Agricultural Outlook Forum
U.S. Department of Agriculture

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Biofuels vs Bioinvasions: Seeding Policy Priorities

Joe DiTomaso, Jacob Barney, Jamie Reaser, Chris Dionigi, and Otto Doering

THE NATIONAL INVASIVE SPECIES COUNCIL (NISC)

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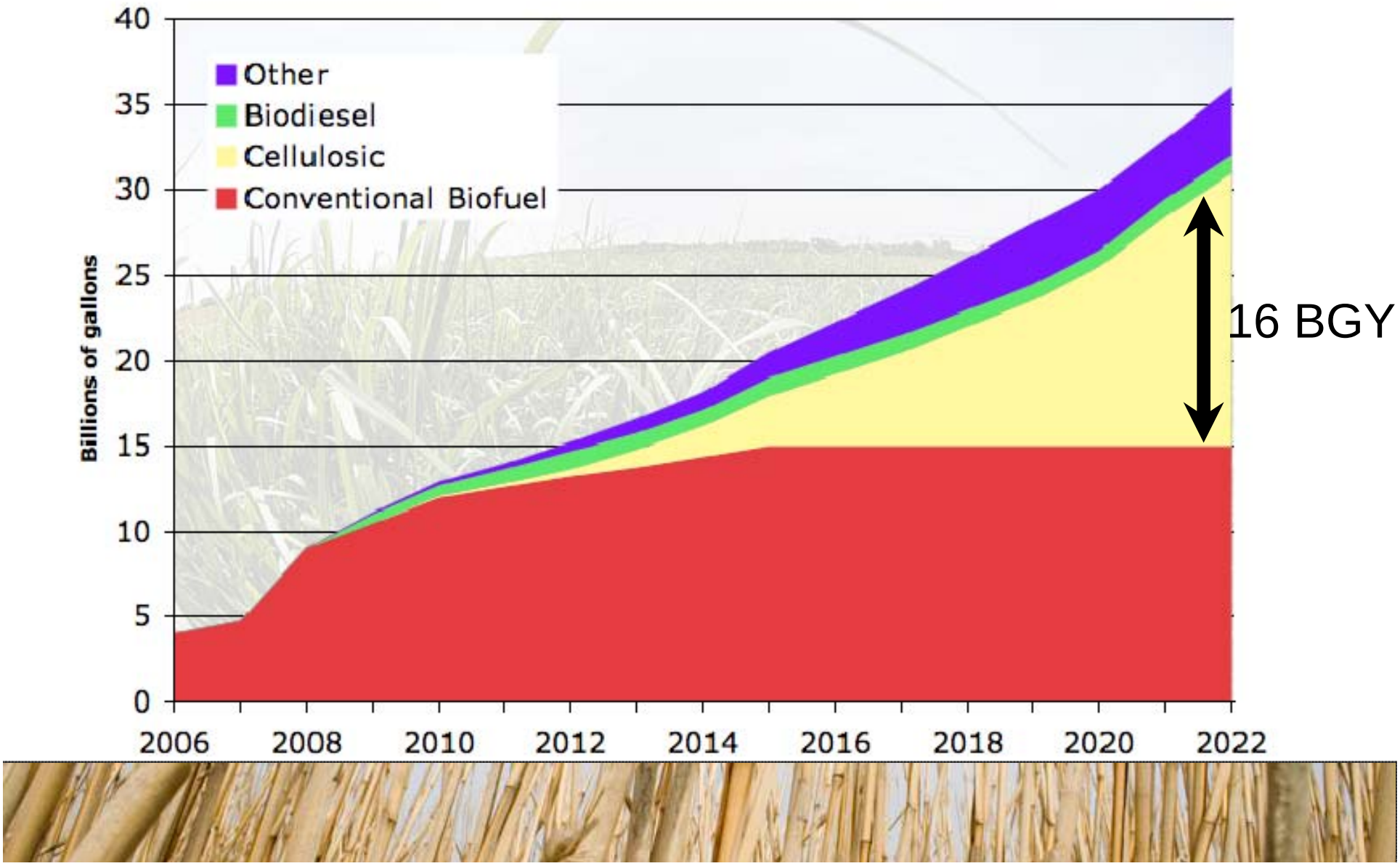
UC DAVIS
UNIVERSITY OF CALIFORNIA

Energy Independence and Security Act 2007



switchgrass

Panicum virgatum

Miscanthus × giganteus

Giant reed

Arundo donax

Ideal agronomic characteristics

- **Life history**
  - Perennial
  - High aboveground biomass production
  - Flowers late / little allocation to seed production
- **Physiology**
  - Tolerates
    - Drought
    - Low fertility
    - Saline soils
  - C_4 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

