

Spring 2010

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Recommended Citation

Rauschert, E.S.J. and A.N. Nord. (2010) Japanese stiltgrass: an invasive on the move. *The Ohio Woodland Journal* 17(2): 15-17 (invited).

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JAPANESE STILTGRASS

An Invasive Plant on the Move

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Driving through our central Pennsylvania woodlands, it's hard not to notice the lush green along the shoulders of the gravel roads. If you stop for a closer look, you'll see a delicate-looking grass whose leaves are short and broad, reminiscent of a miniature bamboo. It's an attractive little plant with a decidedly unattractive reputation among Ohio's neighbors. Japanese stiltgrass (*Microstegium vimineum*) is one of the most problematic invasive plants in Ohio's neighboring states of Pennsylvania, West Virginia, and Kentucky, as well as in many other states in the eastern U.S. While it is not currently among Ohio's worst invasive plant problems, it is found in the southern portion of the state.

Japanese stiltgrass (sometimes called Nepalese browntop) is native to Asia from Japan to Nepal and Malaysia. In the days before Styrofoam peanuts, its abundant long stems were used to pack crates of Chinese porcelain sent to the U.S. It was first recorded growing in Tennessee in 1919, and is now found

throughout the eastern U.S. It will grow in a wide variety of environments, from roadsides to wetlands, from open sun to full shade. It thrives in disturbed areas, such as forests following timber harvest. It can grow so abundantly in the

forest understory that it interferes with forest regeneration and reduces native plant diversity, and degrades habitat for declining species such as bog turtles and ground-nesting birds. Its impacts are felt below ground as well: its presence changes the characteristics of the soil, altering things like nutrient cycling,



Japanese Stiltgrass (*Microstegium vimineum*)
Line drawing: Nelson DeBarros, Masters Candidate,
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litter decomposition rates, and the nature of the soil-dwelling bacterial and microarthropod communities. Stiltgrass can also change the way that fires burn in a forest due to the thick thatch of flammable, dead plant material that it can form.

As abundant as stiltgrass can be, white-tailed deer do not eat it. Overly large deer herds can actually benefit stiltgrass, as they devour the native plants and shrubs that could otherwise compete with it. In fact, Dr. Benjamin Baiser and Dr. Julie Lockwood of Rutgers University have dubbed the combination of deer over browsing and stiltgrass invasion "a perfect storm" that creates irreversible change in forest composition and bird communities.

At Penn State's weed ecology lab, under the direction of Dr. David Mortensen, we have been studying how stiltgrass spreads and what environmental factors may be helping it succeed. In 2003 we planted some patches of stiltgrass on Penn State forest land, which we carefully monitored over the next several years. Since stiltgrass had swept through nearby Rothrock State Forest in less than ten years, we expected to see the patches spread



Logging sites are often later heavily infested by stiltgrass

aggressively. Surprisingly, they actually spread quite slowly, telling us that stiltgrass really doesn't disperse well on its own. We concluded that there must be something else helping the seed spread through the forests. Stiltgrass seeds float well and will move easily in water, but that can't explain how it has spread throughout our hills and ridges. We suspected that human activities were largely responsible for aiding stiltgrass dispersal. This has led us into an investigation of what role roads might play in the spread of this and other invasive plants.

Many researchers and land managers have noticed an association between roads and invasive species. The unpaved roads traversing Pennsylvania forests require frequent maintenance

such as grading. The disturbance associated with building, using, and maintaining roads promotes the growth of invasives by breaking up the forest canopy to let in more light, as well as reducing competition



Stiltgrass is frequently seed in places like this roadside.

from native species that don't tolerate the disturbance. Roads also play an important role in the movement of invasives. In Rothrock State Forest, the entire road network is heavily infested with stiltgrass.

