

# *Invasive species and state weed laws: where do bioenergy crops fit?*

**Jacob Barney**  
Assistant Professor  
Invasive Plant Ecology





# Origins of Invasive Plants

85% of invasive woody species from landscaping

63% of Cal-IPC's most invasive species have horticultural origin

69% of FL-EPPC's list have horticultural origin

**Invasive species impacts:**

**\$120 billion (US)**

**\$1.4 trillion (global)**



# Invasive Plant Impacts

- Reduce native species diversity
- Increase fire frequency
- Increase flooding
- Alter successional patterns
- Alter nutrient cycles
- Increase soil salinity
- Disrupt trophic interactions
- Reduce pollinators
- Disrupt mutualisms
- *ad infinitum...*



# Cellulosic portfolio



switchgrass



Arundo



miscanthus



reed canarygrass



sorghum

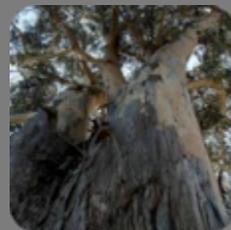


Saccharum

## GRASSES



## TREES



eucalyptus



poplar



black locust



willow

# Cellulosic portfolio



switchgrass



poplar



switchgrass



miscanthus



reed canarygrass



poplar



switchgrass



miscanthus



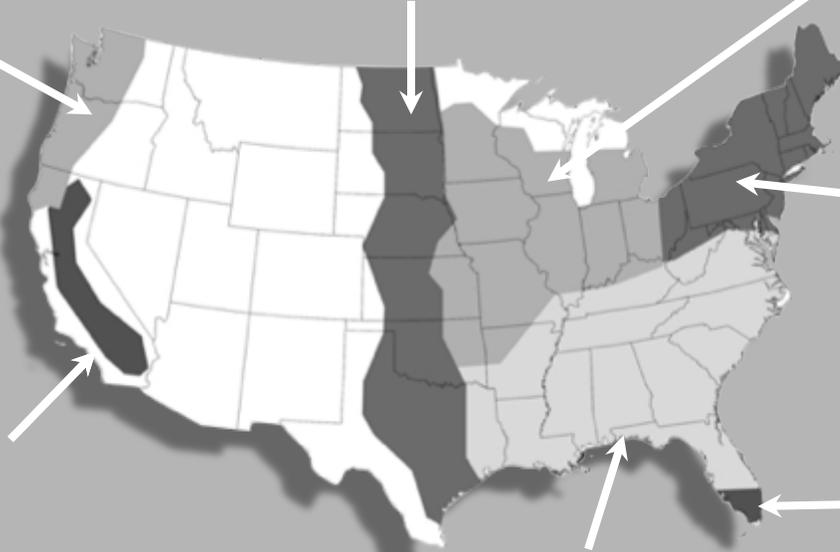
poplar



switchgrass



eucalyptus



willow



sorghum



eucalyptus



Arundo



black locust



switchgrass



miscanthus



sorghum



Saccharum

# Cellulosic portfolio



switchgrass



poplar



switchgrass



miscanthus



reed canarygrass



poplar



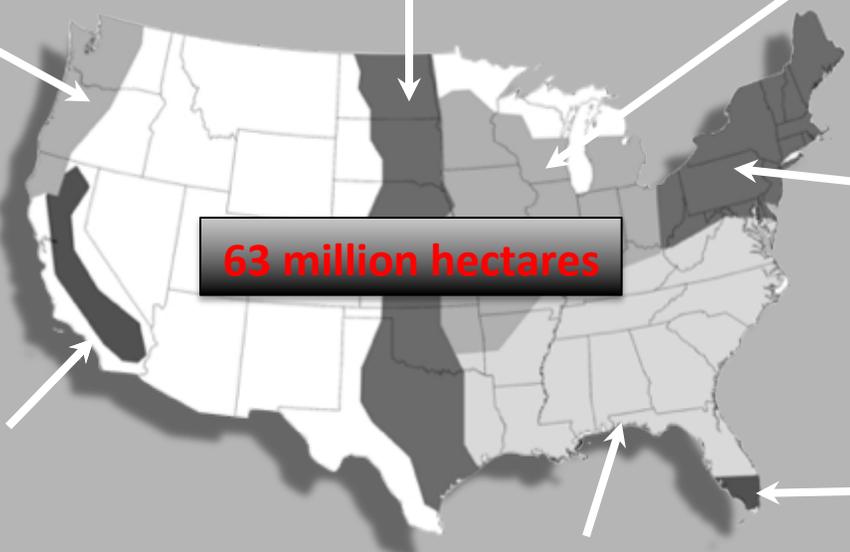
switchgrass



miscanthus



poplar



willow



sorghum



switchgrass



eucalyptus



eucalyptus



Arundo



black locust



switchgrass



miscanthus



sorghum



Saccharum

# Ideal agronomic characters

- **Life history**
  - Perennial
  - High aboveground biomass production
  - Flowers late / little allocation to seed production
- **Physiology**
  - Tolerates
    - Drought
    - Low fertility
    - Saline soils
  - C<sub>4</sub> photosynthetic pathway
  - High water/nutrient use efficiency
- **Other**
  - Highly competitive (reduces herbicide use)
  - Few resident pests (reduces pesticide use)
  - Allelopathic
  - Re-allocates nutrients to roots in fall



