

# NEWBio: The Northeast Woody/Warm-season Biomass Consortium

Tom Richard, Penn State University  
NARA Annual Meeting  
May 3, 2016



United States  
Department of  
Agriculture

National Institute  
of Food and  
Agriculture



Cornell University



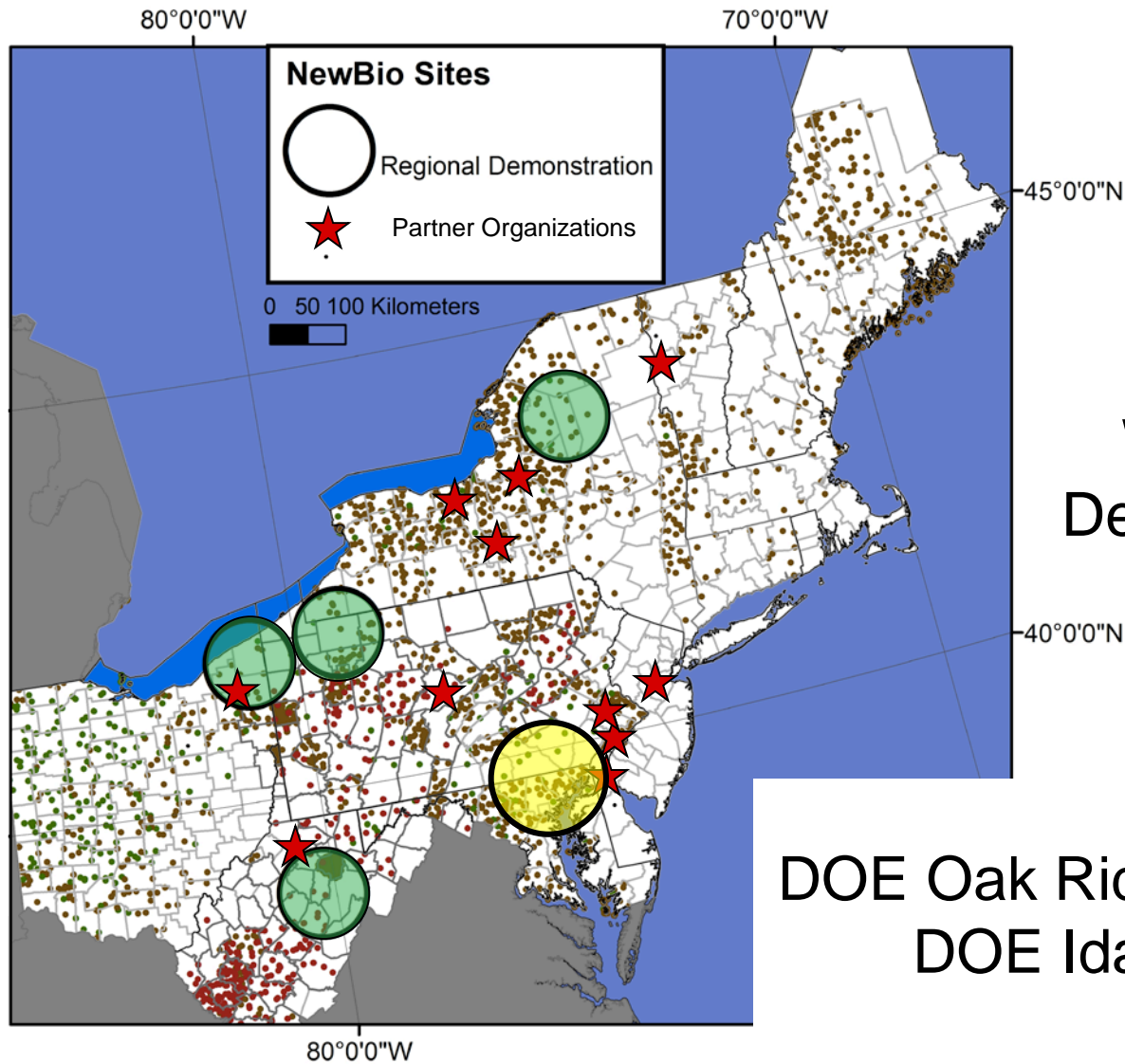


Northeast Woody/Warm-Season Biomass Consortium  
2015 Annual Meeting

*NEWBio's vision is to build robust, scalable, and sustainable value chains for biomass energy in the Northeast.*



