August 3, 2005 version

Official Assessment of Lespedezas (including *L. cuneata, L. bicolor, L. thunbergii, Kummerowia stipulacea, and K. striata)* in Indiana's Natural Areas

Assessed July 6, 2004- by Ellen Jacquart, Gary Langell, Phil O'Connor, Lee Casebere, and Ed Guljas
Answers are underlined, comments and discussion are in italics.

Contents of the Assessment:

Section I – Invasion Status. Determines whether the species being evaluated is invasive in Indiana.
Section II – Ecological Impacts of Invasion. Evaluates the significance of impacts of the species.
Section III – Potential for Expansion. Evaluates the actual and/or potential expansion of the species.
Section IV – Difficulty of Management. Evaluates how hard it is to control the invasive species.
Section V – Commercial Value. Evaluates how valuable the species is economically in Indiana.

Questions in Sections I – V may direct you to one or more of the following sections for particular invasive species:
Section A. For species which have impacts limited to a few sites, assesses the potential for further spread.
Section B. For species which have medium impacts but high value, assesses whether species could be used in specific circumstances that would prevent escape and invasion.

A worksheet for use with the assessment is found on page 10.

The meeting started with a summary of the Asian lespdezas to be assessed. They fall into three groups: Sericea lespedeza: L. cuneata is a perennial lespedeza with woody stems, well known and planted for many years for wildlife purposes and for erosion control on poor soils. Most Indiana agencies have already stopped planting it or recommending it because of its aggressiveness.

Shrub lespedezas: This is a confusing group consisting of L. bicolor, L. thunbergii, and perhaps L. japonica. They are all perennial, but it is not clear which of these species were introduced where in Indiana and how to tell them apart (seed color is one characteristic to use, but no one has collected these species to distinguish them). L. japonica is not a recognized species and must be an alias for one of the other two Lespedezas, but no one knows which. All that we are sure about is that one (or perhaps two) of these species were planted extensively around the state as part of the Save Our Small game program in the 1970's. Currently these species are recommended and planted around the state, but not in CRP lands.

Annual lespedezas: There are two species of short annual lespedezas which are now put in the genus Kummerowia; K. striata (striate lespedeza, with cultivars including Kobe and Marion) and K. stipulacea (Korean clover, with cultivars including Korean and Summit). Currently, Kobe and Marion cultivars of striate lespedeza are recommended through NRCS but not cultivars of Korean clover. DNR – Division of Fish and Wildlife recommends cultivars of both species for planting.

In general, all the lespedeza species seem to be more common in the southern half of the state where they were planted on infertile old farm fields and coal mined lands. Currently, while we see all of these species moving outside of planted areas the movement seems limited to rather disturbed sites – roadsides, powerline ROWs, etc. They are not known to have moved into natural areas in the state.

Automatic Exemption From the Assessment

Is this species listed on any federal or on an Indiana state noxious, or prohibited plant lists?

If **YES** then do not proceed with assessment but indicate a conclusion of **Do not use this plant** on the front of the response form.

If **NO** then go to Section I.

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Section I Invasion Status

1-a Current Invasion in Indiana

1. Does this species occur in any natural areas in Indiana?
   If **NO** then go to Section III-c.
   If **YES** then go to 1-a 2. *Note – while there were no examples of lespedezas moving into pristine natural areas, there were many examples of each species moving into roadsides, old fields adjacent to natural areas, and disturbed glades and forests in southern Indiana counties. Given this, Section II was also completed.*
2. Does it ONLY occur in natural areas of Indiana because it has persisted from its previous cultivation (e.g., in abandoned farmland or homesteads)?
   If **YES** then go to Section III-c.
   If **NO** then go to Section 1-b (below).

