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THE INTRODUCTION, SPREAD, AND CONTROL OF NON-NATIVE, INVASIVE SPECIES IN TENNESSEE FORESTS

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An abandoned woods trail containing several invasive species: autumn olive, kudzu, and Japanese stiltgrass (Credit: Wayne Clatterbuck, University of Tennessee).

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The introduction to the following peer-reviewed article originally was written by a natural resource college student to express her concern to the University of Tennessee community about the excessive presence and expansion of non-native species on campus, greenways, parks, neighborhoods, and forested areas in the Knoxville vicinity, often supplanting or displacing the native vegetation. We have expanded the article to include descriptions and control measures of common non-native species, about which UT Extension receives many inquiries. The fact sheets in this publication provide background information about troublesome invasive plants that occur in Tennessee forests: kudzu, tree-of-heaven, callery pear, Japanese stiltgrass (Microstegium), honeysuckles, princess tree (Paulownia), Chinese privet, Chinese silvergrass (Miscanthus), and autumn olive. Weblinks are provided from various universities and organizations with supplemental information that are peer-reviewed.

Kudzu. Most Americans have heard of it. But what do people really know about it? It is everywhere, and it is dreadful. Some may even recognize it as "the vine that ate the South." Why is that?

Kudzu's story starts with its introduction into the United States from Japan in the late 1800s as an ornamental, but it was not until the 1930s that its presence truly exploded as the U.S. Soil Conservation Service utilized kudzu in an initiative to control soil erosion. Little did they know they were introducing (and spreading) a species that would threaten southern forests for decades as one of the leading risks to the natural environment.

Kudzu is a non-native, invasive species, meaning that it has spread out of control with limited or no predation and competes with or displaces native species. Its rapid growth (sometimes a foot a day) allows kudzu to climb its native neighbors, covering them in a thick layer of foliage to intercept much of the available sunlight. Blocked from their natural source of energy, these native species die as they are unable to photosynthesize. Kudzu will also uproot many plants as well.

The University of Tennessee, Knoxville, campushas recognized the presence of kudzu in its midst. In 2019, an arborist at the University started a program of treating the kudzu on campus. He introduced goats to an acre of kudzu-infested land to eat the kudzu back so the subsequent resprouts could be sprayed with herbicide to kill the roots. The initiative was a success. The goats did their job, and the University is constructing a plan to spray the area. However, kudzu is not the only problem. What about the numerous other non-native invasives that are abundant?

The temperate environment in Tennessee is a haven for not just kudzu but a wide variety of non-native, invasive species such as Bradford/callery pear, Chinese silvergrass, privet, tree-of-heaven, Chinese parasol, Japanese barberry, mimosa, and nandina. Many of these plants were planted on the UT Knoxville campus not knowing their invasive properties, even though many instructors promote use of native species. Of the 5,000 non-native plant species that have been introduced and established in the United States, 10 percent of those have become invasive and cost the nation billions of dollars in annual damages for their detection, management, prevention, restoration, and research (Kerns and Guo 2012).

Chris Graves, a senior lecturer at the UT School of Natural Resources and a certified wildlife biologist was recently asked to give a presentation on non-native species present on the Knoxville campus to the University Undergraduate Student Senate. Graves did not take this task lightly as an advocate for native plant communities. Into a room full of formal business-wear, Graves carried a garbage bag of more than 20 different non-native and invasive plant species that he collected from around campus, which he then identified. “Santa Claus is outraged,” he said as he identified and emptied his not-so-jolly sack of leaves and branches. “As a faculty member, I’m embarrassed,” Graves said. There are plenty of native species available for planting in nurseries and greenhouses around Knoxville. Graves tells a story about little bluestem grass being sold at a Walmart and how he was so excited to see a native prairie grass being sold in a popular superstore. He proceeded to purchase their entire bluestem supply. The availability of non-native plants for purchase results in their continued use. The logic is that if a plant is available for purchase, it must be OK to plant. Unfortunately, that is not true with many non-native plants.

Graves urges that the non-native plant issues should be addressed collectively by students, faculty, staff, and everyone in-between on the Knoxville campus. A plan of action should be formulated and a cumulative “naughty list” of non-native plants composed. Then a control and/or eradication program of non-native, invasive vegetation can be implemented and replaced with native alternatives. The kudzu-goat initiative is a step in the right direction for kudzu control. While kudzu is the poster plant of invasive, non-native species, there are many more begging for attention.

CONTROL A LITTLE NOW OR CONTROL A BUNCH LATER

Most invasives that have become issues in Tennessee and elsewhere are “generalist” plants that are able to adapt to a variety of environments and habitats. They can reproduce prolifically, whether by seed or vegetatively (roots) or both, advancing their spread to nearby areas. One example is tree-of-heaven that begins to produce seed within three years after seed germination, but it also root sprouts profusely. Invasive plants should be controlled as soon as they appear or become colonies that are detected. Otherwise, their populations will continue to increase and escalate as suggested in Figure 1. Early detection and rapid response allow greater efficiency in controlling the plant. A low infestation level, invasives covering less than 30 percent of the area, has a high probability of success for invasive control with less costs and shorter periods for suppression.