# University and Federal Partners



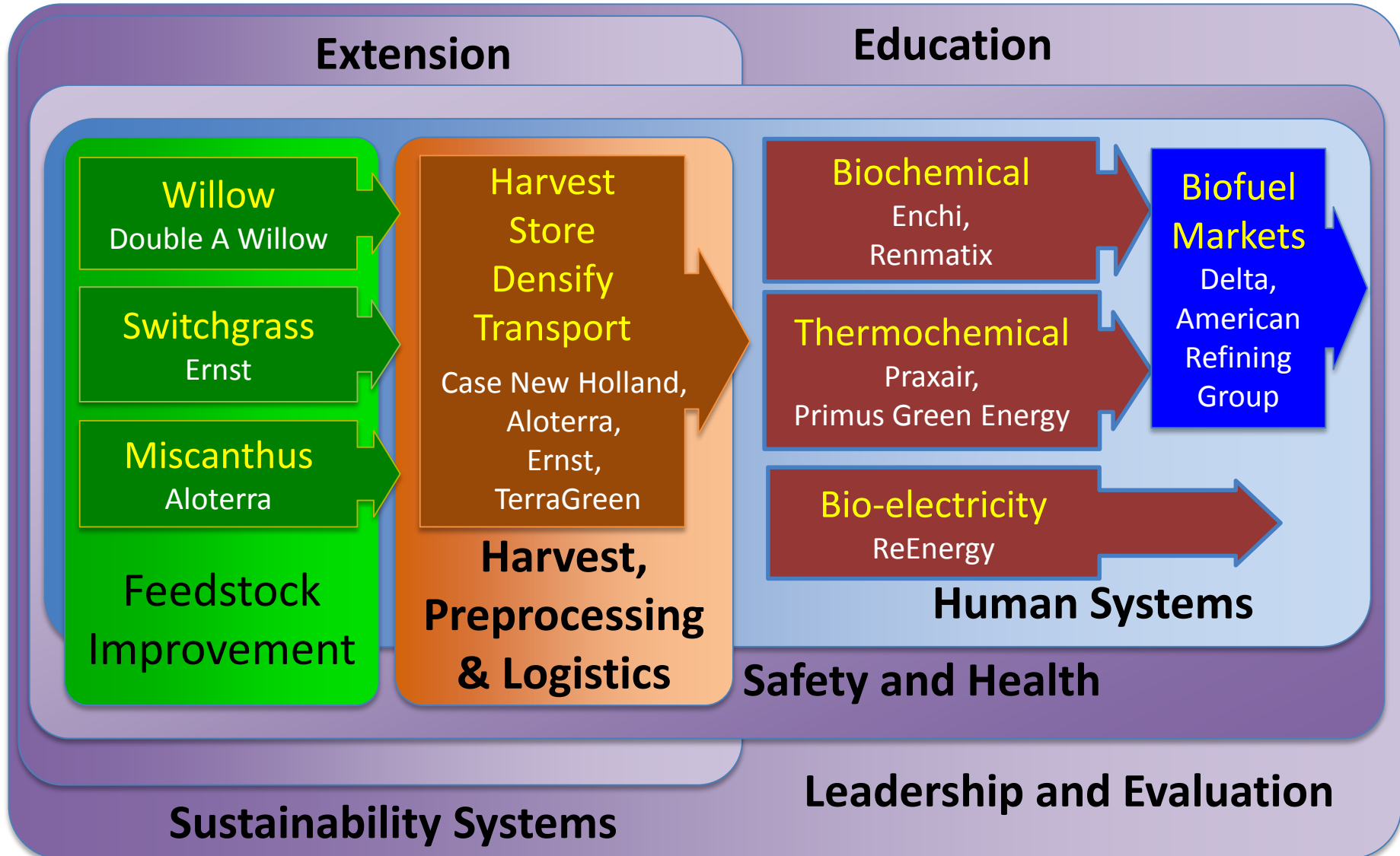
Penn State University  
Cornell University  
SUNY ESF

West Virginia University  
Delaware State University  
Ohio State University  
Rutgers University  
Drexel University  
USDA ARS ERRC

