregions can become problematic for their neighbors. As John Riggins and Andrew Londo point out (page 6), even native insects that have no history of outbreaks can rise to the level of pest because of anthropogenic disturbances. Similarly, the Mescalero tribe (page 15) is thinning a native species to restore natural forest conditions.

This issue of *Forest Wisdom* not only delves into invasive threats to the forest but also suggests a response to the threat of invasives: excellent forestry, because it engages intact forests, discourages land conversion, and takes an active approach to managing forest threats. One of the central tenets of excellent forestry is to ensure that forest ecosystems remain whole and thus more resistant to invaders. Guild members discourage land conversion by helping landowners realize financial benefits from healthy forests, often through a combination of easements, harvests, non-timber forest products, and the sale of carbon and other ecosystem services.

The selective harvests employed by many Guild foresters generate income while minimizing the sorts of disturbance that invasives exploit. Charlie Moreno (page 8) explains how he has built invasive control into his standard harvest planning, and Christopher Riely (page 4) describes a holistic approach to multiple threats in the forests managed by Providence Water.

If there ever was a time when forest preserves could just be fenced off to protect them for future generations, that time has past. The active management Guild members offer may be the only way to combat the insidious spread of invasives into conservation lands. Conservationists must play an active role in forests to combat the rising tide of invaders and force of climate change.

As the Guild's research director, I would be remiss if I failed to mention the importance of science in providing land stewards with tools to recognize and combat invasives. While the long experience of Guild members informs much of their relationship with the land, new research is essential to deal with new threats. As one step in that direction, we have compiled information on invasives (those mentioned in this issue as well as many others) on the Guild's Ecological Forestry Initiative webpage at www.forestguild.org/invasives.html.

Sincerely,

Zander

Zander Evans

Staying Ahead, from page 1

Currently known invasive species such as multiflora rose (*Rosa multiflora*), Oriental bittersweet (*Celastrus orbiculatus*), privet (*Ligustrum sinense*), and autumn olive (*Elaeagnus umbellata*) may be the least of our future management worries in the face of climate change. Conceivably, we could see niche contraction of some of these species and subsequent declines in populations. I believe it is far more likely that we will have to deal with a whole new set of invasive species: those that are completely new to our forest ecosystems, or background species that do not currently cause problems but will become invasive due to climatic release. In Great Smoky Mountain National Park, for example, there are 380 exotic species currently documented, but only 35 of these are considered invasive. Changing climate could release many of these species from environmental or competitive constraints, providing a whole new suite of invasive species needing management. In addition, we could find some native species becoming more aggressive and taking over sites, leading to regeneration failure and damage to current stands. We may already be seeing this in the Southeast with the increased growth of woody vines such as poison ivy (*Rhus radicans*) and grape (*Vitis sp.*). These scenarios require that we shift some of our attention and resources away from fighting well-established species and focus instead on a proactive approach of predicting and managing what lies ahead.

How can we manage the successful invader?

Plant ecologists have done much of the work determining which life history traits make a species a successful invader. These traits include early sexual maturity, many light and widely dispersed seeds, rapid growth, extended growing periods, high photosynthetic rates, and the ability to rapidly colonize disturbed sites. As forestry professionals, it is our responsibility to assess the variety of management prescriptions at our disposal for their tendency to either promote or limit the invasion of managed sites by exotic species.

Conditions that could facilitate invasion during the course of management include exposed mineral soil, high light environments resulting from complete canopy removal, fragmentation of stands, permanent roads into forest interiors, and short rotation lengths. These conditions not only promote the colonization of exotic invasive species, they also limit the ability of native, forest-interior plant communities to maintain viable populations due to physiological stress, low reproductive rates, and physical damage.

Regeneration treatments can be designed to limit the probability of invasion while creating environments favorable to native woodland species. The small openings created by group selections (above) can reduce the area/perimeter ratio of gaps, while shelterwood systems (below) retain some canopy structure during regeneration.

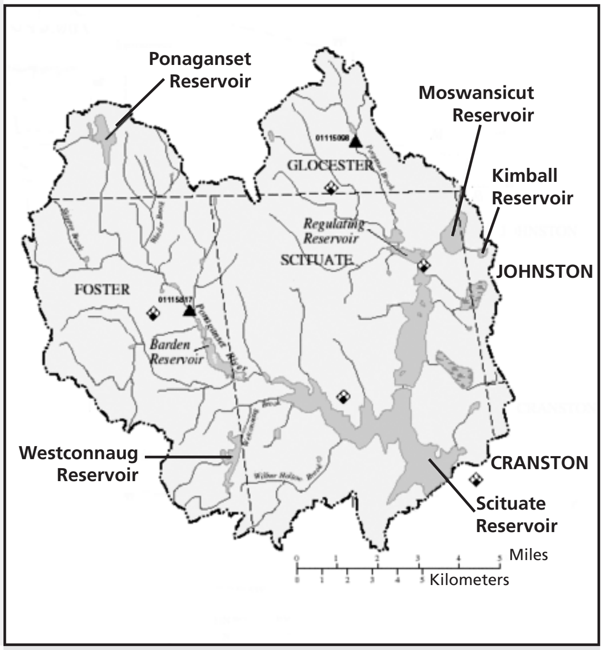
Keeping this in mind, I believe the most effective management practices will not only limit the probability of invasion, but also provide a competitive advantage to native forest species. Such practices would include: (1) creating irregularly shaped harvest gaps with viable populations of native species remaining along gap edges, (2) using small group selections to maintain smaller area-to-perimeter gap ratios, thereby limiting the extent of high-light gap centers which favor early successional colonizing species, (3) relying on advance regeneration whenever possible, (4) limiting road systems to reduce the amount of bare mineral soil exposed during operations, and (5) establishing shelterwood systems that maintain canopy structure during regeneration.

continued on page 12

"In most cases it is not reasonable to use the words "elimination" or "eradication" in our invasive species management plans."

