THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

Statement of

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Summary

- Biomass feedstocks produced with environmental safeguards, processed efficiently and used in efficient vehicles can reduce our dependence on oil for transportation, reduce emissions of heat-trapping carbon dioxide, contribute significantly to a vibrant farm economy, and avoid impacting food prices.
- Pursued without adequate guidelines, large scale biofuels production carries grave risk to our lands, forests, water, wildlife, public health and climate.
- The Renewable Fuel Standard contained in EISA contributed important advances to our energy and climate policy that can help mitigate global warming, reduce the environmental impacts of biofuels, and start to take biofuels out of the food price equation. The latest research confirms Congress' foresight in crafting the RFS to:
    - Require conventional biofuels from all new facilities to achieve at least a 20 percent reduction in lifecycle greenhouse gas emissions compared to conventional gasoline and advanced biofuels to achieve at least a 50 percent reduction.
    - Define lifecycle greenhouse gas emissions to include the full cultivation, production, and combustion cycle of fuels and both the direct and indirect emissions caused by this cycle.
    - Encourage production of plentiful biofuels feedstocks—including woody-biomass—while ensuring the RFS mandate does not result in the loss of old-growth forest, native grasslands, "critically imperiled", "imperiled", "vulnerable" ecosystems pursuant to a State Natural Heritage Program, the degradation of our federal forests[1], or conversion of natural forests on non-federal lands.
    - Require the vast majority of new biofuels required under the law to be advanced biofuels derived from renewable cellulosic biomass with a 60 percent lifecycle greenhouse gas emissions reduction.
    - Establish a no-backsliding requirement to protect air quality by directing EPA to adopt regulations that "mitigate, to the greatest extent achievable … any adverse impacts on air quality."[2]
- New crops and conversion technologies are developing rapidly that will make it easier to produce lots of biofuels with a smaller environmental footprint and without impacts on food prices, but the technologies are not a guarantee of good environmental performance. We need to maintain the environmental safeguards and performance standards in the RFS and build on them guiding the market so

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[1] Biomass obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, at risk from wildfire is excepted from these restrictions, on both federal and non-federal lands.
[2] Section 211(v)(2)(A) of the Clean Air Act (42 U.S.C. 7545) as amended by Section 209 of EISA07.

that innovation and competition will drive biofuels to provide the greatest benefits.

- The RFS also includes important requirements for studies of various aspects of current and future biofuels. Seemingly every day now, we learn of new technologies that promise to improve the performance of biofuels and of new negative environmental impacts that biofuels can have if pursued carelessly. These studies are critical to ensure that we identify unintended consequences of our policies as soon as possible and get the greatest good from our policies.
- Congress should make sure EPA is fully funded to aggressively and effectively implement these critical safeguards and should monitor their progress closely to ensure that science rather than politics drives the resulting regulations. The effectiveness of EPA's implementation of the RFS will entirely determine the law's success.
- Congress should build on the foundation of the RFS by:
    - Adopting a low-carbon fuel standard that requires progressive reductions in the average greenhouse gas emissions per gallon of all transportation fuels sold, as California and Massachusetts are planning to do.
    - Passing comprehensive climate legislation built around a mandatory, economy-wide carbon cap and a carbon credit trading system with all of the benefits of the trading system dedicated to public benefits.
    - Reforming the current ethanol excise tax credit, the ethanol import tariff, and the biodiesel blending tax credit to be technology-neutral, performance-based to encourage water efficiency, reduced water pollution, better soil management, and enhanced wildlife management.

Introduction

Thank you for the opportunity to share my views regarding the opportunities and challenges of implementing the Renewable Fuels Standard (RFS). My name is Nathanael Greene. I'm a senior policy analyst for the Natural Resources Defense Council (NRDC) and one of our main experts on renewable energy technologies. NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington, Los Angeles, San Francisco, Chicago, and Beijing.