DOE Oak Ridge National Laboratory  
DOE Idaho National Laboratory

# NEWBio:

## Northeast Woody/Warm-season Biomass Consortium

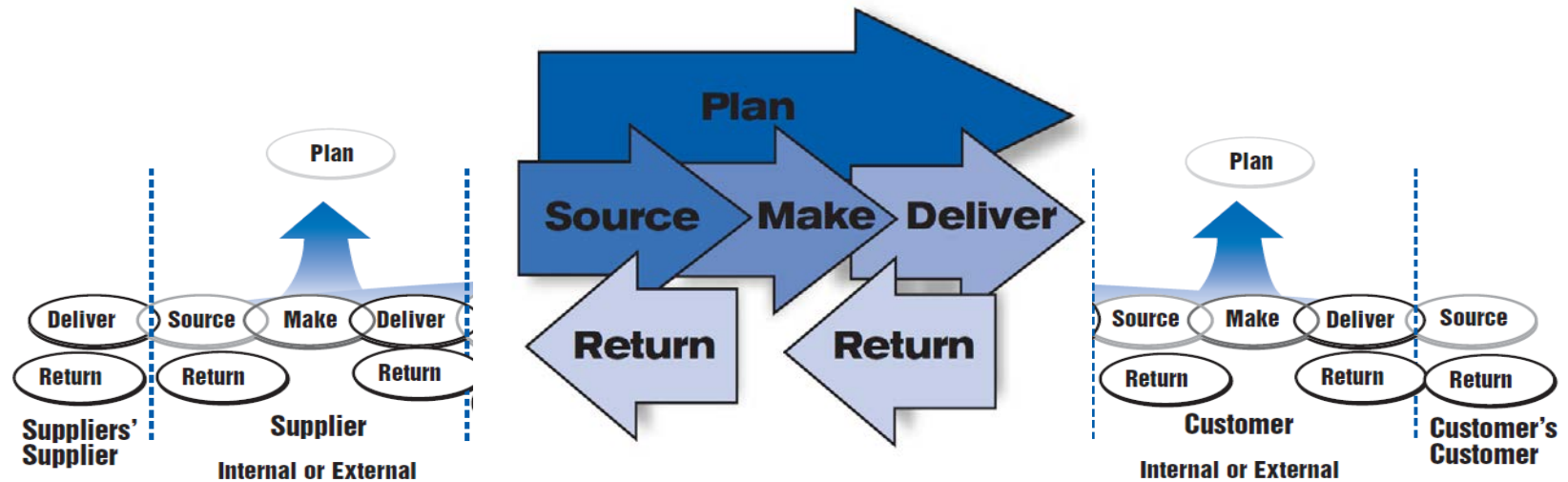


# NEWBio Outcomes

Knowledge: *shared discovery*

Actions: *solving challenges*

Conditions: *a growing bioeconomy*



Suppliers of woody biomass  
and perennial grasses

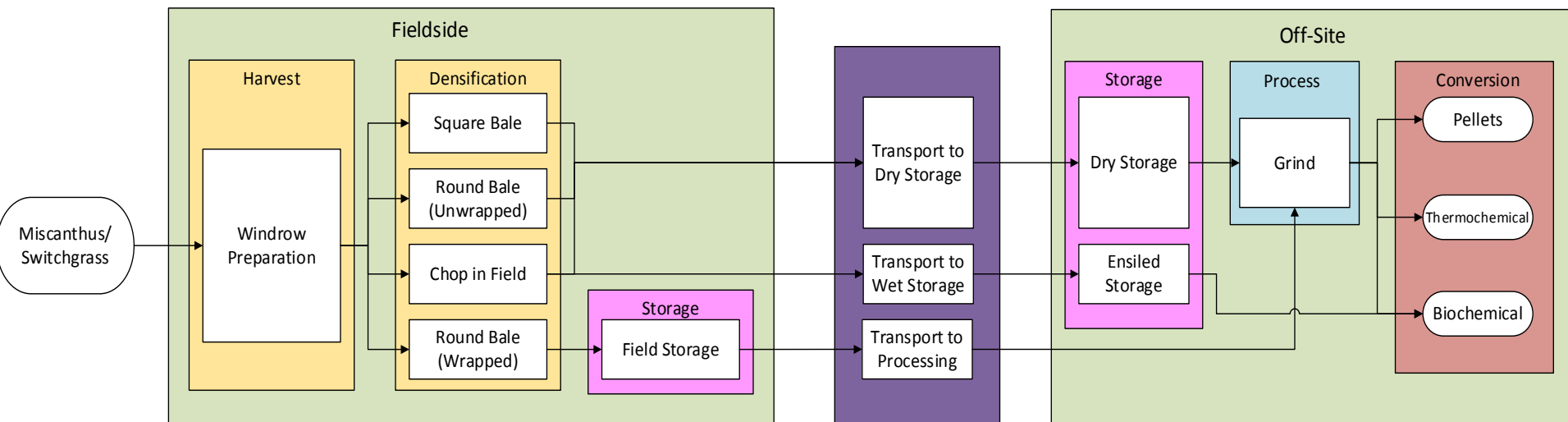
**Biomass Conversion Facility**

Downstream  
Operators

# Knowledge

- Capacity for participatory decision-making
- Stakeholder engagement processes
- Stakeholders' economic & social barriers
- Necessary incentives to overcome barriers
- Data for models, Decision Support Systems, policy, extension programs
- Genetic basis of willow and switchgrass yield
- Professionals & producers trained in biomass production & management
- Improved understanding of economics and environmental impacts of perennial biomass
- Quantified feedstock to fuel systems
- Regional prioritization of feedstock systems
- Changes/tradeoffs in ecosystem services in different feedstock systems
- Increased worker awareness and knowledge about biomass industry hazards
- Management safety awareness
- Increased knowledge about biomass resource as community or regional asset
- Pipeline of practitioners (1,000) trained
- Increased knowledge of sustainable bioenergy systems, measured by pre-and post exams, surveys and interviews
- > 30 faculty and 40 graduate students with demonstrated transdisciplinary collaborations, and perspectives

