The Sun Grant Intitaitive and Sustainable Biomass Production Systems

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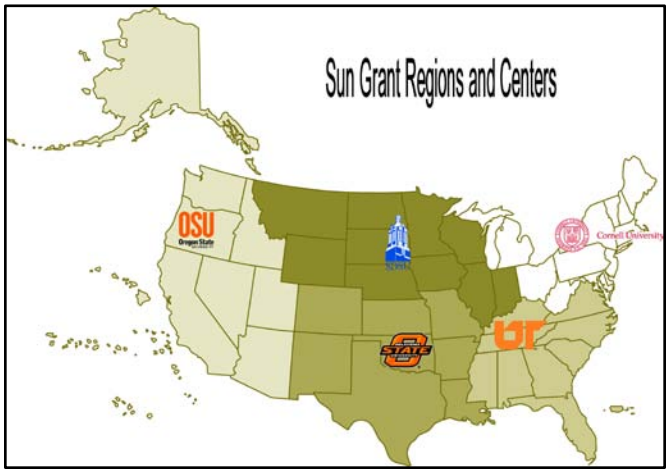
The Sun Grant Initiative is a national program authorized in The Food, Conservation and Energy Act (Farm Bill) of 2008 and receives financial support from the U.S. Department of Energy, U.S. Department of Transportation, and U.S. Department of Agriculture. This initiative engages land-grant universities in partnerships with federal/state agencies and industry to: enhance national energy security through the development, distribution and implementation of bio-based energy technologies; promote bio-based diversification and environmental sustainability of America's agriculture; and promote opportunities for bio-based economic diversification in rural communities. There are 107 universities in the land-grant system with at least one institution in each state and U.S. Territory. The Sun Grant Initiative established 5 Regional Centers (Oregon State University, South Dakota State University, Oklahoma State University, Cornell University, and the University of Tennessee) to facilitate communication and interaction with the land-grant universities. Each Regional Sun Grant Center conducts a competitive research grant program focusing on topics relevant to their region. The 5 Centers coordinate their regional grant programs to provide a balanced research portfolio addressing national issues. Sun Grant research is conducted with federal dollars thus all inventions will be disclosed and an active attempt will be made to commercialize each invention under the rights and obligations of the Bayh-Dole Act.



Land-grant universities and the land-grant system have a successful track record in conducting multidisciplinary, systems research that employs new developments in technology. Current production levels of food, feed and fiber are the result of collaborations among agronomists, biologists, economists and engineers. Many of the research grants funded through the Sun Grant Initiative are capitalizing on these multi-institutional, multidisciplinary teams. One key focus of many of these grants is sustainable biomass feedstock supply systems.

One component of a sustainable biomass feedstock system is species diversity. A diversity of plant species across the landscape reduces the probability of total crop failure due to insects, disease or weather event. Thus it was determined very early that the best biomass production system is very location dependant. The selection of best species and production system depends on where you are within a geographical region. Sun Grant funded research is currently investigating optimum feedstock production systems across a landscape. Plant species selection is based on location, landscape position and soil conditions. There are

Perennial, often native, plants that can out produce switchgrass (the model bioenergy crop) on certain lands. Prairie cordgrass would be an excellent example. Research at South Dakota State University has documented prairie cordgrass substantially out yielding switchgrass on marginal land that is wet and/or saline (salty). Mixed species at particular landscape positions are also under evaluation.

Carbon and nutrient cycling are also key components of a sustainable biomass production system. The importance of soil health or quality and the role carbon plays in an agro-ecosystem became very evident during the 1930's. Tillage of the native prairie led to the rapid loss of half the carbon stored in the soil system. This carbon was the cement holding soil particles together helping to prevent loss or soil erosion. When drought conditions prevailed, vegetation, which also protected the soil, was lost leading to accelerated wind erosion. Extensive research on farming systems since that time has lead to advances such as no-till planters and improved herbicides that have helped to restore some of the soil carbon lost by the "breaking" of the prairie. These new farming systems have restored twenty percent of the lost soil carbon in some areas. There is understandable concern that utilizing biomass for biofuels will lead to the same outcome as the drought conditions in the 1930's. Many of our Sun Grant funded research projects are quantifying changes in soil carbon sequestration when crop residues and energy crops are removed for biofuel production. Production management guides that optimize biomass production while preserving the soil resource are being developed from this research. Also several research projects are investigating alternative cropping systems that will allow increased biomass removal with increases in soil carbon sequestration. The carbon rich soils of the prairie were formed under ecosystems where above ground biomass was frequently removed by fire and large herds of bison.

A sustainable biomass production system has to also consider the feedstock conversion system it is supplying. The Sun Grant Initiative is supporting several research projects investigating low cost, small scale, thermo-chemical conversion systems that produce bio-oil or pyrolysis oil. These systems lend themselves to a distributed pre-treatment/conversion before large-scale refining model. The pre-treatment can be done close to the feedstock source allowing the by-product, biochar, to be cost effectively returned to the soils that produced the feedstock. The bio-oil can be stored and shipped to a large-scale biorefinery. Biochar contains most of the minerals (plant nutrients) from the original biomass feedstock and stable carbon compounds. Returning biochar to the soil should allow more biomass to be harvested without degrading the soil resource.

Other Sun Grant research projects are investigating technologies to density biomass for direct shipment to a large-scale biorefinery. Biomass is too bulky and light weight to be shipped cost effectively without densification. It will be less feasible for nutrients and carbon to be cycled back to the soil in this type system. The biorefinery would probably be designed to utilize all of the biomass feedstock thus minimizing by-products. The feedstock production systems supplying these conversion facilities would have to adjust their production system to retain more carbon in order to maintain their soil quality and thus remove less biomass.

I am confident sustainable biomass production and conversion systems will be developed that preserve our soil resource and sequester more carbon while providing food, feed, fiber and fuel.