

Eradication of Kudzu (*Pueraria lobata*) in Ohio with Good Science and Interagency Cooperation

John E. Silvius and Matthew B. Silveira

Department of Science & Mathematics, Cedarville University, 251 North Main St., Cedarville, OH 45314



Purpose

To identify traits and conditions that enable kudzu, *Pueraria lobata*, to propagate at or near its northern limit in SW Ohio, and to apply this knowledge toward a plan for eradication from this and other sites.

Background

Historical

- ◆ 1876 -- Introduced to U.S. from Asia as a livestock forage crop and as an ornamental plant (Hoagland, et al. 2007)
- ◆ 1933 -- Seedlings distributed by US Soil Conservation Service for agricultural erosion control
- ◆ 1970 -- Listed as a common weed in the South by USDA
- ◆ Current Status in Southeast: covers estimated 7 million acres
- ◆ Reported in Ohio in the 1980's; currently, in 10 counties along the Ohio River; and, in several outlying counties including Greene Co.

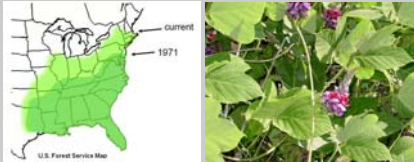


Figure 1. Distribution map of kudzu (2007), and, kudzu in bloom (August).

Traits of This Invasive Legume

- ◆ Seedlings establish in a wide variety of soils and terrains; spread clonally by vines which may grow at rates up to 30 cm per day and form adventitious roots from the nodes (Miller, J.H. 2003).
- ◆ Vines produce trifoliate leaves and form a twisted, braided mat that can eventually overtop the crowns of shrubs and trees.
- ◆ Taproots form large, tuberous reserves and reach depths of 5 m.
- ◆ Energy and nutrient reserves of the taproot enable vines to enter even temporarily unfavorable microhabitats before growing upward and overtopping trees and shrubs.
- ◆ Herbivorous predators do not limit this non-native species as they might for a native species (Sun, J., et al., 2005).
- ◆ Reproduction -- Late-summer flowers in racemes; fruit a legume covered with red-brown, villous hairs; seed stratification required.

Eradicating Kudzu from Greene County, Ohio

In summer, 2007, CEMEX, Inc.- Fairborn Plant (Fairborn, OH) entered into an agreement with the authors, representing Cedarville University (Cedarville, OH) to study a kudzu infestation at their quarry site in Greene Co., OH, for the purpose of developing and implementing a successful strategy of eradication. The infestation includes a "lake patch" and 3 other patches west of the lake totaling 4 acres. The project affords us the opportunity to study the ecology and physiology of kudzu in what may be its northernmost site in western Ohio.



Figure 2. The kudzu infestation at the "lake site", Greene Co., Ohio.

Objectives

1. To characterize the growth, reproduction, and survival potential of kudzu in Greene County, Ohio.
2. To obtain information on kudzu ecology, physiology, and eradication through published literature and invasive plants networks.
3. To eradicate kudzu from local sites with minimal negative impact.

Methods

Ecological Assessments -- Summer, 2007

1. Mapped boundaries of local infestations (Figures 2 and 3).
2. Identified plant species located in affected plant communities.
3. Noted drainage features as part of plan to contain herbicide damage.

Develop Eradication Strategy -- 2007-08:

1. Surveyed eradication efforts, specialists, funding sources in Midwest.
2. Networked with Ohio Invasive Plant Council (OIPC) and herbaria.
3. Studied ecology and physiology of local infestation. (See points below.)

Seed Development Study -- Summer, 2007:

1. Located five sample sites representing different slopes and aspects.
2. Monitored inflorescences weekly at each site until seed maturity (Fig. 3).
3. Obtained photographic record of floral, fruit, and seed development.
4. Collected specimens for Cedarville University Herbarium (Figure 4).