MAP KEY

Water Body
Wetland
Basin Boundary
Town Boundary
Precipitation Monitoring Site
U.S. Geological Survey Station



Providence Watershed Map. Courtesy of the U.S. Geological Survey.

How Invasive Plants and Deer Herbivory Impact One Municipal Watershed

by Christopher Riely

Christopher Riely
A licensed forester and certified arborist, Christopher Riely is a Forest Guild member who has returned to his native New England after gaining a wide range of on-the-ground experience as a journeyman professional in Pennsylvania, Missouri, and Washington State. He is now a watershed forest manager for the City of Providence's public water utility.

The Providence, Rhode Island, Water Supply Board (Providence Water) was established in 1926 and is now an independently operating city department supplying water to about 600,000 people, or two-thirds of all Rhode Islanders. Providence Water manages a total of about 17,500 acres of city-owned lands, within the 93-square-mile public drinking supply watershed. The surface areas of the main Scituate Reservoir and five smaller tributary reservoirs comprise 5,000 acres, which are surrounded by 12,500 acres of mostly forested lands. The current mixed oak-pine forest has been heavily shaped by human settlement and changing land uses over the past three and a half centuries.

When I describe trying to control invasive plants to non-forestry acquaintances, I often compare it to epidemiology or the practice of triage in an emergency medical setting. Inevitably the question arises: How do we allocate limited staff and financial resources to control invasives when eradication is clearly impossible? Personal observation at Providence Water has led me to believe that one place we should particularly focus our efforts is where invasives are hindering the development of regeneration in stands that have been harvested fairly recently. Regeneration is essential to the health of the future forest and is especially important in light of the fact that most of our stands are relatively mature, largely even aged, and less than 100 years old.

Some well-intended silvicultural interventions were undertaken in the recent past to mitigate looming forest health problems caused by invasives on the Providence watershed. The mitigations have been successful in solving the target problem but have also produced unforeseen side effects. The best example comes from the hundreds of acres of red pine (*Pinus resinosa*) stands which were planted between 1926 and 1940, during a period of forest reestablishment on former agricultural lands. The red pine scale insect (*Matsucoccus resinosae*) was not known to those who supervised the planting of the red pines on the lands around the reservoirs. However, this exotic insect, introduced to the New York area around 1939, slowly migrated northward as the red pine plantations around the Providence reservoirs were maturing.

Around 1990, forest managers commenced an aggressive red pine harvesting program to combat the threat of widespread mortality and to shift the composition of these stands back to native species. Intentionally light to reduce the risk of windthrow, initial shelterwood preparatory cuts were intended to both establish and release regeneration. Subsequent harvests were then designed to further release regeneration or promote its development if none had become established after the first cut. Finally, variable retention harvests and patch clearcuts were commenced a few years ago in stands where trees had started dying from the insect infestation.

The red pine harvesting effort is now winding down, but many of the few remaining red pines in difficult-to-access locations or around the reservoir shorelines are now dead or dying due to red pine scale. While many areas are doing fine, a few of the former plantations—especially those along roads where invasive seeds easily colonized the openings and disturbed soil inevitably roughed up by logging—are now the location of some of our most significant invasive plant problems. Complicating ecological detective work, these roadside edges are also the forest areas most heavily impacted by past human activities, and in many locations the invasives were already present in the understory and influencing the stands.

> *"Our invasives are often most problematic in areas where deer browsing prevents native forest -regeneration from becoming truly established."*

Invasive plants

It is easy to comment in hindsight that these roadside harvests were a recipe for either inviting invasives onto watershed lands or releasing established populations. However, the plans were supported by traditionally sound silvicultural reasoning; the dying trees posed real wind and fire hazards; and as recently as ten years ago, our understanding of invasives was much more limited than it is today. Reclaiming and establishing native trees in these stands which have been overtaken by bittersweet, barberry, and/or buckthorn is one of our management priorities.Oriental bittersweet (*Celastrus orbiculatus*) forms dense tangles and thickets along roadside edges, in forest openings, and in forest stands in which harvesting has allowed enough light to reach the understory. Where it is particularly well established, its thick, ropelike vines even climb and slowly kill the native trees.

Japanese barberry (*Berberis thunbergii*) can grow in the shade of forest understory and thus may be the most widely distributed invasive in our forest. Our ownership contains at least two several-acre barberry understory monocultures. Common buckthorn (*Rhamnus cathartica*) quickly grows into tall clumps along roadsides, edges, and open areas. The presence of these invasives, especially barberry, seems to be highly correlated with locations of past human inhabitance and land use, such as old cellar holes and cemeteries. In a few places, which resemble a restoration ecologist's nightmare, these species may even be found growing together or with another invasive such as garlic mustard (*Alliaria petiolata*) or burningbush (*Euonymus atropurpureus*).