Mr. Chairman, as you know, U.S. energy policy must address three major challenges: reducing America's dangerous dependence on oil, reducing global warming pollution, and providing affordable energy services that sustain a robust economy. Biofuels have the potential to contribute significantly to all three of these goals. Sustainably produced biomass feedstocks, processed efficiently and used in efficient vehicles can reduce our dependence on oil for transportation, reduce emissions of heat-trapping carbon dioxide, and contribute significantly to a vibrant farm economy. Pursued without adequate guidelines such as those contained in current law, however, biofuels production carries grave risk to our lands, forests, water, wildlife, public health and climate.

The potential for biofuels to be done right or wrong is reflected in recent headlines, which just a few months ago regularly haled biofuels as the solution to our oil addiction and now roundly condemn biofuels in light of high food prices and recent studies that show how biofuel can increase global warming pollution and contribute to environmental degradation. While these concerns should certainly motivate greater efforts to get biofuels right, we need to be careful not to throw the baby out with the bathwater. We should go beyond all or nothing headlines and pursue a transition to biofuel strategies that realize the compatible objectives of replacing oil, expanding opportunities for existing producers, and securing both food supplies and a sustainable future.

The updated RFS does more to promote careful development of biofuels than it is generally given credit for. The RFS will dramatically expand the use of renewable transportation fuels and is a major step forward for biofuels policy in that it contains the minimum performance standards and incentives needed to promote biofuels that are part of the solution, rather than part of the problem. The challenge before us is to ensure that this law is implemented aggressively and effectively so that biofuels actually meet these standards.

I'd like to call your attention to four requirements under the updated RFS that were particularly far sighted of Congress to embrace and are critical to the law's success:

- Requiring conventional biofuels from all new facilities to achieve at least a 20 percent reduction in lifecycle greenhouse gas emissions compared to conventional gasoline and advanced biofuels to achieve at least a 50 percent reduction.
- Defining lifecycle greenhouse gas emissions to include the full cultivation, production, and combustion cycle of fuels and both the direct and indirect emissions caused by this cycle.

- Encouraging production of plentiful biofuels feedstocks—including woody-biomass—while ensuring the RFS mandate does not result in the loss of old-growth forest, native grasslands, "critically imperiled", "imperiled", "vulnerable" ecosystems pursuant to a State Natural Heritage Program, the degradation of our federal forests[3], or conversion of natural forests on non-federal lands.
- Requiring the vast majority of new biofuels required under the law to be advanced biofuels derived from renewable cellulosic biomass with 60 percent reduction in lifecycle greenhouse gas emissions.

The importance of the RFS's minimum lifecycle GHG requirements

Section 201 of the RFS established minimum lifecycle GHG requirements for advanced and cellulosic biofuels. Section 202 established similar standards for conventional biofuel. To the best of my knowledge, these are the first lifecycle GHG standards established under any federal law. Under these standards, all renewable fuels from new facilities have to have lifecycle GHG emissions that are at least 20 percent lower than gasoline or diesel, depending on which they are replacing. In order to comply with the "advanced biofuels" definition, fuels need to have emissions that are at least 50 percent lower and to comply with the "cellulosic biofuels" definition, fuels need have emissions that are 60 percent lower.

This is the first time that biofuels policy in the US has required renewable fuels to proactively show an environmental benefit in return for benefiting from a government incentive program such as the RFS. Nowhere is the need for better performance more evident and urgent than when considering the global warming pollution impacts of biofuels. It is possible to produce ethanol derived from corn in a way that produces less than the lifecycle greenhouse gas emissions of gasoline

[3] Biomass obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, at risk from wildfire is excempted from these restrictions, on both federal and non-federal lands.

(per BTU of delivered fuel). Conversely it is possible to produce ethanol from cellulosic feedstocks in a manner that produces far more CO_2 than gasoline. Unless our policies value, encourage and ultimately require biofuels to produce greenhouse gas reductions as the RFS has done for the first time, the market will provide whatever is cheapest and fastest. There is no reason to believe that such fuels will be better than gasoline and plenty of reason to believe they could be worse.

