



Department of Agriculture Agriculture Research Service



USDA/ARS *Bioenergy Research*

3 Components

- *Feedstock Development*: Enable new varieties and hybrids of bioenergy feedstocks with optimal traits
- *Sustainable Feedstock Production Systems*: Enable new optimal practices and systems that maximize the sustainable yield of high-quality bioenergy feedstocks
- *Biorefining*: Enable new commercially-preferred biorefining technologies

Integrate components within 5 Regional Centers

Southeast

North-Eastern

West

East-Central

Northwest

Focus research on 5 promising feedstocks

energy cane

woody biomass

sorghum

perennial grasses

oilseed crops



USDA Regional Feedstock Centers

Overarching objective

Coordinate existing ARS research capacities to accelerate large-scale sustainable biomass production

Approach

- **Optimize feedstock supply within existing agricultural and forestry systems**
- **Coordinate research of laboratories within a Region as one comprehensive program**
- **Whole-system, life-cycle assessments (e.g., input use efficiency, natural resources management, greenhouse gas emissions)**
- **Target multi-functional landscapes**
- **Address economic, environmental and social uncertainties/risks upfront**
- **Target commercial viability and recruit commercial partners up-front**



USDA Regional Feedstock Centers

A Center – network of existing ARS and FS laboratories

- **Leverage external resources...**
 - **NIFA (e.g., CAP program)**
 - **university partners**
 - **other Federal laboratories**
 - **biorefiners & other corporate collaborators**
 - **agricultural producers**
 - **engaged NGOs**
- **Leverage ARS-wide scientific and technical expertise**
 - **crop-centric teams (*Perennial grasses, Energy cane, Sorghum, Oilseed Crops, Agroforestry*)**
 - **natural resource teams (*GRACENet, CEAP, Biophysical/economic modeling*)**
 - **biorefining & co-products teams (*Cellulosic ethanol, Pyrolysis, Starch-based ethanol, Biodiesel, Techno-economic analysis*)**
 - **feedstock logistics team**



USDA Regional Feedstock Centers

Anticipated Outcomes

Region	Potential Capacity	National Contribution	Number of Facilities	Estimated Investment
	<i>billion gallons</i>	<i>%</i>		<i>\$ billion</i>
Southeast	10.4	49.8	263	83.3
Central-East	9.1	43.3	226	72.0
Northwest	1.0	4.6	27	8.3
North-Eastern	0.4	2.0	11	3.5
West	0.1	0.3	2	0.5

21 billion gallons
527 new biorefineries
\$168 billion capital investment



ARS *Bioenergy Research*
Feedstock Development

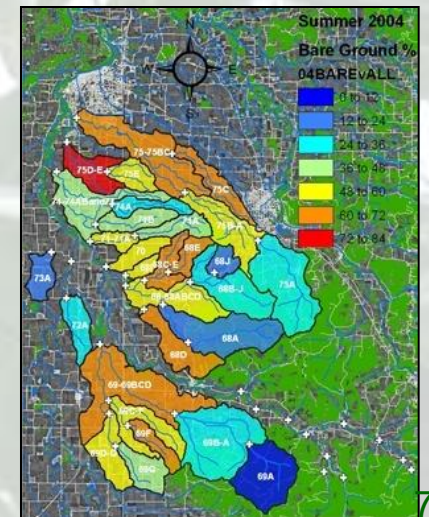
- **Biological and molecular basis for plant traits**
 - **Understand molecular basis for key traits** (*cell-wall structure, growth biomass yield, conversion potential*)
- **Breeding and evaluation of new germplasm**
 - **Improved germplasm & varieties for energy crops**





ARS *Bioenergy Research* *Sustainable Feedstock* *Production Systems*

- **Region-specific, sustainable practices to maximize feedstock harvest**
 - **Whole-farm optimization tools to incorporate bioenergy feedstock production into farm operations**
- **Analytical tools to estimate potential feedstock amounts and the implications of harvest on natural resource base**
 - **Decision tools for farmers and biorefinery operators**
- **On-farm utilization of biorefinery coproducts**
 - **Physical, chemical and biological value of byproducts as soil amendments and nutrients**





ARS *Bioenergy Research* *Biorefining Research*

Enable new commercially-preferred
biorefining technologies

- **Biocatalytic (EtOH & BuOH)**
 - **1st Gen. – *starches & sugars***
 - **2nd Gen. – *cellulosic***
- **Thermochemical**
 - **Pyrolysis (*CHP, advanced biofuels*)**
- **Biodiesel**
 - **Fuel quality (*cold flow, ox. stability*)**



- ✓ **Biorefinery co-products/byproducts**
 - **for each biorefining platform**
- ✓ **Biocatalysis & industrial microbiology**
- ✓ **Techno-economic analyses**
 - **identify R&D goals & priorities**
- ✓ **Early-stage technology transfer plans**
- ✓ **Pilot facilities**

Focus Going Forward

1. **Feedstock-flexible**
2. **Farm-scale**
3. **Coordinate with DOE**