Deer herbivory

These invasive plants are not the only challenge to forest regeneration on the watershed. White-tailed deer populations are high across southern New England due to the large amount of suitable habitat, low levels of natural predators, and slow decline of sport hunting. Closed to casual public access for security reasons, the watershed offers a refuge for deer as well as other species of wildlife. Research on deer herbivory has shown that deer help spread invasive plants long distances by eating seeds in edge or disturbed habitats where invasive plants are more common and then depositing them in forest interiors to germinate and grow. Deer also encourage some invasives because they avoid them and preferentially browse their native competitors. For example, deer will avoid garlic mustard or Japanese barberry and allow them to flourish while decimating populations of native Canada mayflower (*Maianthemum canadense*) or white trillium (*Trillium grandiflorum*).

Hardwood tree seedlings, particularly the oaks that form such an important forest component, are among the preferred staples of a deer's diet in Providence Water forestlands. The fact that the deer have an apparent distaste for invasives compared to native plants compounds the problem. A walk through our forests during the growing season will typically reveal oak seedlings with signs of having been nibbled for several successive years, and likely some small white pines with nipped tops. Most unsettling are the stands where an oak shelterwood regeneration harvest has been conducted and one can find hardly any hardwood seedlings at all: the anticipated regeneration is just not there.
At the Water Supply Division, our team is

continued on page 13

Two examples of invasive species:
Above - This worst-case scenario example shows Oriental bittersweet vines in winter that have overrun an unmanaged former red pine stand.
Below - Japanese barberry has taken over the understory in this roadside stand.

WOLVES IN SHEEP'S CLOTHING

Outbreaks of Previously Obscure Native Forest Insects

by John J. Riggins and Andrew J. Londo

Adult male red oak borer.

John J. Riggins is an assistant professor of forest entomology in the Department of Entomology and Plant Pathology at Mississippi State University (MSU). His research utilizes traditional ecological methods and remote sensing techniques to better understand the ecology of native and introduced forest insect pests.

Andrew J. Londo is a professor in the Department of Forestry at MSU. He serves as the state pine silviculture extension specialist and extension forestry coordinator for the MSU Extension Service.

Well-known native epidemic pests such as the southern pine beetle (*Dendroctonus frontalis*) have exhibited outbreak behavior throughout recorded history. Although unpredictable, their outbreaks are expected to occur. Recently, changes in the frequency, severity, and range of certain well-known native forest pests such as the mountain pine beetle (*Dendroctonus ponderosae*), among others, have been investigated because of linkages to climate change.

The advent of a "global society" has subjected our forests to exotic insect species such as the gypsy moth (*Lymantria dispar*), emerald ash borer (*Agrilus planipennis*), and Asian long-horned beetle (*Anoplophora glabripennis*). These alien invaders are prone to spectacular outbreaks because they have been liberated from their natural regulatory influences, such as parasites, predators, and diseases. Not surprisingly, these invaders have attracted the attention of forest health specialists.

However, almost no consideration has been given to understanding the effects of direct and indirect anthropogenic disturbance on obscure forest insects with no track record as agents of forest mortality. Outbreaks of previously innocuous native forest insects are rare in their native ranges and on their native hosts, but several examples do exist. In 1999, an outbreak of the red oak borer (*Enaphalodes rufulus*) occurred in the Arkansas Ozarks. More than 400,000 hectares were affected, and more than 60 percent of the mature red oak component died, drastically altering the dominant forest type (oak-hickory) in the Ozark-Ouachita Highlands. While no previous reports of outbreaks or association with tree mortality existed, in this outbreak the red oak borer was a major contributor to the mass death of thousands of trees.

Population densities of fewer than one adult beetle emerging per tree were once considered severe infestations, but densities of up to 175 emerging adults per tree were estimated during

"Despite over 50 oak decline events within the home range of the red oak borer during the last 100 years, the red oak borer had never before been associated with oak decline."

this outbreak. Despite over 50 oak decline events within the home range of the red oak borer during the last 100 years, the red oak borer had never before been associated with oak decline. Evidence suggests that logging activities at the beginning of the 1900s and fire suppression coincided to bring about densely stocked, over-mature stands of northern red oak (*Quercus rubra*) on relatively poor sites (xeric ridges and southern slopes) where the highest populations of red oak borer were observed. Periods of acute short-term drought in the 10-20 years previous to the outbreak may have served as the inciting factor for this event.

Another obscure forest insect, the pine looper (*Phaeoura mexicanaria*) defoliated approximately 25,500 hectares of ponderosa pine (*Pinus ponderosa*), its native host, in southeastern Montana in 1969 and 1970. When the outbreak was discovered, it represented the first time the pine looper had been collected in Montana. In fact, there had been no previous reports of high population densities or tree damage anywhere. As in the case of the red oak borer, very little was known about *P. mexicanaria* before the outbreak. The larval host tree was not even identified until 1962. *P. mexicanaria* has a rather large range (in suitable habitat throughout western Canada and the United States), but had previously been found only in very low numbers. This outbreak remains unexplained but did follow the outbreak of another well-known pest species, the pine tussock moth (*Dasychira grisefacta*), that took place in a densely stocked forest, which provided an overabundance of host material.