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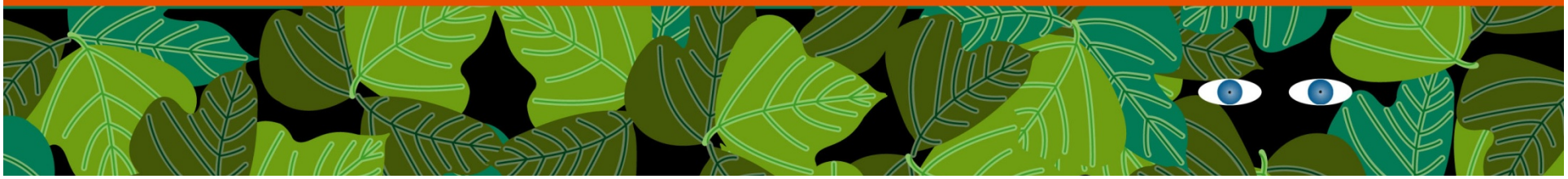
Why are we concerned?

- Arundo is a state listed noxious weed in California and Texas
- *Miscanthus sinensis* is a known invasive in the eastern US, *M. sacchariflorus* listed in MA: *M.* x *giganteus* parents
- Reed canarygrass (*Phalaris arundinacea*) is state listed in WA, MA, CT

2006

“Experts must assess ecological risk before introducing biofuel crops, to ensure that we do not add biofuels to the already raging invasive species fire.’



Executive Order 13112

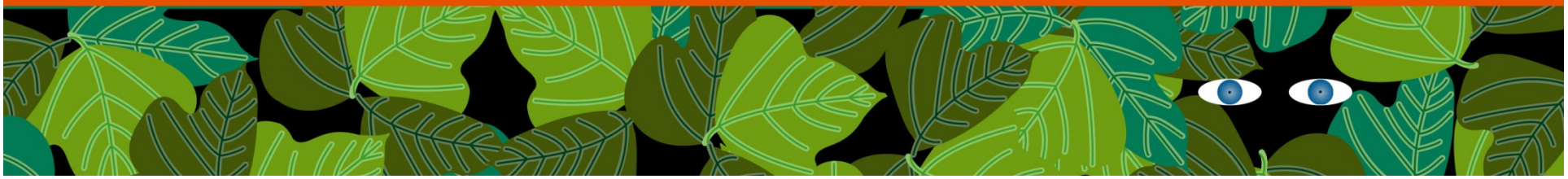
(Issued in February of 1999)

- Established the National Invasive Species Council (NISC) co-chaired by the Secretaries of Agriculture, Commerce and Interior
- Established the Invasive Species Advisory Committee (ISAC)
- Invasives defined as species:
  - Not native to the ecosystem under consideration
  - Whose introduction does or is likely to harm human health, the economy, or the environment

THE NATIONAL INVASIVE SPECIES COUNCIL (NISC)

Invasive Species include:

Plants, Animals and Microorganisms



Recommendations from ISAC Biofuel White Paper

Recommendation #1. Review/Strengthen Existing Authorities.

Recommendation #2. Reduce Risk of Escape.

Recommendation #3. Determine the most appropriate areas for cultivation.

Recommendation #4. Identify plant traits that contribute to or avoid invasiveness.

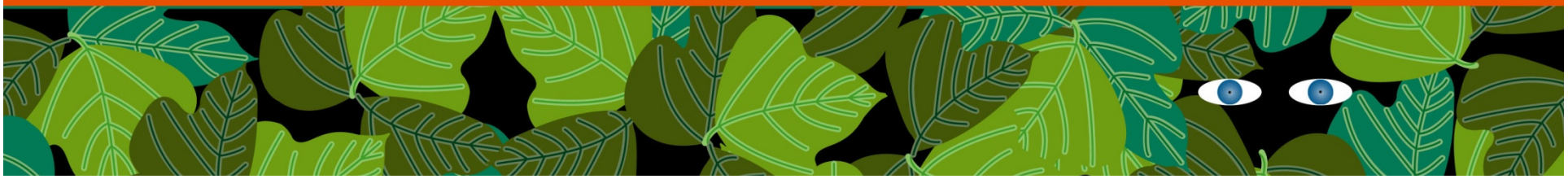
Recommendation #5. Prevent dispersal.

Recommendation #6. Develop Early Detection and Rapid Response (EDRR) plans and rapid response funds.