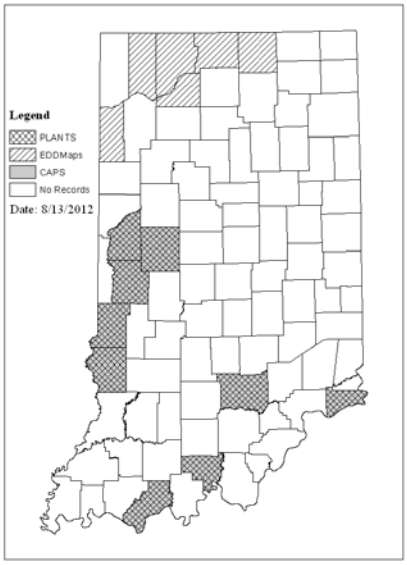
1-b Invasion Status in Indiana

Evidence of invasion (forming self-sustaining and expanding populations within a plant community with which it had not previously been associated) must be provided. If not available in a published, quantitative form, this evidence must include written observations from at least three appropriate biologists.

1. Is species invasive ONLY when natural disturbance regime and scale have been altered? (e.g. where frequency, extent, or severity of fires have been reduced by human activity).
   If **YES** then go to questions 1-b 2.
   If **NO** – the species is invasive, go to Section II (below).

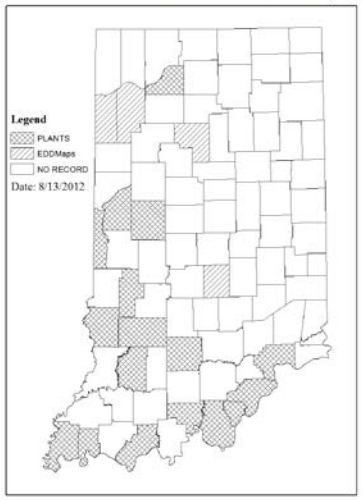
2. Has this species ever been known to persist, following colonization, when the natural regime is resumed and the natural flora/communities recover? (e.g., is not an early successional species that only temporarily invades disturbed sites.)
   If **YES** (or unknown) - the species is invasive, go to Section II (below).
   If **NO** (known not to persist) the species is currently not invasive in Indiana. Go to Section III-c to assess the species' potential for future invasion.

Reported Status of Sericea Lespedeza, Lespedeza cuneata



Reported Status of Japanese clover, Kummerowia striata

Reported Status of Korean clover, Kummerowia stipulacea



Reported Status of Shrubby Lespedeza, Lespedeza bicolor

Section II Ecological Impacts of Invasion Impact Index

II-a Known Impacts at WORST SITE(S) (without, or before, any control effort)

Add up points for ALL impact statements (i through vi) that are true at the worst affected site(s) then go to question II-b. Evidence of impacts must be provided. If not available in published, quantitative form, this evidence must include written observations from at least *three* appropriate biologists, including specific locations of observations. Scientific names of impacted species (e.g., State-listed or native species with which hybridization occurs) must be included on the response form. If there is no evidence of an impact, then assign 0 points unless the impact is considered very likely (e.g., fixes N_2 in low nutrient soil that can change the flora) or the impact (except vi) has been demonstrated in similar habitats in states. In these cases assign 0.5 points. *All three species/groups are assessed, with points as shown.*

L. cuneata
L. bicolor/thun
K. striata/stip

Points

i) Causes long-term, broad alterations in ecosystem processes changing the community as a whole (e.g. invasion of cattails changes hydrology, drying the site and allowing open aquatic systems to become forested). **15** 0 0

L. bicolor and L. cuneata are known nitrogen fixers (Song & Kim, 1992; Miller, 2003) though Veimeiere et al. (1998) notes that L. cuneata "furnishes very little nitrogen to surrounding plants and actually makes it necessary to add nitrogen fertilizer to maintain productivity of introduced forages. The shoots of grass exposed to the toxins of [L. cuneata] residue have lower nitrogen content and overcoming the loss of production caused by toxins requires nitrogen fertilization." L. cuneata may also reduce water availability (Vermeire et al. 1998). Stevens et al. (2002) notes that L. cuneata can readily establish itself on disturbed lands and causing problems particularly along roadways, drainages, trails, and burned areas: chemicals produced by L. cuneata, such as tannins, can inhibit growth of other plants and promote growth of itself (Morisawa, 1999; Stevens et al. 2002; Heffernan & Gravuer, 2007). Vanderhorst et al. (as cited in Heffernan & Gravuer, 2007) notes "At riverscour bedrock prairie sites, establishes in cracks and appears to be altering the natural sedimentation by trapping more sediment than the natural vegetation does; this may lead to increased rooting medium for habitat generalists and possibly other exotics." Populations of L. bicolor that significantly impact ecosystems have yet to be observed (Glenn & Moore, 2009[a]).