Beginning with an outbreak in 1996, three species of native geometrid defoliators were implicated in major tree mortality events in the southeastern U.S. *Nepytia janetae* was identified as the causal agent of a major spruce and fir defoliation event (more than 4,000 hectares) in eastern Arizona in 1996. *N. janetae* is another "looper" moth and was not described by science until 1966. The defoliation attracted a secondary attack from bark beetles, ultimately causing

Northern red oak in final stages of decline.

extensive tree mortality. Similar to the red oak borer, the population suddenly crashed in 1999. Subsequently, *N. janetae* and two other species of native geometrids (*Enypia griseata* and *Galenara consimilis*) have had outbreaks in

Aerial view of landscape-scale tree mortality in Ozark National Forest in 1999 during red oak borer outbreak.

the southwestern U.S. (Personal communication, Bobbe Fitzgibbon, USDA Forest Service, 2008).

The pale-winged gray moth (*Iridopsis ephyraria*) is another relatively rare species that normally exists at low population levels and has a rather large range (Alberta to Nova Scotia in Canada, and south as far as Texas). In 2002, in southwestern Nova Scotia, it was found in very high numbers, causing significant damage to eastern hemlock (*Tsuga canadensis*). Causes of this outbreak are not clear, but evidence suggests that an increase in host suitability due to drought-induced tree stress or airborne pollutants may have contributed to this event (Personal communication, Dr. Graham Thurston, Canadian Forest Service, 2008).

Three major types of anthropogenic disturbances (climate change, fire suppression, and even-aged stand management) may be causing a world-wide increase of insect outbreak severity, frequency, and distribution, as well as allowing normally harmless insects to reach epidemic populations. Climate change is being increasingly indicted for changes in forest pest systems. Some well-known outbreak species are potentially being influenced by climate change (e.g., bark beetles, eastern larch beetle, western pine beetle, and mountain pine beetle), and these changes are expected by some to worsen if global warming continues. In addition, fire suppression and even-aged stand management during the last century have created conditions more akin to agroforestry (low diversity, high stem density, even age) than to natural forests. Therefore, we are now beginning to see agro-forestry-like problems: destructive outbreaks of secondary or formerly inconsequential pests. In the case of red oak borer and some of the

"*We are now beginning to see agroforestry-like problems: destructive outbreaks of secondary or formerly inconsequential pests.*"

continued on page 14

It is essential to remove the entire root to prevent re-sprouting.

Close-up of Japanese barberry in bloom. Photo credit: R.A.Howard ©Smithsonian Institute @USDA-NRCS Plants Database.

FORESTRY TIPS

Controlling Invasive Plant Species in New Hampshire Forests

by Charlie Moreno

Charlie Moreno
lives in Strafford, New Hampshire, where he has practiced as a consulting forester since 1980. He has a forestry degree from the University of New Hampshire and has been involved with the Forest Guild since its inception.

Glossy buckthorn (*Rhamnus frangula*), Oriental bittersweet (*Celastrus orbiculatus*), and burningbush (*Euonymus atropurpureus*) are among the most serious exotic invasive plants threatening New Hampshire's forests.

- **Glossy buckthorn** exemplifies site "plasticity," growing in a wide variety of conditions ranging from fully lit canopy openings to shaded softwood stands, from mesic to xeric soils. It will overtake a disturbed forest understory, often after logging, with astonishing speed.

- **Oriental bittersweet**, a fast-growing climbing vine, entangles and eventually strangles a forest. Roadsides and field edges are major vectors for forest invasion.

- **Burningbush** has been widely planted for residential and commercial landscaping. The ensuing spread into local forests is just beginning. The multitude of shoots from seed and root suckering render burningbush a challenge to rein in.

These plants typify the management challenge facing foresters across the country. In almost every region non-native plants imperil the forest environment. Once unleashed, alien invasives compromise forest heath in a variety of ways that result in impoverished plant diversity, diminished nutrition for wildlife, and increased difficulty in natural forest regeneration. Near-monocultures may also disrupt pollinating insects and allow increased soil erosion.

Early detection is key to keeping problematic non-native plants at bay. Eradication is possible in the earlier stages of infestation, when plants are relatively few in number. Control is a compromise option for widespread infestations. With this latter approach, plants are present but not allowed to produce seed, thus curtailing their spread. Invasive plant management is now routinely considered in our silvicultural prescriptions, both from preventive and control perspectives. Prior to a forest harvest, removal of stray invasive plants in the forest and surrounding area is recommended. We often uproot these plants, if manageable in number, while marking trees during the preparation for a thinning. Uprooted plants are hung in shrubs, piled on rocks, or carried out of the forest, as they can re-root if left on the ground.

A multi-step approach is necessary for large shrubs and vines or more extensive infestations.

This process involves plant detection, removal, disposal, and follow-up eradication or control.

Detection

An excellent time to find non-native invasive plants is early in the spring growing season, as many alien plants green-up before the natives. Since it is possible for even a well-trained eye to overlook individual plants during the summer, a "mop-up" search is nearly always warranted in the fall. During autumn leaf fall, non-native plants are relatively easy to detect because many remain green long after native plants. In addition, many species have characteristic fall color. For example, burningbush turns bright crimson, while bittersweet is a distinct mustard yellow. These color nuances are important for finding small shoots that have sprouted during the summer after initial control efforts in the spring.

