NAME OF SPECIES: Microstegium vimineum
Synonyms: Microstegium vimineum, Andropogon vimineus, Eulalia viminea
Common Name: Japanese Stiltgrass, Nepalese browntop, Japanese Grass, Nepal grass, eulalia

A. CURRENT STATUS AND DISTRIBUTION		
I. In Wisconsin?	1. YES ☐	NO ☒ Plant Conservation Alliance, N. Carolina Museum of Natural Sciences, USDA Forest Service: Northeastern Area
	2. Abundance: Not found in WI	
	3. Geographic Range:	
	4. Habitat Invaded: Invades rapidly following disturbance and more slowly invades undisturbed areas. Because of its ability to seed in shade, forested areas are in danger of being invaded (7). Disturbed Areas ☒ Undisturbed Areas ☒	
	5. Historical Status and Rate of Spread in Wisconsin:	
	6. Proportion of potential range occupied:	
II. Invasive in Similar Climate Zones	YES ☒ NO ☐ Where: AL, AR, CT, DC, DE, FL, GA, IL, IN, KY, LA, MA, MD, MO, MS, NC, NJ, NY, OH, PA, SC, TN, TX, VA, WV	
III. Invasive in Similar Habitat Types	1. Upland ☒ Wetland ☒ Dune ☐ Prairie ☐ Aquatic ☐ Forest ☒ Grassland ☐ Bog ☐ Fen ☐ Swamp ☐ Marsh ☐ Lake ☐ Stream ☐ Other: Stream banks, floodplains, ditches, trails, old fields, yards, utility corridors, edge communities	
IV. Habitat Effected	1. Soil types favored (e.g. sand, silt, and clay, or combinations thereof, pH): acidic to neutral soils (generally pH 4.8 to 5.8), high in nitrogen, alluvial or moist ground. Soil type ranges from silty loams to loamy sands (3).	
	2. Conservation significance of threatened habitats:	
V. Native Habitat	1. List countries and native habitat types: Tropical East/Central Asia, Japan, Korea, China, Malaysia, India	
VI. Legal Classification	1. Listed by government entities? AL, CT, MA, GA, KY, TN, VA .	
	2. Illegal to sell? YES ☐ NO ☒ Notes:	
B. ESTABLISHMENT POTENTIAL AND LIFE HISTORY TRAITS		
I. Life History	1. Type of plant: Annual ☒ Biennial ☐ Monocarpic Perennial ☐ Herbaceous Perennial ☐ Vine ☐ Shrub ☐ Tree ☐	
	2. Time to Maturity: Plant fruits within one growing season. Seeds mature in about 2 weeks in late summer/early fall.	
	3. Length of Seed Viability: >3 yrs	
	4. Methods of Spread: Asexual ☒ Sexual ☒ Please note abundance of propagules and and other important information: Individual plants may produce between 100 and 1000 seeds that fall near parent plant. Invasions increase in area and density during the growing season when plants produce lateral tillers with adventitious roots (8).	
	5. Hybridization potential:	

