DON'T LOG THE FORESTS FOR THE FUEL:

A POSITION PAPER ON THE POTENTIAL ENVIRONMENTAL AND ECONOMIC IMPACTS OF THE CELLULOSIC ETHANOL INDUSTRY IN THE SOUTHERN UNITED STATES

By Scot Quaranda
Research Assistance by Mollie Petersen, Siara Cowan and Kathryne Crane

DOGWOOD ALLIANCE

A report by the Dogwood Alliance
POB 7645, Asheville, NC, 28802
www.dogwoodalliance.org

We live in a rapidly changing world in which the cumulative impacts of 200 years of industrialization and population growth are catching up with us in the form of global climate change. Add to this our ever growing need for energy to support our Western lifestyle and the continuously growing global population and we are setting ourselves up for an ecological nightmare unless dramatic changes are made in the short-term.

As oil prices climb and global demand threatens to overwhelm supply, we flail in the dark for alternatives to fossil fuels that will allow us to sustain current and growing levels of energy demand and keep the global economy humming. The list of solutions grows daily, with inventors and investors hoping to find the silver bullet. Some solutions seem hopeful and others do not. Add to that growing list a second generation biofuel, called cellulosic ethanol, which when looked at under close scrutiny is at minimum a false solution and, in the worst case scenario, a disaster for our forests that will exacerbate global climate change rather than combat it. Cellulosic ethanol is made by breaking down woody fiber and converting the byproduct into fuel.

We certainly are not suggesting that our current reliance on fossil fuels is a viable alternative. However, based on the inefficiency of the current production technology and its reliance on fossil fuels in production combined with the environmental and community impacts that will be outlined below make cellulosic ethanol a false solution. It should be set aside in favor of more positive solutions. Biofuel has served as a distraction and diverted funding which could have been utilized for more proven or promising technologies in the area of conservation and efficiency, solar, wind and hydrogen technology, and more.

The forests of the Southern U.S. are a global treasure. These forests house amazing levels of animal and plant biodiversity, provide unique locales found nowhere else in the world, comprise a large percentage of total US wetlands and store millions of tons of CO2 as plant based carbon. From the Appalachians to the Ozarks and from the coastal swamplands to the majestic upland hardwood forests of the Cumberland Plateau these forests have the potential to support a sustainable combination of wood products companies, forest-based tourism, and cultural resources for local communities for generations to come.

That potential has already been degraded by the massive footprint of the Southern paper industry and traditional industrial forestry methods. Now these forests stand on the brink of disaster. They are facing an energy industry that sees our forests as fuel rather than as the important communities that make up our biological and cultural heritage. This could push them over the edge.

Cellulosic ethanol, a product that will primarily be produced from the forests of the Southern US, is a short-sighted solution and should be avoided on a large-scale at all costs because the risks far outweigh the benefits. Not only will the cellulosic ethanol industry compete with an already unsustainable pulp and paper industry in the Southern US which is already firmly entrenched and hasmade huge capital investments in the region, it will also cause irreparable harm to the forests and communities of the region. This harm will come in the form of more forest destruction, unsustainable levels of water use in an already drought-stricken region, loss of critically

important carbon sinks, competition for land better served for food production, and opening the door to untested technologies with potential untold consequences.

In this paper, we will first provide a definition of cellulosic and other second generation biofuels and compare them to both fossil fuels and first generation biofuels like corn ethanol. We will then draw the connection between these fuels and forests and outline the potentially devastating environmental impacts including forest and habitat loss and degradation, increased greenhouse gas emissions, and the impacts on water quality and quantity. We will then take a closer look at community impacts including both increased competition with the pulp and paper industry and the impact on local quality of life. Next we will take a look at the economic impacts including bloated government subsidies. And we will conclude with a final analysis and potential solutions.

WHAT IS BIOFUEL AND CELLULOSIC ETHANOL?

