Lessons learned from six years of kudzu research

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My Story

From 2006 to 2010 I studied biological control of kudzu at the University of Delaware under the guidance of Professor Judy Hough-Goldstein. But kudzu has always been a part of my life. As a boy, I swung on kudzu vines suspended from a tree near our house in Westchester County, NY. Back then we only knew it as “the vine,” and my dad started his battle against kudzu in 1974.
Where did it come from?

Kudzu is native to Asia, and was intentionally introduced to New York in 1855, but most notably in 1876 at the Centennial Exposition in Philadelphia.
Where do we find it?

Kudzu was planted extensively as a forage crop and a soil stabilizer throughout the Southeastern US. Today, the most severe infestations of kudzu can be found in Mississippi, Alabama and Georgia.
Where do we find it?

In the Northeast, we typically find kudzu where it was planted. This includes steep slopes and along rights-of-way such as railroad tracks and power lines.
What’s the problem? Kudzu’s rapid growth and perennial habit allow it to displace native vegetation. Vines compete with surrounding plants for light, ultimately killing trees and shrubs on a patch’s periphery. Kudzu can also contribute to ozone pollution, alter nutrient, water and fire cycles, and decrease ecosystem function and productivity.
In addition to negative environmental impacts, kudzu is responsible for economic damage when vines must be removed from power lines, railroad tracks and roads.
How does it spread? Limited dispersal of kudzu might occur from seeds. Purple flowers are produced in the summer on raceme-like panicles of established plants. Flowers can be found on aerial and trailing (along the ground) vines, and yield fuzzy green seedpods with variable numbers of seeds per pod.
Biology: Seeds

Green seedpods mature to brown as the fall progresses. In winter months, seedpods drop and can be wind dispersed several meters from the patch. Seedpods are subject to attack by insects and birds, but not much is known about animal dispersal of seed.
Biology: Seeds

For a review on insect frugivores, see Thornton, 2004.
Kudzu seeds have a thick seed-coat that prevents water absorption and ultimately leads to low germination rates under natural conditions. However, several methods of breaking coat-imposed seed dormancy have been investigated, including cold stratification, boiling, and soaking seeds in ethyl alcohol or sulfuric acid (Susko et al. 2001). In my experiments, I cut off one end of the seed-coat to break dormancy and found higher germination rates for seeds from Delaware than New York. One potential explanation for this observation is the known genetic variation among kudzu populations based on its history of multiple introductions (Pappert et al. 2000).
Biology: Seedling Growth

Despite poor seed set and naturally low germination rates in the field, kudzu plants in North America produce viable seed. Shown here are kudzu seedlings grown from hand scarified seeds in a greenhouse.
Biology: Seedling Growth

One explanation for poor seedling survival in the field is low light availability. Kudzu’s large leaves and resulting dense canopy shade out other plants (including kudzu seedlings). In greenhouse experiments, we found that kudzu seedlings were able to grow in 0% direct light, but only one of 53 seedlings survived to the end of the experiment. Kudzu seedlings grown in the shade were etiolated and often produced only cotyledons (no true leaves). In nature, these plants are unlikely to survive without exposure to sunlight.
Biology: Seedling Growth

In my six years studying kudzu, I observed only a few seedlings in nature. These were located where the canopy and soil had been disturbed (my field sites) and along a roadside where high heat and salinity could have contributed to weakening the seed coat.
How does it spread?

Therefore, the primary mechanism of kudzu dispersal in the US is human introduction (intentional or otherwise) and subsequent vegetative reproduction. Stem nodes (where leaves attach) in contact with the soil can form adventitious roots. Over time, these rooted nodes can become independent plants.

During its first year of growth, this stem node sent roots into the soil. The vines and node lignified, becoming woody and surviving the winter. The next year, three new (green) branches grew from this rooted node. Importantly, if the woody vines were cut, this node would survive as an independent plant.
Biology: Root Crown

Root nodes can become root crowns when vine connections between nodes are severed. Root crowns represent the interface between aboveground plant parts (meristematic tissue that was formerly a stem node) and belowground roots (differentiated tissue that cannot regenerate a plant). Both root crowns and stem nodes are easily identified in the spring when new stems/shoots emerge from these structures.
In the fall, kudzu plants allocate resources to roots, which are tuberous, starchy storage organs located in the soil below the root crown. Kudzu roots are considered differentiated tissue, meaning that they cannot regenerate a whole plant.