ii) Has negatively impacted Indiana State-listed or Federal-listed plants or animals (choose one of the following):

Displacement, death or hybridization has been documented AND occurs in at least 20% of known locations of the listed species, OR these effects occur in less than 20% of known locations of the listed species, but at least 4 different listed species are affected. 12

Displacement, death or hybridization occurs in less than 20% of locations of the listed species OR impacts are considered likely because the listed and invasive species closely co-habit (e.g., compete for light). *No points counted for any species/group – no knowledge of impacts to rare species in Indiana.* 4

iii) Displaces or precludes native vegetation (affecting mortality and/or recruitment) by achieving infestations in the state that have at least 50% coverage of this species (as defined in the glossary) in the affected stratum that meet any of the following criteria:

a) collectively add up to at least 10 acres
b) are 5 infestations of at least 0.25 acres
c) are 5 infestations that cover an entire localized community (e.g. sinkhole, seeps, fens, bogs, barrens, cliffs)
d) are 5 infestations some of which are at least 0.25 acres and others of which cover entire localized communities. **12** 0 0

There are many acres of L. cuneata with > 50% cover in old fields of southern Indiana, where it displaces native vegetation.

iv) Changes community structure in ways other than vegetation displacement (e.g., alters wildlife abundance, adds a new stratum, or increases stem density within a stratum by more than 5-fold). **4** 0 0

L. cuneata outcompetes other herb layer species and decreases invertebrate diversity (Eddy & Moore, 1998; Stevens et al., 2002; Heffernan & Gravuer, 2007). It can create a dense monotypic herb layer but evidence lacks for eliminating a layer (Glenn & Moore, 2009[b]).
L. bicolor may become dominant in disturbed areas (Tomaino, 2006; Gucker, 2010[a]).
For Kummerowia striata and K. stipulacea, Gucker says: "Few sources reported that Japanese and Korean clovers have negative impacts on natural vegetation" (Gucker, 2010[b]).

v) Hybridizes with native Indiana plants or commercially-available species. 4
No points counted for any species/group.

vi) Covers over 15% of invaded stratum (but if 12 points were assigned for statement iii, do not assign points here) on > 10 acres in the state. 0 **3 3**
No points counted for L. cuneata; both L. bicolor group and Kummerowia species can be found >15% cover on over 10 acres in old fields in southern Indiana.

Total points (place in worksheet page 10): **31 3 3**

II-b Range of Habitats in Which Species is Invasive

Forest: 1)Dry upland, 2)Dry-mesic upland, 3)Mesic upland, 4)Mesic floodplain, **5)Wet-mesic floodplain**, **6)Wet floodplain**, 7)Bluegrass till plain flatwoods*, 8)Boreal flatwoods*, 9)Central till plain flatwoods, 10)Dry flatwoods*, 11)Sand flatwoods*, 12)Southwestern lowland mesic flatwoods*

Savanna: 13)Mesic savanna*, 14)Dry sand savanna*, 15)Dry-mesic sand savanna*

Barrens: 16)Limestone bedrock***,** 17)Sandstone bedrock*, 18)Siltstone bedrock*, 19)Chert*, 20)Gravel*, 21)Sand*, 22) Clay*

Prairie: 23)Dry-mesic prairie*, 24)Mesic prairie*, **25)Wet prairie*,** 26)Dry sand prairie*, 27)Dry-mesic sand prairie*, 28)Wet-mesic sand prairie*, **29)Wet sand prairie***