Biofuel, agrofuel, alternative fuel, biomass fuels… we have all heard so many names for seemingly the same thing: fuels meant to lighten our dependence on foreign oil and significantly reduce greenhouse gas emissions. In this early stage of the search for alternative fuels there are many different competing technologies and fuels. It is important to begin by clearly defining the fuels most closely connected to forests: biofuel and cellulosic ethanol.

Fiber from crops and other organic material is used to make a wide variety of fuels. According to the Center for International Policy, "Agrofuels are combustible fuels made from organic material—plants or animal by products," while "Biodiesel is made of palm, soybeans, canola, or other plant oils; and cellulosic ethanol is made by breaking down fiber from grasses or almost any other kind of plants." (Carlsen, L, 2007) Cellulosic ethanol is made using either thermal or enzymatic processes.

Currently, in the United States the leading biofuel in production by volume is the heavily subsidized corn ethanol. (Koplow, D, 2007) U.S. farmers planted 8.8 million acres of corn to produce 2.9 billion gallons of ethanol in 2004. That equaled two percent of our total annual gasoline consumption (Pimentel and Patzek, 2005). Corn ethanol is still mixed with petroleum and harvested by tractors that must use gas, not to mention the use of 4-5 gallons of water for every 1 gallon of ethanol produced and pesticides on the crops, ethanol actually has a carbon debt of 93 years on land cleared specifically for planting. (Johnson, A, 2007) Abandoned cropland, according to a study in *Science*, has a carbon debt of about 48 years. So, instead of producing a 20% savings, corn-based ethanol nearly doubles greenhouse emissions over thirty years and increases greenhouse gases for 167 years. (Righelato, R and Spracklen, D, 2007)

While corn was the first crop to be tested and grown for producing ethanol on a large-scale in the United States, it wasn't difficult to determine that corn is a net energy and carbon loser. Now scientists have broadened their base of crops from corn and sugar, a crop widely used for fuel in Brazil, to what they call second generation biofuels that do not compete for food. The new ethanol feedstocks include algae, switchgrass, trees, and jatropha.

Research and development is focused on creating cellulosic ethanol from potentially any kind of organic material, although the main focus is currently on woody material and switchgrass. The technological challenge for cellulosic ethanol is the difficulty in separating out the carbohydrates (sugars) to be fermented to produce ethanol.

THE TECHNOLOGICAL HURDLES THAT ARE PRESENTED BY WOODY MATERIALS ARE:

- The separation of lignin from the cellulose and hemi-cellulose to make the material susceptible to hydrolysis.
- The hydrolysis of cellulose and hemi-cellulose takes place at different rates and over reaction can degrade the sugars into materials that are not suitable for ethanol production.
- The hydrolysis of these materials produces a variety of sugars. Not all of these sugars are fermentable with the standard yeast that is used in the grain ethanol industry. The pentose sugars are particularly difficult to ferment. (Environment Canada, 1999)

Additionally, "In the case of cellulosic ethanol, only the cellulose and hemicellulose are partially converted after being broken down to sugars. The lignin and other unconverted carbon compounds end up as (wet) waste, suitable for burning as process fuel only if thoroughly dried. Conversion is limited to those components which can be broken down into the right kind of sugars and fermented." (Rapier, R, 2006) This difficulty in separating the lignin from the cellulose is leading to research into reducing lignin in trees through genetic modification, which could open the proverbial Pandora 's Box of unintended genetic mixing of laboratory and wild trees.

No one is currently producing cellulosic ethanol on a commercial scale, though a number of companies claim to have perfected commercially viable ethanol-from-cellulose (EFC) processes, including Range Fuels, a company building an EFC production plant in Georgia that will utilize wood "waste" from existing wood products.

THE POTENTIAL ENVIRONMENTAL IMPACTS OF LARGE-SCALE CELLULOSIC ETHANOL PRODUCTION

Southern forests are one of the world's environmental jewels. Despite a long history of exploitation from various industries they house a wide-variety of species, unique forested ecosystems, and provide economic and aesthetic values for the people of the region. Southern forests house an abundance of plant and animal diversity and pristine watersheds. Many of the region's plant and aquatic species can be found nowhere else in the world.