II. Climate	1. Climate restrictions: prefers shade (can also survive in high light areas, but with more difficulty photosynthesizing in full sunlight), [this may not be entirely true – peak photosynthetic activity occurs below full sun conditions (Horton et al) but with sufficient soil moisture, *Microstegium* can produce massive amounts of biomass in full sun]may require cold for seed germination with the coldest reported winter temperatures of invasive sites being -5.8 to -9.4 degrees Fahrenheit (-21 to -23 degrees Celsius), lives at elevations from sea level to up to 4000 ft (1000m)
	2. Effects of potential climate change: New places for possible invasion could develop with a changing climate that would be hospitable to the needs of the plant. On the same note, places that are currently suitable may become inhospitable. Note: Increased atmospheric CO_2 can negatively (produces less biomass than under normal CO_2 conditions) affect a community of this plant during wetter seasons.
III. Dispersal Potential	1.Pathways - Please check all that apply: Intentional: Ornamental ☐ Forage/Erosion control ☐ Other: Formerly used as packing material in transport of porcelain Unintentional: Bird ☐ Animal ☒ Vehicles/Human ☒ Wind ☐ Water ☒ Other: Hay
	2. Distinguishing characteristics that aid in its survival and/or inhibit its control: rooting at nodes along stem aids in spreading quickly, ability to survive in low light conditions (capable of seeding in conditions as low as 5% full sunlight); uniquely competitive w/native vegetation in shaded wetlands/forests b/c of C4 metabolism; seeds germinate early in spring before most native vegetation, reproductive plasticity to environmental conditions **Note: white-tail deer aid in its survival by eating native plants and avoiding the plant, thus allowing it to spread, colonial in nature
IV. Ability to go Undetected	HIGH ☐ MEDIUM ☒ LOW ☐
C. DAMAGE POTENTIAL	
I. Competitive Ability	1. Presence of Natural Enemies: Balansia andropoginis, Meliola setariae, Phyllachora leptotheca, Phyllachora ischaemi, Phakospora incomplete, Puccinia aestivalis, Puccinia benguetensis, Puccinia polliniae, Puccinia polliniae-imberbis, Puccinia polliniicola, Cerebella paspali, Ustilaginoidea polliniae, Semiaphis Montana, Lethe confuse, Lethe europa, Melanitis phedima, Mycalesis mineus, Ypthima balda, Ypthima balda zodina, Ypthima baldus *Note: May be slower to establish in places with deep litter, especially oak litter.
	2. Presence of Competitors: Lonicera japonica, *Dichanthelium clandestinum* (under high light conditions)
	3. Rate of Spread: HIGH(1-3 yrs) ☒ MEDIUM (4-6 yrs) ☒ LOW (7-10 yrs) ☐ Notes: Can replace competing ground vegetation in 3-5 yrs and can reduce native herbaceous productivity and diversity in 1 growing season.

II. Environmental Effects	1. Alteration of ecosystem/community composition? YES ☒ NO ☐ Notes: Forms thick thatch of litter, possibly preventing natives from establishing. Can crowd out native vegetation in just a few years by reducing available light at ground level.
	2. Alteration of ecosystem/community structure? YES ☒ NO ☐ Notes: May reduce native tree seedling emergence and reduce the growth rate of surviving tree seedlings. Greater density of earthworms found in areas w/microstegium than in areas with native plant populations.
	3. Alteration of ecosystem/community functions and processes? YES ☒ NO ☐ Notes: Alters soil conditions to benefit itself by increasing pH, nitrification, and nitrate, which also prevents the original natives from re-establishing.
	4. Allelopathic properties? YES ☐ NO ☒ Notes:
D. SOCIO-ECONOMIC Effects	
I. Positive aspects of the species to the economy/society:	Notes:
II. Potential socio-economic effects of restricting use:	Notes:
III. Direct and indirect effects :	Notes: Loss of historically desired ecosystems
IV. Increased cost to a sector:	Notes: Removal (costs of labor, machines, chemicals, time), prevention (costs of labor, machines, chemicals, time) after removal and in new areas, monitoring/surveying, habitat rehabilitation, continued managment **These costs will be necessary now and yrs into the future.
V. Effects on human health:	Notes:
E. CONTROL AND PREVENTION	
I. Detection Capability:	Notes: Can be difficult to distinguish between different grasses. Microstegium is often confused with a native grass, Leersia virginica (white grass).
II. Costs of Prevention (including education; please be as specific as possible):	Notes: several times a year there should be efforts to maintain native communities, conduct surveys, monitor likely sites of invasion (disturbed areas such as waterways, roadsides, adjacent old fields, etc), remove by hand small populations, apply post and pre-emergent herbicides to remove larger populations and reduce continued growth from seed bank.
III. Responsiveness to prevention efforts:	Notes: (Based on study by Luke Flory – Indiana University)Most effective prevention achieved when using a grass specific post-emergent herbicide followed by a pre-emergent herbicide the following spring as noted under *Chemical Effective Control Tactics #5,* reducing end of season cover by 99.9% and returning spring cover is <1% original extent. Applying just a grass specific post-emergent herbicide results in 99.8% reduction by the end of the growing season with 25% returning spring cover. Hand weeding alone reduces cover by 86.9% by the end of the season with 70%