Wetland: **30)Marl beach*, 31)Acid bog*, 32)Circumneutral bog*, 33)Fen*, 34)Forested fen*, 35)Muck and Sand flats*, 36)Marsh, 37)Sedge meadow*, 38)Panne*, 39)Acid seep*, 40)Calcareous seep*, 41)Circumneutral seep*, 42)Forest swamp, 43)Shrub swamp**

Lake: **44)Lake, 45)Pond**

Stream: **46)Low-gradient creek, 47)Medium-gradient creek, 48)High-gradient creek, 49)Low-gradient river, 50)Medium-gradient river, 51)Major river**

Primary: **52)Aquatic cave*,** 53)Terrestrial cave*, 54)Eroding cliff*, 55)Limestone cliff*, 56)Overhang cliff*, 57)Sandstone cliff*, 58)Lake dune*, 59)Gravel wash*

Is this species known to be invasive in at least four habitat-types *(*note – rare habitat-types are marked with a * and count as 2 when adding*)* OR does it occur in at least one habitat-type of each of the terrestrial and palustrine/aquatic lists (palustrine/aquatic habitats are shown in **bold**) L. cuneata – 2 common (dry and dry-mesic forest) = 2; L. bicolor/thun – 1 rare (mesic prairie) = 2; K. striata/stip – 2 rare (limestone and chert barrens) plus 2 common (dry and dry-mesic forest)= 6

If YES then multiply total score from II-a by 1.5
then go to Section II-c (Below)
If **NO** then multiply total score from II-a by 1
then go to Section II-c (Below)

Place point total in worksheet, page 10.

II-c Proportion of Invaded Sites with Significant Impacts

Of the invaded sites, might any of the worst impacts [items i-v in section II-a] only occur under a few, identifiable, environmental conditions (i.e., edaphic or other biological conditions occurring in 1-10% of the sites)? Documentation of evidence must be provided for a **YES** answer.

If **NO** or **NO SCORE** on items i to v in section II-a
then go to Section III

If **YES** then go to Section A

Section III — Potential for Expansion — Potential Index

This section evaluates a species' actual and/or potential for expansion in Indiana.

III-a Potential for Becoming Invasive in Indiana

1. Is information available on the occurrence of new populations of this species in Indiana over the last 5 years?

   If **YES** then go to section III-b
   If **NO** go to Section III-c to estimate potential for expansion based on the biology of the species.

III-b. Known Rate of Invasion.

1. Was this species reported in more than two new discrete sites (e.g., lakes, parks, fragments of habitats at least 5 miles apart) in any 12 month period within the last 5 years?

   If **NO** then P = Low; then go to Section IV
   If **YES** then P = High; then go to Section IV

III-c. Estimated Rate of Invasion. This section is used to predict the risk of invasion for species that are 1) not currently invasive in the state, and 2) invasive in the state but for which no data on current rate of spread exists. These questions are based on Hiebert et al. 1995. *Initially, we answered each question separately for each species – L. cuneata, L. bicolor, L. thunbergii, K. stipulacea, and K. striata. At the end, it was apparent that all of these species had the same answer for each question, so that answer is shown below and applies to all the species.*

1. Does this species hybridize with any State-listed plants or commercially-important species? (E.g., exhibit pollen / genetic invasion.)

   If **YES** then go to Section B
   If **NO** then go to question III-c 2.