A weed wrench can be used to successfully uproot invasives.
Photo credit: courtesy of www.weedwrench.com

Removal

Multitudes of smaller shoots can be efficiently pulled from rain-softened earth. It is essential to remove the entire root to prevent re-sprouting. Bittersweet vines usually have a very long rhizome—sometimes as long as the vine. A canvas shoulder sack is handy to collect the pulled shoots. Large plants (too large to pull by hand) can be removed with a weed wrench or cut with a rotary saw or chainsaw. Stems loaded with seeds should be bagged or cut above a tarp to capture as many seeds as possible. The best time to harvest well-established plants is prior to seed maturation (spring to midsummer), thus avoiding the need to contain the new crop of seeds.

Disposal

Disposal involves burning, desiccation, or other means that preclude the inadvertent re-rooting of cut stems or planting of seeds. Burning usually requires a hot coal fire, as piles of non-native plants tend to smolder. Solar desiccation is a passive disposal method—we pile the stems on a blue tarp (commonly used by campers), dice the pile with a chainsaw to pack it down, and then cover it with a thick black plastic sheet. Dried stems are usually nonviable after a year. However, seeds in the pile may remain viable well after stem desiccation. Rodents may also find their way into the cached seeds—and later spread them. Therefore, it is best to keep stems with seeds out of desiccation piles. Piles of plants may also be deeply buried (at 5-plus feet), which can be an option if an excavator is on-site for creating a woods road, landing, or field conversion. A final disposal option for a small volume of stems, though controversial for some, is traditional avenues via a regional, contained landfill or trash-burning facility.

Follow-up

Follow-up control takes varied forms, beginning with the inevitable stump sprouting and root suckering that occurs when invasive plants are cut. Sprouting can be managed either by continuous mowing (generally unfeasible in a forest setting), annual stem cutting prior to seed production, or the use of an herbicide to kill the remaining root stock.

Herbicides may be a cost-effective control mechanism. However, herbicides can impair soil mycorrhizae; harm birds, insects, and microorganisms; and cause the unintended die off of non-targeted plants. Negative effects may be mitigated by reducing and carefully targeting the plant surface area to be treated, in one of two ways: (1) Herbicide can be painted with a foam brush onto the surface of cut stumps. This should be done within an hour or two of cutting; adding food coloring to the herbicide

continued on page 14

> *"An excellent time to find non-native invasive plants is early in the spring growing season, as many alien plants green-up before the natives."*

These four photos show volunteers working to control jubata grass in Mendocino County, CA.

FOREST GUILD MEMBERS

Observations, Hunches, and Experience with Invasives

You can receive your *Forest Wisdom* electronically!

You can save trees, reduce the Post Office's carbon footprint, and help the Forest Guild keep its overhead down simply by having future issues of Forest Wisdom delivered to you electronically. Just send us an email at membership@forest-guild.org and put "e-wisdom" in the subject line.

We'll do the rest!

Thank you for supporting the Guild.

Barrie Brusila
(Warren, Maine) on turkey resurgence and the spread of invasives

In the last ten years or so, I've seen an alarming increase in the abundance and frequency of invasive species in southern and midcoast Maine where I work. I was involved in a 30-acre barberry eradication project last year, and the farm manager of this property mentioned noticing a turkey "browse line" on the Japanese barberry (*Berberis thunbergii*) prior to the control work. This sparked my (as yet not scientifically proven) theory that turkeys are likely responsible for the rapid spread of barberry and perhaps other invasives as well. The turkey population resurgence in Maine correlates with proliferation of barberry. I see flocks of 40 or more feeding and then walking through the forest, where they scratch up the duff layer to look for more food, then pass seeds through their droppings into a freshly prepared seed bed! Of course, we humans still contribute to the problem of invasives by not immediately eradicating them when we find them, and even more so by continuing to plant them.

Gerry Hawkes
(Woodstock, Vermont) on mechanical removal of invasives

Over the past several years, my business has been experimenting with new ways to control invasives without the use of herbicides, or at least the minimal use of herbicides. Our efforts have centered around the development of moderately sized mechanical treatment equipment based on armored, four-wheel-drive tractors with attached implements that can work effectively in the wildland-urban interface to reduce fuel loading and wildfire hazard. I believe that the brush-and-debris rake on the front of our machines is highly effective in uprooting woody invasives, which we then shred with a rear-mounted mulcher/shredder. I've found this process to greatly retard the resprouting of the invasives and to leave a debris-free site with patches of bare ground that can be readily replanted with desired species. If you are interested in finding out more about this, please email me at ghawkes@wildblue.net.

Darcie Mahoney
(Elk, California) on dealing with jubata grass

In a watershed on one property we manage in Mendocino County, we are trying to curb jubata grass (*Cortaderia jubata*), which is very aggressive on bare soil, such as roads and landings. Local community members have been interested in helping with on-the-ground work in this forest. Last fall, along a 2-mile section of the property, many community members and I cut off the flowering heads of jubata (to reduce the seed source) and dumped them in the forest understory but not on bare ground. Our thinking was that if any germinated, they would not fare well in the shade. In December, we also began pulling the actual plants out of the ground by their roots using shovels and pulaskis and piled them on the property. This spring, the community group will cost share with The Conservation Fund for a small excavator to remove the largest plants before they flower and seed. Most jubata control efforts I am aware of seem to involve scraping the soil. I believe that creates perfect conditions for invasives' growth. Although we don't have any results yet, I think minimizing soil disturbance, keeping mulch on the ground, and reducing the seed source may be a more effective method over the long term. We'll see.

