

# The Introduction, Spread, and Control of Non-Native, Invasive Species in Tennessee Forests: Tree-of-Heaven

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## TREE-OF-HEAVEN (*AILANTHUS ALTISSIMA*)

Tree-of-heaven is one of the more invasive, non-native tree species in Tennessee. The species is native to China and was introduced first to Europe and later to the eastern United States in the late 1700s. The Chinese also brought the species directly to the west coast of the United States during the mid-1800s.

The tree reproduces and spreads profusely from both seed and root sprouts. Most any disturbances that expose the soil invite the establishment of tree-of-heaven. Viable seeds are produced by 2- to 3-year plants and can be spread 300 feet from the parent tree by wind. Mature trees produce more than 300,000 seeds per year. The double whammy with tree-of-heaven reproduction is that the roots sprout profusely. Cut stump and root segments can sprout and grow more than 10 feet per year during the first year and continue this rate of growth for several years. The sprout growth then amplifies seed production within a few years. Tree-of-heaven is also allelopathic, producing chemicals that affect the establishment of other plants. The fast growth, prolific seeding and sprouting capability, and allelopathy of tree-of-heaven create dense, shade thickets at the expense of other vegetation.

Tree-of-heaven is a deciduous tree that can exceed 80 feet tall. The leaves are pinnately compound with 10 to 40 leaflets. The leaves are often mistaken for walnut, hickory, sumac, and ash, but can easily be distinguished by the two circular glands that occur on each lobe on the underside of each leaflet base which smells like rancid peanut butter. The leaflets of the other species are serrated (toothed), while tree-of-heaven leaflets are smooth except for the lobes where the glands are located on the lower margin. The species is dioecious with separate male and female trees. The seed clusters (samaras) occur on the female tree.

Root sprouts can emerge 30 to 50 feet from the nearest existing stem. Tree-of-heaven sprouts can grow 8 to 10 feet in height during the first year, often outgrowing and displacing native species. Seedlings can grow 3 to 6 feet per year. The species should be controlled as soon as it is found.

Mowing, burning, cutting trees, or pulling seedlings are ineffective control measures because of the profuse stump and root sprouting capacity of tree-of-heaven. The root system must be killed before the plant is controlled. The most effective control measure is to use herbicides applied to foliage, stems, or cut surfaces that translocate to the roots and eventually kill the root and the plant. The procedure and chemical used depends on the size of the plant. The good news is that most herbicides will control tree-of-heaven if the chemical is translocated to the roots.

For **large trees**, make stem injections (hack and squirt) and apply glyphosate, triclopyr or imazapyr to cut spacings as specified on the herbicide label (midsummer to midwinter is best). For felled trees, apply these herbicides to the stump surface immediately after cutting taking care not to drip herbicide on the ground. Avoid cut surface applications when the sap is rising prior to leaf emergence.



*Thicket of tree-of-heaven on a disturbed road bank spreading by seed and root sprouts. Photo Credit: Wayne K. Clatterbuck*



*Tree-of-heaven seed cluster samaras that are wind disseminated.  
Photo Credit: Wayne Clatterbuck.*



*A spreading island of tree-of-heaven.  
Photo Credit: Wayne Clatterbuck.*

For **saplings** (less than 4 inches in diameter), apply treatments of triclopyr in a commercially available basal oil with a penetrant to young bark near base of stem as a basal spray. The entire stem should be completely encircled with the application because the portion of the stem not in direct contact with the herbicide may continue to live. Application should be in late summer to early spring before leaves appear.

For **seedlings** and easy to reach saplings, thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to late September): glyphosate, triclopyr, or imazapyr. Follow herbicide label for foliage applications.

Remember to follow the label-specified herbicide amounts that are permissible to control the target species, i.e., tree-of-heaven. The herbicides mentioned in this article are those that have widespread and traditional use. Other herbicides can be used for tree-of-heaven control.

Well-established tree-of-heaven usually requires follow-up surveillance and further treatment of root sprouts and plant germinants that originate from the soil seed bank. Herbicide application at an early age before seed production or roots become more widespread is necessary. Treatments often only reduce the root system making follow-up applications necessary. Small portions of the original root system that survive after treatment can regrow quickly. Total control of tree-of-heaven requires repeated applications to deplete root reserves, patience, and diligence.

## **FURTHER REFERENCE WEBLINK**

Plant Conservation Alliance (PCA) <https://www.invasive.org/alien/fact/pdf/aial1.pdf>