Recommendation #7. Develop eradication protocols for rotational systems or abandoned populations.

Recommendation #8. Minimize Harvest Disturbance.

Recommendation #9. Engage Stakeholders.



Recommendation #2. Reduce Escape Risks.

Use species that have been shown, through tested weed risk assessments and other evaluations, to be not invasive in the target region. Choose plants with a low potential for escape, establishment and impact. Where appropriate, implement mitigation strategies to minimize escape and other risks.

Weed Risk Assessment

Switchgrass - *Panicum virgatum*

California:

Standard WRA = **Reject**

Sterile = **Accept**

Giant Reed - *Arundo donax*

Florida:

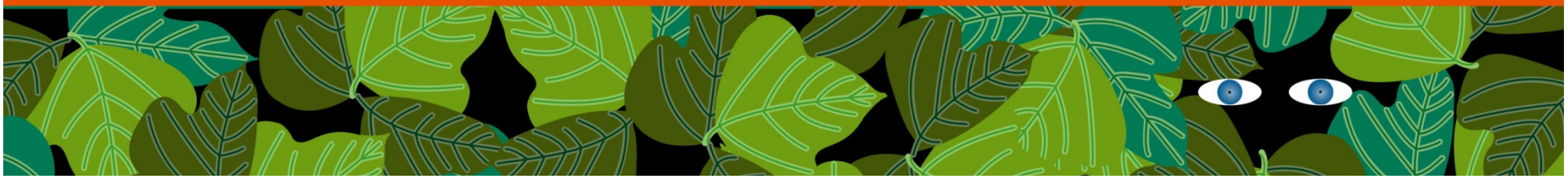
Standard WRA = **Reject**

Miscanthus - *Miscanthus x giganteus*

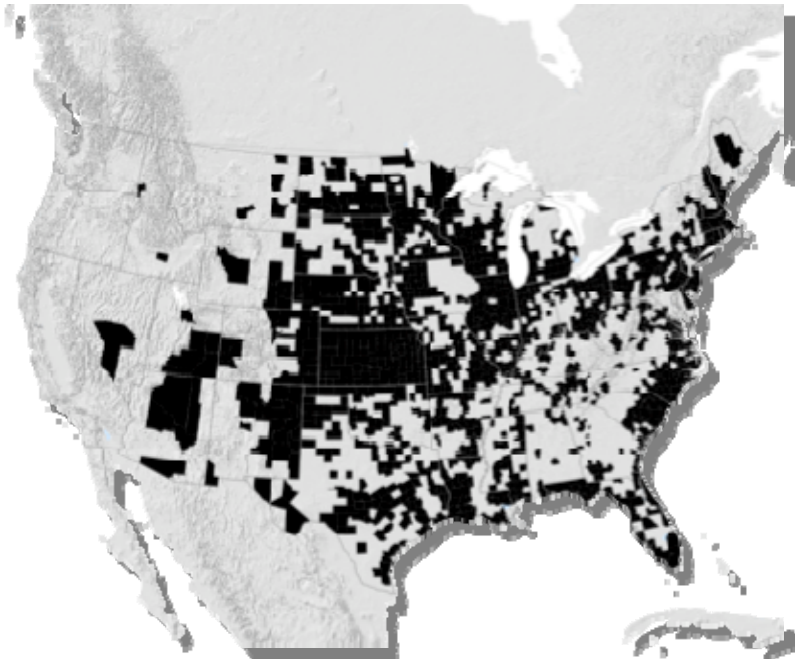
Entire US:

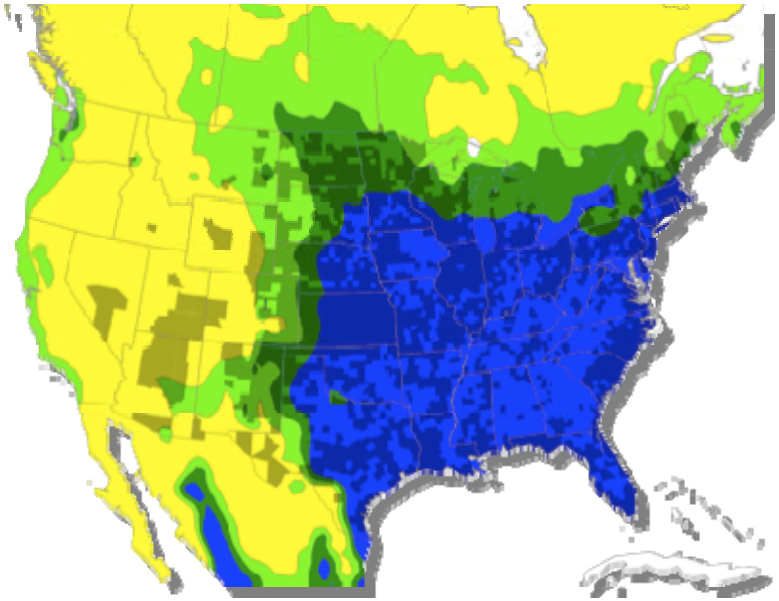
Standard WRA = **Accept**

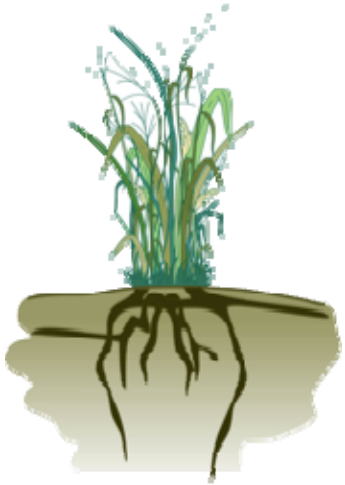
Barney & DiTomaso 2008 *BioScience*



Recommendation #3. Determine the most appropriate areas for cultivation. Use research findings to identify the most appropriate sites for cultivation of biofuel crops within landscapes. Avoid converting natural habitats for cultivation. Support for biofuel research and demonstration projects should be linked to appropriate site selection.







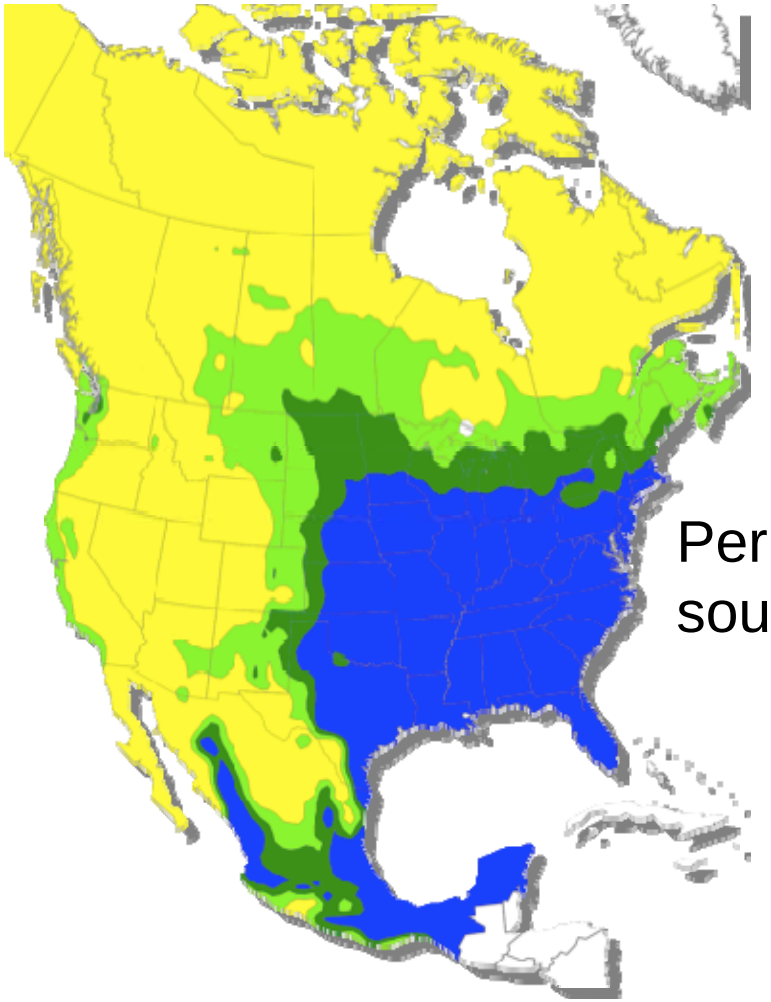
EI=0-10 (not suitable)

EI=11-20 (low suitability)