Southern forests contain the highest concentration of tree species diversity in North America, the highest concentration of aquatic diversity in the continental United States, including one of the richest temperate freshwater ecosystems in the world, and the highest concentration of wetlands in the U.S., 75% of which are forested. (Wear, D and Greis, J, 2002)

The future of these magnificent forests and the people of the region whom have come to rely on them are seriously in jeopardy should cellulosic ethanol go into large-scale production. More forests will be cut down, a greater number of greenhouse gases will be released into the atmosphere, air and water quality will be compromised, and our already taxed water supply will be further depleted, threatening both our environment and quality of life.

IMPACT ON FORESTS AND WILDLIFE

Currently, the Southern US is the largest paper producing region in the world, providing nearly 15% of the world's paper supply. (Wear, D and Greis, J, 2002) The prices our forests have paid from a generation of paper production have been severe.

According to the US Forest Service, nearly six million acres of forests are clear-cut every year for paper production. (Wear, D and Greis, J, 2002) Included in that mix are some of our region's last remaining endangered forests. Unsustainable forestry has already pushed 14 forest community types to less than 2% of their original range. (Wear, D and Greis, J, 2002)

Additionally, nearly 43 million acres of our forests are sterile pine plantations (U.S. Forest Service, 2008) and countless pounds of fertilizers, pesticides and herbicides have been dumped on these plantations harming human health, wildlife and water quality. In fact there has been an 800% increase in the use of chemical fertilizers in plantations since 1990. (Wear, D and Greis, J, 2002)

The Southern US has the highest concentration of endangered species in the nation. Many of these species are forest dependent. Should we continue to expand forestry operations like clear-cutting and conversion of natural forests to plantations we will lose more habitats and therefore more species. According to Harvard biologist E.O. Wilson, a pine plantation is 90-95% less diverse than a natural forest. (Williams, T, 2000)

According to a recent piece by former EPA scientist John Laumer, "Because natural forests contain the highest amount of cellulose per hectare, and because the infrastructure and labor force needed for logging and chipping exists where significant harvests are already underway, regions already known for their forest products are likely to dominate initially in [Cellulosic ethanol] feedstock provision." (Laumer, J, 2007)

Imagine this already unsustainable level of forest management for the pulp and paper industry was combined with large-scale consumption for use in the production of cellulosic ethanol. Clear-cutting will increase well beyond current levels, threatening more of our already endangered forests. A greater level of conversion will occur, including the loss of natural forests to become fast growing tree plantations for use in production. More chemicals will be used and wildlife habitat will be lost at a much faster pace. Can we really afford to implement this false solution?

GREENHOUSE GAS EMISSIONS

A common misperception in the energy world is that ethanol does more good for the environment than bad. However, producing biofuel affects more than simply crops available for food. Besides destroying the habitats of thousands of animals, clear cutting forests releases thousands of pounds of carbon dioxide per year. According to a recent article in *Science*, the carbon sequestered by retaining existing forests and restoring degraded forests is greater than the emissions avoided by the use of cellulosic biofuels (Righelato and Spracklen, 2007).

Although biofuel producing companies claim that they are environmentally friendly and they will replant trees after they cut many down, the amount of carbon released outweighs the benefits. The amount of carbon absorbed by the young trees planted in place of those cut down is only a small fraction of the amount the

older forests can hold. This means that the amount of carbon released from cutting a natural, older forest is much higher than what will be absorbed later. If we are serious about mitigating climate change we are better served by saving and restoring forests than by using those forests to produce transportation fuels.