# Perennial Grass Supply Chains

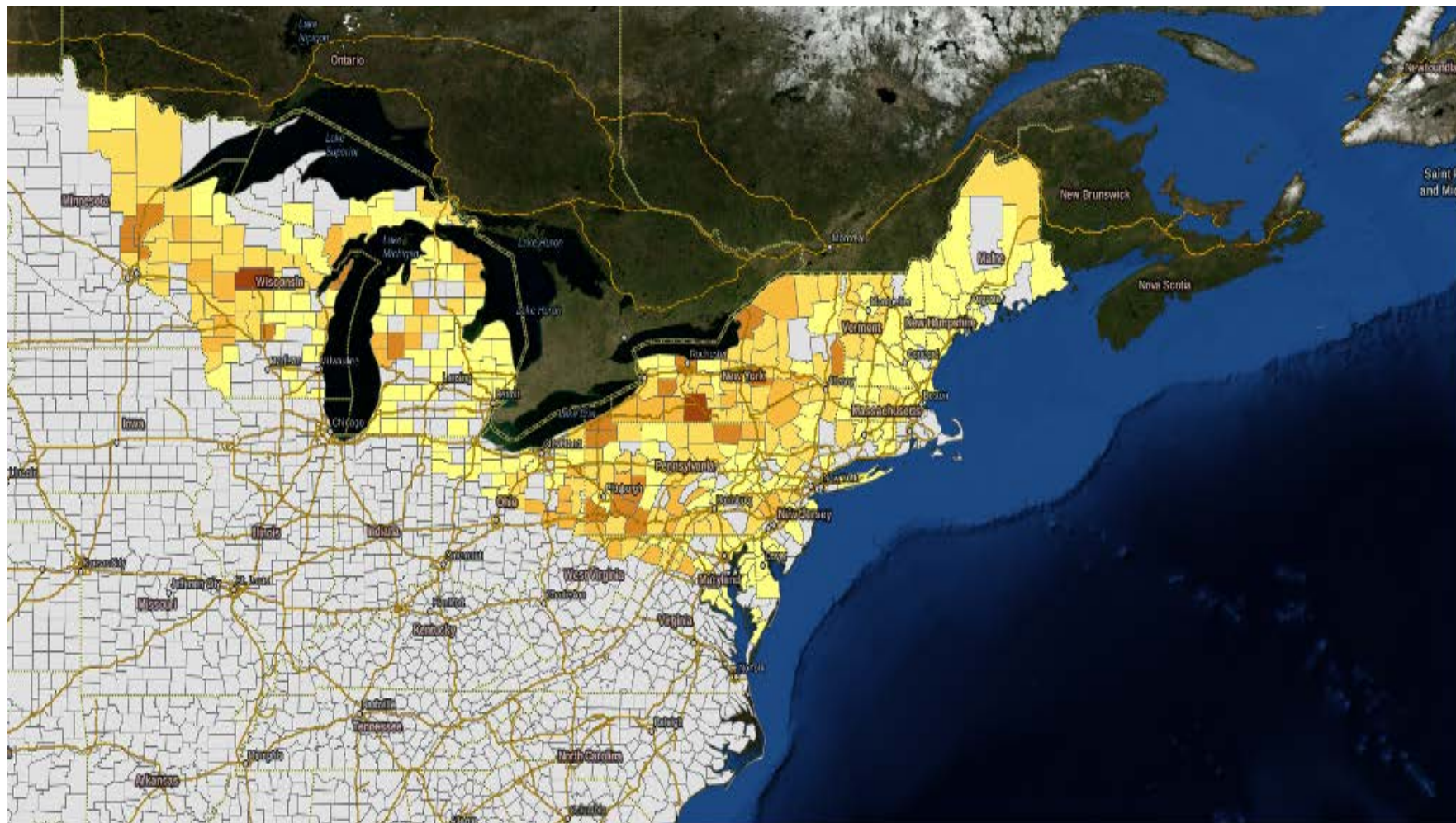


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Agriculture

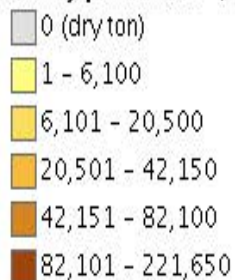
National Institute  
of Food and  
Agriculture

NEWBio

Northeast Woody/Warm-season Biomass Consortium



Woody production \$ Cnty



**Short Rotation Woody Crops (Willow and Poplar), 2017, \$55 Farmgate Price, Base Case Scenario**

# Actions

- Collaborative approaches to research, extension, education
- Landowner, community and public participation
- Expanded range of new, commercialized crop varieties
- Increased diversity & availability of perennial feedstocks
- Improved harvest, transport and logistics systems.
- Comprehensive public dataset used in integrated tools and models for sustainability analysis
- Use of hazard assessment tools, management plans and employee safety training programs
- Increased efficiency and capacity in biomass supply chain
- A sustainable flow of biomass to support emerging biofuels industry
- Commercial biorefineries operating and procuring biomass
- Increased employment in biomass production and use sectors
- Partner commitments to maintain regional coordination and increase permanent biomass workforce.





