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# Native Kenyan Grasses as Biofuel

In a State of the Union Address President Bush proposed a thirty-five billion-gallon mandate for alternative fuel production within a decade. The rush to build corn-based ethanol plants is starting to transform agriculture. So much so, that I believe using food as fuel is going to severely affect the world's food supplies. This will be especially disastrous in developing countries such as Kenya. I am not the only one to watch with dismay as ever-greater amounts of the world's grain are turned into motor fuel. Norman Borlaug stated in an interview, "Biofuel isn't going to solve our energy problems and it's going to disrupt our food system." As the world struggles with the proper balance between food production and fuel production we need to seek greater investment in alternative energy. "What we should have done is to spend much more research on many different sources of energy, and we neglected that," Said Borlaug, "If we have to start with grain, that's very different than starting with wood chips." I believe that growing diverse mixtures of long-lived, deep-rooted native plants on damaged, unproductive farmland; along field margins, in areas that are difficult to farm or on low-yielding soils and burning these mixtures as grass pellets can provide subsistence farmers in Kenya with the fuel they need. This type of Natural Systems Agriculture is a viable alternative to petroleum based or grain based fuel. I believe that American agriculture faces a great opportunity to provide agricultural science and innovation to help move this technology from its beginning stages to become a viable energy source for subsistence farmers in Kenya.

Kenya is located in Eastern Africa. It faces the Indian Ocean. Kenya's temperatures range between tropical along coast to arid in the interior. Large sums of people in Kenya are poor subsistence farmers; making on average Two hundred seventy one dollars per year. According to the FAO Corporate Document Repository, forty-seven percent of households live on only one and a half acres of land. Making the most profit out of the land they have is essential for the survival and well-being of these subsistence farmers. A typical Kenyan farmer would grow posho beans, kale, and sweet potatoes. It is common throughout Kenya for the women to work in the fields, tend the children, and cook. The work in the fields is usually done manually, since machinery is too expensive for most rural communities.

With the human population and the poverty still on the rise, feeding and providing enough income to support all these people will be a real challenge. "Kenya's average rate of population growth for the past thirty years has been over three percent a year," said UNICEF spokesman, Michael Bociurkiw. Families have on average four or five children, and having an entire family in a one room house is very common. With all the people each family is supporting on such little land, it is not surprising that FAO states about seventeen million households earn on average twenty-six cents in United States dollars per person per day

Agricultural innovation is becoming a necessity in Kenya. There is not enough land to let fields recover from last years crops. Fertilizer is too expensive for the subsistence farmers to use, so the soil gets poorer and less fertile. Because of this, problems like soil erosion and having negative nitrogen balances are becoming more and more common among small family farmers. In 2006, Kenyan farmers were affected by heavy flooding that washed away precious top soil. Another big issue in Kenya is the continued drought that has made it hard to produce good yields. Severe climate change has also made marginal land unfarmable for crops that are typically grown.

Global Warming has intensified this drought significantly and the increasing emissions of carbon dioxide in the world are only encouraging this problem. At this point environmentally friendly energy is mostly unavailable in Kenya. Cost of alternative energy is what prohibits these energy forms.

Kenya has lost indigenous species, and vital ecosystems and habitats from its growing rate of deforestation. Fuel wood and charcoal constitute 95 to 98 percent of the total energy used by families for cooking, heating, and lighting in Kenya. This is detrimental to the land and its people. "The Effects of Wood fuel Consumption in the ASAL areas of Kenya and the Case of Marsabit Forest found that wood for fuel harvested was approximately 56,000 tons per year. This dependence on wood fuel along with the fact that Kenya's average rate of population growth for the past thirty years has been over three percent a year has put enormous pressure on the land and its people. The poor are having a harder time finding the fuel they need for daily use. It is taking more of their time and resources to forage or pay for this energy source.