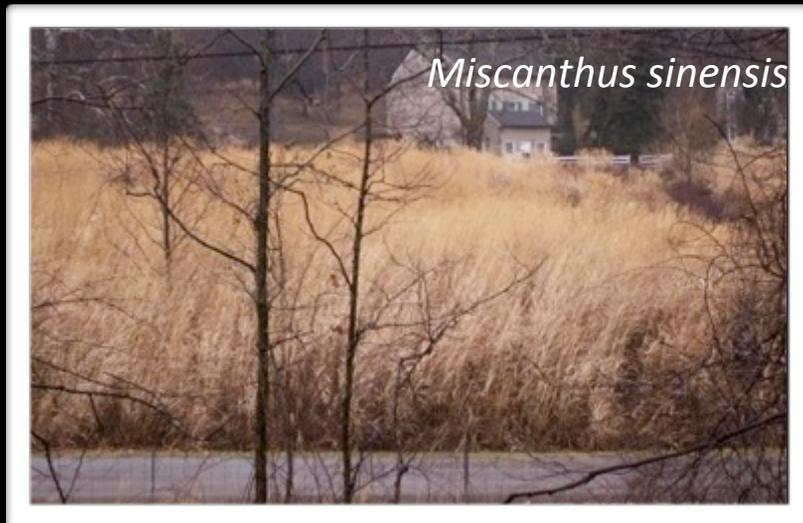
# Ideal “weedy” characters

- **Life history**
  - **Perennial**
  - **High aboveground biomass production**
  - Flowers late / little allocation to seed production
- **Physiology**
  - **Tolerates**
    - **Drought**
    - **Low fertility**
    - **Saline soils**
  - **C<sub>4</sub> photosynthetic pathway**
  - **High water/nutrient use efficiency**
- **Other**
  - **Highly competitive**
  - **Few resident pests**
  - **Allelopathic**
  - **Re-allocates nutrients to roots in fall**



# Why are we concerned?

- Arundo is a state listed noxious weed in California and Texas
- Switchgrass was on the CDFA noxious weed list
- *Miscanthus sinensis* is a known invasive in the eastern US, *M. sacchariflorus* listed in MA: *M. x giganteus* parents
- Reed canarygrass state listed in WA, MA, CT



**We know how this  
movie ends...**



- fast growing
- deep rooted
- no pests
- tolerates disturbance

**85 MILLION SEEDLINGS PLANTED**

**FIELD**



**HARVEST**



**TRANSPORT**



**CONVERSION**



**STORAGE**





Diverse land-use types

# Invasion arithmetic

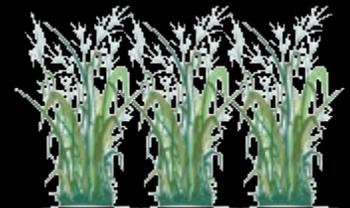


## Non-native

- + Most of our worst invasive sp. were intentionally introduced
- + “weedy” characters
- + 60 million hectare propagule source
- + Transporting across diverse land use types

---

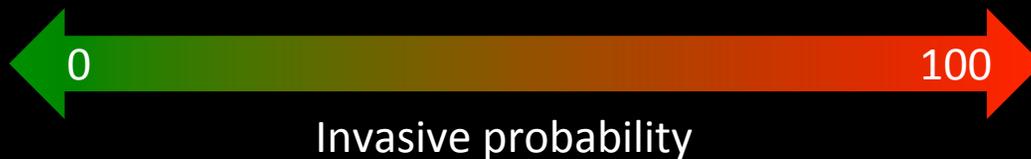
*relatively high probability of invasion*





# Putting invasions in context

1. Most introduced species do not become invasive
2. Invasiveness is not universal
3. Populations are invasive, not species
4. All species have a non-zero invasive probability



**Will bioenergy crops fall under  
existing state or federal regulations?**

# Food, Conservation, and Energy Act 2008

## **Title IX: Sec. 9011: Biomass Crop Assistance Program**

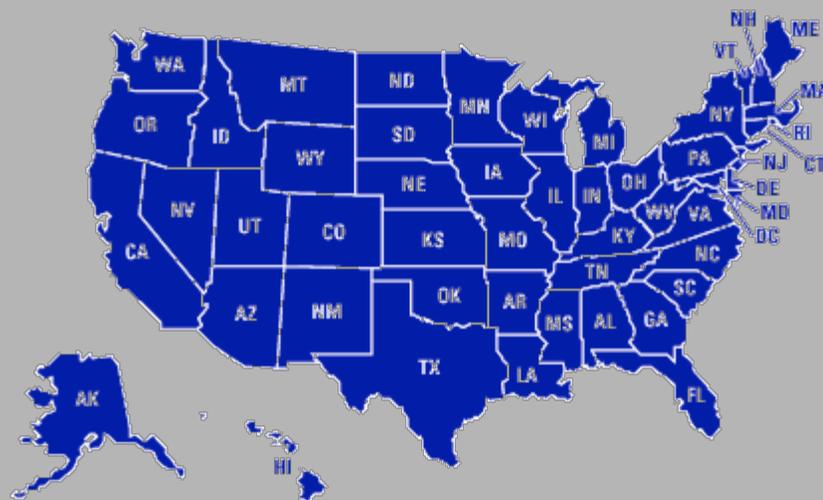
Eligible crop does not include:

**“any plant that is invasive or noxious or has the potential to become invasive or noxious, as determined by the Secretary, in consultation with other appropriate Federal or State departments and agencies.”**

