If You Cut It, Will They Come?

Plant and Animal Community Response to Chinese Privet Removal

By James L. Hanula, Scott Horn, Michael D. Ulyshen, Steven B. Castleberry, Michael S. Murphy, and John W. Taylor

You can spray the foliage, use basal bark sprays, mulch it, cut it with a chainsaw or machete, pull it, and even graze it with goats and sheep. Some methods may work better than others but they all have the same goal: getting rid of Chinese privet (*Ligustrum sinense*). However, once all that is done, what do you end up with? Everyone agrees that a privet-choked forest is not a pleasant place, but what does the forest look like if privet is removed? That's the question we have been trying to answer over the last few years.

Fig. 1 – Privet was eliminated from 5-acre plots by hand-felling with saws (above) and machetes or by mulching with a Gyrotrac mulching machine (bottom). Residue was left where it fell.

To find out, we tested two methods of removing privet in the fall of 2005. In one, we felled privet with saws and machetes and then immediately treated stumps with a herbicide (triclopyr). In the other, we mulched the privet in place with a Gyrotrac™ mulching machine. The stump treatment was not very practical in mulched areas mainly because of the way the Gyrotrac shredded or buried the stumps. Both worked well for removing the privet shrub layer but neither prevented smaller seedlings and stump sprouts the following year. In fact, there was as much privet in the low-growing herbaceous plant layer of the treatment plots as in the control plots the summer following treatment.

Because privet was still abundant a year after removing the shrub layer, we followed up with 2% glyphosate using backpack mistblowers and sprayers to treat all the remaining low-growing privet in the herbaceous layer during winter when other plants were dormant (Harrington and Miller 2005). This was done on eight 5-acre plots (1 mulched and 1 felled per location) at four different locations near Athens, Georgia. Some, like the State Botanical Garden and the Sandy Creek Nature Center properties, are in areas that receive a lot of visitors so they can be used for educational as well as research purposes. Others are more remote.

Immediately after the initial treatment, we measured the amount of privet biomass on the felling plots in 25 1-m^2 subsamples per plot. Plots had an estimated 44,627.2 kg of privet/ha (19.9 tons/acre) (oven dry wt.; SE=5989.1 kg/ha) which contained 0.61% (SE=0.075%) nitrogen or 272.2 kg of N/ha (242.8 lb/acre). The treatments put a lot of plant material on the ground which had the potential to release substantial amounts of nitrogen over time.

We then investigated how privet removal affected plant and animal communities, particularly their recovery compared to forests with no history of privet invasion. We had an untreated control plot at each location and we picked three areas of bottomland hardwood forest on the Oconee National Forest. These areas had never been invaded by privet and represented a desired future condition or recovery goal. These were not pristine, old-growth forests but they were useful as a reference condition.

What Did We Achieve?
Plants

Our first goal was to eliminate privet and by 2007 we nearly achieved it. Both treatments resulted in less than 1% privet cover in the herb layer and none in the shrub layer of the forests; the results were dramatic. Bottomland hardwood forests are some of the prettiest places in the South when they aren't choked by privet and, after eliminating privet, desired plants returned (Fig. 2). Two years after

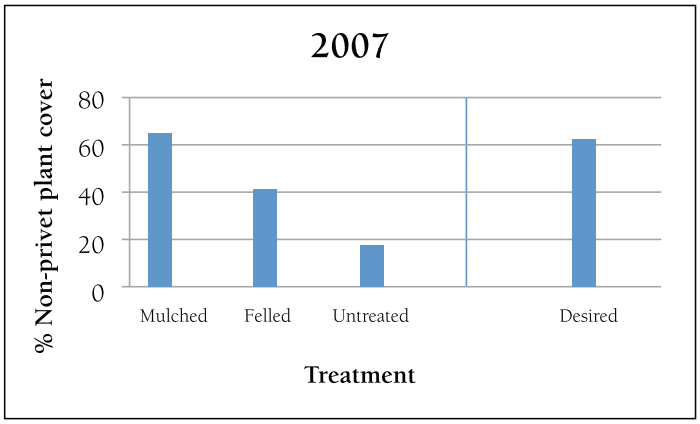

Fig. 3 – Percent of plot surface area covered by non-privet herbaceous plants two years after privet was eliminated by either felling or mulching. Desired plots were in forests never invaded by privet.

treatment, both mulching and privet felling resulted in higher non-privet herbaceous plant cover (Fig 3).

Mulched plots had the highest cover, probably due to greater soil disturbance caused by the mulching machine. Felling privet also resulted in much more non-privet plant cover. Mulched plots had similar plant cover to the desired future forests. Plant communities on the newly-cleared plots looked nothing like the desired forests. As might be expected, disturbing the forest by removing privet invited a lot of the early-colonizing plant species common to disturbed habitats (e.g., American burnweed and pokeweed). But other plants associated with healthy riparian forests (e.g., switchcane) are also showing up and even a rare plant has made an appearance (see page 15). Bottom line where plants are concerned: if you remove privet, other plants will come—not always what you want (e.g., Japanese stiltgrass), and sometimes beyond expectations (e.g., yellow fumewort), but all are better than privet.