The RFS gets the definition of lifecycle GHG emissions right

Of course, the minimum lifecycle GHG standards for biofuels in the RFS would mean little without a good definition of lifecycle emissions. This is an area of the law where Congress showed particular foresight. Section 201(1)(H) of the RFS defines lifecycle GHG emissions as follows:

> *'(H) LIFECYCLE GREENHOUSE GAS EMISSIONS.—The term 'lifecycle greenhouse gas emissions' means the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes), as determined by the Administrator, related to the full fuel lifecycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential.*[4]

Less than two months after this definition became law, two articles that appeared in *Science* made it clear that the direct and indirect emission associated with changes in land-use could dominate the lifecycle emissions of biofuels. The first article, "Land Clearing and the Biofuel Carbon Debt," addresses the direct greenhouse gas emissions from growing biofuel feedstocks on land recently converted from natural

[4] "Energy Independence and Security Act of 2007," Title II, Section 201(1)(H), signed into law on December 17, 2007.

ecosystems to managed agriculture.[5] This article is authored by a team from the Nature Conservancy and the University of Minnesota including Dr. David Tilman. The second article, "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases through Emissions from Land Use Change," addresses the emissions from land use change induced by the economic pressures when crops and land are diverted from food, feed, and fiber to fuels.[6] This article is authored by a team lead by Tim Searchinger now from Princeton, the Woods Hole Research Center, and Iowa State's CARD.

While there is little controversy over the notion that the emissions from lands converted specifically to produce biomass for renewable fuels should be accounted for in the lifecycle of those fuels, the first of these articles showed how large these emissions could be. The second article broke newer ground, pointing out that land conversion could be induced by biofuels when they increase the competition for land and thus lifecycle accounting needs to look beyond just direct conversion of land for biofuels. Devoting an increased share of U.S. agricultural output to fuel production rather than food and livestock feed will result in increased demand for animal feed from sources abroad. If any significant portion of this additional feed is obtained by converting mature forests into pasture or cropland the CO_2 emissions from this land use change could greatly exceed the emission reductions from the use of biofuels. The Argonne GREET model and most lifecycle analyses conducted to

[5] Fargione, J., et al., "Land Clearing and the Biofuel Carbon Debt," *Science* [DOI: 10.1126/science.1152747] February 7, 2008.
[6] Searchinger, T., et al., "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change," *Science* [DOI: 10.1126/science.1151861] February 7, 2008.

date have either ignored these land use related emissions or minimized them. These emissions, however, are caused by using certain crops and types of land for biofuels feedstocks, and they have the potential to negate all of the global warming benefits of poorly designed biofuels policies.

A recent letter in *Science* does a particularly good job of showing how complicated but important these indirect land-use impacts can be. The letter explains how increased demand for corn to make ethanol is reducing domestic production of soy beans and thus driving up the production of soy beans in Brazil. The letter details how increased Brazilian soy farming leads directly and indirectly to clearing of Brazilian rainforests:

> *Some Amazonian forests are directly cleared for soy farms. Farmers also purchase large expanses of cattle pasture for soy production, effectively pushing the ranchers farther into the Amazonian frontier or onto lands unsuitable for soy production. In addition, higher soy costs tend to raise global beef prices because soy-based livestock feeds become more expensive, creating an indirect incentive for forest conversion to pasture. Finally, the powerful Brazilian soy lobby is a key driving force behind initiatives to expand Amazonian highways and transportation networks in order to transport soybeans to market, and this is greatly increasing access to forests for ranchers, loggers, and land speculators.* [Footnotes not included.][7]

Not all biomass material leads to increased demand for new agricultural lands and not all lands brought into production are rainforests. Nevertheless, it is important to understand the scale of impact that greenhouse gas emissions from these indirect land-use changes can have. Looking at a number of estimates, new very efficient corn ethanol refineries should be able to produce about 420 gallons of ethanol from

[7] Laurance, W.F., "Switch to Corn Promotes Amazon Deforestation," *Science* (Letters), December 14, 2007, Vol. 318, page 1721.

an average acre of corn. Putting aside emissions from land-use change, this ethanol would reduce greenhouse gas emissions by about 37 percent per gallon or about 2,500 pounds worth of CO2 per acre each year. Now, according to another article in *Science*, one acre of tropical rainforest if cleared and used to grow crops will release about 655,000 pounds worth of CO2 over 30 years or an average of nearly 22,000 pounds per year.[8] In other words, if the conversion of an acre of corn from food and feed to fuel resulted indirectly in the conversion of just one-tenth of an acre of rainforest all the greenhouse gas emissions benefits of the ethanol would be whipped out for the first 30 years.