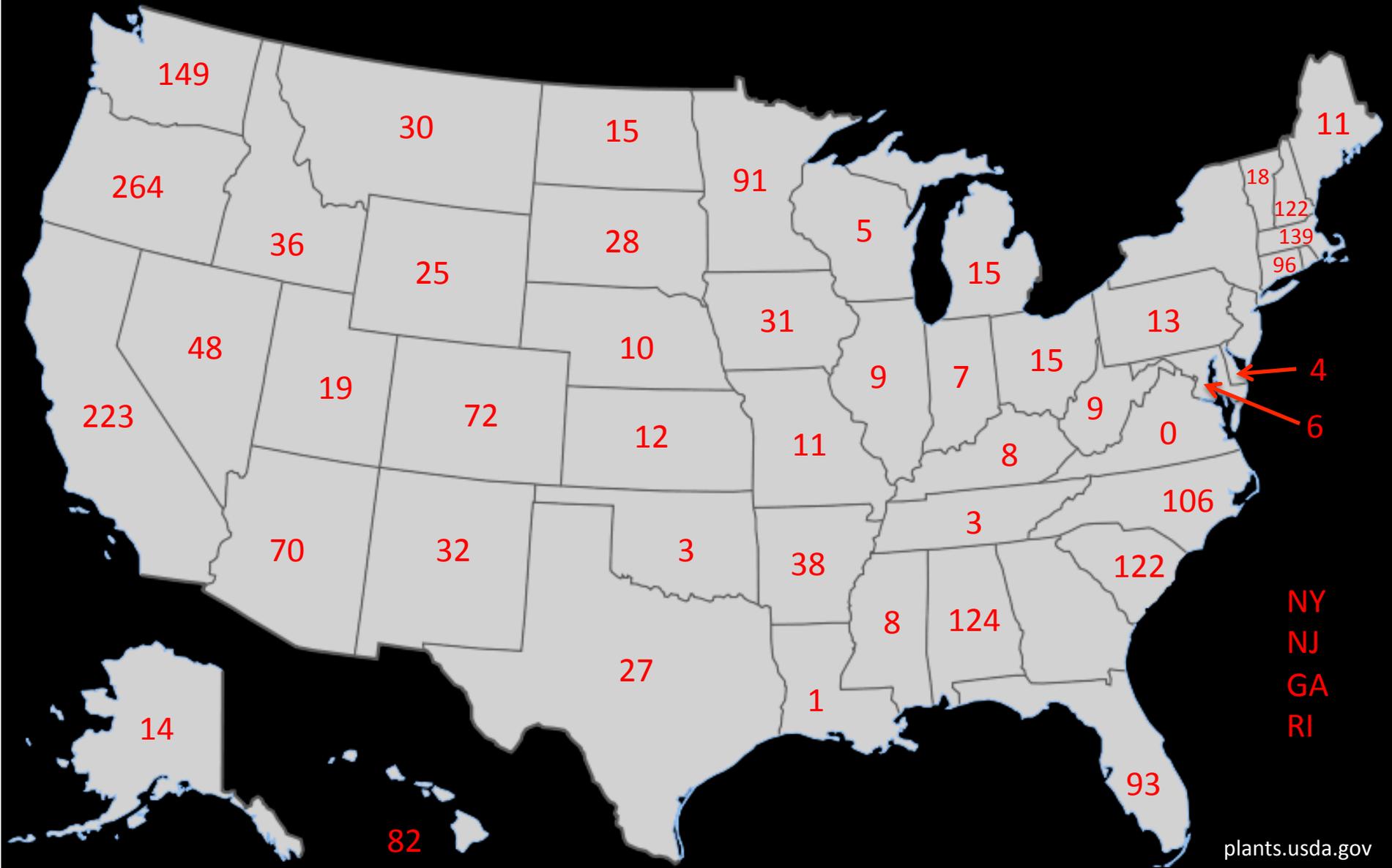
**invasive ≠ exotic ≠ weed ≠ noxious**

# STATE WEED LAWS

- 46 states maintain noxious weed lists
- Some states also maintain seed laws (primarily for seed purity)
- Listed taxa range: 0 – 264 ( $\bar{u} = 49$ )
- Some states also list federal taxa (Bryan will cover this)



# Listed noxious weed species



# STATE WEED LAWS

No spatial autocorrelation (states no more likely to list similar to nearby states)



## Three regulatory typologies:

- 1) Government branch (legislative vs administrative)
- 2) Level with authority (top-down vs bottom-up)
- 3) Enforcement (state agency vs local authority)



**Legislative regime**: the state legislature via a statute designates specific species for incorporation on the official state noxious weed list

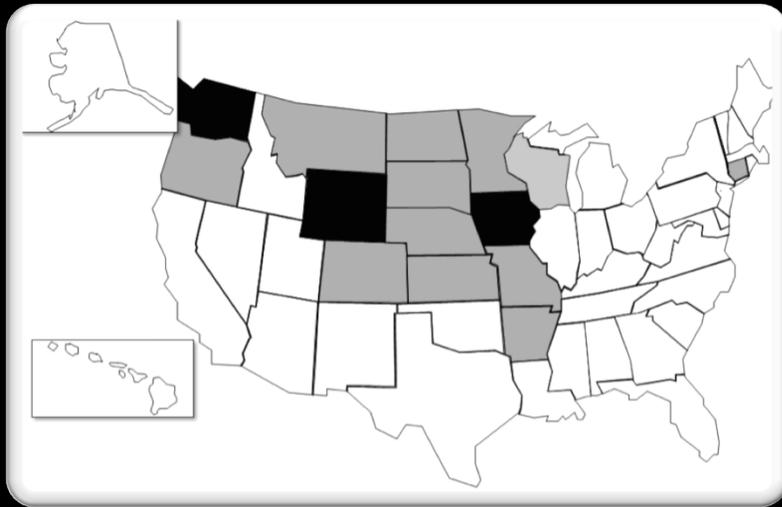
**“hybrid” regime**: the state legislature via a statute designates specific species for incorporation on the official state noxious weed list, amended by a stated agency

**Administrative regime**: the state legislature delegates responsibility for developing the noxious weed list to regulatory officials at a state-level agency such as a department of natural resources or department of agriculture

## TOP DOWN

State-level agency  
determines list  
composition

(white states)



(black states)

Local authority  
determines list  
composition

## BOTTOM UP

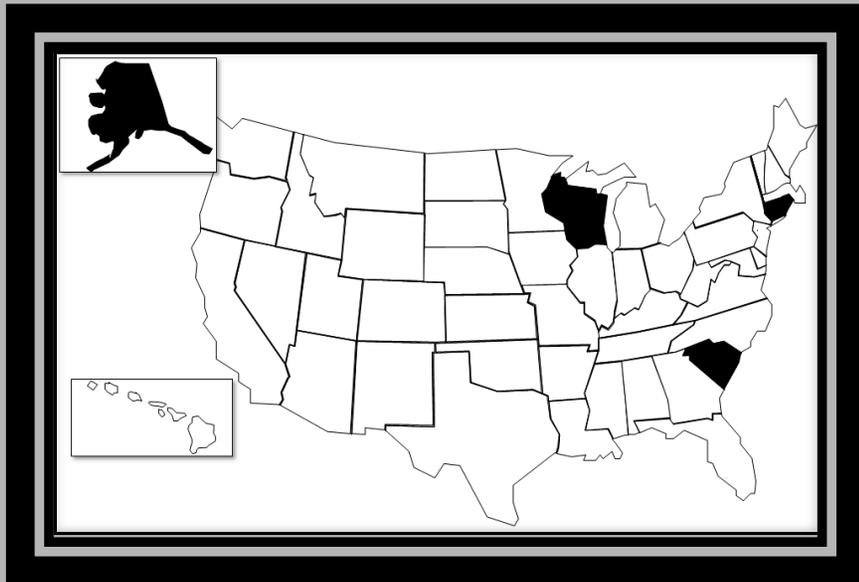
Hybrid system  
(gray states)

# ENFORCEMENT

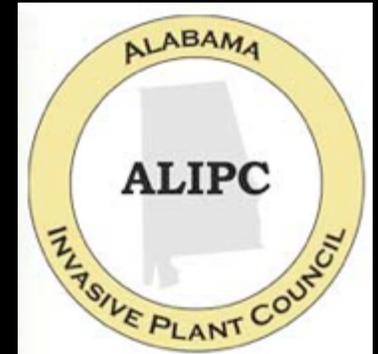
Agriculture Dept (white states)

Natural Resource Dept (black states)

No cases of  
enforcement are  
known, anywhere...



