Ohio Invasive Plant Assessment Protocol

Botanical Name: *Pueraria lobata*
Common Name: Kudzu
Family Name: Fabaceae
Posted Date: 7/20/16
Initial assessment conducted by: Allison Mastalerz

Step I Outcome: **Invasive**
Step II Score: **56**
Step II Outcome: **Invasive**

Step I

Directions: Place an "X" in the Score column next to the selected answer to each of the four questions.

		Score	Notes	References
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?	Yes. *Place on invasive plant list, no further investigation needed.* ***STOP***			
	No. *Continue on to question 2.*	X		
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]	Yes. *Place on invasive plant list, no further investigation needed.* ***STOP***			
	No. *Continue on to question 3.*	X	Species occurs in counties located next to the Ohio river (regions 4 & 5), but information is lacking about individual populations	1, 8
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?	Yes	X	Self-replicating populations are occurring in counties along the Ohio river. Kudzu infestations are documented to significantly alter soil carbon and nitrogen content and cycling, as well as fungal and bacteria biomasses. Kudzu forms dense populations that overtop and completely smother native vegetation, altering structural and compositional elements (flora and fauna) of invaded habitats. Kudzu can interfere with forest stand recovery after storms because its rapid growth in tree fall gaps prevents pioneer species from establishing. Species has been documented to alter water and fire cycles. By increasing the availability of nitrates in the soil, water systems can ultimately become eutrophic, and impact aquatic biodiversity. Species also releases phenolic compounds into soils at amounts considered to be allelopathic.	7,8, 9,10,11,12
	No			
	Unknown			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]	Yes	X	PA, IN, MI, WV, NY, CT, MA, KY, IL	1,2,3,4,5,6
	No			
	Unknown			

If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II.

Step II: Invasion Status

Directions: Place the appropriate numerical score (or "U") in the Score column next to the selected answer to each of these 18 questions.

	Score	Notes	References
1. Current Invasion in Ohio - plant is not found in natural areas (**0 pts.**) - plant is found in natural areas but only because it persist from previous planting in that location (e.g. old home sites) (**0 pts.**) - plant is only expanding from sites of previous planting (**1 pt.**) - plant occurs in natural areas away from site of planting (**3 pts.**) - Information unknown (**U**)	3		10, 11
2. State Distribution[a] - plant is not naturalized in any region of Ohio (**0 pts.**) - plant is naturalized in only one region in Ohio (**1 pt.**) - plant is naturalized in two regions in Ohio (**2 pts.**) - plant is naturalized in three regions in Ohio (**3 pts.**) - plant is naturalized in four regions in Ohio (**4 pts.**)	3	Regions 3,4,5	1,8,10,21

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	Score	Notes	References
- plant is naturalized in five regions in Ohio (**5 pts.**) - Information unknown (**U**)			
3. Regional/US Distribution - plant is not considered to be a problem in any other state (**0 pts.**) - plant has been reported as a widespread problem in another non-neighboring state within the USDA Plant Hardiness Zones 5-6 (**1 pt.**) - plant has been reported to be a widespread problem in 1-2 adjoining states (**3 pts.**) - plant has been reported to be a widespread problem in 3 or more adjoining states (**5 pts.**) - plant has been reported to be a widespread problem in similar habitat outside the US (**1 pt.**) - Information unknown (**U**)	5	PA, IN, MI, WV, NY, CT, MA, KY, IL 14: Species will advance northward with climate change.	1,2,3,4,5,6,14
Step II: Biological Characters			
4. Vegetative Reproduction - no vegetative reproduction (**0 pts.**) - reproduces readily within the original site (**1 pt.**) - has runners or spreading rhizomes that root easily (**3 pts.**) - fragments easily and fragments can be easily dispersed (**4 pts.**) - has runners or spreading rhizomes that root easily AND fragments easily and fragments can be easily dispersed (**5 pts.**) - Information unknown (**U**)	5	15: Major method of spread is vegetative; species can root when vines touch the ground (explained in detail in this reference).	8,15
5. Sexual Reproduction - no sexual reproduction (**0 pts.**) - infrequent sexual reproduction (**1 pt.**) - frequent sexual reproduction, but high variation among years in seed production (**3 pts.**) - frequent sexual reproduction (one or more events per year) (**5 pts.**) - Information unknown (**U**)	1	15: Most of spread of this species is due to vegetative growth with seed production very limited (0 to 3.3% seed set of ovules).	8,9,15
6. Number of Viable Seeds or Propagules per Plant - few (0-10) (**1 pt.**) - moderate (11-1,000) (**3 pts.**) - prolific (>1,000) (**5 pts.**) - Information unknown (**U**)	1	8: "Low overall investment combined with low seed set and low recruitment suggests that sexual reproduction and subsequent seedling recruitment are not currently major factors in dispersal and establishment." 15: Seed production is usually less than 3% and varies extensively among populations; seeds require scarification. 18: Some populations have copious seeds while others have none. 20: Seeds can germinate in a variety of conditions, but not with flooding.	8,9,15,18,20
7. Flowering Period - one month or less per year (**0 pts.**) - two months (**1 pt.**) - three to five months (**2 pts.**) - longer than five months (**3 pts.**) - Information unknown (**U**)	2	8: July-Sept., but can be impacted by sun exposure, patch size and other factors. 18: Flowering is mid- to late-summer.	8,18
8. Dispersal Ability - low potential for long-distance seed/propagule dispersal (>1km) (**0 pts.**) - medium potential for long-distance seed/propagule dispersal (**3 pts.**) - high potential for long-distance seed/propagule dispersal (**5 pts.**) - Information unknown (**U**)	3	8: The primary introduction route is intentional	8,18
9. Generation Time			