Bruce White
(Raleigh, North Carolina) on battling shrubby lespedeza

Shrubby lespedeza (*Lespedeza bicolor*) is a non-native, invasive shrub originally planted throughout the South for quail habitat. While it is very good habitat when maintained, if left alone for more than three years, shrubby lespedeza (also referred to locally as "bicolor") will spread widely and often takes over forest openings to the exclusion of most other plants. It is a particular problem in tracts managed for longleaf pine, as many longleaf stands are located in or near managed quail plantations, where the pesky plant is likely to have been planted. Fire simply spreads the plant faster, and the seeds lay dormant in the soil for many years, waiting for sunlight to release them. Herbicides have been effective; however, when bicolor occurs in a young longleaf stand, there are very limited herbicidal options that will control the invasive but not damage longleafs. The most important lesson I've learned so far is that it pays to eliminate the bicolor before any attempts at longleaf planting or restoration are made. Options become very limited if you wait until the longleafs are established to attempt control.

Russ Richardson
(Arnoldsburg, West Virginia) on equipment hygiene

Many invasives, including Japanese stiltgrass (*Microstegium vimineum*) and garlic mustard (*Alliaria petiolata*), produce small seeds numbering close to 500,000 per pound. Seeds are easily spread by any equipment used in forest management, i.e., everything from logging boots to ATVs to skidders. Mud on boots can easily track seed from one property to another, and muddy landings containing a lot of stiltgrass can spread from one property to the next. In addition, dried mud that becomes dirt and dust on the floor of a forester's pickup will spread seeds to nearly every place a forester walks. A regular vacuuming before driving to a new site is recommended to remove woodland detritus from the floor of pickups. It is also a good practice to empty the dusty debris that accumulates on floor mats…anywhere…but NOT onto the ground.

Increasingly, foresters are using ATVs during timber sale administration and inventory work. In addition to their obvious potential for spreading weeds with muddy wheels, many models of ATVs have skid plates that can trap and hold large quantities of trail debris, including weed seeds. Every type of trailer, whether it is a small one used to haul ATVs or a flatbed that transports bulldozers and skidders, can be a significant source of invasive plant infection. Regular high-pressure cleaning of trailers used to move equipment to and from infected properties is an effective way to stifle the spread of some of the worst invasive plants. Bulldozers (and bulldozer tracks), skidders, skidder chains, chain chokers, wire cables, and anything else that passes through the dirt can also disperse seeds. For property owners, making sure that only clean logging equipment enters their woodland is presently the best peace of mind available.

Staying Ahead, from page 3

> *"My mentor is fond of saying that good silviculture does not come from a cookbook."*

While we can implement management practices that limit the negative effects of invasive species, in most cases it is not reasonable to use the words "elimination" or "eradication" in our invasive species management plans. Many of these species cannot be realistically removed completely and prevented from returning long term unless intense resources are expended. When those resources include repeated herbicide treatments, the potential for negative side effects could outweigh the management goal. This is especially true in forest stands that are surrounded by non-forested landscapes or forest blocks that are small and isolated.

Native woodland species such as Trillium grandiflorum may find refuge from invasive species and climate change in north-facing cove forests of the Southern Appalachians.

The desire to eliminate or eradicate invasive species can in part be attributed to our desire to return our forests to their historic conditions. However, the combination of a century of intensive management combined with changing climate most likely makes historic conditions unattainable. A more appropriate approach to invasive species control would be to manage these species at "acceptable levels"; what constitutes an acceptable level should shift on a case-by-case basis depending on the individual site and the desired management outcome. Forests of unique conservation or social value, or high economic value, should merit lower acceptable levels than more widely represented forest types or non-production forests.

The species we choose to manage against should also be prioritized by the probability of success, as well as the amount of damage they can inflict on the forest system. What this means is that some exotic invasive species might have to be accepted as part of our "natural" forest systems so that other more detrimental species, or species that are more reasonably considered controllable, can be given increased attention. Unfortunately, many of our worst invasive species threats might still be on the horizon and very difficult to predict, let alone prioritize.

Using our place-based knowledge to protect forest resiliency

Using the place-based knowledge that comes along with sound ecological forestry will be an important tool in identifying potential problem plants before they become full-scale invaders. This work cannot be left to researchers alone. It must also be a task for the practitioner in the field to use his or her intimate knowledge of a forested landscape to identify and bring attention to subtle changes in forest structure and composition. One priority will be to identify and document any plant species, exotic or native, early in the population growth cycle that could indicate the beginning stages of invasion. This would include new species that suddenly occur as well as background species that become more abundant or diversify the habitat types where they can be found. Another important task will be the identification of landscape features that could become refugia where native plant communities could persist in spite of invasive species and climate change, due to their ability to compete in temporally stable conditions. As with our management practices, it will be as important to identify and protect the attributes of forest systems that provide resiliency against invasion as it will be to control invasive species once they have arrived.

My mentor is fond of saying that good silviculture does not come from a cookbook. Now, with climate change and the probability of novel forest community types on the horizon, this may be truer than ever. We could be entering a time when the path to desired outcomes is less clear than it has been in the past, and most management becomes experimentation. In such times, we will not be able to rely solely

continued on page 13

Staying Ahead, from page 12

on a reactionary approach of controlling invasive species that are already well established. A truly proactive approach must focus not only on management practices that control invasive species, but also identify the components of forest ecosystems that provide resilience to invasion, and be able to predict future invasive species before they become regional problems.