**invasive ≠ exotic ≠ weed ≠ noxious**



Invasive Plant Atlas of New England



California Invasive Plant Council

Cal-IPC

Protecting California's wildlands through science, education, and policy

# INVASIVE PLANT COUNCIL / EXOTIC PEST PLANT COUNCIL

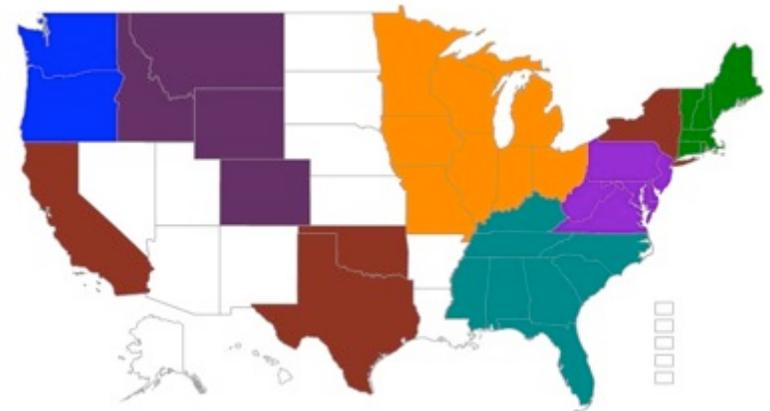
## Goals:

1. Improving the Federal Noxious Weed Act to include weeds of natural areas, and pertinent enabling legislation.
2. Increase Biological Control funding.
3. Promote good Weed Control by federal and other land management agencies and organizations using current technologies including mechanical and chemical methods.
4. Improve the methods of Prevention of new infestations of exotic pest plants from importation into the USA and through interstate movement.

## Areas of Collaboration:

5. Strategies for increasing Membership of EPPC units.
6. Strategies for increasing Funding.
7. Strategies for formation of new state or regional EPPC units.

6 regional  
17 state chapters



Created in 1995

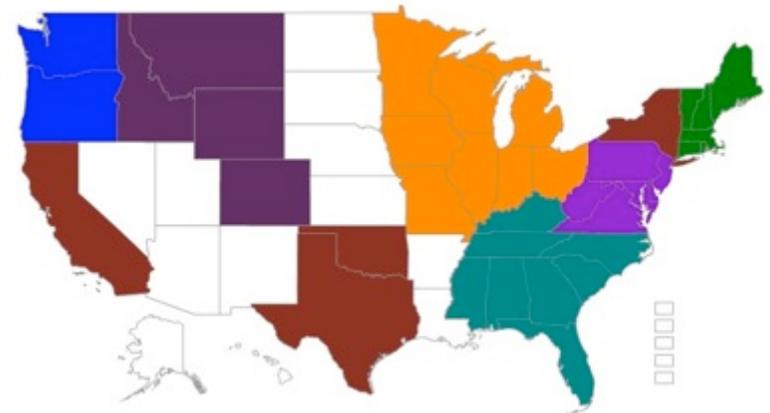
# INVASIVE PLANT COUNCIL / EXOTIC PEST PLANT COUNCIL

## Goals:

1. Improving the Federal Noxious Weed Act to include weeds of natural areas, and pertinent enabling legislation.
2. Increase Biological Control funding.
3. Promote good Weed Control by federal and other land management agencies and organizations using current technologies including mechanical and chemical methods.
4. Improve the methods of Prevention of new infestations of exotic pest plants from importation into the USA and through interstate movement.

## Areas of Collaboration:

5. Strategies for increasing Membership of EPPC units.
6. Strategies for increasing Funding.
7. Strategies for formation of new state or regional EPPC units.



Created in 1995

	Number of species	Categories	Listing method
<i>Regional</i>			
Invasive Plant Atlas of New England	111	1	No listed criteria for listing.
Mid-Atlantic	80	1	No stated criteria for adding/removing species.
Midwest Invasive Plant Network	53	1	No formal list, but publishes a "Field Guide" with 53 species listed.
New England	111	1	Cataloging evaluates naturalization potential, dispersal capabilities, population growth rates, and history of invasiveness. No stated criteria for removing species.
Northern Rockies	0	0	No list is maintained.
Pacific Northwest	206	6	No stated criteria for adding/removing species.
Southeast	466		Compilation of state lists noxious and EPPC lists.
<i>State</i>			
Alabama	68	5	Categorized based on growth rate, competitiveness, distribution, and invasiveness elsewhere. No stated criteria for adding/removing species.
California	204	6	Non-native species that threaten wildlands. Each species is empirically evaluated on impact, invasive potential, distribution, and documentation level. No stated criteria for adding/removing species.
Connecticut <sup>1</sup>	25	2	Invasive Plant Working Group lists as Early Detection and Priority species. Also has an Invasive Plants Council.
Florida	147	2	Species are nominated and voted on by FLEPPC List Committee.
Georgia	144	4	Categorization based on membership votes. No stated criteria for adding/removing species.
Ohio	18	1	No stated criteria for adding/removing species.
Kentucky	93	3	No stated criteria for adding/removing species.
Michigan	40	1	An Invasiveness Plant Assessment exists to evaluate impact. No stated criteria for adding/removing species.
Mississippi	166	4	Categorized based on growth rate, competitiveness, distribution, and invasiveness elsewhere. No stated criteria for adding species.
New York <sup>1</sup>			Does not maintain a list, but proposed a 4-tier ranking of 176 species.
North Carolina	74	3	NC Native Plant Society and organizational suggestions for listing. No stated criteria for removing species.
Oklahoma	53	2	List developed by OK Native Plant Society and OK Biological Survey
South Carolina	84	4	Ranked based on reproductive capacity, distribution, competitiveness, and history of invasiveness. No stated criteria for adding/removing species.
Tennessee	136	4	Ranking of species by invasiveness. No stated criteria for adding/removing species.
Texas <sup>2</sup>	146	1	Non-native species that threaten wildlands. Each species is empirically evaluated on impact, invasive potential, distribution, and documentation level. Only 11 species evaluated. No stated criteria for adding/removing species.