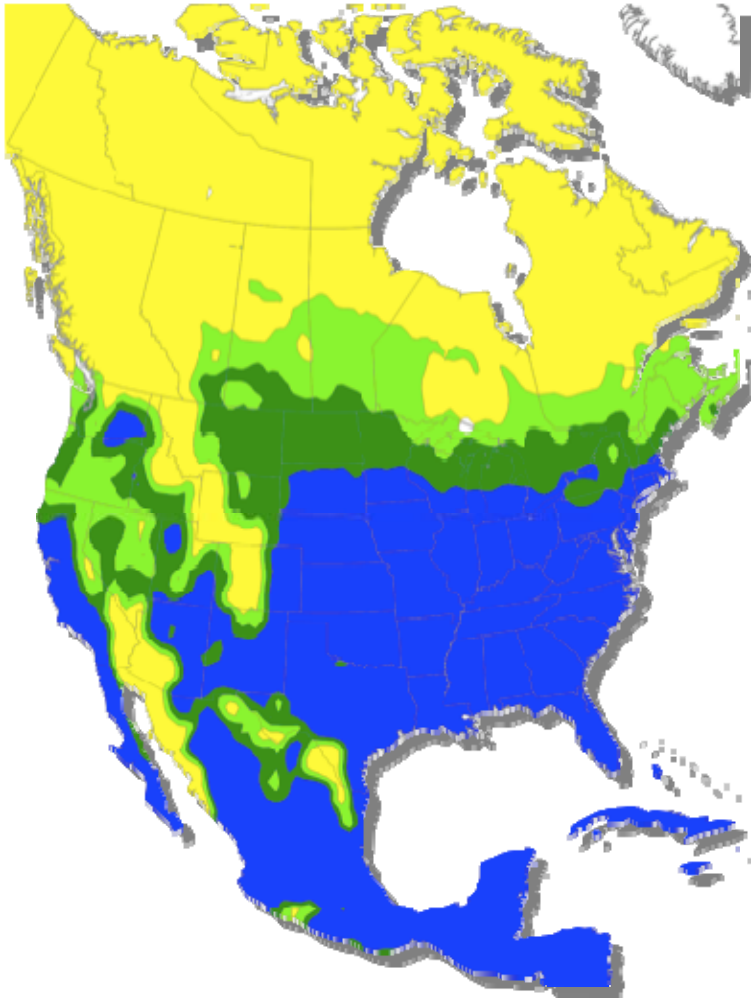
EI=21-30 (moderate suitability)

EI=31-100 (high suitability)

