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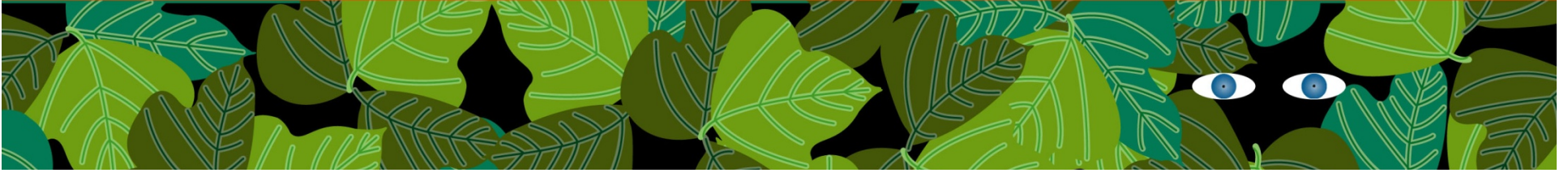
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Agricultural Outlook Forum
U.S. Department of Agriculture

Presented: February 18-19, 2010

Biofuels vs Bioinvasions: Seeding Policy Priorities

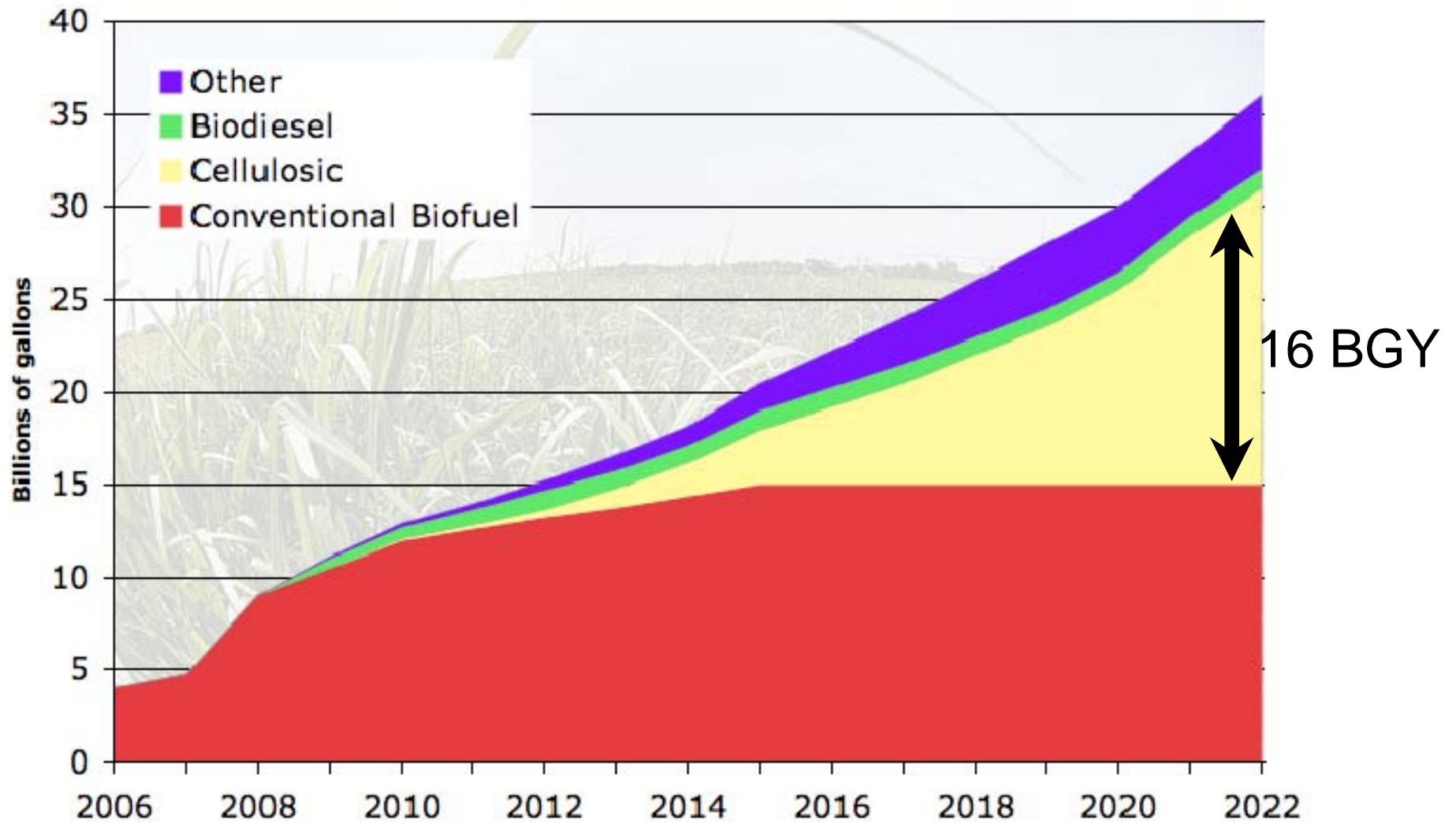
Joe DiTomaso, Jacob Barney, Jamie Reaser, Chris Dionigi, and
Otto Doering