	returning spring cover.
IV. Effective Control tactics:	Mechanical ☒ Biological ☐ Chemical ☒ Times and uses: **Mechanical**: Can be pulled by hand or mowed during peek bloom in September before seeds set. May also try to plant ginseng, goldenseal, or trees to help curve invasions. **Chemical**: **1)** Using herbicide glyphosate is effective in a 2% solution sprayed slowly & thoroughly. **2)** May also use herbicidal soaps, i.e. pelargonic acid or grass-specific herbicides, i.e. sethoxydim. For dry areas: imazapic plus methylated seed oil used before or after emergence is effective. As with Mechanical methods, it is best to apply herbicides late in the growing season before the plant has a chance to seed. Any action will require continued follow-up for up to 7 years in order to remove those plants that germinate from the seed bank. Restoration of native plants is also helpful to prevent reestablishment by the plant. A combination of methods is most successful at eradicating the unwanted plant. **3)** Georgia Example: "Using a crabgrass pre-emergent in mid February and again in early June (for my zone 7b/8a Georgia location) prevents 95+% germination for that year. Unfortunately with an established seed bank, the process will have to be repeated for 3-5 years. Pre-emergent herbicides (like imazapyr) don't harm native perennials, but do block their germination from seed. I have found it easier to collect the seed of desirable plants and germinate them in a seedling bed for transplantation back later. Chasmanthium latifolium was being used (within its native range) to out-compete Microstegium with promising results."(email source #11). "The best rate for maximum selectivity is 4 oz. per acre, applied as a broadcast application with backpack sprayers. Sprayers should be fitted with an 8003E flat fan nozzle and calibrated at 15 to 20 gpa. Another option that may be appropriate for certain situations is to apply a pre-emergent (only) treatment with Pendulum® Aquacap™ at 2.4 qts. to 4.8 qts. per acre (15 to 20 gpa). The higher rates have provided season long control." (nps fact sheet) **4)** W. Virginia example: "1% Envoy + 0.25% NuFilm IR surfactant resulted in over 95% kill. Similar results with Fusilade and Poast, other grass-specific herbicides" (email source #12). **5.)** 2006 study by Luke Flory – Indiana University Grass specific post-emergent (Fusilade DX 0.75 oz/gal; Fluazifop-P-butyl) herbicide followed by a spring application of a pre-emergent herbicide (Pendulum AquaCap 3.2 oz/1,000 ft; pendemethalin) "I now recommend this approach with extreme caution because the recovery of the plant community is significantly inhibited when the pre-emergent herbicide is applied the following spring (new data analysis since I presented in WI). At the eight study sites I used, that spanned a range of environmental conditions and land use history, native plant community recovery was the greatest when only the post emergent herbicides was used. If it is known ahead of time that the invasion is very new and the native perennial plants have not yet been reduced (unlikely), then following the post emergent with the pre-emergent in the spring is probably fine. However, if the invasion has been in place long enough to significantly reduce native plant diversity or

	productivity (which may not be very long) I recommend that the pre-emergent herbicide be avoided in order to allow the native plant community to recover through growth of new plants from seed. The idea above about collecting seed, growing plants in the greenhouse, and planting seedlings is a good one but is probably not often feasible at the scale *Microstegium* invades (i.e. up to hundreds of acres)" -Luke Flory **Biological:** At this time there is no bio control, however, the Northern Pearly Eye (Enodia anthedon) eats grass and needs further study to establish a connection to Japanese stilt grass
V. Minimum Effort:	Notes: This would include mechanical or chemical removal of plants several times for years until plant no longer returns.
VI. Costs of Control:	Notes:
VII. Cost of prevention or control vs. Cost of allowing invasion to occur:	Notes:
VIII. Non-Target Effects of Control:	Notes: Using chemicals to remove plant may cause unwanted loss of surrounding native species. Graminoid species are reduced when grass specific post emergent herbicides are used. Use of pre-emergent herbicides inhibits the recovery of the native plant community.
IX. Efficacy of monitoring:	Notes:
X. Legal and landowner issues:	Notes:

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F. REFERENCES USED:

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☐ TNC
☒ Native Plant Conservation Alliance (nps.gov)
☒ IPANE
☒ USDA Plants
☒ Other:

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2. Southeast Exotic Pest Plant Council Invasive Plant Manual http://www.seeppc.org/manual/japgrass.html
3. UC Davis Element Stewardship Abstract http://tncweeds.ucdavis.edu/esadocs/documnts/micrvim.pdf
4. North Carolina Museum of Natural Sciences http://tncweeds.ucdavis.edu/esadocs/documnts/micrvim.pdf
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9. Invasive and Exotic Species – Microstegium vimineum http://www.invasive.org/weeds/asian/microstegium.pdf
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