# Willow Harvest Program

- 100 acres – Celtic Energy commercial biomass. West Branch, NY
- 30 acres – ESF bioremediation site. Solvay, NY
- 2 acres – ESF yield trial. Constableville, NY
- 2 acres - ESF various trials and nursery beds. Tully, NY
- 20 acres – Cornell various trials and nursery beds. Geneva, NY
- 2 acres – Cornell yield/amendment trial. Fredonia, NY
- 1 acre – Cornell yield trial. Potsdam, NY
- 30 acres – Penn State research trial. Rockview, PA
- 4 acres – Penn State yield and polyculture trial. Rocksprings, PA
- 15 acres – East Lycoming school biomass. Hughesville, PA
- 50 acres – IBSS poplar trials. Tennessee and Mississippi
- 25 acres – ESF Lafayette Road Trials. Syracuse, NY
- 4 acres – Vernon-Verona-Sherrill High School
- 6 acres – Cornell. Various trials

# Conditions

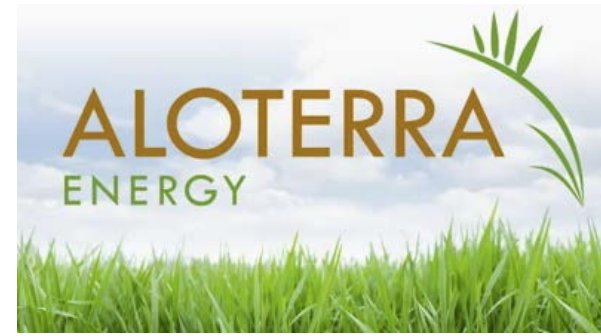
- Stakeholders engaged in all portions of the biomass supply system
- Rural development and resilience for entrepreneurs, employment, income
- Increase willow and grass yield 25% & reduce production & harvesting costs 20%
- Viable crop systems on marginal lands; toolkit for mycorrhizal fungi establishment
- Improved GHG balance & energy yields
- Reliable, consistent, affordable perennial biomass supply across the region
- Improved, sustainable land management
- New supply chain businesses models
- Advanced biofuels, biochemical and biomaterials facilities and biomass production systems competitive in NE
- A balanced, sustainable flow of ecosystem services from feedstock systems
- Reduced exposure to hazards and risks. Reduced lost-time work injury & costs
- Strengthened educational pipeline to support the biomass industry
- Greater public understanding of and support for biomass energy systems
- Increased capacity in 3 EPSCoR states and regional 1890s universities
- Strong and lasting partnerships between biomass stakeholders in the region

# Feedstock Partner: Switchgrass



Over 5000 acres of switchgrass in production.  
Currently processing over 20,000 tons/year

# Feedstock Partner: *Miscanthus x giganteus*



Over 4000 acres of miscanthus in production.  
Current markets primarily biocomposites and biomaterials

# Conversion Partner: Biopower



Operating nine biomass fueled power plants in the Northeast  
Corporate headquarters in Latham, NY  
Currently contracting for willow biomass from Celtic Energy