# INVASIVE PLANT COUNCIL / EXOTIC PEST PLANT COUNCIL

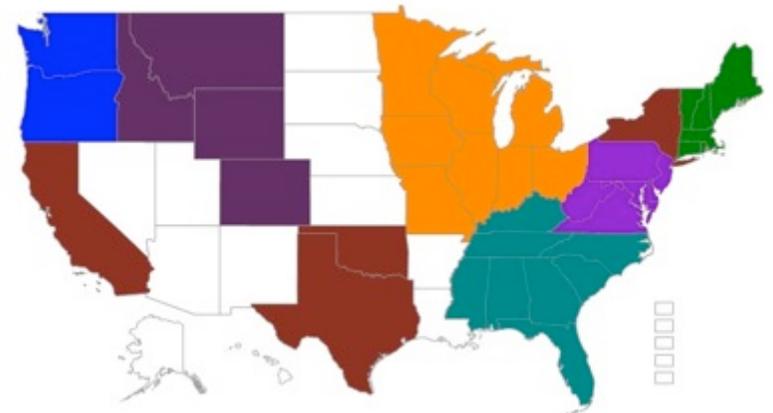
## STRUCTURE AND FUNCTION

Regional and/or state chapters

Typically governed by a Board of Directors

Maintain a list of plant species

**No legal or regulatory authority**

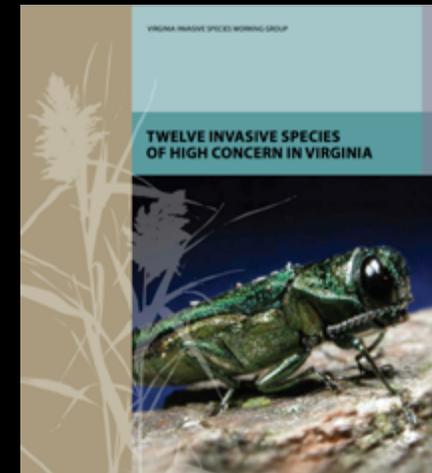


**invasive ≠ exotic ≠ weed ≠ noxious**

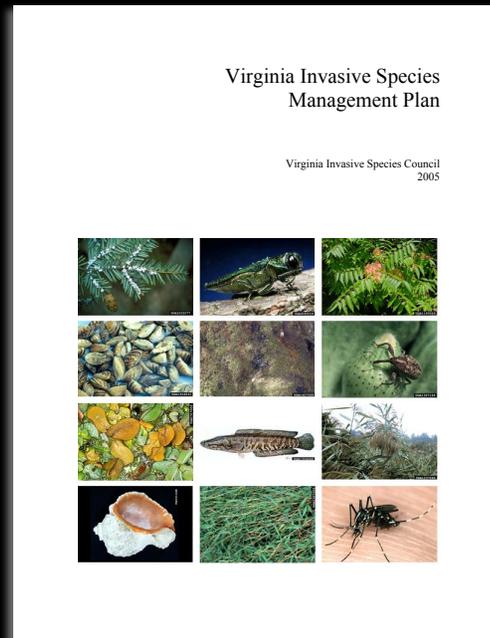
State noxious weed lists cover  
~17% of invasive species

# INVASIVE SPECIES COUNCIL

Legislatively created organization  
 Comprises Secretaries of state departments  
 Directed to draft a management plan  
 Advisory Committees usually created  
 Some groups rank taxa on current/potential threats



2.2-220.2



EO 2004-1

# Biomass Permitting

Supporting the  
**Farm to Fuel**  
Initiative



Division of  
**PLANT INDUSTRY**  
Fresh Florida. Protection through Detection  
Florida Department of Agriculture & Consumer Services

Charles H. Bronson, Commissioner  
Richard Gaskalla, Director

# SO WHAT DO WE DO?

## Application

- \$50 application fee (for each non-contiguous planting)
- Cover letter / letter of intent
- Proof of site ownership
- Voucher specimen of plant
- Description of plant, estimated cost of removal and basis for calculation

## Requirements

- NOT ALLOWED for state/federal noxious weeds
- $\geq 2$  contiguous acres
- Traps / filters must be created
- Equipment should be cleaned
- Wildfire protection
- Quarterly site visits by division inspectors
- Permit holder required to destroy planting
- Surety bond required (150% of cost)

# U.S. WRA (PPQ-WRA)

Species:				
Question ID	Question	Answer	Uncertainty	Score
<b>Establishment / Spread Potential</b>				
ES-1	Select one: (A) Introduced elsewhere long ago (>75 years) but not escaped; (B) Introduced recently (<75 years) but not escaped; (C) Never introduced elsewhere; (D) Escaped/Casual; (E) Naturalized; (F) Invader.	f	negl	5
ES-2	Is the species highly domesticated (y, n, or ?).	n	mod	0
ES-3	Congeneric weed (y, n, or ?).	n	low	0
ES-4	Shade tolerant at some stage of life cycle (y, n, or ?).	y	mod	1
ES-5	Climbing or smothering growth habit (y, n, or ?).	n	negl	0
ES-6	Forms dense thickets (y, n, or ?).	y	negl	2
ES-7	Aquatic (y, n, or ?).	n	negl	0
ES-8	Grass (y, n, or ?).	y	negl	1
ES-9	Nitrogen-fixing woody plant (y, n, or ?).	n	negl	0
ES-10	Produces viable seed or spores (y, n, or ?).	n	mod	-1
ES-11	Self-compatible or apomictic (y, n, or ?).	n	mod	-1
ES-12	Requires specialist pollinators (y, n, or ?).	n	negl	0
ES-13	Minimum generative time (A) less than 1 (multiple generations per year), (B) 1 year (annual-1 gen per year), (C) 2or3 years, (D)>3years; (?)	a	low	2
ES-14	Prolific seed/spore production (see scoring guide) (y, n, or ?).	n	low	-1
ES-15	Propagules likely to be dispersed unintentionally by people (y, n, or ?).	y	negl	1
ES-16	Propagules likely to disperse in trade as contaminants and hitchhikers (y, n, or ?).	n	low	-1
ES-17	No. natural dispersal vectors	1		-2
ES-17a	Propagules adapted to wind dispersal (y, n, or ?).	n	mod	
ES-17b	Propagules water dispersed (y, n, or ?).	y	negl	
ES-17c	Propagules bird dispersed (y, n, or ?).	?	low	
ES-17d	Propagules dispersed by other animals (externally) (y, n, or ?).	?	low	
ES-17e	Propagules dispersed by other animals (internally) (y, n, or ?).	?	low	
ES-18	Evidence that a persistent propagule bank (e.g., seed bank) is formed (>1yr) (y, n, or ?).	n	low	-1
ES-19	Tolerates/benefits from mutilation, cultivation or fire (y, n, or ?).	y	negl	1
ES-20	Is resistant to some herbicides or has potential to acquire herbicide resistance (y, n, ?)	n	mod	0
ES-21	Number of USDA cold hardiness zones suitable for survival	0		-1
ES-22	Number of climate types suitable for survival	0		-2
ES-23	Number of precipitation bands suitable for survival	0		-1

