

# Sustainable Advanced Biofuels Across the United States



The United States has the potential to produce vast supplies of biomass from farms and forests that can be tapped to produce sustainable transportation fuels.

**Advanced biofuels** can be produced locally from renewable resources. These fuels will help meet national energy needs and reduce dependence on foreign oil.

The fuels will be flexible and made to be fully compatible with existing engines and infrastructure to directly replace or supplement fossil fuels for cars, trucks, and airplanes.

Investing in the renewable and alternative energy industry will create jobs and local prosperity, especially in rural communities.

**The USDA National Institute of Food and Agriculture** (NIFA) has invested \$156 million in seven projects across the US to assist with the research and development for regionally-based advanced biofuel industries.

These projects are addressing biomass feedstock production, transportation logistics, conversion technologies, and associated impacts on agricultural and forestry markets, rural communities, and ecosystems.

**The NIFA Agriculture Food and Research Initiative** (AFRI) projects are developing regional systems for the sustainable production of biofuels (e. g. bio-jet fuel and diesel), biopower (heat and electricity), and biobased products.

These seven projects involve: 26 land-grant universities; 6 other public universities; 1 regional consortia of community colleges; 2 non-profit organizations; 10 federal agencies; and 28 private industry partners.

# USDA Funded AFRI Biofuel Projects

## Grass-based



Led by Louisiana State University AgCenter, SUBI is planning to use existing refinery infrastructure in the Southeast to convert energycane and sweet sorghum into biofuels and bioproducts.



Energycane is being grown in Louisiana as a biofuels feedstock.



## cenusa bioenergy

Led by Iowa State University, CenUSA Bioenergy is investigating a Midwestern system for producing biofuels and bioproducts using perennial grasses grown on marginal lands. The system improves agricultural sustainability as the perennial grasses reduce nutrient runoff and increase soil carbon sequestration.



CenUSA, IBSS and NEWBio are researching switchgrass, which can be baled and stored for future use.

## Grass and Wood-based



The Northeast Woody/Warm-season Biomass Consortium (NEWBio) is led by Penn State University. NEWBio is investigating a variety of feedstocks including shrub willow, switchgrass, and miscanthus for advanced biofuels.



Shrub willow can be planted on idle lands in the Northeastern US and harvested with a forage harvester.



In the Southeastern US, IBSS is led by the University of Tennessee with the purpose of working on solutions to produce sustainable biofuels and bioproducts from pine, poplar, eucalyptus, and switchgrass feedstocks.

## Wood-based



Advanced Hardwood Biofuels Northwest (AHB), led by the University of Washington and is working to prepare the Pacific Northwest for a biofuels industry. Potential fuels include diesel, bio-jet fuel, and gasoline.



Biofuels and bioproducts can be produced from poplar chips.



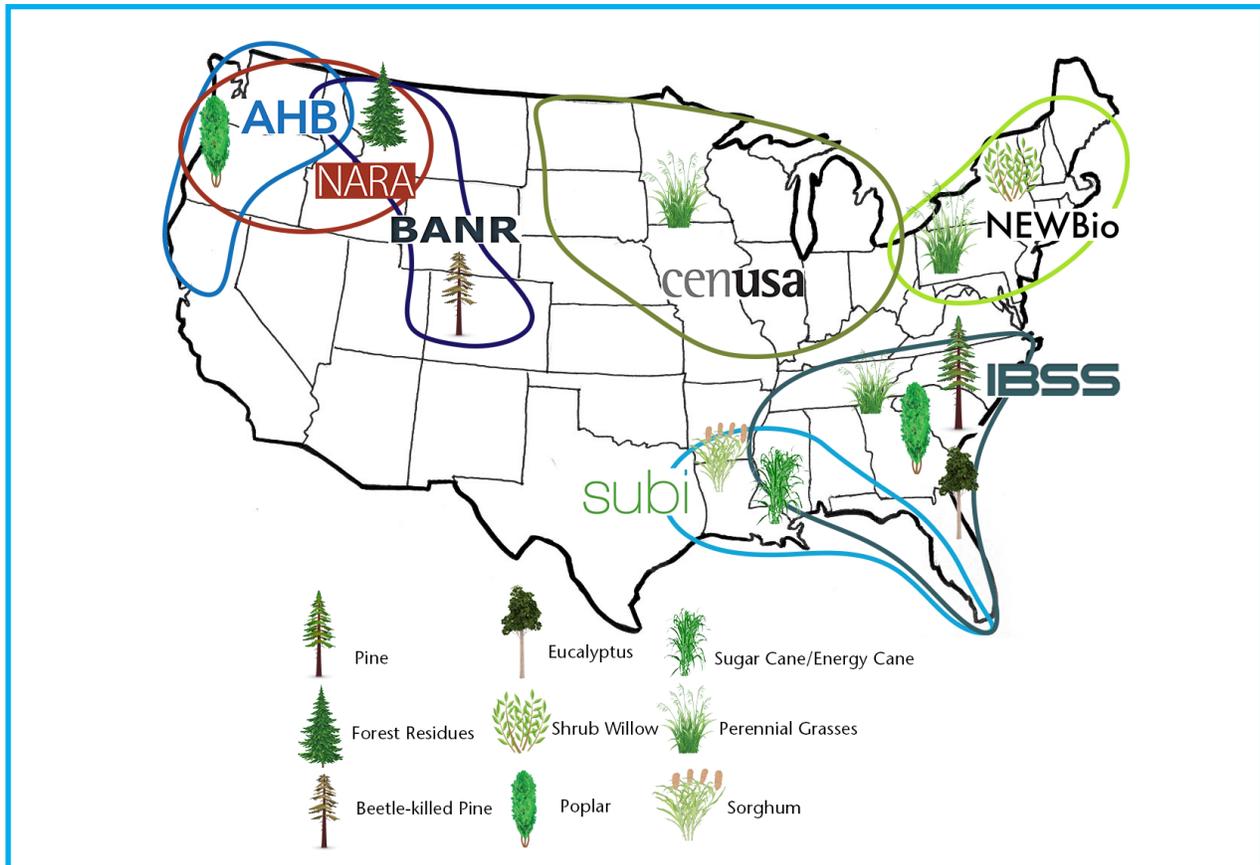
The Bioenergy Alliance Network of the Rockies (BANR) is led by Colorado State University. BANR is investigating use of insect-killed trees as a sustainable feedstock to produce biofuels and biochar.