# Conversion Partner: Supercritical Sugars

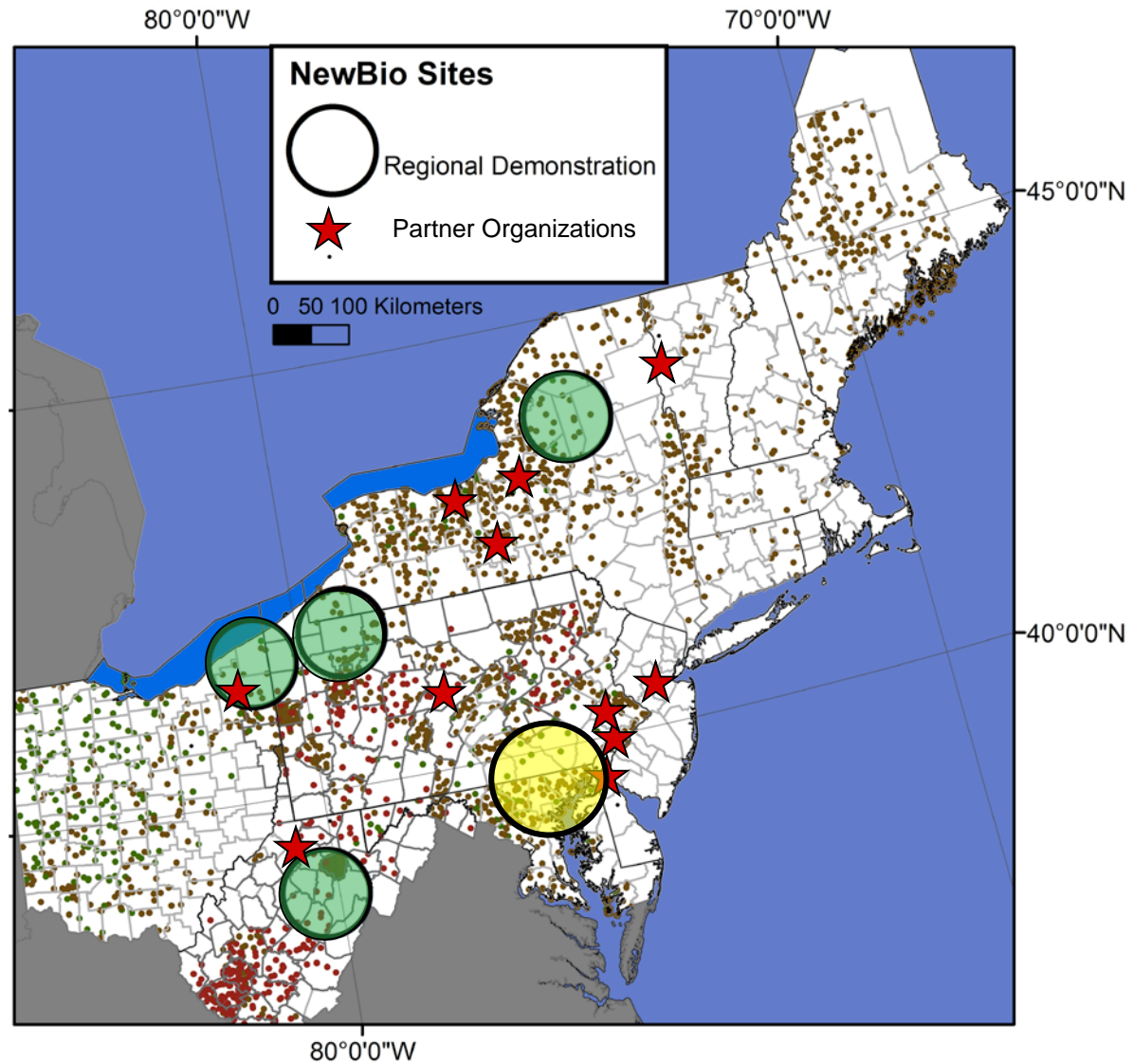


Operating Pilot Plant in Kennesaw, GA since 2008  
Corporate headquarters in Valley Forge, PA since 2011  
Partners include BASF, Total, Amyris, Virent

# Transdisciplinary Targets for Year 4

- Demonstration regions – ReEnergy, Ernst, Aloterra, Green Team, TerraGreen, Renmatix
- Landowner and community perspectives
  - Feedstock production
  - Technical and business supply chains
  - Sustainability assessment
  - Economic impact
- Policy opportunities –Chesapeake Watershed, Clean Power Plan
- Business development – niche energy applications, biochemicals and bioproducts