Of course, there are many more types of land being converted to agriculture than just rainforests. And the marginal impact of land-use changes here in the United States on land-use in the rest of the world is extremely hard to predict with economic equilibriums and agricultural and trade policies all interacting in complex ways. But to ignore these indirect emissions is to assume they are zero, which could easily lead to the government subsidization of fuels that are worse for global warming than gasoline or diesel.

While these two article have already stirred a lot of debate about the specific amounts of carbon released from different land types, the amounts of different lands being cleared, and the exact economics driven by growth in biofuels production, three conclusions are clear now: 1) absent the GHG standards in the RFS and the carefully crafted definition of lifecycle emissions, these two dynamics make it very

[8] Righelato, R. and Spracklen, D., "Carbon Mitigation by Biofuels or by Saving and Restoring Forests?" *Science*, August 17, 2007, Vol. 317, page 902.

likely that most biofuels would be responsible for greenhouse gas emissions significantly higher than gasoline or diesel; 2) the fundamental dynamics addressed by these two articles (direct land use emissions and economically induced land use emissions) are driven by the fundamentals of soil science and the laws of supply and demand; and 3) the importance of implementing the minimum GHG emissions standards and land-use safeguards in the RFS aggressively and effectively is clearer than ever. I return to this last point later in my testimony.

Under the RFS, EPA is directed to promulgate regulations to implement these GHG performance standards and the environmental safeguards by the end of 2008. Perhaps the most complicated part of this is developing the accounting protocol to measure and certify the lifecycle greenhouse gas emissions of different renewable fuels. Fortunately, EPA has a head start in this effort. Early in 2007, President Bush directed EPA, in coordination with other federal agencies, to promulgate regulations to reduce US gasoline use by 20 percent within 10 years and to do so in a way that complied with the federal court ruling that CO2 is a pollutant. Before the passage of the EISA07, EPA was on track to issue a notice of proposed rulemaking to implement the so called 20-in10 executive order around the end of 2007. As part of these draft rules, EPA had done significant work developing a lifecycle accounting methodology.

The RFS includes critical land and wildlife safeguards

In addition to the minimum GHG standards, the RFS includes a definition of renewable biomass that provides essential safeguards for wildlife, native grasslands, old-growth, natural forests, and federal forests. At the same time, it is broadly inclusive of the kind of material that typically provides the biggest sources of biomass, assuring diverse opportunities for landowner participation and a wide diversity of feedstocks.

- ***Eligible Biomass***

The renewable biomass definition includes:

- All crops and crop residue from current agriculture land and non-forested, fallow land
- All crops and crop residue from any non-forested land cleared prior to the enactment of EISA, including newly established tree plantations[9]
- All trees and logging residue from non-federal tree plantations, excluding those converted from natural forests after passage of EISA07 (See below)
- "Slash and pre-commercial thinnings" from non-federal natural forests, which, importantly, constitute the lion's share of woody-biomass from natural working forests that would typically be used for biofuels, while keeping forests from being converted
- All material removed from the immediate vicinity of homes and communities at risk from wildfire, on federal and non-federal lands
- Animal waste and animal byproducts
- Waste material, including separated yard waste, food waste, and cooking and trap grease.

- ***Protecting Wildlife***

The definition of renewable biomass ensures the RFS does not encourage biomass harvesting from sensitive wildlife habitat. The RFS employs the State Natural Heritage programs to identify critically imperiled, imperiled and vulnerable wildlife habitat. The Natural Heritage programs are readily accessible, widely recognized,

[9] While I recognize that the term "plantation" carries negative historical connotations, it is used throughout my testimony because "tree plantation" it is a technical term distinct from "tree farm". "Tree plantation" is also the term used in the Renewable Biomass definition legislative text.

and embraced by all 50 states. They are the leading sources on the precise locations and conditions of rare and threatened species and ecological communities found within each state. These databases and ranking systems are used effectively for forest management and in partnership with many forest-product industry leaders.