Biofuels vs Bioinvasions: Seeding Policy Priorities

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

Energy Independence and Security Act 2007





University of Illinois

Miscanthus* × *giganteus

switchgrass
Panicum virgatum



USDA NRCS

Giant reed
Arundo donax



Giant reed
Arundo donax
Photo by A. Murray
Copyright 2001 Univ. Florida

Ideal agronomic characteristics

- **Life history**
 - Perennial
 - High aboveground biomass production
 - Flowers late / little allocation to seed production
- **Physiology**
 - Tolerates
 - Drought
 - Low fertility
 - Saline soils
 - C₄ 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

POLICY FORUM
Adding Biofuels to the Invasive Species Fire?
 S. Raghu,* R. C. Anderson,† C. C. Daehler,‡ A. S. Davis,† R. N. R. M. Mack

CAST Commentary
 QTA2007-1 November 2007

CAST
 The Science Source for Food, Agricultural, and Environmental Issues

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Introduction

In an effort to decrease greenhouse gas emissions, expand domestic energy production, and maintain economic growth, public and private investments are being made to pursue dedicated feedstock crops for biofuel production. Lignocellulose-based energy crops (e.g., switchgrass) typically have a neutral or negative carbon budget, require relatively few economic or environmental inputs, and can be cultivated on marginal, lower-productivity land. Thus, a rapidly growing industry related to crop selection, cultivar improvement, and conversion technologies is emerging.

A variety of plant species, including grasses, herbs, and trees, are being considered for use as dedicated biofuel crops across much of the United States (Figure 1). The leading candidates for lignocellulose-based energy, however, are primarily rhizomatous (i.e., having belowground vegetative reproductive structures) perennial grasses. Most of these grasses are not native to much of the region where production is proposed (Lewandowski et al. 2003). From an agronomic perspective, their life history characteristics, rapid growth rates, and tonnage of biomass produced by these nonnative grasses make them ideal feedstock crops.

This material is based upon work supported by the United States Department of Agriculture under Grant No. 2006-38002-02539 and Grant No. 2007-37100-0001802 Project No. 413-46-02. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or Iowa State University.

“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

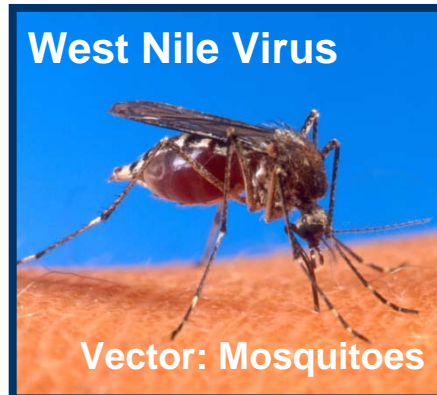
(Issued in February of 1999)

