Land Stewardship Project Fact Sheet #14

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Biofuels—Sustainable Energy from the Land

Grain-based ethanol is getting a lot of attention, but biofuels based on perennial plant systems may hold the key to sustainable energy security.

The biofuels boom

Producing fuel from corn-based ethanol is creating a lot of excitement these days. Promoters say ethanol can help wean the U.S. off its dependence on foreign oil, while reducing emissions of greenhouse gases and other pollutants. It's become clear in recent years that true energy security will only be accomplished through a combination of strategies, including significant increases in energy conservation in the general economy as well as agricultural production systems. It has also become clear that corn-based ethanol is only an interim step in creating a biofuel system that is environmentally sustainable in the long term.

Cellulosic biofuels

There are alternatives to corn-based ethanol that show great promise environmentally and economically. One of the most exciting areas of biofuel research and development is something called cellulosic energy. Whereas corn ethanol is made from the actual grain of the corn plant, cellulosic fuels can be cooked up from the other parts of a plant, such as the stalks of grasses and the woody material in trees.

Making native perennial grasses, forbs and woody plants into cellulosic biofuels could provide many long-term environmental benefits. Besides protecting the soil year-round, such stands could store carbon and provide excellent wildlife habitat, while conserving water and improving its quality. For cellulosic biofuels to be environmentally and financially sustainable, perennial plant systems must play a major role.

Diverse landscapes, not just monocrops

Research out of the Department of Energy's Oak Ridge National Laboratory shows that making fuel from switchgrass could be 15 times more energy efficient than corn-based ethanol.[1] But planting monocrops of switchgrass isn't the ultimate answer. Monocrops, including grass, usually must rely on chemical inputs such as petroleum-based fertilizer to stay viable year-after-year.

Diverse stands of grasses and forbs which replicate the native prairie ecosystems of the past, on the other hand, can be self-supporting for decades, according to David Tilman, a University of Minnesota ecologist who has been working with an interdisciplinary scientific team to research how biofuels can be produced in environmentally and economically sustainable ways. The excess biomass would be harvested in the fall for energy, leaving a permanent stand of perennial plants as ground cover and a future source of growth. This could be done on marginal farmland without high amounts of fertilizer, pesticides and energy, says Tilman. Cellulosic energy could offer a way for working farmland to produce numerous ecological, economic and energy-based services. Integrated farming systems, rather than individual techniques and practices, are needed to provide sustainable energy production that reduces the production of greenhouse gases.

A Tilman study featured in a recent issue of the journal *Science* found that 51 percent more biofuel energy per hectare was produced by a diverse mix of native grasses when compared to corn-based ethanol. The research also found that highly diverse plots of grasses containing such species as goldenrod, Indian grass, big bluestem and switchgrass yielded 238 percent more energy than stands consisting of just one species. These stands were more energy efficient because they were grown without fertilizers and other energy-intensive inputs. And since grasses are perennials, they grow back year after year on their own, eliminating the energy and other resources that go into planting them each spring.[2]

Good for the climate & water

Diverse stands of perennial grasses that are used for biofuels actually soak up and trap more carbon than they produce, a result that's catching the attention of scientists concerned about how carbon and other greenhouse gases are affecting the global climate. Such plant systems also cut greenhouse gases by avoiding or significantly reducing the use of nitrogen fertilizers.

Another benefit of utilizing perennial plants as biofuels is that it could dramatically improve water quality in rural watersheds. A modeling study conducted on two Minnesota watersheds found that land use changes such as establish-

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ment of more perennial plants reduced the amount of soil sediment eroding into a local waterway by as much as 84 percent. These land use changes also produced other water quality benefits. By getting more perennial vegetation on the land in the form of grasses, hay crops and trees, water runoff was reduced as much as 35 percent in both watersheds. That meant more water was percolating into the soil and less was rushing to the waterways, carrying soil and other contaminants along the way.[3]

Hurdles remain

It should be noted that there are many questions to answer about how perennial plant cellulosic fuel production will fit into current farming systems. For example, could stands of native perennial plants and forbs planted for biofuel production also be used for grazing livestock?

And much research and development is needed before cellulosic energy production is viable on a widespread, commercial basis. The process used in cellulosic-based digestion is more complicated than making ethanol out of corn. However, there are other processes such as gasification and burning that may be feasible sooner.

Local plants, local benefits

In comparison to corn grain, grass and other biomass is more difficult to transport long distances in an efficient manner. However, such a "problem" could also be to the benefit of rural communities, as it would then require the establishment of many smaller community-based cellulosic plants, rather than a handful of mega-operations. Such a model of many smaller plants would allow more communities to enjoy the economic benefits of biofuel and feedstocks for other bio-products such as plastics or fibers for clothes.

Iowa State University researchers have found that local ownership can make a big difference in what kind of impact biofuel plants have on an economy. For example, a new corn ethanol plant that had no local ownership created or stimulated 133 jobs in the regional community. But then researchers studied other ethanol plants in Iowa that had an increasingly bigger percentage of local ownership. They found 29 more jobs would be created for every 25 percent increase in local ownership. For a firm that had 27 percent local ownership, the local ownership dimension accounted for 47 more jobs, according to the study. For a plant that was 63 percent locally owned, the local ownership dimension added 80 more jobs.[4]

Whether the fuel is being produced from corn or grass, local ownership's positive impact is an important point to keep in mind as ethanol's profitability makes it increasingly attractive to outside investors, some from as far away as Australia and South Africa.

State & federal policy changes can help

State and federal policies could help promote critical research into and development of cellulosic biofuel systems. Good policy could also help avoid the problems that come with concentration of ownership and management when it comes to biofuel facilities.

A major focus of the 2008 federal Farm Bill will be the role agriculture can play in producing biofuels. The Land Stewardship Project supports establishing in the Farm Bill sustainability criteria to guide all conservation and energy title programs that are designed to develop and promote the use of agriculturally-based renewable energy.

States like Minnesota can be leaders in developing and promoting renewable energy that is community-based and that benefits farmers, the environment and rural communities. During the 2007 session of the Minnesota Legislature, the Land Stewardship Project supported creating a "Renewable Energy Standard" of 25 percent renewable energy by 2020. The Land Stewardship Project also supports funding research and demonstration projects related to cellulose based energy.

How you can make a difference

To learn how you can make your voice heard on promoting federal policies that support sustainable, farm-based energy production, contact Adam Warthesen at 612-722-6377 or adamw@landstewardshipproject.org. On the state level, contact Bobby King at 612-722-6377 or bking@landstewardshipproject.org.

Sources

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This fact sheet is brought to you by the members and staff of the Land Stewardship Project, a private, nonprofit organization devoted to fostering an ethic of stewardship for farmland and to seeing more successful farmers on the land raising crops and livestock. For more information, call 651-653-0618 or visit www.landstewardshipproject.org.