## Predictive measures

- Modified from A-WRA
- 41 ‘yes’ or ‘no’ questions
- Supporting documentation
- Two measures of assessment
  - Establishment/spread
    - Similar to A-WRA
    - Character based
    - Historical spread
    - Adaptive potential
  - Impact Potential
    - Cause direct or indirect harm
    - Toxic

# U.S. WRA (PPQ-WRA)

Species:				
Question ID	Question	Answer	Uncertainty	Score
<b>Establishment / Spread Potential</b>				
ES-1	Select one: (A) Introduced elsewhere long ago (>75 years) but not escaped; (B) Introduced elsewhere			
ES-2	Is the species highly domesticated (y, n, or ?)	n	mod	5
ES-3	Congeneric weed (y, n, or ?)	n	low	0
ES-4	Shade tolerant at some stage of life cycle (y, n, or ?)	y	mod	1
ES-5	Climbing or smothering (y, n, or ?)			
ES-6	Forms dense thickets (y, n, or ?)			
ES-7	Aquatic (y, n, or ?)			
ES-8	Grass (y, n, or ?)			
ES-9	Nitrogen-fixing (y, n, or ?)			
ES-10	Produces viable seed or spores (y, n, or ?).	n	mod	-1
ES-11	Self-compatible or apomictic (y, n, or ?).	n	mod	-1
ES-12	Requires specialist pollinators (y, n, or ?).	n	negl	0
ES-13	Minimum generative time (A) less than 1 (multiple generations per year), (B) 1 year (annual-1 gen per year), (C) 2or3 years, (D)>3years; (?)	a	low	2
ES-14	Prolific seed/spore production (see scoring guide) (y, n, or ?).	n	low	-1
ES-15	Propagules likely to be dispersed unintentionally by people (y, n, or ?).	y	negl	1
ES-16	Propagules likely to disperse in trade as contaminants and hitchhikers (y, n, or ?).	n	low	-1
ES-17	No. natural dispersal vectors	1		-2
ES-17a	Propagules adapted to wind dispersal (y, n, or ?).	n	mod	
ES-17b	Propagules water dispersed (y, n, or ?).	y	negl	
ES-17c	Propagules bird dispersed (y, n, or ?).	?	low	
ES-17d	Propagules dispersed by other animals (externally) (y, n, or ?).	?	low	
ES-17e	Propagules dispersed by other animals (internally) (y, n, or ?).	?	low	
ES-18	Evidence that a persistent propagule bank (e.g., seed bank) is formed (>1yr) (y, n, or ?).	n	low	-1
ES-19	Tolerates/benefits from mutilation, cultivation or fire (y, n, or ?).	y	negl	1
ES-20	Is resistant to some herbicides or has potential to acquire herbicide resistance (y, n, ?)	n	mod	0
ES-21	Number of USDA cold hardiness zones suitable for survival	0		-1
ES-22	Number of climate types suitable for survival	0		-2
ES-23	Number of precipitation bands suitable for survival	0		-1

- **Two measures of assessment**

- **Establishment/spread**

- Similar to A-WRA
- Character based
- Historical spread
- Adaptive potential

- **Impact Potential**

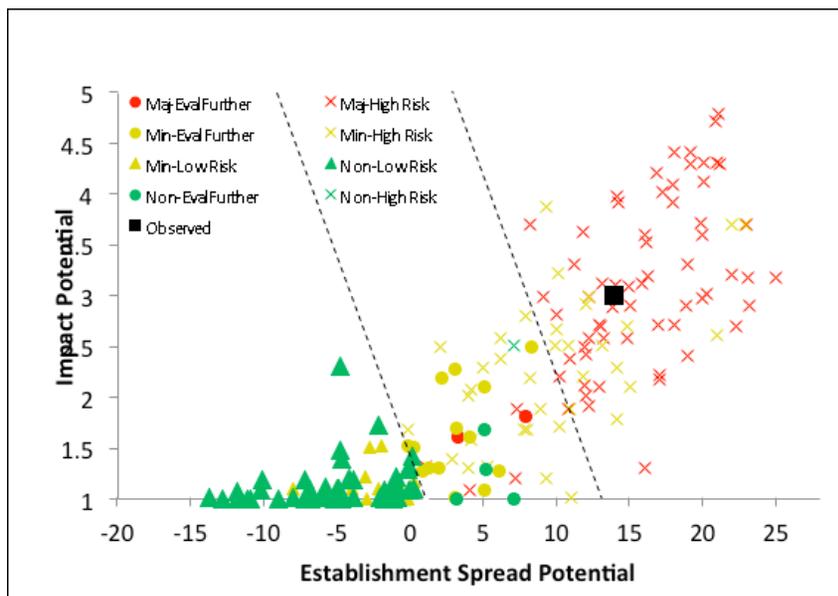
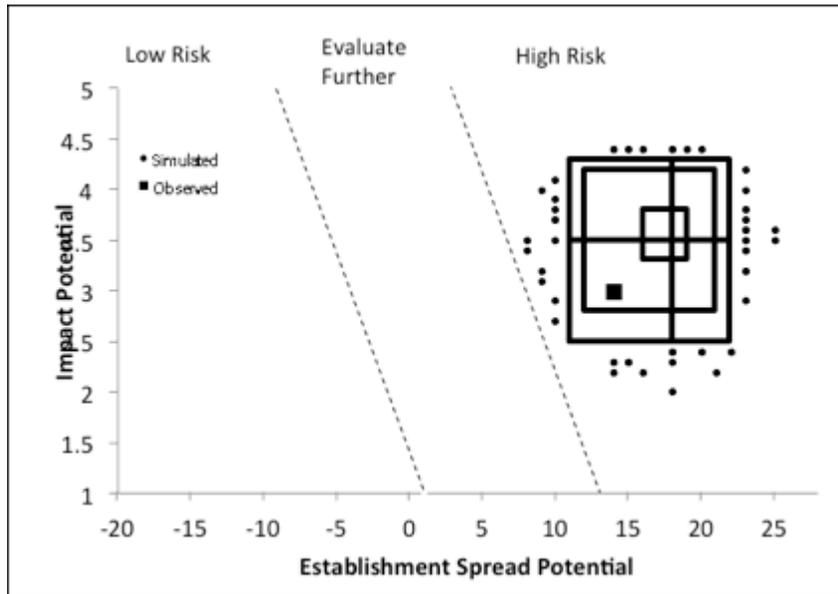
- Cause direct or indirect harm
- Toxic