The use of fuel wood is also found to be detrimental to the environment. The United States is second only to China in carbon dioxide emissions. It is almost embarrassing to put this in because Kenya's total emissions in 1998 was 9,131 versus the world at 24,215,376 thousand metric tons. But the fifty-seven percent increase in Carbon Dioxide Emissions in Kenya over the past eight years is alarming, and every country and individual must do their part to lessen their impact on the World.

I believe that growing diverse mixtures of long-lived, deep-rooted native plants on damaged, unproductive farmland; along field margins, in areas that are difficult to farm or on low-yielding soils and burning these mixtures as grass pellets can provide subsistence farmers with the fuel they need while saving the Kenyan forests.

Burning grass for energy has been a well-accepted technology in Europe for decades. "Burning grass pellets as a biofuel is economical, energy-efficient, environmentally friendly and sustainable", says Jerry Cherney the E.V. Baker Professor of Agriculture at Cornell University. Cherney pointed out that grass biofuel pellets were much better for the environment because they emit up to ninety percent less greenhouse gasses than oil, coal and natural gas do.

This system of using native Kenyan grasses as fuel pellets appears to accurately fit the definition of a 'soft energy path', because it is not only powered by a renewable source of energy; but it provides power sources which are multiple, small-scale and local rather than few, large-scale and distant. It is also flexible and a comparatively low technology system.

In May of 2006, David Tilman and two colleagues published a paper in *Nature* that proved that ecosystems containing many different plant species are not only more productive, they are better able to withstand and recover from climate extremes, pests, and diseases over long periods of time. "Diverse prairie grasslands are 240 percent more productive than grasslands with a single prairie species," says Tilman a Regents Professor of Ecology in the College of Biological Sciences which operates the Cedar Creek field station. "That means that if a plot with one or two plant species produces one hundred pounds of vegetation a year, a plot with sixteen species will produce three hundred and forty pounds. This huge advantage comes when you plant numerous grasses and legumes and various prairie flowers together." Experiments now under way in Germany and the Netherlands are yielding similar effects of diversity on yields, says Tilman, even though they use totally different species. Also because prairie plants are perennial, they would not have to be replanted year after year. Prairie plants also have far more root mass than annual crops such as corn. These roots store nutrients and are a buffer against climate variations.

Andrew D.Q.Agnew wrote a book called *A Field Key to Upland Kenya Grasses.* For each of the four hundred and sixty species the life form, size, habitat and biogeographic zones in which it occurs is

indicated as far as are known. This resource along with KARI which is the Kenya Agriculture Research Institute could be consulted to see which mixtures of grasses would yield the greatest mass.

Using farmland year after year for annual crops depletes the soil's organic matter, steadily reducing fertility. This is especially catastrophic for small subsistence farmers like those in Kenya who can't afford the nitrogen fertilizer to replenish their soil. Native perennial grasses would add organic matter because the plants extend nearly as far below the ground as above. With its network of stems and roots, the native grasses would hold onto soil even in the dry season to prevent erosion.

Besides helping slow runoff and anchor the soil, native Kenyan grasses can also filter runoff from fields planted with traditional row crops. Buffer strips of these native grasses planted along stream banks and around wetlands could remove soil particles, pesticides, and fertilizer residues from surface water before it reaches groundwater streams.

Native Kenyan grasses would also remove carbon dioxide from the air as it grows; it has the potential to slow the buildup of these greenhouse gases in Earth's atmosphere. Unlike fossil fuels which simply release more and more carbon dioxide that's taken approximately seventy million years to make.