The transition to using biofuels is said to potentially reduce greenhouse gas emissions by 20%. If you count only the immediate carbon costs of planting and processing biofuels, they appear to reduce greenhouse gases. When you look at the total impacts, you find they cause more warming than petroleum. (Monbiot, G, 2007) In the case of our forests, this is due to the vast amount of carbon released from southern forest clear-cuts and all of the associated emissions from extraction and production.

According to the *Science* study cited above, global warming pollution could be reduced *two to nine times* more by conserving or restoring forests and grasslands than by razing them and turning them into biofuels plantations -- even if we continue to use fossil fuels as our main source of energy. (Righelato, R and Spracklen, D, 2007) That's because those forests and grasslands act as the lungs of the planet and their dense vegetation sucks up far more carbon dioxide and breathes out far more oxygen than any biofuel crop ever could.

When you destroy that wilderness, much of the carbon stored in its living matter is either burned or otherwise oxidized -- which is why the destruction of tropical forests accounts for more than 20 percent of global greenhouse-gas emissions (more than China produces). (Righelato, R and Spracklen, D, 2007) Meanwhile, we'd be saving all the creatures that rely on those wildlands for habitat. The scale is huge: replacing even 10 percent of our gas with biofuels would require 43 percent of U.S. arable land. (Righelato, R and Spracklen, D, 2007)

IMPACTS ON WATER QUALITY AND QUANTITY

The Southern US is in the midst of one of the worst droughts in recent recorded history. (O'Driscoll, P and Copeland, L., 2007) Many states in our region are experiencing water shortages and a number of heavily water-dependent water businesses have had to slow or halt production all together in the face of the drought. (Jonsson, P, 2008) The drain on our water resources, both in the form of water for growing tree plantations and water for use in cellulosic ethanol refineries could be immense.

According to a study in the International Journal of Agricultural Sustainability on the impact of first generation biofuels like corn, "Growing plants for fuel will accelerate the already unacceptable levels of topsoil erosion, soil carbon and nutrient depletion, soil compaction, water retention, water depletion, water pollution, air pollution, eutrophication, destruction of fisheries, siltation of dams and waterways, salination, loss of biodiversity, and damage to human health" (Tegtmeier 2004). The jump from corn to trees does not significantly change the results.

In the latest version of Soils and Soil Fertility (6th edition), "Soil erosion is a serious source of water pollution, since it causes runoff of sediments, nutrients, salts, eutrophication, and chemicals that have had no chance to decompose into streams. This increases water treatment costs, increases health costs, kills fish with insecticides that work their way up the food chain" (Troeh 2005).

And in Natural Resources Research, first generation ethanol plants "generate 13 liters of wastewater for every liter of ethanol produced." (Pimentel March 2005). This could wreak havoc on our already taxed rivers and impact the availability of clean drinking water. Fifty percent of Americans rely on groundwater (Glennon 2002), and in many states, this groundwater is being depleted by agriculture faster than it is being recharged. This is already threatening current food supplies (Giampetro 1997).

Energy crops may not be sustainable due to water, fertilizer, and harvesting impacts on the soil (DOE Biomass Plan, 2005). Like all other monoculture crops, ultimately yields of energy crops will be reduced due to "pest problems, diseases, and soil degradation" (Giampetro, 1997). In the Southern US, this plays out in the form of more intense Southern pine beetle infestations, greater occurrence of invasive pests, and short-rotation forestry impacting our soil quality.

GENETICALLY ENGINEERED TREES

Cellulosic ethanol is derived from fermenting the sugary substance once the cellulose and lignin in plant is broken down. To make this process easier, some scientists are tampering with plant DNA to create a "naturally" lignin-free or lignin-light plant from which cellulose would be easy to extract. Unfortunately, genetically modifying plants and other organisms could lead to some unexpected consequences. (Petermann, A, 2007)

Producing trees with less lignin could have disastrous effects if the pollen is released and intermingles with our natural forests. Low-lignin trees will be lacking in the "bone" structure necessary for keeping a tree healthy and strong. This in turn will lead to more trees breaking in heavy wind and ice storms prevalent across the region. With little resistance to wind, cold, disease or insects, more fertilizers and chemicals will be needed to grow them. Additionally, it could impact the survival and the long-term viability of our forests.