What is the potential range? CLIMEX



Permanent water source



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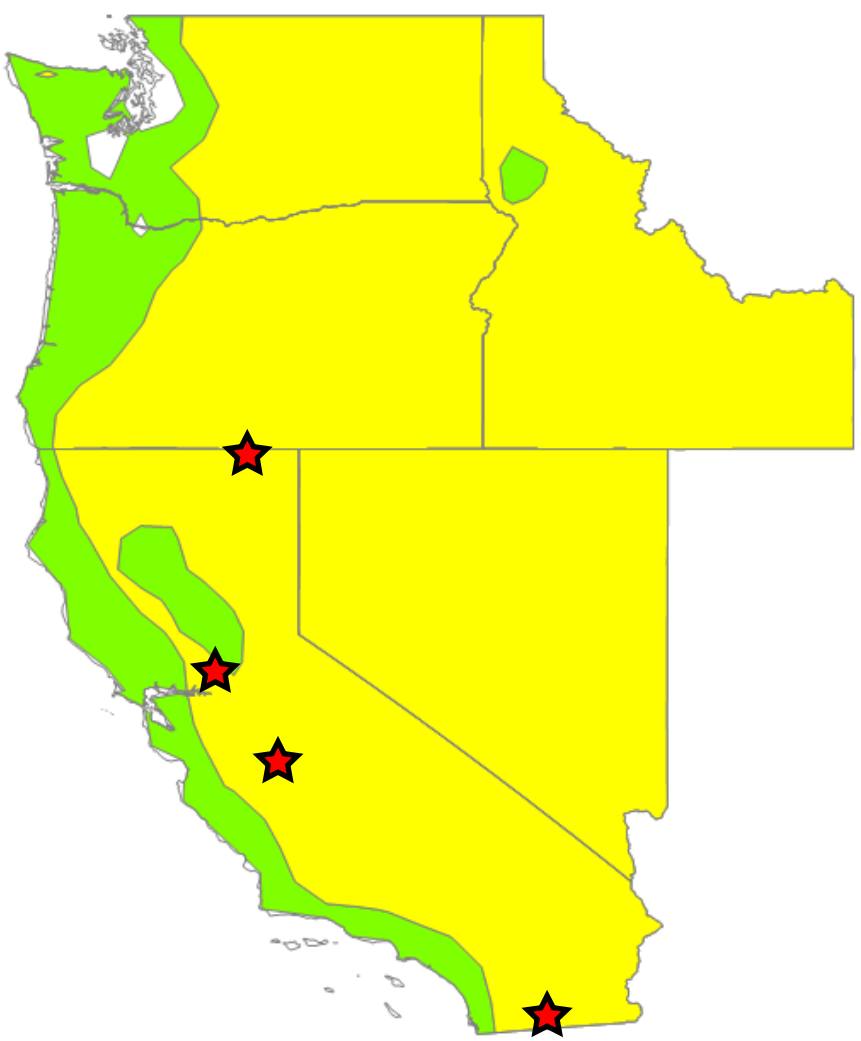
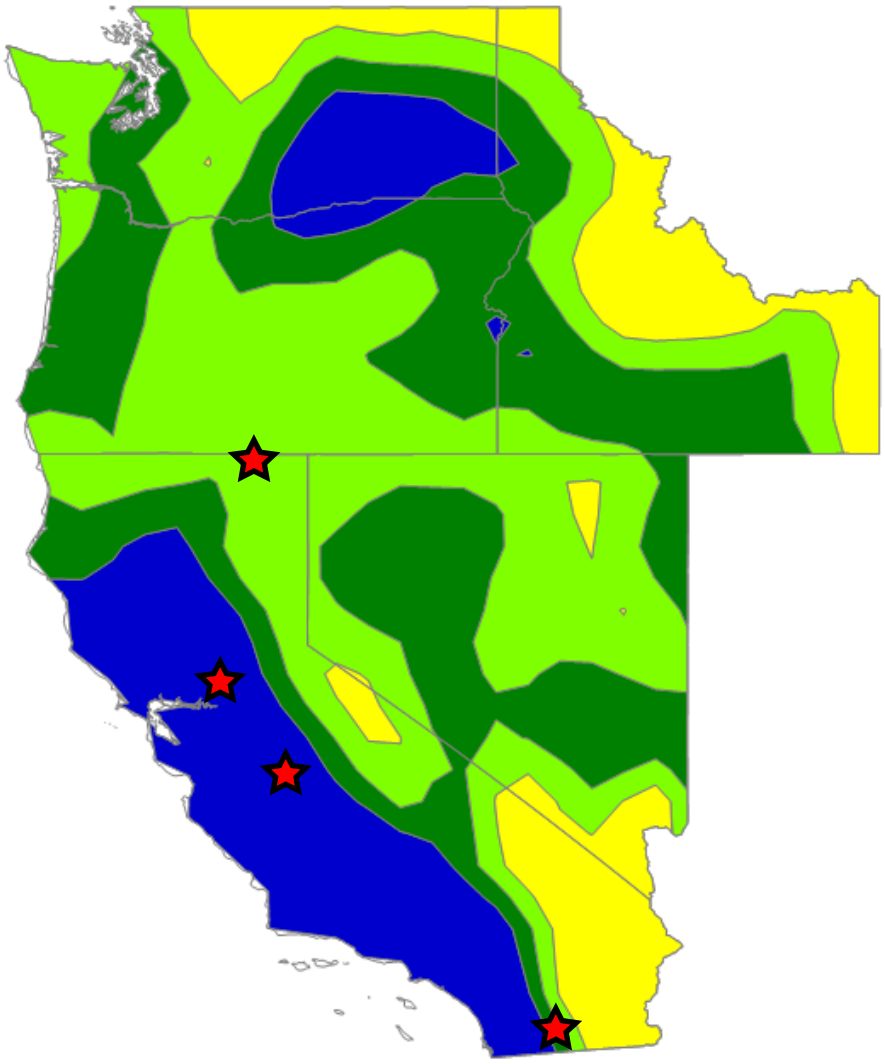
dry-land

+ irrigation





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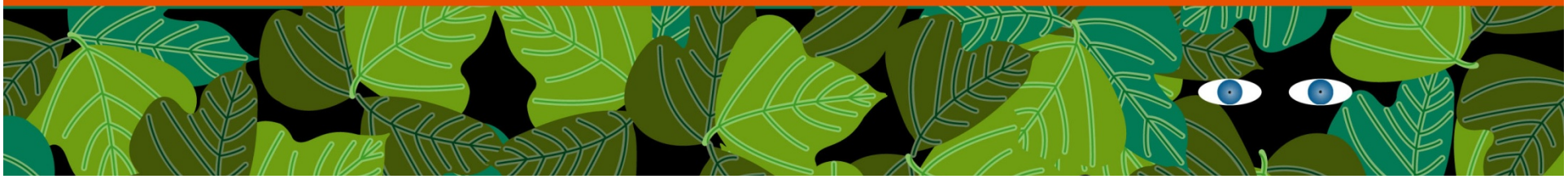
Ecological analyses: field studies



Recommendation #4. Identify plant traits that contribute to or avoid invasiveness.