Seed Scarification and Viability Studies -- Fall, 2007:

1. Collected legumes in "dry rattle" stage from field study sites (Figure 5).
 2. Harvested seeds from pods; divided randomly into 4 groups of 10 seeds.
 3. Scarification: abraded seed coats with sandpaper as follows (Figure 5).
 - > Controls: No abrasion
 - > Light abrasion: Minimal abrasion of seed coats
 - > Moderate abrasion: Thorough abrasion but seed coats still intact
 - > Rigorous abrasion: Seed coats entirely removed by abrasion
 4. Seeds placed in Petri dishes in a slanted position with 5 ml distilled H₂O as moisture reserve at bottom edge to keep filter paper damp (Figure 5).
- ◆ Seedling Establishment On-Site -- 2008: Monitored local 2007 field sites for evidence of kudzu seedling establishment in 2008.

Results

Ecological Assessment and Eradication Strategy (In progress or pending):

Based upon our survey of literature, landscape assessments, biotic community survey, and contact with potential eradication specialists, we selected NOVCO, Inc., Columbus, OH to conduct a summer, 2009 herbicide treatment as follows:

1. **Herbicide:** Transline® (clopyralid) 3,6-dichloro-2-pyridinecarboxylic acid, a systemic herbicide
2. **Application Strategy:**
 - > **Phase 1:** Targeted application (helicopter) leaving an unsprayed buffer zone along lake shore (2009)
 - Aim: To minimize collateral damage; buffer zone will limit runoff into lake (Figure 2)
 - > **Phase 2:** Ground-based application to surviving kudzu and remaining buffer along lakeshore (2010)
3. **Funding:** Collaboration between USFWS, Dow Chemical, CEMEX, Inc., and NOVCO, Inc.
4. **Other Considerations:**
 - > **Long-Term Success** requires that the extensive root system be completely destroyed
 - > **Mechanical methods** including use of grazing livestock usually offer only a short-term, often costly option; must be persistent to prevent re-growth and thus prevent carbohydrate supply to roots.

Seed Development and Seedling Establishment:

1. Despite a shorter Ohio growing season, kudzu flowered in late summer and set seeds (Figures 1 & 5).
2. We verified that scarification was essential to germination of kudzu seeds. See Table →
3. We also verified that kudzu seeds germinated and produced viable seedlings on site without human intervention (Figure 7). Mechanism and time requirement for scarification in nature have not been determined.

Figure 7. Kudzu seedling with its distinct root system, May 31, 2008 (near-right photo); unearthed seedling, Oct. 25, 2008. (far-right photo).



Figure 3. Field study at "lake site" (left) and monitoring seed development (right)



Figure 4. Herbarium records (above); reported sites according to U.S. Fish and Wildlife Service inventory (right).



Figure 5. Kudzu legumes (left); seed scarification experiment with varying abrasion.



Figure 6. Kudzu site in Clermont County, Ohio

Scarification	% Germination
None	0
Light Abrasion	30
Moderate Abrasion	100
Rigorous Abrasion	70



Discussion and Recommendations

Ecological Threat

Reduction in barriers to long-distance dispersal, combined with disruption of natural landscapes, has allowed kudzu to threaten the composition and stability of biotic communities (Sage and Coiner, 2008). With the help of climate warming, the limiting cold temperature has been receding northward, allowing kudzu to survive increasingly more northern latitudes including the Great Lakes Region. In addition, elevated atmospheric CO₂ concentrations strongly favor kudzu growth (Dukes and Mooney, 1999). Together, these forces may have caused increased kudzu occurrences in Ohio (Figures 1 and 4).

Recommendation:

Eradication of kudzu from within and beyond Ohio will require coordination between land stewards and researchers, education of the public, early detection and eradication of new infestations, and persistent action and restoration of currently infested areas.

Implementation:

Network -- We have begun to establish a network among land stewards, researchers (Ohio and regional), federal agencies, NGO's, and private industry to maintain a kudzu site status database, report effective practices, and develop a regional perspective.

Educate and motivate the public to identify and report kudzu sites

Link Program to Wise Land Stewardship that seeks to restore and reclaim disturbed landscapes and restore native species.

Result: Early detection of new infestations, eradication of current ones, and restoration of degraded landscapes that invite kudzu.

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Contact Information

John E. Silvius, Ph.D., Senior Professor of Biology
Cedarville University, Department of Science & Mathematics
251 N. Main St., Cedarville, OH 45314
E-mail: silviusi@cedarville.edu Phone: (937) 766-7948
<http://www.cedarville.edu/academics/sciencemath/silvius/>