# U.S. WRA (PPQ-WRA)

Impact Potential						
General impacts						
Imp-G1	Allelopathic (y, n, or ?)	General Impact		Answer	Uncertainty	Score
Imp-G2	Parasitic (y, n, or ?)					
Impact to Natural areas (national parks, refuges, preserves, and wilderness areas)						
Imp-N1	Change ecosystem species? (y, n, or ?)	Imp-G1	Allelopathic (y, n, or ?)	?	mod	
Imp-N2	Change community? (y, n, or ?)	Imp-G2	Parasitic (y, n, or ?)	n	low	0
Imp-N3	Change community? (y, n, or ?)					
Imp-N4	Likely to affect any globally outstanding ecoregions? (y, n, or ?)			?	mod	
Imp-N5	Likely to affect any globally outstanding ecoregions? (y, n, or ?)	y		low		0.1
Imp-N6	For conservation/natural areas, choose the best answer. (A) Plant not a weed; (B) Plant a weed but no evidence of control by people; (C) Plant a weed and evidence of control.	c		low		0.6
Impact to Anthropogenic areas (cities, suburbs, roadways)						
Imp-A1	Impacts human property, processes, civilization, or safety? (y, n, or ?)	y		low		0.1
Imp-A2	Changes or limits recreational use of an area? (y, n, or ?)	y		low		0.1
Imp-A3	Outcompetes, replaces or otherwise affects desirable plants and vegetation? (y, n, or ?)	y		low		0.1
Imp-A4	For urban/suburban areas, choose the best answer. (A) Plant not a weed; (B) Plant a weed but no evidence of control by people; (C) Plant a weed and evidence of control;	c		low		0.4
Impact to Production systems (agriculture, nurseries, forest plantations, orchards)						
Imp-P1	Reduces crop/product yield? (y, n, or ?)	?		mod		
Imp-P2	Lowers commodity value? (y, n, or ?)	n		mod		0
Imp-P3	Is it likely to impact trade? (y, n, or ?)	?		mod		
Imp-P4	Reduces the quality or availability of irrigation, or strongly competes with plants for water? (y, n, or ?)	y		low		0.1
Imp-P5	Toxic to animals, including livestock/range animals (y, n, or ?).	?		mod		
Imp-P6	For production systems, choose the best answer. (A) Plant not a weed; (B) Plant a weed but no evidence of control by people; (C) Plant a weed and evidence of control.	a		mod		0

- **Two measures of assessment**
  - Establishment/spread
    - Similar to A-WRA
    - Character based
    - Historical spread
    - Adaptive potential
  - **Impact Potential**
    - Cause direct or indirect harm
    - Toxic

# PPQ-WRA



## Outcome

- Monte Carlo simulation
- Low or high risk or evaluate further
- Secondary screening for further evaluation
- Risk analysis not risk management

## Predictive value

- 95.6% overall accuracy
- 0.0% false positive
- Minimizes unknowns

# PPQ-WRA outputs



Candidate bioenergy crops	Species	Variant	ES	Imp	Result	Secondary Screening
	<i>Arundo donax</i>		4	2.5	Evaluate Further	High Risk
	<i>Miscanthus sacchariflorus</i>		7	1.8	Evaluate Further	High Risk
		no domestication	10	1.8	Evaluate Further	High Risk
	<i>Miscanthus sinensis</i>		11	3	High Risk	
		no domestication	14	3	High Risk	
	<i>Miscanthus x giganteus</i>	"Illinois" clone	0	1	Low Risk	
		Mendel material (seeded)	7	1	Evaluate Further	Evaluate Further
		using <i>M. sinensis</i> impacts	12	3	High Risk	
	<i>Panicum virgatum</i>		5	1.1	Evaluate Further	Evaluate Further
no domestication		8	1.1	Evaluate Further	Evaluate Further	
sterile & undomesticated		1	1.1	Evaluate Further	Evaluate Further	
herbicide resistant & undomesticated		9	1.1	Evaluate Further	Evaluate Further	
<i>Pennisetum purpureum</i>		10	3	High Risk		
<i>Phalaris arundinacea</i>		13	2.6	High Risk		
<i>Sorghum bicolor</i>	w/ shattercane info	7	3.5	High Risk		
	w/o shattercane info	-4	1	Low Risk		

# How do we prevent cultivating the next invasive species?

1. Reduce Escape Risks
2. Determine the most appropriate areas for cultivation
3. Identify plant traits that contribute to or avoid invasiveness
4. Prevent dispersal
5. Develop Early Detection and Rapid Response (EDRR) plans and rapid response funds.
6. Develop eradication protocols for rotational systems or abandoned populations.