The ecosystems identified by the RFS as off-limits are home to our most rare, threatened, and imperiled wildlife. While tree plantations and young forests are increasing in parts of the United States, older forests that provide critical wildlife habitat and store tremendous amounts of carbon are disappearing faster than they are being regrown, both nationally and globally, and loss of native habitat is the greatest threat to biodiversity here and abroad. Animals are currently going extinct at a rate nearly 1,000 times higher than they have historically, and under current trends that may increase to 10,000 times over the next century.[10] Moreover, as global warming escalates, wildlife is increasingly threatened by loss of safe harbors and migration routes, making habitat protection even more important. The RFS safeguards ensure that the law's new demand for feedstocks does not translate into irreversible loss of these at risk habitats.

- ***Native Grasslands and Old-Growth Forest***

The RFS safeguards also protect against the use of biomass harvested from native grasslands and old-growth and late successional forest. Native grasslands represent one of the most threatened ecosystems in the world. Less than 4 percent of our

[10] "Environmental Science and Engineering for the Twenty-First Century: The Role of the National Science Foundation," National Science Foundation, February 2000; Peter Raven, "Plants in Peril: What Should We Do?" Missouri Botanical Garden, 1999.

country's original native prairies exist today. These imperiled ecosystems represent a last remnant of our natural heritage and provide invaluable habitat for migrating birds and other endangered species. Similarly, our remaining old-growth trees constitute a rare and vulnerable ecosystem type that provides unique wildlife habitat, water filtration, and ecosystem resiliency. Nationally, old-growth forests are severely diminished. In the lower 48 states, old growth forest makes up just 2 percent of the remaining forest.[11] As we struggle to maintain and restore these ancient forests, it is imperative that federal policy not further their endangerment.

- ***Conversion of Natural Forests***

Loss of forests is one of the greatest threats to biodiversity worldwide and a major contributor to global warming.[12] Natural forests are under severe threat from unsustainable logging practices, global warming, and real estate development. While deforestation is the most dramatic example of this growing crisis, equally critical is the conversion of natural forests to single-species tree plantations. Plantations may look like "forests," but they are biological deserts when compared to the natural forests that they replace—lacking the diversity of species, structure, and ecological functions that make natural forests so important.

A potent example of conversion's sweeping impacts can be found in the forests of the Southern United States which contain some of the most biologically rich forests in North America, housing an abundance of plant and animal diversity that exist

[11] Palmer, T., *The Heart of America: Out Landscape, Our Future*, Island Press, 1999.
[12] Intergovemental Panel on Climate Change, *Climate Change 2007: Synthesis Report Summary for Policymakers*, pg. 5. Available at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

nowhere else in the world. Unfortunately, these unique forests are under increasing pressure from the wood products industry as well as urban sprawl and development. Pine tree farms have been displacing natural forests for the past 50 years and now occupy 32 million acres (15 percent) of the current Southern "forest."[13] Seventy-five percent of the pine plantations established in the last two decades were carved out at the expense of natural forests. Moreover, 40 percent of the region's native pine forests have already been converted to single-species plantations, eliminating the rich diversity that the area is known for.

The RFS definition of renewable biomass does not by any means exclude woody biomass, but does ensure that federal policy is not making this bad situation worse. The RFS renewable biomass definition includes all biomass from existing tree plantations, new tree plantations established on previously cleared non-forested lands, and "slash and pre-commercial thinnings" from natural forests. In concert, these provisions allow woody-biomass to contribute to biofuels, while protecting against the clearing of forests or the conversion of natural forests to monoculture tree plantations, thus losing their natural ecosystem functions. It is important to emphasize that the terms "slash and pre-commercial thinning" are interpreted with substantial flexibility - allowing the use of all harvest byproducts, as well as small and low-value trees from natural forests, as long as the forest is naturally regenerated after harvest as opposed to converted into a tree plantation or other crop.

[13] See USFS SFRA 2001 Summary–Section 3.2.2

Sustainable forestry practices that identify and protect high conservation values such as old-growth or late successional forest and specific wildlife habitat, and avoid conversion, are well established. These practices allow natural forests to remain working forests, without sacrificing critical wildlife habitat and other important environmental values. For example, Forest Stewardship Council certification, a global standard used in the forest products industry, incorporates these considerations.