Perhaps most difficult of all, this approach must be realistic enough to prioritize our efforts and always be aware of the uncertainty that lies ahead. This will take forestry professionals who have intimate knowledge of the forests they manage. We will need practitioners who are willing and imaginative enough to integrate the current body of knowledge with future predictions on forest ecosystem trajectories and develop management practices that are flexible enough to adapt to a moving target of unknown size and shape. I believe these goals are obtainable and that uncertainty should not lead to inaction. While I realize that I may not be right in some of these predictions, I know that I am wrong if I do not ask the questions.

Editor's note: A copy of the complete article including references and endnotes may be downloaded at the Forest Guild website at www.forestguild.org/invasives.html

Photo credit for Dave Ellum's headshot: Dylan Flood.

MISSION

The Forest Guild promotes ecologically, economically, and socially responsible forestry–"excellent forestry"– as a means of sustaining the integrity of forest ecosystems and the welfare of human communities dependent upon them. The Guild provides training, policy analysis, and research to foster excellence in stewardship, to support practicing foresters and allied professionals, and to engage a broader community in the challenges of forest conservation and management.

Deer Herbivory, from page 5

trying to develop a more systematic approach to managing both our invasive plant and deer herbivory problems. We have been coming to see these two issues (at first approached separately) as increasingly interrelated, and to realize that they require a thoughtful, holistic approach to management and control. Our invasives are often most problematic in areas where deer browsing prevents native forest regeneration from becoming truly established.

Managing for the future

We are currently developing a deer management strategy. As work on that strategy proceeds, the watershed management staff is trying to develop a more comprehensive plan for managing invasive plants across the watershed forest. We are performing an ownership-wide qualitative inventory of invasives, trying to become adept at recognizing the less-common species and emerging threats, and actively researching treatment strategies that are being used elsewhere. Effective treatments may employ a site-specific combination of judicious herbicide use (glyphosate and/or triclopyr), mechanical mowing or clearing, and possibly even spot applications of heat or fire. Although often suitable in other contexts, small-scale methods such as hand pulling seem impractical given the extent of the invasive populations, the sizeable acreage we manage, and the lack of a volunteer workforce. We are unaware of practical scientific sampling methods for invasive inventory on large ownerships but would love to learn of a method that could be combined with traditional forest inventory.

Choosing one's battles and sticking with them seems to be an important lesson for managing invasives. Following through by returning to particular infestations and treating them in successive years can successfully kill the plants—but will the invasives return to the site if the deer eat the oak seedlings and other native plants that naturally take root or are planted there? Providence Water's efforts to control deer herbivory and invasive plants on the Scituate Reservoir watershed are very much a work in progress. It appears that reducing deer pressure will be a key factor. The outcome will be determined in part by what happens on the larger landscape surrounding the watershed lands and by a great many actions and decisions far out of our control. Whenever we find an answer, more questions arise. As watershed forest managers, we face a continual learning process, and we hope that engaging with others may help improve our work on the ground.

Native Forest Insects, from page 7

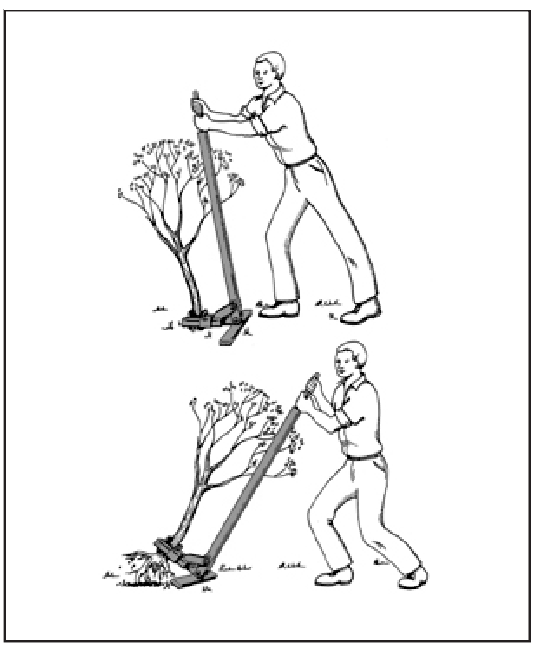
other "new" severe pest species, we may have witnessed the beginnings of new pest dynamics brought about by anthropogenic disturbances. Indeed, the Ozark National Forest may be a prime example of what is to come for future forest decline and insect outbreaks. A common thread among the previous examples may be an unnatural overabundance of susceptible host material in combination with severe climatic conditions serving as the igniter.

Due to a general lack of information regarding most forest insect species of little or no economic concern, forest health practitioners are forced into a reactive stance when an outbreak occurs. By the time enough information is gathered to pinpoint the causes of the outbreak, management options are extremely limited. Years can be lost to describing basic insect ecology and life history. Our only defenses against the unpredictable outbreak of an obscure forest pest are twofold: to expand scientific knowledge of obscure forest insects over the long term and to optimize forest health conditions through proper management practices before hints of problems arise.