2. Add up all points from statements that are true for this species.	Points	L. cuneata	L. bicolor/thun	K. striata/stip
i. Ability to complete reproductive cycle in area of concern				
a. not observed to complete reproductive cycle	0			
b. observed to complete reproductive cycle		**5**	**5**	**5**
ii. Mode of reproduction				
a. reproduces almost entirely by vegetative means	1			
b. reproduces only by seeds			**3**	**3**
c. reproduces vegetatively and by seed		**5**		
iii. Vegetative reproduction				
a. no vegetative reproduction				**0**
b. vegetative reproduction rate maintains population		**1**	**1**	
c. vegetative reproduction rate results in moderate increase in population size	3			

L. cuneata is frequently cited as reproducing by seed bank and vegetatively, most frequently from the caudex or regrowth from damaged aboveground tissue (Eddy & Moore, 1998; Stevens et al. 2002; Olenbusch et al., 2007; Munger & Gucker, 2010).
L. bicolor reproduces mostly by seed (Glen & Moore, 2008[a]).
L. thunbergii Nakai reproduces only from seed (Tjaden & Lewis, 2000).)

d. vegetative reproduction rate results in rapid increase in population size 5

L. cuneata can resprout from cutting or fire from extensive underground root system (Heffernan & Gravuer, 2007; Glenn & Moore, 2009[b])
L. bicolor can resprout from root crowns (Tomaino, 2006; Gucker, 2010[a]).
K. stipulacea & K. striata does not reproduce vegetatively but can regrow if clovers are not cut too close to the ground or too late in the season (Offutt & Baldridge, 1973; Beuselinck & McGraw, 1994; Gucker, 2010[b]).

iv. Frequency of sexual reproduction for mature plant

a. almost never reproduces sexually in area 0
b. once every five or more years 1
c. every other year 3
d. one or more times a year **5 5 5**

v. Number of seeds per plant

a. few (0-10) 1
b. moderate (11-l,000) **3 3 3**
c. many-seeded (> l,000) 5

L. cuneata can produce up to 1500 seeds per stem or ramet(Ohlenbusch et al., 2007; Rossow, 2009), but actual seed production in natural areas is thought to be less depending on soil nutrient levels, moisture, and day length (Munger & Gucker, 2010).
"Common" L. bicolor yield, as described by Busing and Vogel, are 336 to 447 kg/ha and up to 560 kg/ha in other sources (Busing & Vogel, 2008). It can produce over 1000 seeds per plant (Glen & Moore, 2009[a]).
L. thunbergii Nakai and L. thunbergii VA-70 can each produce 300-500 pounds of seeds per acre on production fields (USDA NRCS, 2002; Tjaden & Lewis, 2000).
K. stipulacea and K. striata can produce up to 450-550 lbs/acre (Beuselinck & McGraw, 1994).

vi. Dispersal ability

a. little potential for long-distance dispersal **0 0 0**
b. great potential for long-distance dispersal 5

L. cuneata: Munger & Gucker cites numerous studies that show seed dispersal by humans, livestock, wildlife, and mechanical disturbances (Munger & Gucker, 2010).
L. bicolor: Is dispersed close to the parent plant by gravity, clitochore (Goto, 1996; Tomaino, 2006).
Gucker notes that K. stipulacea and K. striata have a long history of dispersal by livestock and humans (Gucker, 2010[b]). For all species, dispersal is generally only over short distances.

vii. Germination requirements

a. requires open soil and disturbance to germinate 0
b. can germinate in vegetated areas but in a narrow range or in special conditions **3 3 3**
c. can germinate in existing vegetation in a wide range of conditions 5

L. cuneata can germinate readily from 20 to about 90 degrees C but there seems to be a debate about whether scarification enhances germination (For details see the Germination section in Munger & Gucker, 2010. Similarly, for L. bicolor, see Gucker, 2010[a]).
L. thunbergii Nakai is thought to require fire for breaking hard coated seeds (Tjaden & Lewis, 2000).
Similar to L. cuneata, K. stipulacea and K. striata have studies that support and oppose the necessity of scarification (For details and sources, see Gucker 2010[b]).

viii. Competitive ability

a. poor competitor for limiting factors **0**
b. moderately competitive for limiting factors **3**
c. highly competitive for limiting factors **5**

L. cuneata are known for their ability to establish and then persist in disturbed areas and grasslands. L. cuneata is a strong competitor in select ecosystems due to its production of allelopathic compounds to

inhibit growth of other species, ability to persist through droughts with deep taproots, tough numerous stems, and as a long-lived perennial (Stevens et al., 2002). Munger and Gucker say: "seedling emergence, seedling establishment, and sprouting of established plants maybe relatively slow compared to many competing plants" (Munger & Gucker, 2010).