Incorporate desirable traits into varieties to minimize their potential for invasiveness. Use information from plant research, agronomic models, and risk analyses to guide breeding, genetic engineering, and variety selection programs.

What qualities can be breed into biofuel feedstocks?

Sterility
- Complete or F2 sterility

} Will this be economical?

Salt tolerance

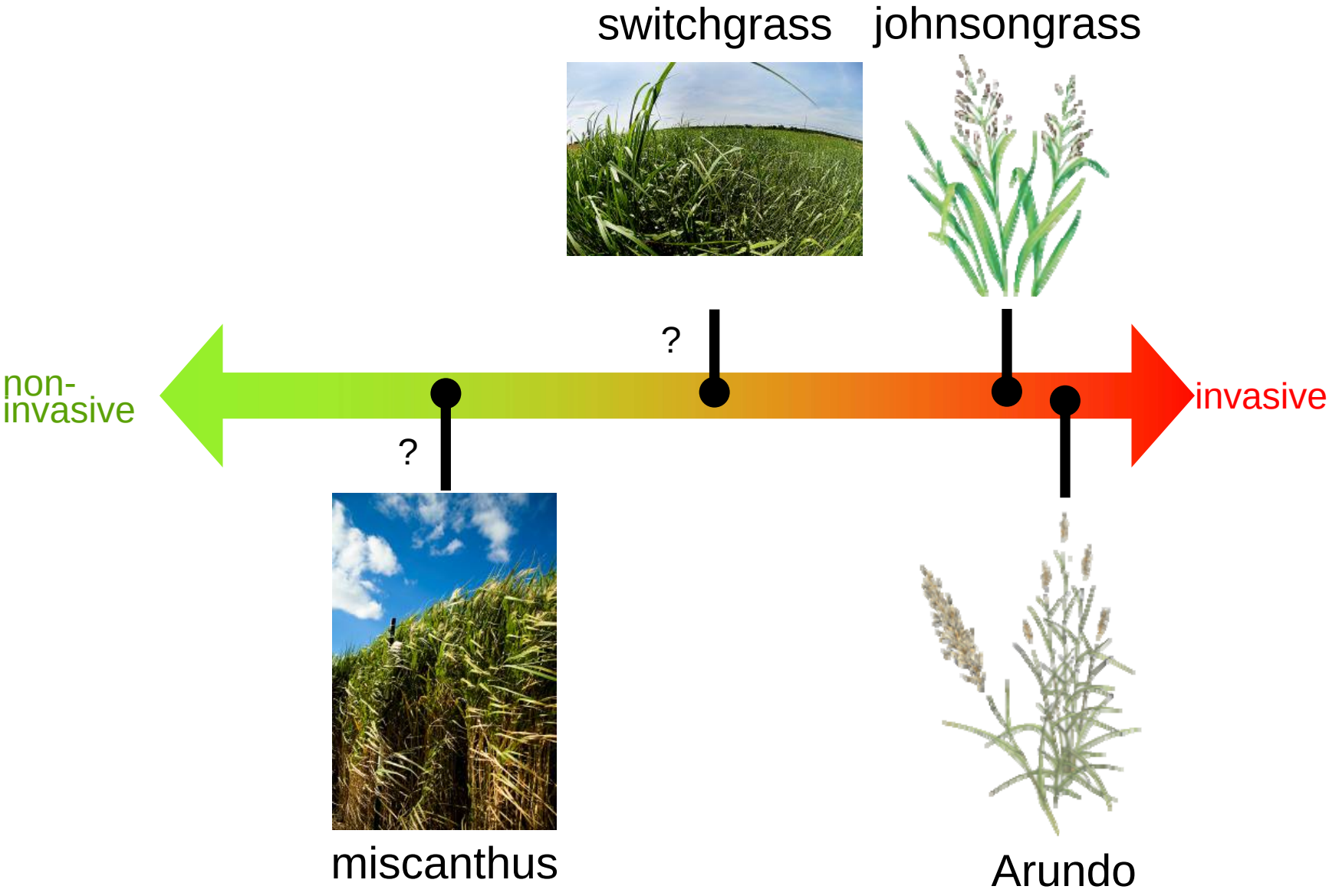
Drought resistance

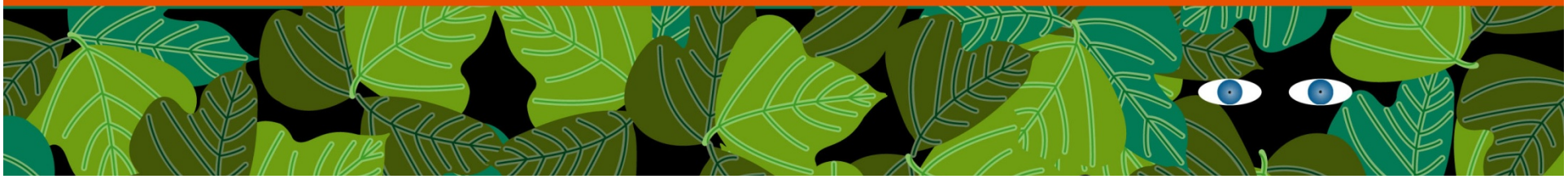
High nutrient use efficiency

} Will these traits allow growth on marginal lands, but increase risk of natural areas?

Seedling vigor } Is low seedling vigor the bottleneck in invasiveness?

Ecological analyses: competition



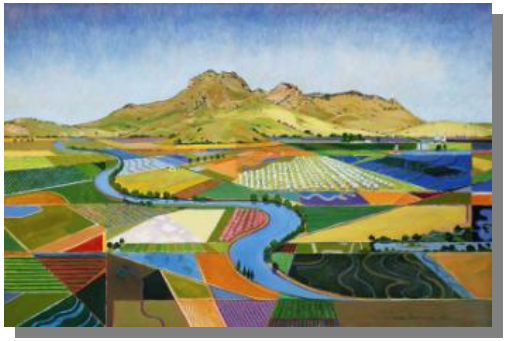


Recommendation #5. Prevent dispersal.

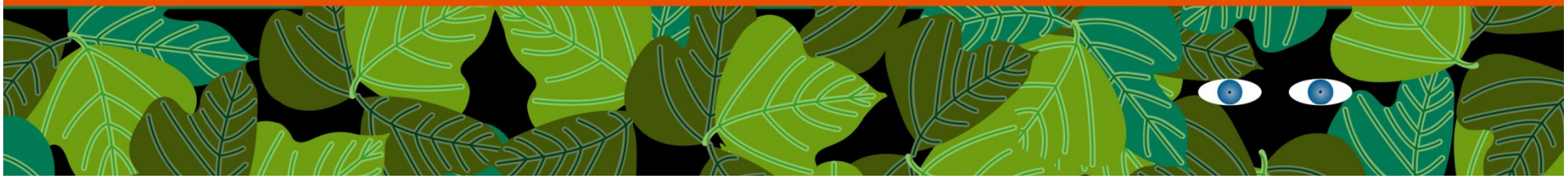
Develop and coordinate dispersal mitigation protocols prior to cultivation of biofuel plants in each region of consideration.