In addition to engineering low-lignin trees, scientists are also seeking to add such traits as herbicide resistance, pesticide resistance, and increasing growth rates. Again all of these could have devastating impacts should they mix with our natural forests and also are likely to help speed the development of super pests and diseases such as the Southern Pine Beetle and various other invasive tree diseases. Escape of these laboratory genes into native forests could devastate forest ecosystems.

And as we have seen in the field of genetic engineering of crops, genetic engineering of our forests could have substantial impacts on private landowners' rights to own the trees in their forests. Companies like Monsanto consistently win in court when their genetically engineered crops contaminate a farmer's natural crops and traces of the genetically engineered properties are found in the farmer's crop. In this case, the genetically engineered seed producing company retains control of the seeds even though they weren't originally theirs. If this were to occur in a landowner's woodlot, the same could potentially occur.

ECONOMIC IMPACTS

WITH THE PAPER INDUSTRY

The Southern US is already the largest paper producing region in the world and as stated above, 43 million out of 200 million acres of forests are already pine plantations. These plantations have cellulosic ethanol companies and decision-makers looking to these same plantations to feed their future mills. Both Governor Sonny Perdue of Georgia and US Congressional Representative Bob Etheridge of North Carolina have

commented that they want their states to be the Saudi Arabia of biofuel, using their state's pine plantations as the feedstock. (Adams, D, 2007 and Boyum, T, 2007)

The diversion of this timber from paper pulp to biofuels, without an attendant drop in paper consumption, will both compete with the existing paper industry and push some of the current demand for paper pulp elsewhere around the globe resulting in accelerated conversion of native forests into monoculture tree plantations, as well as increased legal and illegal logging of forests worldwide.

Additionally, any proposed gain in jobs in the industry will likely be balanced out by loss of jobs in the paper industry. Though there may be some synergies in turning pulp mill waste into fuel, mention the words biofuel in most paper industry board rooms and it typically strikes fear in their hearts.

CURRENT PROPOSED FACILITIES

Sixteen new bio-energy projects have been announced for the Southern US over the past two years, which will lead to intense competition for wood waste and eventually chips. Three of those facilities are slated to be biofuel facilities – Gulf Coast Energy in Mossy Head, FL, Range Fuels in Soperton, GA, and BlueRidgeXethanol in Spring Hope, NC. (Timber-Mart South, 2008)

The Gulf Coast Energy mill in Florida is proposing to produce 70 million gallons of biofuel using one million tons of wood per year. The expected opening date of this facility is unknown. The Range Fuels facility in Georgia, backed by venture capitalist Vinod Khosla, is expected to open in 2009 and produce 50 million gallons of fuel per year using 750,000 tons of wood. The North Carolina facility, which also does not have a projected start-up date, is small in comparison, producing 5 million gallons of fuel using 75,000 tons of wood. (Timber-Mart South, 2008)

Though the Range Fuels facility is likely the first to be open and these numbers may seem small at first, the market is waiting for the first to succeed in order to begin rapidly investing in future mills which will have massive compounding results and devastating impacts for our forests and communities.

Additionally, as noted above, there are also thirteen facilities under consideration or in operation that will burn wood waste, wood chips and residuals for energy. For example, the Green Circle Energy facility in Florida is already creating wood pellets from the forests of North Florida and exporting them to Europe in order for countries of the EU to be able to meet their renewable energy standards.

IN THE COMMUNITY

Cellulosic ethanol production will not only impact environmental quality, but the associated practices in the forest and the production processes at the mill will harm local communities and their quality of life. Beyond just forest destruction, fiber production and mill output will impact soils, increase noise and dust pollution, increase hazardous truck traffic on rural roads, increase property devaluation, impact local forest-based tourism, deplete water tables and lead to greater water quality degradation.