L. bicolor is noted to be moderately drought resistant, frost intolerant, somewhat shade tolerant, and suggests this plant allocates biomass to a few taller shoots to enhance light-gathering competitiveness (Malyugin, 1979; Morisawa, 1999; Anten & Hirose, 1999; Gucker, 2010[a]).

Tjaden and Lewis notes that: L. thunbergii Nakai grows well on sandier soils than other Lespedezas but does not do well on wet, water logged soils, very deep, fine sands, or highly alkaline soils: similarly, L. thunbergii VA-70 does not grow well on deep sand or extremely alkaline soils and does well on droughty, well drained, or poorly drained soils(Tjaden & Lewis, 2000).

Gucker notes that K. stipulacea and K. striata need constant disturbance to persist for many years and that K. striata may be more shade tolerant than K. stipulacea (Gucker, 2010[b]).

Total points for questions i – viii (place in worksheet page 10): **27 23 19**

Section IV Difficulty of Management Management Index

IV Factors That Increase the Difficulty of Management

Add up all points from statements that are true for this species then go to Section V. Assign 0.5 p each statement for which a true/false response is not known.

	L. cuneata	L. bicolor/thun	K. striata/stip
			Points
i) Control techniques that would eliminate the worst-case effects (as listed in Section II) have been investigated but none has been found.			15
ii) This species is difficult to control without significant damage to native species because: it is widely dispersed throughout the sites (i.e., does not occur within discrete clumps nor monocultures); it is attached to native species (e.g., vine, epiphytes or parasite); or there is a native plant which is easily mistaken for this invader in: (choose one)			
≥ 50% of discrete sites in which this species grows;	**10**	**10**	**10**
25% to 50% of discrete sites in which this species grows.			7
It is also extremely difficult to control with most common herbicides (Griffith 1996; Peterson et al. 1996; Remaley 1998).			
iii) Total contractual costs of known control method per acre in first year, including access, personnel, equipment, and materials (any needed re-vegetation is not included) > $2,000/acre (estimated control costs are for acres with a 50% infestation)			5
iv) Further site restoration is *usually* necessary following plant control to reverse ecosystem impacts and to restore the original habitat-type or to prevent immediate re-colonization of the invader.			5
v) The total area over which management would have to be conducted is: (choose one)			
≥ 100 acres;	**5**		
< 100 but > 50 acres.			**2**
≤ 50 but > 10 acres.	1		
≤10 acres		½	
vi) Following the first year of control of this species, it would be expected that individual sites would require re-survey or re-treatment, due to recruitment from persistent seeds, spores, or vegetative structures, or by dispersal from outside the site: (choose one)			

at least once a year for the next 5 years; **10 10 10**
one to 4 times over the next 5 years; 6
regrowth not known 2

vii) Occurs in more than 20 discrete sites (e.g., water-basins, parks, fragments of habitats at least 5 miles apart). **3 3 3**

viii) The number of viable, independent propagules per mature plant (e.g., seeds, spores, fragments, tubers, etc. detached from parent) is > 200 per year AND one or more of the following:

A. the propagules can survive for more than 1 year;
B. the propagules have structures (fleshy coverings, barbs, plumes, or bladders) that indicate they may spread widely by birds, mammals, wind or water;
C. the infestations at 3 or more sites exhibit signs of long distance dispersal. Some possible indicators of long distance dispersal include: the infestation has outlier individuals distant [>50 yards] from the core population; the infestation apparently lacks sources of propagules within ¼ mile. **3 3 3**

ix) Age at first reproduction is within first 10% of likely life-span and/or less than 3 months.