Fig. 2 – A control plot (left) with privet intact and a mulched plot (right) with a much more diverse and abundant herbaceous plant layer two years after privet removal.

Pollinators

Plants need pollinators and pollinators need plants, but when most people think of pollinators, they think of honeybees or maybe bumblebees. However, most forest pollinators are rarely noticed solitary bees. Because pollinators are so important to forests, we wanted to know how different methods of removing privet affected them. To measure pollinator abundance and diversity on the plots, we placed yellow and blue Solo® bowls (pan traps) filled with soapy water to attract and catch bees and butterflies.

As surprised as we were about the plant community response to eliminating privet, we were more surprised by the pollinator response. After two years, there were 4 to 5 times more bee species in privet-free areas. An average of nearly 40-50 species were captured on removal plots in 2007 compared to 10 on control plots. Removal of privet also resulted in a lot more bees. An average of over 650 bees were collected from mulched plots and 380 on felled plots. Control plots had an average of 33 bees per plot. Three times as many butterfly species were caught on mulched plots and nearly 7 times as many individuals. Clearly, bees and butterflies appreciated the resulting forest condition.

Beetles

Most people appreciate butterflies more than beetles but beetles play important roles in forests. We trapped beetles flying through the forest at ground level (0.5 m), at 5m (about the top of the privet canopy) and at 15 m. Beetle diversity was much higher in privet-removal plots at ground level than in the untreated control plots. Traps just above the privet canopy (5 m) caught similar numbers of species regardless of the treatment or lack of treatment below and the same was true in the tree canopy (15 m). The only beetle caught in higher numbers in traps 5 m above the ground was an exotic, the Asian ambrosia beetle, *Xylosandrus crassiusculus*, which was much more abundant above the untreated control plots.

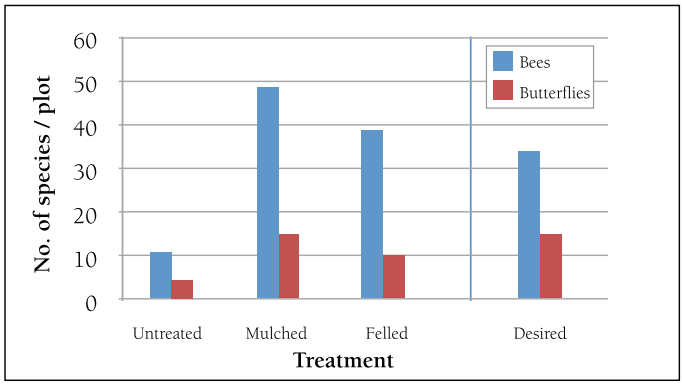

Fig. 4 – Average number of bee and butterfly species captured on forest plots which were either left untreated or had privet eliminated by mulching or hand-felling. Mulching privet resulted in the highest numbers of bee and butterfly species but felling also increased species richness of both groups over the untreated, privet-infested forest.

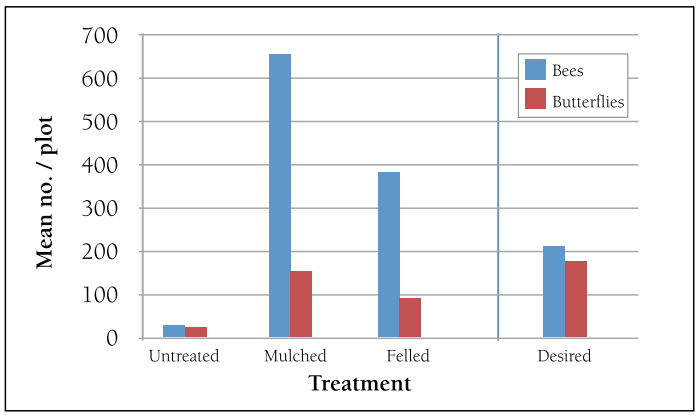

Fig. 5 – Average number of bees and butterflies (individuals) captured on forest plots that were either left untreated or had privet eliminated by mulching or hand-felling.

White-footed mouse (Peromyscus leucopus)

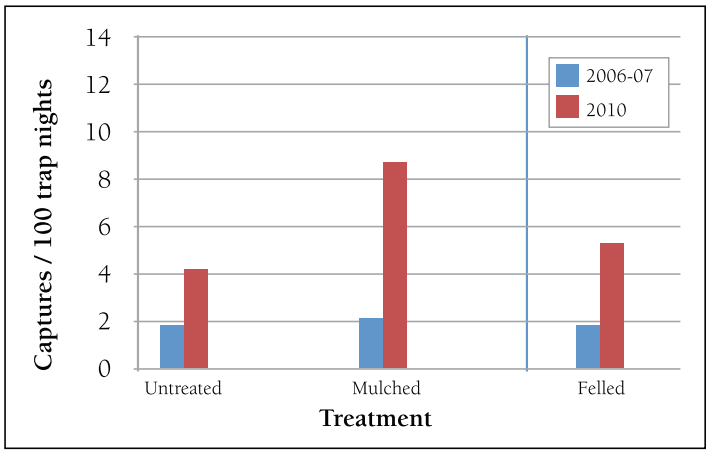

Fig. 5 – Average number of small mammals captured on forest plots that were either left untreated or had privet eliminated by mulching or hand-felling. Trapping was conducted four times each year in 2006 and 2007, and in the summer and fall in 2010.