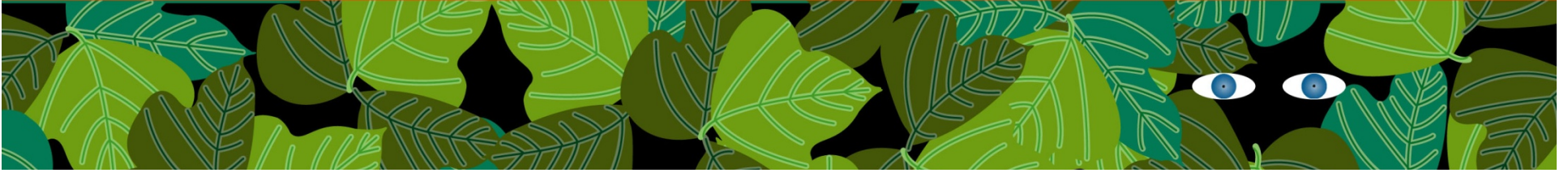
- Established the National Invasive Species Council (NISC) co-chaired by the Secretaries of Agriculture, Commerce and Interior
- Established the Invasive Species Advisory Committee (ISAC)
- Invasives defined as species:
 - ❑ Not native to the ecosystem under consideration
 - ❑ Whose introduction does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



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.

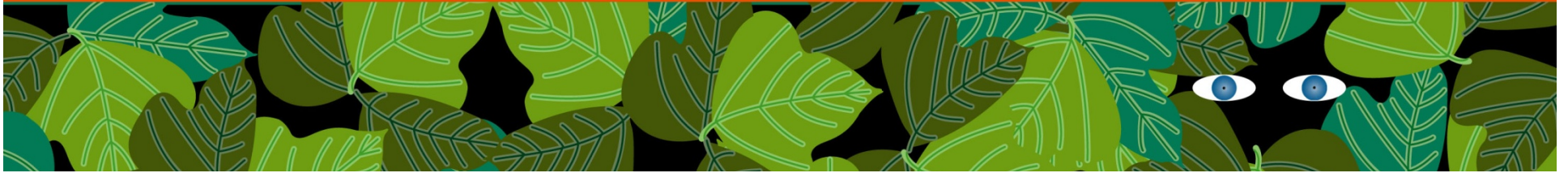
Recommendation #5. Prevent dispersal.

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*

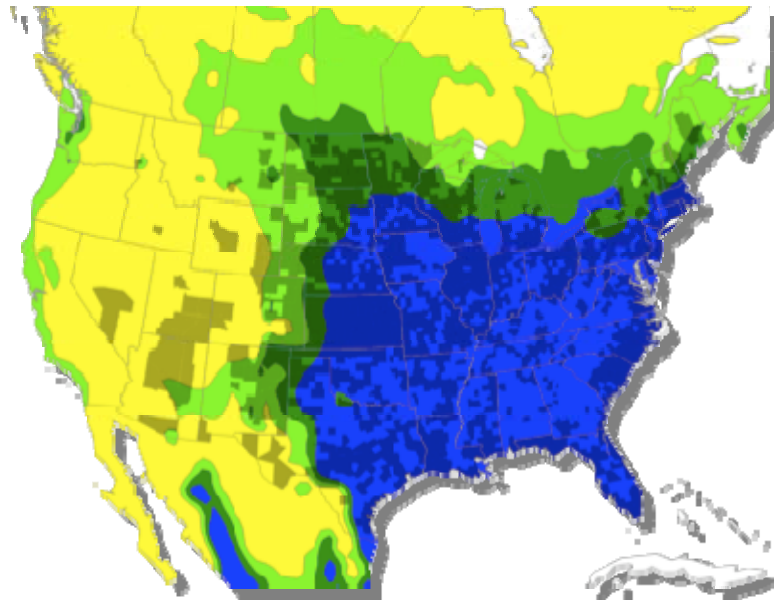
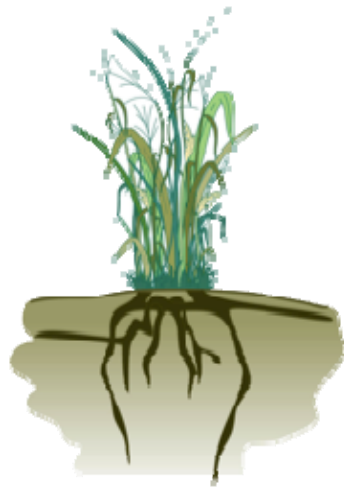
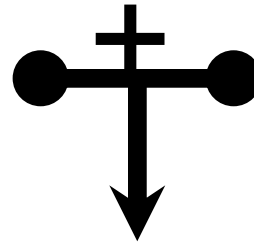
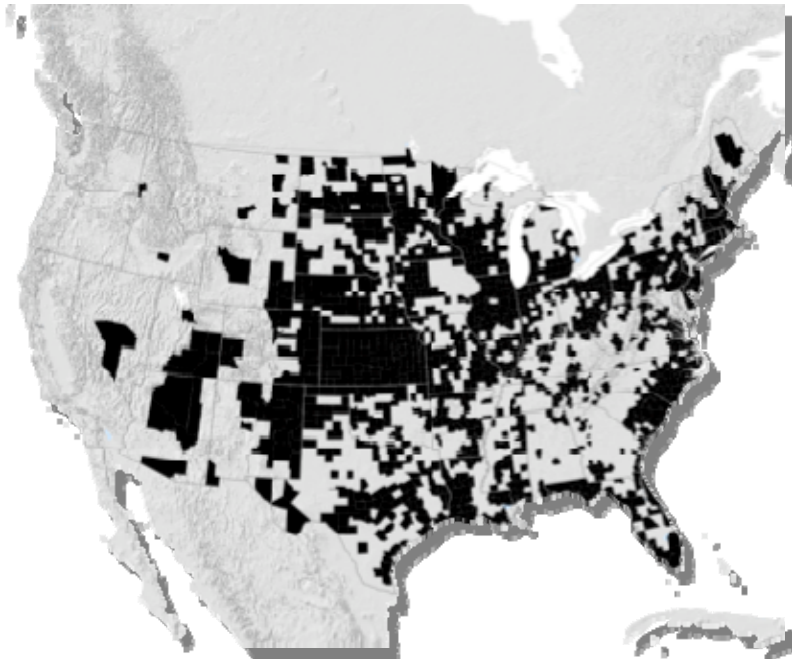
Entire US:

