Will Plants Run Your Car?

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There is debate in the scientific community about the role of biofuels in mankind's future energy supplies. At first glance biofuels might seem like a good idea for solving dependence on foreign oil, while producing lower net greenhouse gases than petroleum. Further, large-scale biofuel production promises guaranteed domestic agricultural markets. However, there are several reasons to be skeptical about biofuels as an answer to the energy needs of our country and planet.

Current and future energy demands are great, but the efficiency of biofuel energy production is not. It is estimated that biofuels produce between 1.3 and 3.2 units of energy for every unit used. This low efficiency means that there will be little net gain for the effort expended and little reduction in the production of greenhouse gases. Recent research suggests that nitrous oxide entering the atmosphere as a result of using nitrogen fertilizer to produce biofuel crops will contribute more to global warming than the amount saved by using less fossil fuel. Furthermore, the most efficient crops are those that require the best agricultural land and the most fertilizer. Large-scale biofuel production will also likely result in an increase in water pollution due to increased use of fertilizer and pesticides for raising crops such as corn and soybeans. They also require significant water to produce the fuel, frequently six gallons of water for each gallon of biofuel produced. Biofuel proponents argue that residues from biofuel production, such as distilled grain and soybean meal, can be used for livestock feed. However, producing even 10% of current energy demand in the U.S. would generate almost 40 times the livestock feed currently used. Clearly the byproducts of large-scale biofuel production must be considered a serious waste disposal problem rather than a benefit at this time.

The biggest issue with large-scale biofuel production revolves around land. Large tracts of land will have to be diverted from other beneficial uses. Producing fuel from crops such as corn, sunflowers, and soybeans will divert land from food crops with a resulting reduction in food security. Some estimates suggest that providing fuel for one average U.S. automobile for one year would require three tons of grain. Latin America, particularly Brazil, Bolivia, Argentina, and Columbia, have potential to greatly expand their agricultural frontiers, but unfortunately this would come at the expense of native forests and grasslands, including some of the world's biodiversity hotspots. A recent report by the United Nations Food and Agriculture Organization (FAO) indicates that biofuel could provide economic opportunities in developing countries if it resulted in an increase of small producers. However, the FAO notes that expansion in biofuel production will most likely result in an increase in local crop prices and a transfer of income from poor urban people to wealthy large-scale farmers.

Large-scale biofuel production will likely also have significant ramifications for the Northern Great Plains of eastern Montana and adjoining states and provinces, even though this region does not have either the climate or irrigation to raise corn, soybeans, or other highly productive biofuel crops. In fact, nearly 80% of Montana's cropland is considered highly erodible by the Natural Resources Conservation Service due to low annual precipitation and potential for wind erosion. Most of our remaining native rangeland also falls into this "highly erodible" category. A great deal of highly erodible land was plowed up nearly 100 years ago and then abandoned during the dust-bowl years when the climate became hotter and drier. Since then, farmers have continued to sodbust native rangeland whenever markets allowed for a profit on dryland crops. These profits were always short-lived however, because the topsoil was thin, and wheat markets are cyclical. The Government Accounting Office reports that 25 million acres of grassland were converted to other uses, primarily cropland, between 1985 and 2003. Conversion continues unabated across the northern plains according to the Farm Service Agency, with over 100,000 acres of grassland

converted to cropland in North Dakota since 2003, and over 26,000 acres converted in Montana the past three years. Now much of this marginal cropland, that should never have been broken in the first place, has been planted to low-diversity grasslands under the Conservation Reserve Program (see *Kelseya* Vol.8, No.3 ; 1995).

Even though Montana will never be a significant source of highly productive biofuel crops such as corn, we have more to lose than many other parts of the Great Plains. Increased demand for biofuel crops and the concomitant higher prices will spark an increased demand for wheat and other dryland crops to replace them in human and domestic livestock diets. In addition, biodiesel can be made from dryland crops such as camelina (*Camelina sativa*). As a result, biofuels are being touted as an economic boon for the Montana farming sector, and they might be in the short-term. However, it should be remembered that the sodbusting of the early 20th Century was also a short-term boom that resulted in a long-term loss due to soil erosion and the cost of reclaiming the land to perennial grass. Biofuels may seem like a good idea right now, but the greenhouse gas emissions, fertilizer use, waste disposal, and food security problems make large-scale biofuel production unsustainable. Humans already appropriate 40% of the earth's biological productivity. Further agricultural disturbance is untenable because natural ecosystems provide critical support for all life on the planet. Because of these problems, a short period of biofuel glory days will likely be followed by a decline in demand and production as better, non-polluting energy sources come on line. Marginal cropland will again become idle and in need of restoration. We could be at the beginning of another round of sodbusting and loss of one of Montana's most precious resources, native prairie.

It is possible that native grasslands could be used for biofuel production. David Tilman at the University of Minnesota proposes that biofuels derived from native grassland hay could provide more energy and greater CO2 reductions than corn-based ethanol or soybean-derived biodiesel without fertilizer or significant

changes in food security (*Kelseya* Fall 2006). His predictions are based on studies showing that high-diversity grasslands sequester more energy per acre than grasslands with one or two species. Furthermore, native grasslands store more carbon in the soil than crops that require annual tillage. If the technology can be developed to extract the energy from native hay, we can produce biofuels with little loss of native habitat and the services it provides.

Most ecologists familiar with the issue agree that biofuels can never be expected to supply more than a small part of our energy. Long-term solutions to humanity's future energy needs must be based on two strategies: non-polluting sources of energy such as solar and wind, and conservation. We will have to live in smaller houses and drive smaller, more fuel-efficient vehicles. We may have to drive less, and we may have to turn down the thermostat and put on a sweater. Native prairie is one of the most endangered ecosystems in North America. Numerous plants and animals depend on this habitat to persist. It is important that any legislation promoting biofuel production also carry provisions to protect native prairie from sodbusting. Whatever role biofuels play in our energy future, it is not worth trading the loss of native prairie ecosystems for a short-term economic surge.

Further reading:

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