Small Mammals

Rats and mice often go unnoticed in forests but several native species of small mammals play valuable roles in natural habitats. Small mammals are important in dispersing seeds of some plants and they serve as prey for a number of snakes, birds, and larger mammals. We live-trapped small mammals using aluminum box traps four times per year in 2006 and 2007, and trapped again in the summer and fall of 2010. Over the course of the study we captured 181 individuals that included 3 species of mice, 2 species of rats, and 1 species of shrew. Most of the small mammals captured were white-footed mice (*Peromyscus leucopus*).

During the first two years after the study was initiated, we found little difference among the treatments. However, in 2010 after the treatments had been in place for four years, we not only captured more small mammals, we also observed a noticeable trend of more small mammals in the felled treatment than in the untreated and mulched plots. Because small mammals are commonly associated with downed woody debris, it was not surprising that our capture rates were higher in the felled treatment. However, it was interesting that the increase in small mammal abundance did not occur until after the treatments had been in place for over 3 years. Although small mammals are usually not abundant in floodplain forests such as the ones in this study, felling the privet and leaving the stems seemed to result in the best habitat for small mammals.

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Success?

The plots are no longer choked with privet but are they the desired future condition? The answer is mixed. The plant community on the plots is far from the desired forest condition. Two years after eliminating privet, there were three very distinct plant communities. The control plots are still dominated by privet and have low overall plant diversity. Removal plots are similar to each other, have much greater non-privet plant cover, and are more diverse. However, despite having similar levels of plant cover and species richness, they still have little similarity to the desired future forest. On the other hand, the bee community has responded much more quickly. After two years, the bee communities on desired and removal forests were almost the same. Butterflies have not responded so quickly, probably due to their more specific habitat needs. Bees are mostly generalists that use a wide variety of flowers for pollen and nectar. In contrast, butterfly larvae often have a relatively narrow range of host-plants, so butterfly communities on desired plots are still dissimilar to those on removal plots, but not nearly as much as the control plots. Neither treatment reduced small mammal abundance and small mammal populations increased on the felling treatment.

Butterflies, bees, mice and plants are important but so are humans. From the human perspective, privet removal has been a great success. On numerous tours through the plots we haven't met anyone who doesn't think privet-free forests are a vast improvement over privet-dominated forests. Just the fact that people can walk through the forests demonstrates success. However, some visitors that frequent the more remote plots are less desirable; feral hogs appear to approve of privet removal as well. It is not clear whether they root more in removal plots or if damage is just more apparent there, but we hope to find out.

Where to now?

It has been 6 years since the initial privet removal so it is time to remeasure the plots to see how the plant and animal communities are progressing. One thing we are keenly interested in is how long we can wait to retreat the privet that is reinvading the plots. We don't want the plots to revert to privet thickets again, but at present the privet is small (>50 cm) and widely scattered. We will also explore whether the overstory trees responded to removal with increased growth. Bird response to privet removal is another area to study. Anecdotal reports from birders suggest that privet removal has benefited birds, as well.

Beyond that, should we undertake active restoration? So far, the two methods of removing privet have resulted in very similar forests, as far as plants, bees, butterflies and beetles are concerned. If that trend is still true after the 6-year evaluation, then it would make sense to select one of the treatment plots at each location and initiate a more active restoration program. Whatever we decide, results thus far are clear: removing privet is good for the forest and has resulted in some unexpected and, for the most part, very welcome changes.

An Unexpected Outcome

A rare plant called yellow fumewort, *Corydalis flavula*, was discovered on plots where the invasive shrub, Chinese privet, was removed. It was discovered by Hugh and Carol Nourse, and confirmed by University of Georgia botanist Linda Chafin, at the State Botanical Garden of Georgia in a plot where a Gyrotrac mulching machine and a subsequent herbicide application were used to clear privet 5 years ago. Yellow fumewort is only known to occur in four other counties in Georgia. None are close to Clarke County where the new patch is located. Yellow fumewort is a small annual in the same family as bleeding heart. Individual plants are only 10-30 cm tall but they cover an area 10 by 30 meters. This is an exciting find that emphasizes the benefits of removing Chinese privet from riparian forests.

Further Reading

Hanula, J.L., S. Horn and J. W. Taylor. 2009. Chinese privet (*Ligustrum sinense*) removal and its effect on native plant communities of riparian forests. Invasive Plant Science and Management 2: 293-300. (Available at: http://www.srs.fs.usda.gov/pubs/ja/ja_hanula018.pdf)

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