Some of our experiments have involved setting out killed, spray-painted seeds in front of a road grader, then looking for them afterward to measure how far the grader can take them. We have found that road grading can move seeds several hundred times further than the unassisted dispersal we observed while monitoring the patches we planted. Most likely, vehicle traffic itself moves invasive seeds long distances, both from recreational use of forests and from logging equipment. Road structures, such as road culverts for moving water off of roads, can both move the seeds of invasives into the forest interior and create ideal habitat for the growth of invasive plants.

Another focus of our work is on the soil changes associated with gravel roads. Our oak-hickory forests naturally have very acidic soils, which are well suited for native plants like blueberries, mountain laurel, and orchids. But when limestone gravel is used on unpaved roads to make a better driving surface, dust from the limestone raises the pH of the soil along the road-

sides, and as far back into the forest as the dust drifts. Unlike some natives, stiltgrass grows quite well in these high-pH conditions. Our surveys of unpaved forest roads show that stiltgrass can be three times more abundant along limestone roads than along roads graveled with native shale, which does not raise the soil pH. Once established on the roadsides, stiltgrass can then move off the roads to invade other habitats.

Identifying stiltgrass

Japanese stiltgrass has light green leaves which are shorter and broader than the leaves of most other grasses. The leaves are slightly hairy and have a silvery midrib. The plant can reach a height of around four feet, but, as the stems are weak, plants of this size are usually sprawling, not upright. The plant earns its name from the secondary prop or "stilt" roots that often grow out of the lower nodes of the sometimes branching stems. In fall, the plants turn a distinctive purplish brown and produce small (3mm) seeds in terminal clusters (at the end of the stems) as well as in smaller clusters tucked inside the leaf sheaths.

Stiltgrass is often confused with native whitegrass (*Leersia virginica*), with which it may be found growing side by side. Stiltgrass is an annual whose root system will not be as developed as that of the perennial whitegrass. Whitegrass leaf sheaths are more hairy than those of stiltgrass, its leaves are slightly longer and narrower without a silvery midrib, and it lacks the "stilt" roots at the lower nodes. Furthermore, whitegrass sets seed earlier than stiltgrass (late summer or early fall as compared to late fall).

What to do about it

The best thing to do is to keep stiltgrass out of areas in the first place, and to immediately remove any that is found in a forest. Particular attention should be paid to keeping stiltgrass out of environmentally or economically sensitive areas. It is also helpful to identify how stiltgrass got there in the first place in order to prevent reintroduction.

Japanese stiltgrass is easy to pull up by hand, but this isn't practical over large areas. Mechanical control like weed-whacking can work fairly well if you do it right before seed set. If done too early, any stems or parts of stems that escape will re-grow vigorously. But mechanical control can be slow and tricky, especially where the ground is uneven with rocks or logs. Stiltgrass is quite susceptible to herbicides, which should be applied in midsummer before flowers are produced. A grass-specific herbicide such as sethoxydim will not affect most other vegetation. However, it is toxic to aquatic organisms, and so can't be used on wetlands or streambanks. An aquatic-approved formulation of glyphosate could be used in these situations. However, we have found that very little vegetation at all comes



Stiltgrass can grow abundantly along streams

back the year after we spray glyphosate on a wetland plot. A bare patch of soil is vulnerable not only to erosion but to repeated invasion. We are increasingly convinced that any management plan has to weigh the immediate success of any management technique against future impacts. Currently there are no biocontrol agents available for stiltgrass. However in 2009 a fungal disease was found to be killing stiltgrass in Indiana and West Virginia. After more work, this may prove successful as a biological control.



In the fall, stiltgrass turns a purplish-brown color before seed set

Stiltgrass seeds can persist in the soil for at least 3 to 5 years, so any management plan needs to involve monitoring for a few years after treatment, to ensure that populations do not rebound. Ultimately, the best way to manage invasive species is to manage the conditions that favor them, such as forest fragmentation and over browsing.

For further information on Japanese stiltgrass, please visit the Weed Ecology lab's website at: <http://weedecology.psu.edu>