Once invasives reproduce, multiply, and spread, their abundance accelerates. A medium level of infestation, 30 to 60 percent of the area occupied by the undesirable invasives is achieved. The invasives are not yet inundating the area, but control measures are much more difficult, costly, and time consuming. This medium stage is where invasive control has become a management priority (Figure 1).

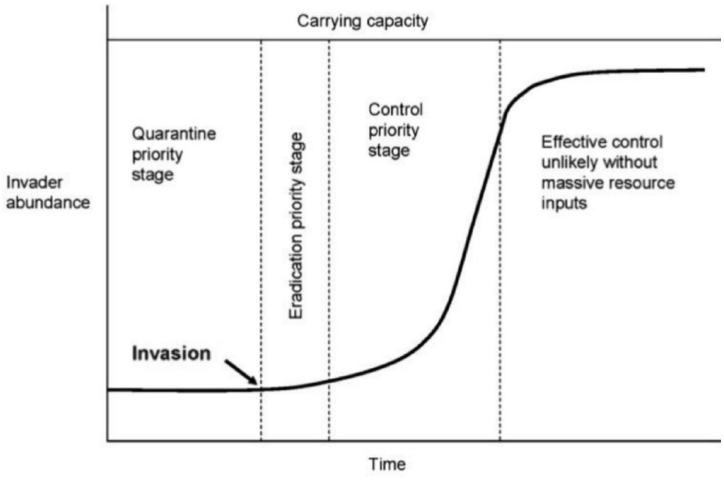

Figure 1. *Control costs versus time since exotic invasion. (Redrawn from Hobbs and Humphries 1995 by Moser et al. 2009)*

Root sprouts extend the spread of the plant and should be controlled (Credit: Wayne Clatterbuck, University of Tennessee).

A high infestation level is when the invasives occupy greater than 60 percent of the area andare dominating and out of control. Effective invasive control is unlikely without massive resources. Several treatments over consecutive years will be necessary to reduce the invasive impact. These areas will require the longest control time and greatest costs and labor.

Controlling invasives and their spread is a process usually involving repeated treatments over time. Most perennial invasive control requires that the roots be killed so the plant does not resprout. Herbicides must be translocated to the roots to suspend metabolic processes resulting in killing the roots. However, many roots are rhizomes or starchy tubers with abundant energy reserves that necessitate repeated applications to deplete those energy reserves and kill the root. Usually, control of invasive plants is a process of several years and not an event where one application is completely effective.

USE OF HERBICIDES

Glyphosate and triclopyr are herbicides that are frequently recommended in this publication for invasive control because they have little soil activity. Other herbicides may be equally effective and should be considered as options for use. Below are a few of the salient features that suggest the safe use of glyphosate and triclopyr by landowners and managers. The herbicides are readily available at supply stores under various tradenames.

Glyphosate

- No soil activity and will not injure desirable plants via root uptake; glyphosate is rapidly deactivated and biodegradable in the soil by micro-organisms.
- Broad spectrum, non-selective herbicide that is absorbed by plant leaves and is systemic (translocated) within the plant.
- Low health and environmental risks. For safety reasons, applicators should wear personal protection equipment (PPE). For more information about possible threats associated with glyphosate, see UT Extension Publication W827 Frequently Asked Questions: Glyphosate.
- The most significant environmental impact from use of glyphosate is the exposure of ground surfaces that are susceptible to soil erosion from killing the invasive plants.

Triclopyr

- Systemic herbicide in two formulations, water-based amine (foliage, hack and squirt) and oil-based ester (basal spray).
- Does not kill grasses or sedges, thus unlikely to result in surface soil exposure.
- Interferes with normal expansion and division of plant cells, resulting in distorted growth such as cupped leaves, twisted stems, and plugged vascular tissues.
- Does not move in the soil.
- More effective than glyphosate on some plants such as black locust. Read the herbicide label for susceptible plants. Applicators should wear PPE.

REFERENCES

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For a comprehensive guide on non-native and invasive species in southeastern United States forests, consult the reference and weblink below.

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DISCLAIMER STATEMENT

This publication contains herbicide recommendations that are subject to change at any time. The recommendations in the publication are provided only as a guide. It is always the herbicide applicator's responsibility, by law, to read and follow all current label directions for the specific herbicide being used. The label always takes precedence over the recommendations in this publication.

The use of trade or brand names in this publication is for clarity and information, it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The authors, the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

Margin of a forest and field on University of Tennessee property near the Knoxville campus that contains at least seven invasive, non-native species: tree of heaven, multi-flora rose, Chinese privet, Japanese stiltgrass, Beale's barberry, honeysuckles, and autumn olive. These invasive plants compose more than 60 percent of the vegetation. Control of these non-natives will take considerable time and effort with repeated herbicide applications for several years (Credit: Wayne Clatterbuck, University of Tennessee).

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