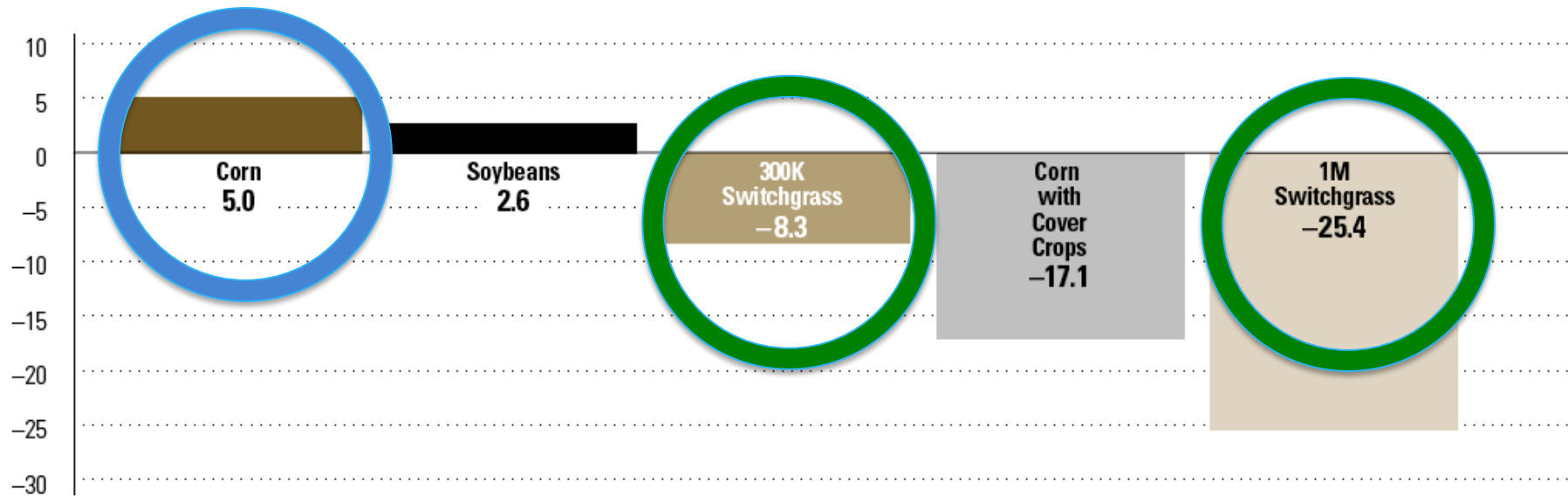
# Demonstration Regions



# Biofuels and the Chesapeake – A Local Driver

## Maximum Nitrogen Load Changes for Biofuels

Millions of pounds per year of nitrogen delivered from the Chesapeake Bay watershed to the Bay under five modeling scenarios.



### Assumptions for Alternative Scenarios:

- Corn:** 300,000 additional acres of corn with typical levels of management practices
- Soybeans:** 300,000 additional acres of soybeans with typical levels of management practices
- 300K Switchgrass:** 300,000 acres of switchgrass, converted primarily from hay and pastureland, with no fertilization
- Corn with Cover Crops:** Cover crops on all existing and new (additional 300,000) corn acres and one quarter of all other row crops, watershed-wide.
- 1M Switchgrass:** 1 million acres of switchgrass, converted primarily from hay and pastureland, with no fertilization

SOURCE: U.S. EPA CHESAPEAKE BAY PROGRAM OFFICE

# Markets for Biomass Crops

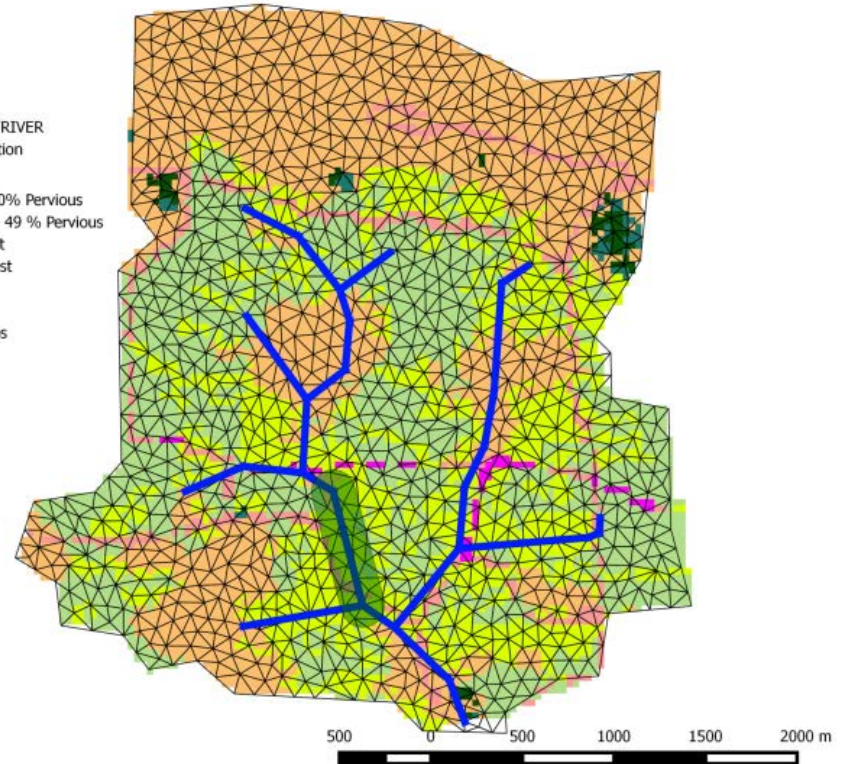
	Supply	Demand
<b>Market goods</b> <ul style="list-style-type: none"> <li>Cellulosic biomass for fuels, power and chemicals</li> </ul>	<ul style="list-style-type: none"> <li>5-12 million tons of biomass per year (Chesapeake Bay Commission 2010)</li> <li>\$100/ton breakeven price (Woodbury et al.)</li> <li>\$135/ton reservation price (Mooney et al. 2014)</li> </ul>	<ul style="list-style-type: none"> <li>\$7.19/GJ - \$8.12/GJ</li> </ul>
<b>Non-market goods</b> <ul style="list-style-type: none"> <li>Water quality               <ul style="list-style-type: none"> <li>N reduction</li> <li>P reduction</li> </ul> </li> <li>Soil Carbon</li> <li>Soil quality</li> <li>Biodiversity</li> <li>GHG reduction</li> </ul>	<ul style="list-style-type: none"> <li>Maize to switchgrass = 23 kg N ha<sup>-1</sup> y<sup>-1</sup> reduction in N loading to the Chesapeake Bay (Woodbury et al., in review)</li> <li>Biomass sorghum for P phytoremediation</li> <li>~1 Mg soil carbon /ha/yr</li> <li>Increased resilience to drought</li> <li>Pollinators, pest control</li> <li>Reduced N<sub>2</sub>O emissions?</li> </ul>	<ul style="list-style-type: none"> <li>\$10.7 kg N<sup>-1</sup> (Woodbury et al.) =\$1.4 GJ<sup>-1</sup></li> <li>?</li> <li>?</li> <li>?</li> <li>?</li> <li>?</li> </ul>