# Self assembled certification

## Criterion 3.2 Avoiding Introduction of Invasive Feedstock Species

Avoid introduction or production of an energy crop that is potentially invasive in the target region and that may disrupt biodiversity on an eco-regional scale.

**IMPLEMENTATION:** An important role in avoiding the introduction of invasive species is that of the seed or cultivar developer and feedstock consumer specifying which crops should be grown. A crop will not be deemed to be "introduced" if it is already in production at a reasonable scale in the target region for similar purposes (e.g., biomass production for pulp), and not been found to be invasive.

### 3.2.S1 Assessment of invasiveness

Program participant does not utilize species that are known to be invasive or are potentially invasive in the relevant eco-region. Prior to planting, an assessment is completed by a suitable 3rd party (e.g., crop developer, academic scientist, government agency).

*(Component of Principle 1: Integrated Resource Management Planning, 1.1 Assessment.)*

**IMPLEMENTATION:** The following decision methodology will be used to determine whether a species is known to be invasive or potentially invasive in the target region.

- A feedstock crop would be "known to be invasive" in the target region if it appears on a list for that target region compiled by a scientifically credible national, state, or county authority, and would therefore not be eligible for certification.
- A feedstock crop will not require assessment for invasiveness if the crop has been grown at a reasonable scale for similar purposes in the target region and not been found to be invasive.
- If the crop is not "known to be invasive" in the target eco-region, but has not previously been grown in the target region or is a variety that includes characteristics beyond the known range of the species, then it will be evaluated to determine if it is "potentially invasive" in the target region. Such evaluation may include a published, peer reviewed, and validated tool (at this time, the Australian Weed Risk Assessment is the only such tool available) or other methods provided that the input data and results are scientifically credible and are made generally available for review. If the results of the assessment determine that the crop is not potentially invasive, it is eligible for certification.
- If the results of the assessment determine that the crop is potentially invasive, additional protocols, still to be determined, will be required to determine whether the feedstock is eligible for certification in target region. This will include evaluating the crop for invasiveness using carefully controlled field trials in the target region.

### 3.2.S2. Deployment of species and cultivars:

Program participant adheres to appropriate conservation practices, crop developer recommendations, and federally-mandated label requirements, where applicable, for species or cultivars being deployed.

### 3.2.S3 Crop spread

Program participant includes, in the Integrated Resource Management Plan, protocols for the biomass crop prior to cultivation that includes, where applicable:

- Adoption of conservation practices that limit potential for the spread of the crop, including:
  - Harvest, transportation, equipment cleaning, and storage protocols(e.g., steps to limit seed dispersal during transport).
  - Chemical or cultural control methods to ensure crop removal at the conclusion of production.
- Conservation practices, or chemical, cultural or physical control methods, for removal of plants or pests that represent a significant risk of establishment outside the production system, including assistance to owners or managers of neighboring properties to respond if spread occurs.

*(Component of Principle 1: Integrated Resource Management Planning, 1.2 Objectives, and 1.3 Management Plan.)*

**IMPLEMENTATION:** Where adoption of conservation practices do not prevent the establishment of a crop or its genetic material outside the production area; control methods taken by the responsible party fail to remediate the invasion of plants or genetic material within two growing seasons; and the invasion is considered problematic to the neighboring landowner/leaseholder or to the integrity of natural ecosystems, CSBP certification will be revoked.

## Criterion 3.3 Land Conversion

Promote the conservation of native ecosystems by limiting land conversion activities to lands that do not support important conservation objectives.

### SILVER LEVEL INDICATORS Indicator 3.3.S1: Documentation of vegetation category

Program participant has documented the vegetation category as of January 1, 2008, of all lands in each contiguous ownership / leasehold where they are seeking certification.

### Indicator 3.3.S2: Lands eligible for conversion

Program participant only shifts the intensity of land management in accordance with the matrix in Appendix C.

### Indicator 3.3.S3: Protection of known communities

Program participant protects known globally- and state-ranked G1-G3 / S1-S3 species and communities and supports inventory of lands where there could be a lack of information and a need for surveys and other information gathering.

**Note:** Global (G) ranks for standard national classification concepts provided by NatureServe. State (S) ranks for community types provided by state Natural Heritage programs.

# “Say what?” science



## Is it invasive?

MFA Oil Biomass has had its miscanthus supply inspected by a third party and has been Quality Assurance approved by OSIA establishing that its miscanthus is non-invasive.

establishing that its miscanthus is non-invasive.

third party and has been Quality Assurance approved by OSIA



**The Ohio Seed Improvement Association**



“Literature documenting the potential for invasiveness of the fertile species of the Miscanthus genus has been discussed along with documentation supporting that giant miscanthus should not be considered invasive due to its sterility and slow rhizome spread within the United States.”

# Mitigating the invasive potential

- Risk assessment
- Agro-ecoregional
- Low cross-hybridization potential
- Escape potential
  - No seed, sterile, low node viability
- Early detection rapid response
- Create eradication plan



**Mitigation via breeding/engineering, cultivation in landscape context, scouting, harvest management**

# Bioenergy balance sheet

Bioenergy  
crop

Invasive  
species

GHG reductions

New agricultural  
commodities

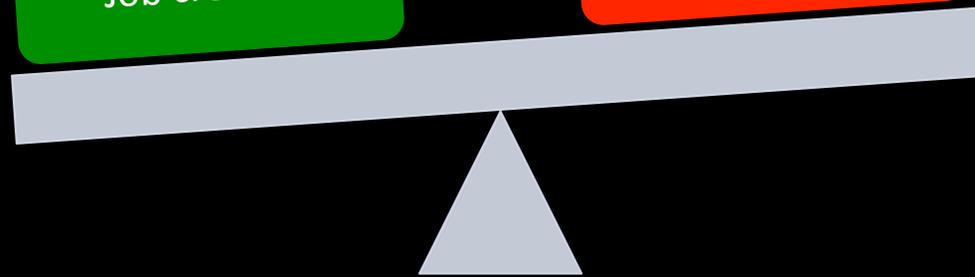
Energy security

Job creation

New management  
costs

Ecosystem  
degradation

Native species loss





Special thanks to Bryan Endres

[jnbarney@vt.edu](mailto:jnbarney@vt.edu)

<http://www.ppws.vt.edu/~jnbarney>