Northwest Advanced Renewables Alliance

Led by Washington State University, NARA is focused on providing a wide range of research and analyses for a developing industry that converts forest residuals into bio-jet fuel and other co-products.

# AFRI Biofuel Feedstocks and Project Locations



## Forest Residuals

Forest residuals include left over wood from timber harvest as well as trees that have died from insect infestations.

In the Northwest, there is a significant amount of logging residuals as well as wood waste from municipal solid waste sites.

In the Rocky Mountain states, many trees, especially pines, have died from beetle infestations and are available as biofuel feedstock.

## Short Rotation Woody Crops

Trees grown on short rotations as woody crops include poplars, shrub willows, eucalyptus, and pine.

Poplars and shrub willows can be harvested every 2 to 3 years and grow back after harvest.

Eucalyptus are grown for 5 to 8 years and pine for 15 years or more before harvesting using traditional timber methods. These species are replanted for subsequent harvests.

## Energy Grasses

Grasses that can be grown for bioenergy crops include sugarcane, sorghum, and perennial grasses such as switchgrass and miscanthus.

Sorghum and sugarcane can only be grown in the Southern US. Energy cane is a wild cane sugarcane hybrid and can withstand colder climates.

Both switchgrass and miscanthus can grow in the midwest and northern parts of the U. S.

# AFRI Biofuel Research, Education, and Outreach



Researchers investigate soil greenhouse gas emissions, students engage in team-building, and landowners learn about the possibility of growing bioenergy crops.

**Research** focuses on all aspects of growing, transporting, and converting a variety of feedstocks for advanced biofuels and additional co-products such as acetic acid and biochar.

Sustainability research includes environmental concerns (soil, water, air quality, pollinators, and wildlife), economic analysis of industry feasibility, and social concerns of the new industry for growers and local communities.

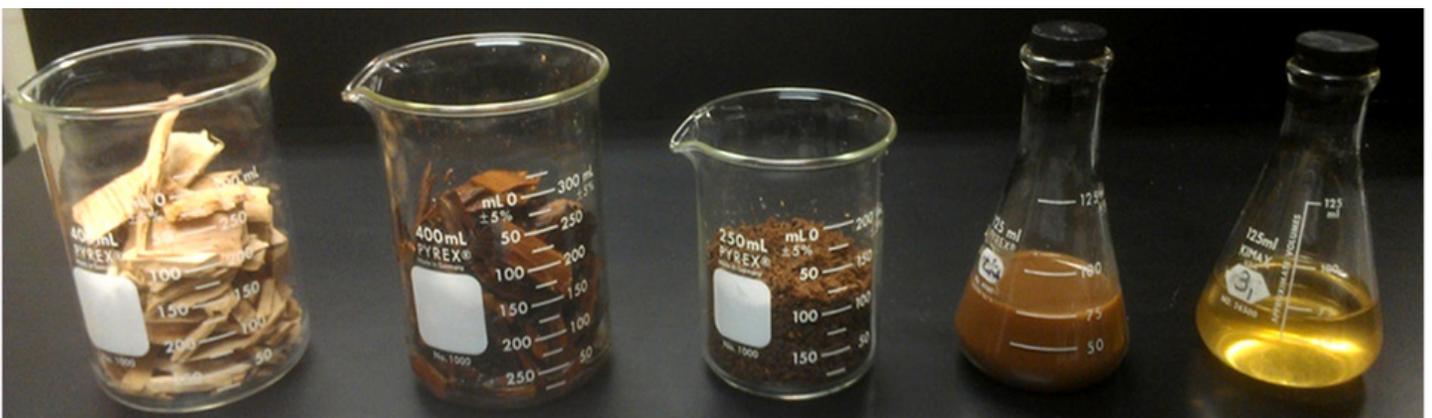
**Education** programs increase bioenergy literacy and build a trained workforce for the new bioenergy industry.

K-12 programs include teacher workshops and a comprehensive bioenergy curriculum.

Undergraduate and graduate students do bioenergy research and may also receive internships in the bioenergy industry.

**Extension** programs provide research-based information to inform stakeholders. The seven AFRI projects work together to spread information on growing crops for bioenergy and how communities can be involved in the new industry.

Information is communicated through websites, webinars, videos, social media, publications, field tours, and eXtension.org, a national extension website.



The AFRI projects focus on the necessary research for developing non-food feedstocks and the conversion technology to produce liquid transportation fuels and other co-products.