L. cuneata can produce seed in the first year of growth (Ohlenbusch et al., 2007; Rossow, 2009; Munger & Gucker, 2010).
L. bicolor can produce seed after 2-4 years (Edminster, 1950; Burger & Linduska, 1967; Munger & Gucker, 2010).
L. thunbergii Nakai takes 2 years to produce seeds (Tjaden & Lewis, 2000). **2 0 0**

Total points (place in worksheet page 10): **33 26.5 28**

Section V — Commercial Value — Value Index

V-a Commercial Value

Does this species have any commercial value?
If response is **NO** then V = 0 and Go to Conversion of Index Scores to Index Categories
If response is **YES** then go to Section V-b

V-b Factors that Indicate a Significant Commercial Value

Add up all points from statements that are true for this species. Assign 0.5 point for each statement for which a true/false response is not known.

	L. cuneata	L. bicolor/thun	K. striata/stip
	Points		
i) This species is sold in national or regional retail stores (e.g., WalMart, Home Depot, Publix).	10		
ii) State-wide there are more than 20 commercial growers of this species.	7		

iii) More than five growers in Indiana rely on this species as more than 10% of their production. 3

iv) This species has provided a crop, turf, or feed source (e.g., forage, nectar) that has been, or resulted in, a significant source of income for at least five farmers for over 20 years. 3

v) This species is utilized statewide 3

vi) There are more than 100 retail seed outlets statewide 3

Total points (place in worksheet page 10): **0 0 0**

These species are certainly in trade, but they are not known to be grown for sale in Indiana, and they are not generally sold in retail stores. They are largely sold on-line by hunting groups for 'wildlife habitat improvement'.

Section A (from Section II-c)

A1 Can the habitats in which the worst-case ecological impacts occur (items i to v in Section II-a) be clearly defined as different from invaded sites where there are no such impacts (e.g., defined by edaphic or biological factors)? (If ecological impacts include negative effects on a State-listed species, then the specific habitats in which that State-listed species occurs must be clearly distinguishable from habitats in which it does not occur.)

If **NO** then return to Section III
If **YES** then Go to question A2 and prepare such a site definition

A2 Can an estimate be made of the maximum distance that propagules (or pollen if hybridization is a concern) might reasonably be expected to disperse?

If **NO** then return to Section III
If **YES** then prepare instructions for Specified and Limited Use based on maximum dispersal distance (e.g., may be acceptable for use in specific areas but not near habitats where impacts are high.) Reassess if the incidence of worst-case impacts increases above 10% or within 10 years, whichever is earlier. THEN resume the assessment at Section III to provide scores for the other indices.

Section B (from Section III-c or if Value = High and Impact = Medium)

B1 Are there specific circumstances in which this species could be used that would not be expected to result in escape and invasion? (E.g., foliage plants that are only used indoors and which can be reasonably prevented, by conspicuous labeling, from use or disposal in the landscape.)

If **NO**, then retain the previously derived Conclusion.
If **YES**, then Acceptable for Specified and Limited Use where regulations and educational programs for penalties and enforcement of misuse exist. Reassess this species every 2 years.

Worksheet for Assessment

Section I:

Follow directions to different sections.

Section II:

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Impacts Point Total: __31__ X (1 or 1.5) = ___31__ **L. cuneata**
Impacts Point Total: ___3_ X (1 or 1.5) = ____3__ **L. bicolor/thunbergii**
Impacts Point Total: ___3_ X (1 or 1.5) = ____6__ **Kummerowia striata/stipulacea**

Section III:

Potential = High Medium or Low ___27____ **L. cuneata**
Potential = High Medium or Low ___23____ **L. bicolor/thunbergii**
Potential = High Medium or Low ___19____ **Kummerowia striata/stipulacea**

Section IV:

Difficulty of Management Point Total: ___33____ **L. cuneata**
Difficulty of Management Point Total: ___26.5__ **L. bicolor/thunbergii**
Difficulty of Management Point Total: ___28____ **Kummerowia striata/stipulacea**

Section V:

Commercial Value Point Total: ____0____ **L. cuneata**
Commercial Value Point Total: ____0____ **L. bicolor/thunbergii**
Commercial Value Point Total: ____0____ **Kummerowia striata/stipulacea**

Conversion of Index Scores to Index Categories

Using the following table, determine the appropriate category (Low to High or Very High) for each index.