"Energy return on energy invested," is EROEI. This is how much energy we "earn" for every unit of energy we "spend" to get it. Gasoline's EROEI is between six –to-one and ten-to-one says Cutler Cleveland, director of the Center for Energy and Environmental Studies at Boston University. In other words, we get anywhere from six to ten gallons of gasoline for every gallon we use to find oil, pump it out of the ground and refine it. The EROEI of corn-based ethanol is 1.34-to-1. Native Kenyan grasses can be converted to usable heat at over eighty percent efficiency with an approximate EROEI exceeding ten-to-one if it does as well as native North American grasses which have been researched.
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The most affordable biomass pellet machine that I could find was from Pellet Pro's. Of those available probably the most useful was the Portable Mill Model PP650D with a production capacity of six hundred and fivty pounds per hour and a fuel usage of about 1 and a half liters per hour. It could be brought from location to location and has a price of four thousand United States dollars. This could be bought by a village or group of farmers and moved to different locations based on need. This also may be a great small loan option for a family, who would charge a small amount for the use of the mill. Churches and civic organizations may want to "adopt" a village and provide a mill for those villages that come up with an equitable plan for it.

Research for sustainable biofuels and the money to make it happen are plentiful in the United States. It is our responsibility as citizens of the world to make this research available to third world countries like Kenya.

As previously stated, on January 23, 2007 President Bush proposed a thirty-five billion-gallon mandate for alternative fuel production within a decade in his State of the Union address. Bush in the farm bill proposal included one point six billion for next generation biofuels like those from prairie grasses. I believe the United States has the facilities already in place to take this research to the next level. Wes Jackson and the Land Institute is a Kansas based nonprofit that's purpose is to encourage collaboration of Natural Systems Agriculture. The USDA Agricultural Research Service is conducting research on switchgrass as a biomass energy crop at several facilities across the United States. The United States Department of Energy has a program at the Oak Ridge National Laboratory. It has assembled a team of scientists to lay the groundwork for this new source of renewable energy. David Tilman and the University of Minnesota are performing experiments on grass biofuel at the Cedar Creek field station. North Dakota State University Research Extension has facilities in place to research biomass for energy production. This is not an exhaustive list of all the research that is going on right now

concerning native grasses as biofuels. The research that is going right now has a tremendous opportunity to help biofuel production in Kenya. I suggest that one of the greatest helps would be to get findings to organizations like Kenya Agricultural Research Station that is already set up there, and give them a grant to teach local farmers about this renewable energy alternative. Kenyan farmers do not have access to new and innovative technology because most do not have access to the internet.

Each of the four hundred and sixty known species of Kenya grasses has a certain biomass. One other thing that researchers in the United States could do is some of the preliminary research on these grasses. Questions like how much biomass each species produce; the suitability of these perennial forages for biofuels; the longevity of the grass species being tested; which combinations of Kenyan grasses would provide the best output are some of the research that could be done here in controlled situations. It might even be some great high school science fair projects that would have real world implications.

With biofuels coming to the forefront, American agriculture faces the greatest opportunity of this generation to lead a future in which we get our energy by the bushel and not by the barrel. In North America, the big focus of biofuel production has been ethanol, made from corn. The rush to build corn-based ethanol plants has started to transform agriculture. In the United States if things continue to unfold as they are now, the price of meat and corn-based products are going to sky-rocket. This turning food into fuel would be devastating to subsistence farmers in third-world countries. In Kenya, expensive sources such as coal and other crude sources are being used for power. Another large source for power is wood. This, along with the increased amount of land needed has really had a negative effect on Kenya's biodiversity. Many animals have become endangered and at risk of extinction because their habitats are being destroyed to provide power to this growing country. If only there was another way to provide fuel to the people of Kenya that would be more environmentally friendly? Fortunately, there is another way; the answer is a different kind of biofuel. It is a natural component, renewable and relatively easy to produce. Kenya is sub-tropical in climate and does not grow corn as a regular crop, but thankfully that is not the only crop that can be used as a bio fuel. Why not use a plant that has been growing and thriving in Kenya for generations such as native Kenyan grasses? There has already been research done on switch grasses being used as a bio fuel. I think that further research into this idea would not just be helpful, it could be the key to providing environmentally friendly energy, and a high profit crop to the country of Kenya. This would reduce the need for wood fuel and could help to save Kenya's forests.

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