Standard WRA = **Accept**

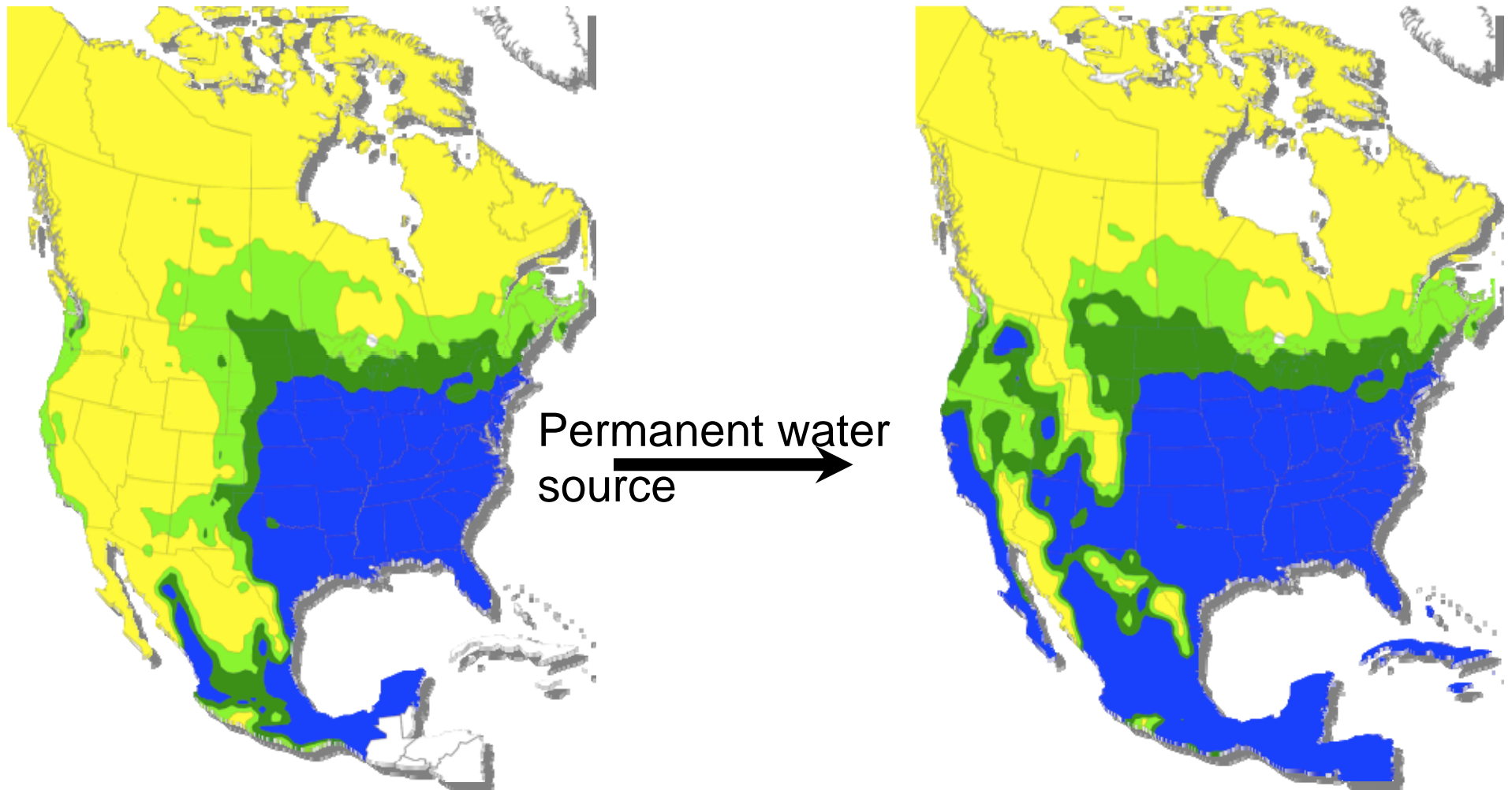




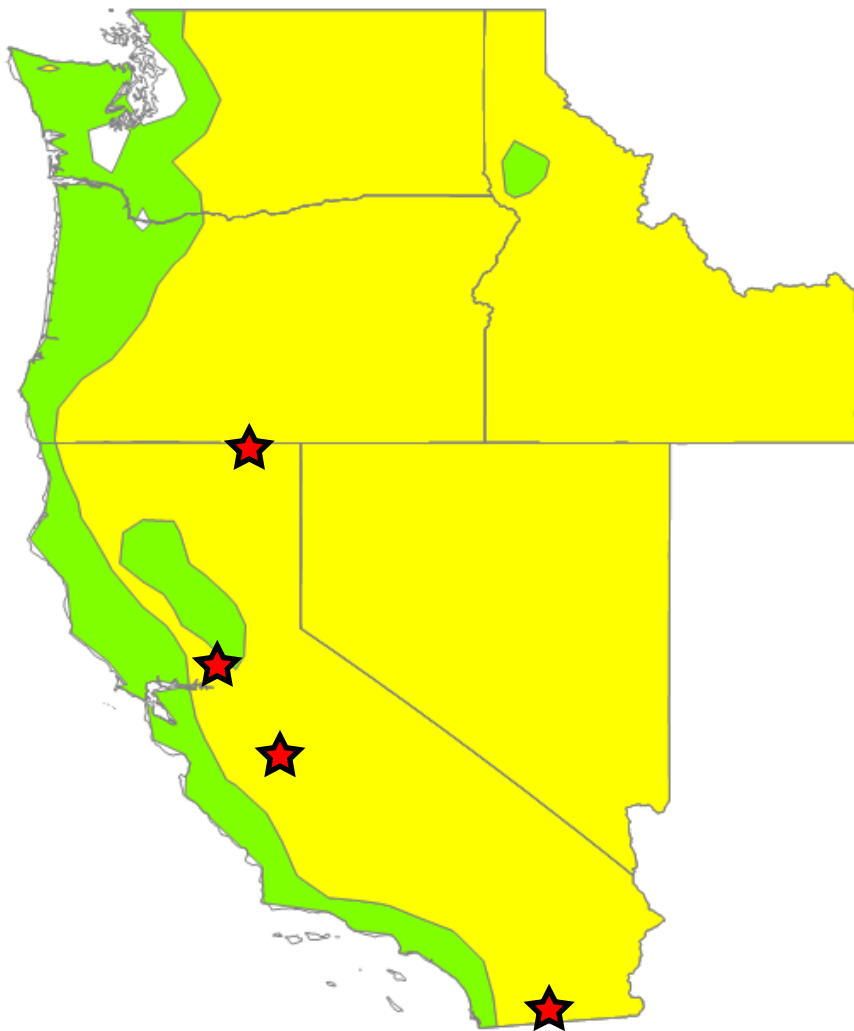
Recommendation #3. Determine the most appropriate areas for cultivation. Use research findings to identify the most appropriate sites for cultivation of biofuel crops within landscapes. Avoid converting natural habitats for cultivation. Support for biofuel research and demonstration projects should be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