Lespedeza cuneata:

Category	Impact	Potential for Expansion	Management Difficulty	Value
Low (L)	< 12	<20	<15	**≤ 6**
Medium (M)	12 – 25	**20 – 30**	15 – 25	
High (H)	**26-41**	>30	**>25**	>6
Very High (VH)	>41			

Lespedeza bicolor and thunbergii:

Category	Impact	Potential for Expansion	Management Difficulty	Value
Low (L)	**< 12**	<20	<15	**≤ 6**
Medium (M)	12 – 25	**20 – 30**	15 – 25	
High (H)	26-41	>30	**>25**	>6
Very High (VH)	>41			

Kummerowia striata and stipulata:

Category	Impact	Potential for Expansion	Management Difficulty	Value
Low (L)	**< 12**	**<20**	<15	**≤ 6**
Medium (M)	12 – 25	20 – 30	15 – 25	
High (H)	26-41	>30	**>25**	>6
Very High (VH)	>41			

Literature Cited

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Glossary

Anthropogenic disturbance. Human-induced disturbance (e.g., mowing) or human-induced changes in natural disturbance regime (e.g., changing the frequency, extent, or severity of fires).

Coverage. Visual or quantitative estimate of the relative amount of area in a stratum where the canopy of the non-native species intercepts the light that would otherwise be available for other species in or below that stratum. Estimated cover may be dispersed or continuous in a site. Cover is usually measured when foliage is fully expanded. In the case of species that form a dense, continuous mat of rhizomes or stolons, the percent of the soil surface or upper level occupied by that root mat can be estimated as soil, rather than canopy, cover.

***Disturbance*.** Mechanisms that limit biomass by causing its partial or total destruction.

Discrete sites. Disjunct habitat-types or fragments of habitats at least 1 mile apart that support invasive plant populations that likely arose by separate long-distance dispersal mechanisms.

Documentation of evidence. One publication including relevant, original research will suffice if data are specific to the taxon and zone(s) under evaluation. If such documentation is not available or needs to be up-dated, at least three individuals who have the expertise on the particular species and zone in question must be identified.

Federal- or Indiana -listed. Species that are listed by Federal laws or Indiana statutes or rules as threatened or endangered within the State of Indiana. This list with notes is available at http://www.state.in.us/dnr/naturepr/endanger/plant.htm

Formal Risk Benefit Analysis. Detailed economic studies of impact and management costs and commercial value for present and future infestations.

Invasive. A species that forms self-sustaining and expanding populations within a natural plant community with which it had not previously been associated (Vitousek *et al*. 1995).

Long-term alterations in ecosystem processes. Examples of ecosystem processes that could be altered: erosion and sedimentation rates; land elevation; water channels; water-holding capacity; water-table depth; surface flow patterns; rates of nutrient mineralization or immobilization; soil or water chemistry; and type, frequency, intensity, or duration of disturbance. For further explanation see Gordon (1998).

Native. Species within its natural range or natural zone of dispersal (i.e., within the range it could have, or would have, occupied without direct or indirect introduction and/or care by humans. Excludes species descended from domesticated ancestors) (Vitousek *et al*. 1995).

Natural areas. Natural areas: Areas with native plant communities supporting native plant and animal species, with long undisturbed soil systems, and hydrological regimes relatively intact or under restoration. Edges of historically or currently disturbed areas (roadsides, trails, adjacent to historically disturbed locations, etc.) should not be included in the assessment of invasion into natural areas. That invasion may have been facilitated by the edges, but has to have extended into the native communities for inclusion in this category.

Pollen or genetic invasion. When a native species is displaced by a non-native species through hybridization.

Stratum. A distinct layer in the architecture of vegetation (e.g., tree canopy or understory shrubs).