Mitigation

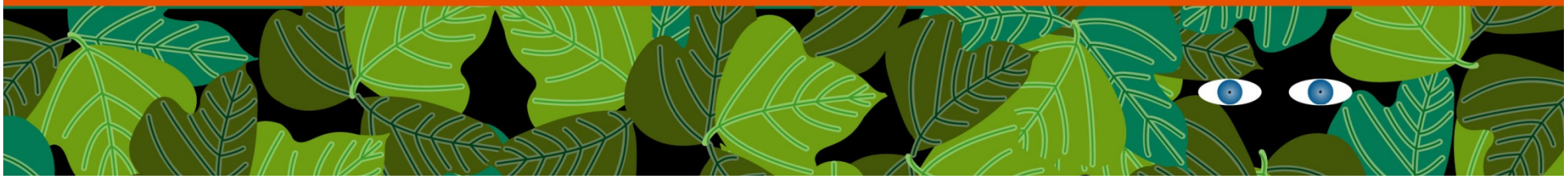
- Cultivate in a landscape context
- Scout field borders, propagule corridors
- Minimize propagule escape via harvest, transportation, storage management



Approximately 20,000 production acres on active agricultural lands



Recommendation #6. Develop eradication protocols for rotational systems or abandoned populations. Establish pre-commercial multiple year management protocols to eliminate abandoned or unwanted populations that may act as source populations for escape to sensitive sites.



Recommendation #7. Develop Early Detection and Rapid Response (EDRR) plans and rapid response funds. Develop EDRR plans that cover multiple years to eliminate to prevent establishment and spread of escaped invasive populations. A funding source supported by the industry should be established to facilitate EDRR efforts.