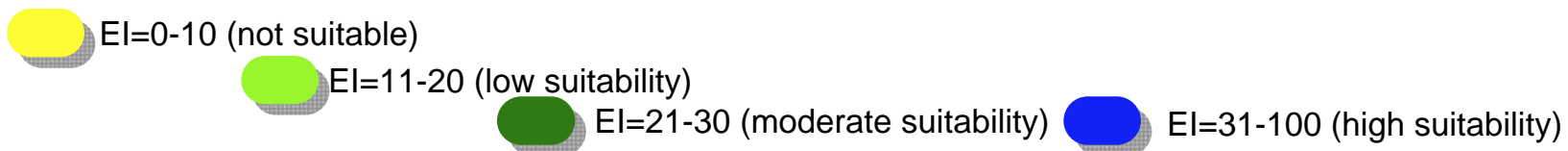
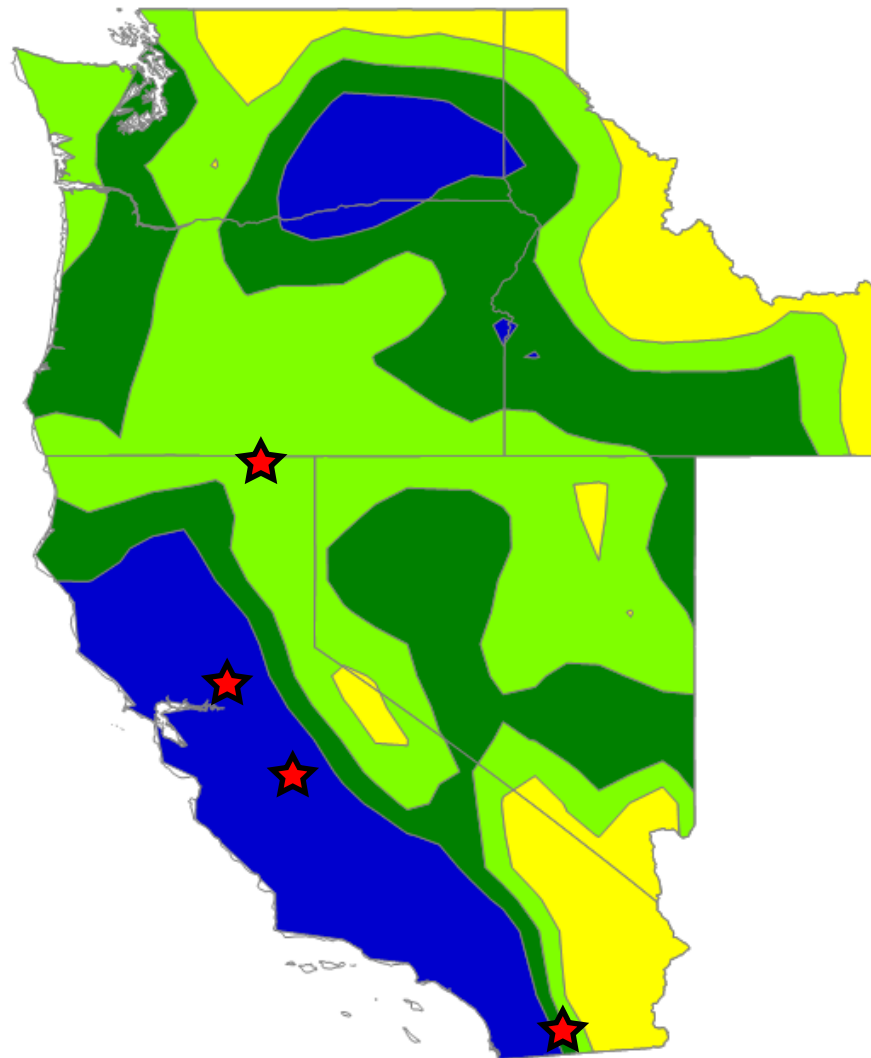
What is the potential range? CLIMEX