In addition, local tax money is used to accommodate the facilities. Hundreds of trucks a day will deliver chips and wood waste to the facilities. Because of this increased traffic, road improvements and maintenance are necessary. Not to mention the push from this industry for tax breaks and subsidies.

BLOATED GOVERNMENT SUBSIDIES

Unfortunately, our government is not typically equated with fiscal responsibility. And with mounting pressure to address the climate crisis, they are looking for any and all solutions that will be a quick fix. Right now, our government is pouring billions of dollars into an unproven technology with no foresight to the potential environmental and community impacts of this technology. Companies across America are lining up to feed at the government trough.

According to a report produced for the International Institute for Sustainable Development, "Total government support for biofuels in the United States reached approximately $6.3–$7.7 billion in 2006… Total support is projected to reach around $13 billion in 2008 and almost $16 billion by 2014. Under existing policies, the industry will, in aggregate, obtain subsidies worth more than $92 billion over the 2006–2012 timeframe." (Koplow, D, 2007)

Those numbers are absolutely staggering and grow every day. Taking a small sampling of the current subsidies, it is no wonder so many investors are getting involved. The Tax Relief and Health Care Act of 2006 provided a 50% write off in cellulosic capital investment. The 2008 Farm Bill added a $1.01/gallon subsidy for cellulosic ethanol produced. The Department of Energy Biomass and Biorefinery research facility received $110 Million in 2006 and will receive close to $400 M/year by 2009. Additionally, the DOE offered grants totaling $385 M in 2007, including a $76 M for Range Fuels. And the list goes on and on.

Also note that we are just looking at federal subsidies, when you add in the additional layers of state and local subsidies, the numbers become even more bloated. According the International Institute for Sustainable Development, producers have been able to tap into multiple pots of funding from local to state to federal sources. (Koplow, D, 2007)

All the while government mandates are driving this process. The Energy Policy Act of 2005 mandated 250 million gallons per year by 2013. And two bills under consideration in 2008 raised those numbers to either 20.3 billion gallons per year by 2030 or a staggering 21 billion gallons per year by 2022.

Finally, the government is setting aside money to pay large landowners to reserve land for biofuel, which on the surface sounds like a conservation-oriented solution. Unfortunately, this will instead subsidize the continued use of intensive business as usual forestry management like conversion of forests to plantations and large-scale clearcutting. The current state of affairs feels like the blind leading the blind and the cliff is only a short distance away.

CONCLUSION AND SOLUTION

Seemingly everyday, we hear new arguments as to why the full-scale rush to biofuels will end our dependence on foreign oil, create energy independence, and solve the climate crisis. The most common arguments from proponents of biofuels include domestic energy security, reduction of greenhouse gases, job creation, environmental protection, and an abundance of renewable resources.

As we have shown, most of these arguments do not hold water when put to the real test and, ultimately, we are sacrificing our forests, communities and quality of life for at best a short-sighted failed investment and at worst an environmental tragedy. We agree that we need to wean ourselves from our fossil fuel addiction and seek out alternatives that allow us to maintain our quality of life. But, our forests and communities can not afford this false solution and it is vital that we find a better way.

The smartest investment we could make in this country right now is in conservation and efficiency. We need to protect our forests as vital carbon reserves, increase the gas mileage in our cars and trucks, invest in hybrid and electric vehicle technology, keep up on the maintenance on our current automobiles, increase investment in alternative and public transportation, build smarter walkable and bikeable communities, invest in less intense natural solutions like fuel from algae, and look at our own individual habits while working to minimize our carbon footprints.

America is known worldwide for its innovation and great ideas. Now is the time to reinvest in research and development of positive solutions, not get bogged down in false solutions. Our forests and communities in the Southern US and worldwide depend on that.

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http://www.globalforestcoalition.org/img/userpics/File/publications/Truecostagrofuels.pdf

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