Editor's note: A copy of the complete article including references and endnotes may be downloaded at the Forest Guild website at www.forestguild.org/invasives.html

Controlling Invasive Plant Species, from page 9

will help keep track of the treated stumps. A recent invention that may greatly improve efficiency is a rotary brush saw which automatically applies the herbicide to the cut stump.
(2) Revisit summer treatment sites one or two weeks after cutting and spraying herbicide on the short cabbage head of sprouts that emanate from the stumps. Use of a simple pump sprayer will precisely target the herbicide onto the intended leaf surfaces only.



The two-step process for using a weed wrench.
Illustration courtesy of www.weedwrench.com

The best time to apply herbicide is in late summer, when plants are storing nutrients and carbohydrates in their roots for the upcoming winter. Consequently, the cutting of large plants is optimally timed for mid to late summer, prior to seed maturation, when the follow-up herbicide treatment is most effective.

Treated sites should always be revisited to check for new sprouts, missed plants, and especially to eliminate overlooked invasive plants that have not yet gone to seed. Several return treatments may be necessary. The bottom line: Follow-up control is imperative to identify and eradicate the remaining root stock of any cut invasive plant; otherwise the hefty investment in initial treatment is all for naught.

Questions for forest managers

Consideration should be given to the status of invasive plants prior to all forest harvests. Are they present? Where and how widespread? Will simple uprooting of a few stray plants while marking trees take care of the problem? If not, should a plan be formulated to control the invasives using the multi-step detection/removal/disposal/follow-up approach? Can the landowner be convinced to invest in this process, and is it logistically possible to apply? These are some of the difficult questions facing forest managers that we simply cannot afford to ignore.

A WHITE FIR THINNING PROJECT

When Native Species Become "Invasives"

Interview with Sharon Paul

We recently interviewed Sharon Paul, tribal silviculturalist at the Division of Resource Management and Protection (DRM) for the Mescalero Apache Indian Reservation in the Sacramento Mountains in south-central New Mexico. Our conversation focused on a major white fir thinning project on a 1,737-acre forested area of South Tularosa Canyon in the southeastern section of the reservation.

Q. Why is the white fir an "invasive"?

A. While not an invasive species in the traditional sense, white fir (*Abies concolor*) creates some of the same management issues for us as non-native invasive species. Due to modern fire suppression, white fir has expanded its range to areas it did not historically grow. Species conversion has occurred in stands that were historically dominated by ponderosa pine (*Pinus ponderosa var. scopulorum*) and Douglas-fir (*Pseudotsuga menziesii*). The understory in this historically ponderosa pine cover type is now dominated by white fir. That is a significant problem for us because white fir is less drought tolerant and more susceptible to insect and disease mortality than ponderosa pine and Douglas-fir. Its dense stands are more susceptible to crown fires. In a stressed mixed-conifer stand, the white fir seems to reach the mortality threshold before the seral species present.

Q. What were your project goals?

A. The tribe's DRM goals are defined in a ten-year forest management plan and further refined in a mechanical fuels treatment plan for the specific project area. Major goals include reducing the risk of a crown fire, improving forest health in the residual stand, and bringing forest age-class distribution and species composition back within the historic range of variability so as to create stands that are more resistant to catastrophic disturbances. When checking for historical evidence of white fir, it became apparent that the current density of the white fir regeneration is much higher than was present historically.

Q. How did you identify historic conditions?

A. A literature search of documents recording tribal logging history, historical photographs, and site observations were used to determine historic conditions. Site visits that were spent field checking for stumps of old-growth white fir were used to determine density on the specific project area. The USDA Forest Service's publication, F*orest Reference Conditions for Ecosystem Management in the Sacramento Mountains, New Mexico*, and Margo Kaye's and Thomas Swetnam's article, "An Assessment of Fire, Climate, and Apache History in the Sacramento Mountains, New Mexico," proved to be excellent references.

Q. What specific treatments did you implement?

A. The area was logged in 1996 utilizing trees down to five inches in diameter. The treatment was a heavy thin with small gaps created when infected trees were removed. Trees knee-high to 9-inch dbh were thinned to a restoration prescription in 2005. The challenge was writing the cutting instructions for the prescription so that production-oriented saw crews could successfully implement the prescription across the landscape. Species retention values (highest to lowest) were (1) ponderosa pine, (2) Douglas-fir, (3) southwestern white pine, and (4) white fir. A range of spacing was described to the crew on field trips where treatment options could be discussed on-site. A broadcast burn was successfully implemented in 2007.

Q. How pleased were you with the treatments?

A. The saw crews did a good job implementing the prescription across the landscape, and the area can now be maintained with prescribed fire. The ground cover has become more diverse, and the amount of forage has increased. The natural seed bank in the soil responded well to increased sunlight hitting the forest floor. The area has a species composition and density that more closely represents what was present historically. The timber stands are more resistant to insect, disease, and drought stress than before treatment. The tribe's goals for reduced wildfire threat and improved forest health were met.

White fir.
Photo credit: Mary Ellen (Mel) Harte.
www.forestryimages.com

"While not an invasive species in the traditional sense, white fir creates some of the same management issues for us as non-native invasive species."

forest GUILD
P.O. Box 519
Santa Fe, NM
87504

forest WISDOM

Guess the Invasive –

How many of these invasive species can you identify?

The correct answers can be found on the Forest Guild website at:
www.forestguild.org/invasives.html