# Spatial Targeting



## Legend

- StreamBuffer
- PIHM STREAM/RIVER
- Finer Triangulation
- LandCover
  - Developed < 20% Pervious
  - Developed 20 - 49 % Pervious
  - Deciduos Forest
  - Evergreen Forest
  - Mixed Forest
  - Pasture/ Hay
  - Cultivated Crops





10 to 20% of the landscape in  
perennials results in  
85 to 95% reductions in N, P and  
sediment!

Zhao et al. 2014

# Clean Power Plan – National Webinar

## Latest Video


Bioenergy in the CPP Webinar: Biomass Market E...  

### WHAT IS THE BASELINE?

Table 3: Historical and Projected\* U.S. Greenhouse Gas Emissions under Current Measures, by Sector: 2000-2030 (Current Measures only, Mt CO<sub>2</sub>e)

Sectors (2)	Historical GHG Emissions (1)				Projected GHG Emissions			
	2000	2005	2010	2013	2015	2020	2025	2030
Energy	4,280	4,345	4,097	3,898	4,004	3,860	3,816	3,657
Transportation	1,862	1,929	1,758	1,739	1,701	1,680	1,622	1,578
Industrial processes	397	367	354	359	388	430	477	497
Agriculture	468	464	525	516	512	504	499	494
Forestry and land use	20	20	20	23	28	28	28	28
Waste	132	131	145	138	138	138	138	137
<b>Total Gross Emissions</b>	<b>7,138</b>	<b>7,310</b>	<b>6,899</b>	<b>6,673</b>	<b>6,772</b>	<b>6,641</b>	<b>6,580</b>	<b>6,392</b>
Forestry and land use (sinks) (3)								
High sequestration	-641	-942	-872	-882	-970	-1,191	-1,201	-1,118
Low sequestration	-928	-1,044	-908	-882	-928	-1,044	-908	-889
<b>Total Net Emissions</b>	<b>6,571</b>	<b>6,438</b>	<b>6,027</b>	<b>5,791</b>	<b>5,802</b>	<b>5,451</b>	<b>5,379</b>	<b>5,274</b>
High sequestration	6,571	6,438	6,027	5,791	5,802	5,451	5,379	5,274
Low sequestration	6,571	6,438	6,027	5,791	5,844	5,597	5,672	5,703

Notes:  
\*Projections are for the current measures and do not reflect the impact of additional measures.  
(1) Historical values are from U.S. EPA/GAP 2015.  
(2) Sectors correspond to inventory-reporting sectors, except that carbon dioxide, methane, and nitrous oxide emissions associated with mobile combustion have been moved from energy to transportation.  
(3) Sequestration is only included in the net emissions total.

 University of Idaho  
College of Natural Resources

## Incorporating Traditional Forest Product Markets in Biomass Evaluations

Greg Latta, University of Idaho

(see below for full description)

## Series Overview

### THE ROLE OF SUSTAINABLE BIOENERGY IN YOUR CLEAN POWER PLAN

- WEBINAR SERIES -

BEGINNING JANUARY 2016

Co-sponsored by the USDA NIFA  
AFRI Regional Bioenergy System  
Coordinated Agricultural Projects



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Department of  
Agriculture  
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of Food and  
Agriculture



Hosted by Sarah J. Wurzbacher,  
NEWBio Consortium Extension  
sjw246@psu.edu

### SERIES GOALS

This series provides guidance, information from cutting-edge research, and expert perspectives on the role biomass can play in state plans designed to meet Clean Power Plan requirements.

### WHO SHOULD TUNE IN?



State  
policy-  
makers



State  
regulatory  
agencies



Stakeholders in  
industry, econ.  
development, the  
environment...



Researchers of  
the bioeconomy,  
carbon markets,  
energy...



Students of  
policy, science &  
tech., business,  
agriculture...



Those who  
want to be  
informed  
citizens

[\(Click here for the full infographic\)](#)

<http://www.newbio.psu.edu/CPPwebinar.asp>



Northeast Woody/Warm-Season Biomass Consortium

# Growing a Sustainable Bioenergy Industry for the Northeast



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