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Step II

	Score	Notes	References
- long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (**0 pts.**) - short juvenile period (<5 years for trees, <3 years for other forms) (**3 pts.**) - Information unknown (**U**)	3		8
10. Establishment - unable to invade natural areas (**0 pts.**) - can only colonize certain habitat stages (e.g. early successional habitats) (**1 pt.**) - aggressively colonizes and establishes in edge habitats (**3 pts.**) - aggressively colonizes and establishes in intact and healthy natural areas (**6 pts.**) - Information unknown (**U**)	6	14: Species will advance northward with climate change. 17: Genetic study shows that clones of kudzu interdigitate with one another; species has high genetic diversity consistent with multiple introductions.	8,14,17
Step II: Ecological Importance			
11. Impact on Ecosystem Processes - no known effect on ecosystem-level processes (**0 pts.**) - moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(**3 pts.**) - causes long-term, substantial alterations in the ecosystem (e.g., changing fire regime of an area, changing hydrology of wetlands) (**6 pts.**)	6	8: Species has been documented affecting mycological communities, nutrient, water and fire cycles. 9: Can lead to changes in an area's nitrogen cycling and trace N gas emission; impact may extend to the atmosphere by contributing to increased concentrations of tropospheric ozone; 15: Species is a nitrogen-fixer; this reference reviews known ecosystem effects; species also emits isoprene gas, which contributes to ozone depletion. 16: Kudzu contributed to ozone pollution. 19: Kudzu is recommended as a biofuel source.	7, 8, 9,15,16,19
12. Impact on Rare Organisms - no known negative impact on Ohio State-listed or federal-listed plants or animals (**0 pts.**) - negatively impacts listed species, such as through displacement or interbreeding (**3 pts.**)	0	No evidence available.	
13. Impact on Native Animals - no known negative impact on animals (**0 pts.**) - documented direct or indirect negative effects on animal taxa (**3 pts.**)	0	8: Through altering plant community, nutrient cycles, water cycles and fire regimes, many native terrestrial and aquatic animal populations are negatively impacted, but no empirical evidence was provided. 13: Plant can be partially controlled by the bioherbicidal fungus *Myrothecium verrucaria*.	8,13
14. Impact on Native Plants - no known negative effects on native plants (**0 pts.**) - negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (**3 pts.**) - impacts native plants to such an extent that community structure is greatly altered (**6 pts.**)	6	8: Kudzu can be allelopathic and its growth overtops and smothers native vegetation. 9: "...community composition is directly and immediately altered by kudzu invasion." 15: reviewed as depressing growth of native tree and understory species.	8,15
15. Hybridization - no known instances of hybridization with other plant species (**0 pts.**) - can hybridize with native Ohio plants or commercially-available species, but seeds are inviable (**1 pt.**) - can hybridize with native Ohio plants or commercially-available species, producing viable seed (**3 pts.**)	0	Evidence is unclear.	8
16. Population Density			

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	Score	Notes	References
- occurs only as small, sporadic populations or individuals (**1 pt.**) - typically forms small, monospecific patches (**3 pts.**) - is a dominant plant in area where population occurs (absolute cover 15-50%) (**4 pts.**) - forms an extensive, monospecific stand (absolute cover >50%) (**5 pts.**)	5		8, 9
17. Role in Succession in Natural Areas - successional information is unknown (**0 pts.**) - is an early successional species that temporarily invades a disturbed site but does not persist as the site matures (**0 pts.**) - readily invades disturbed sites and persists, but does not interfere with succession (**1 pt.**) - readily invades disturbed sites, persists and interferes with succession of native plants (**4 pts.**)	4	8: "Kudzu may also interfere with forest stand recovery after storms. Resulting tree fall gaps may be quickly dominated by kudzu, which prevents pioneer species from establishing".	8
18. Number of Habitats Invaded ***Forestlands:*** Floodplain forest, hemlock-hardwood forest, mixed mesophytic forest, beech-maple forest, oak-maple forest, oak-hickory forest. ***Grasslands:*** Alvar*, beach-dune community*, bur oak savanna*, slough-grass-bluejoint prairie*, sand barren*, big bluestem prairie, little bluestem prairie (xeric limestone prairie*+), post oak opening*+ ***Wetlands:*** Bog*, fen*, twigrush-wiregrass wet prairie*, marsh, buttonbush swamp, mixed shrub swamp, hemlock-hardwood swamp*, maple-ash-oak swamp, white pine-red maple swamp* * Considered a rare plant community in Ohio by ODW's Biodiversity Database Program. + = xeric limestone prairies or cedar glades and post oak openings are unique to the Interior Low Plateau Region of Adams, Highland and Pike counties, and are not included in Schneider and Cochrane (1997). - not found in any natural habitats in Ohio (**0 pts.**) - only found in 1 broad category (**1 pt.**) - found in 2 broad categories or 2 rare habitat types (**3 pts.**) - found in 3 broad categories or 3 rare habitat types (**4 pts.**) - found in 4 or more rare habitat types (**5 pts.**)	3	8: "forest areas, tree plantations, rights-of-way, shores and floodplains, roadsides, embankments, edges of fields, abandoned fields, fencerows and disturbed areas, growing profusely in open habitats with fertile, well-drained soils".	8

Total Score: **56**
Number of Unknowns: **0**
Outcome: **Invasive**

Total Points	Assessment Decision
4 or more U	Insufficient Data
0-34	Not Known to be Invasive
35-44	Pending Further Review
45-80	Invasive