dry-land



+ irrigation



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

Salt tolerance

Drought resistance

High nutrient use efficiency

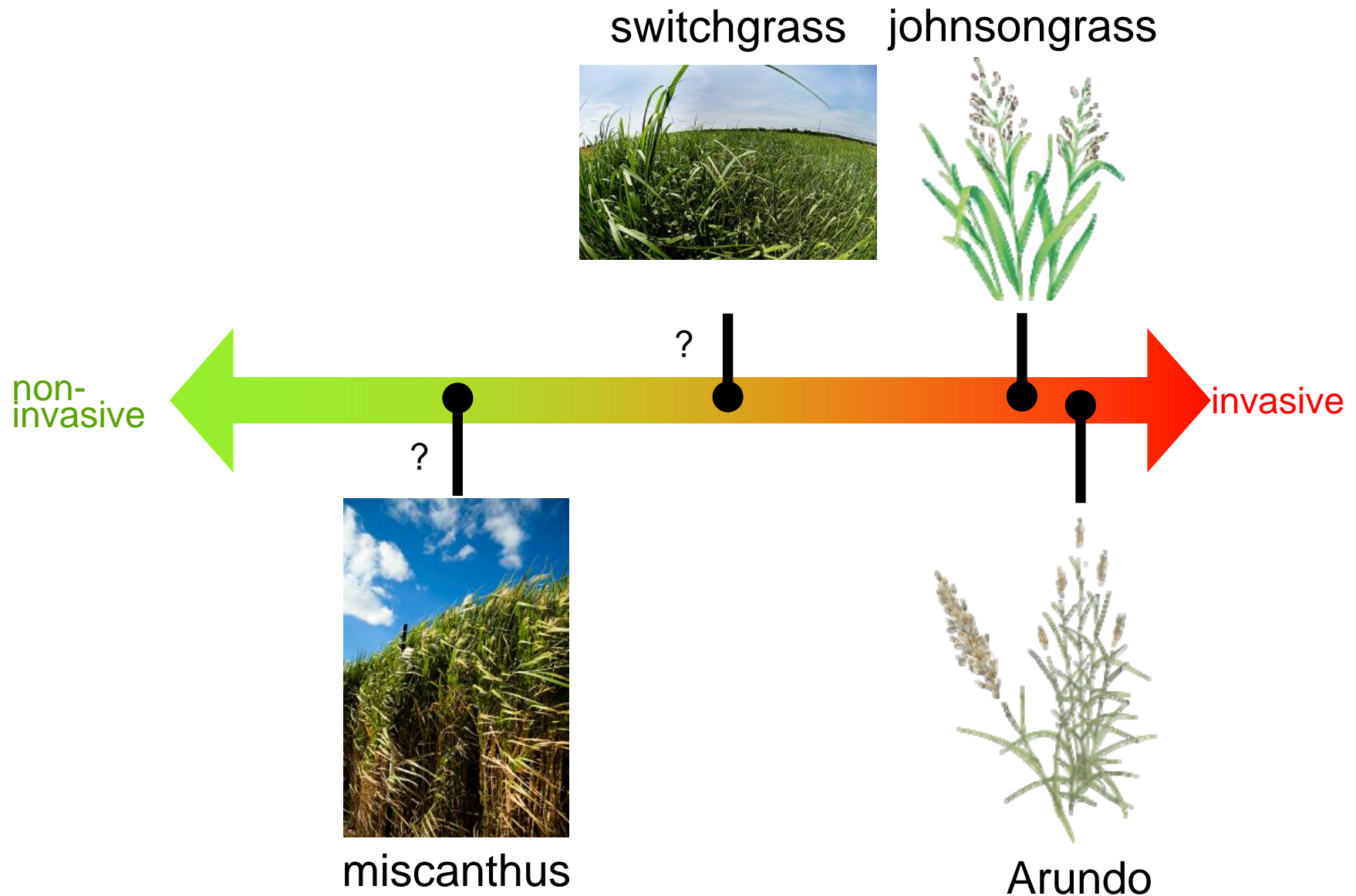
Seedling vigor

} Will this be economical?

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

} 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.