- ***Federal Forests***

Our federal forests represent unique reservoirs of biologic diversity, genetic diversity, significant carbon stores, and many other ecological services, and stand to play a critical role in the face of global warming's growing impacts, including loss of biodiversity, decreased ecosystem resilience, and the spread of invasive species.[14] It is therefore becoming commensurately more important that our federal forest resources are managed and preserved for their numerous non-commodity values and that we assiduously avoid policies that would impose additional pressures on these already stressed, and increasingly crucial, public resources.

In this context, proposals to use "preventative thinnings" from national forests as a biofuels source make little economic or ecologic sense. First, it is important to understand that preventative thinning—the removal of forest biomass including anything from small brush to large trees to address forest health—is essentially logging and thus not devoid of ecological impacts, such as soil compaction, spread of

[14] See, for example, Lovejoy, Thomas, *Climate Change and Biodiversity*, Yale University Press, August 2006.

invasive species, hydrologic disruption, and in the case of associated road building, increased fire risk due to lost resiliency and increased human traffic.[15]

The argument for the production of biofuels from national forest preventative thinnings hinges on three basic assumptions, all three of which would have to be valid for the proposition to add up: first, preventative thinnings based biofuels do not negatively impact global warming; second, preventative thinnings will safely and sustainably produce a meaningful volume of biofuels; and third, biomass removal is beneficial to addressing wildfire. Unfortunately there is uncertainty and debate around each of these assumptions.

The GHG benefit of preventative thinnings for biofuels is highly uncertain. As noted above, preventative thinning represents the removal of biomass—or stored carbon—through mechanical harvest. For preventative thinnings to make sense from a GHG perspective, the fuel produced would have to be "better" than the lost carbon storage, including soil carbon, the emissions resulting from the removal, transportation, and processing of the biomass, and the burning of the final fuel. It is also important to note that fire risk reduction thinning, even where appropriate (see below), is successful only to the extent that occasional intense burns are replaced by cooler burns that occur perhaps 20 to 25 times more often. While ecotype specific

[15] The literature on the ecologic impacts of logging and road-building is extensive. For a collection of independently reviewed material, see http://www.nrdc.org/land/forests/roads/eotrinx.asp. *See also* USDA. "Roadless Area Conservation Final Environmental Impact Statement." US Forest Service. Vol. 1. (November, 2000). pp. 3-116. Eastman, J. C., et al. "Roadless Areas and Forest Fires in the Western United States." American Geographical Union Spring Meeting. (May 29, 2002). Pyne, S. J. *Tending Fire: Coping with America's Wildland Fires*, Island Press, 2004, p. 208.

data are still not available, on the face of it, the much more frequent burns are likely, if anything, to result in greater emissions.

Even if preventative thinning were ecologically necessary, most scenarios indicate a limited supply of material within economic haul distances, making biofuels from preventive thinning at best a drop in the overall bucket.[16] Preventative thinnings are single-entry activities pursued for restoration purposes and do not provide a renewable resource from any given location. Thus they are severely constrained by the energy and economic costs of transporting biomass from individual sites to central processing facilities. Incenting the establishment of a whole industry in order to supply a negligible volume of fuel from a time-limited supply of any arguably legitimate feedstock presents likely negative outcomes, including either a boom-bust cycle, or future pressure to shift to an unsustainable scale of extraction. This is particularly unappealing considering there are other, proven, and more readily scalable uses for harvest and preventative thinning byproducts where it is economic to remove them from the woods, such as community heat and electricity production and manufactured products. These factors are particularly important when considering utilization of slash and byproducts from sources other than preventive thinning, including any backlog like slash piles. While this material may

[16] For example, the DOE "Billion Ton Study" available at http://www1.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf reports only 11.7 million dry tons of biomass available from national forest preventative thinnings. Even this estimate may be optimistic due to economic costs, haul distances, and serious questions regarding ecological impacts.

be available for the short term, it would soon be exhausted, representing a nonrenewable supply far more appropriate for more scalable uses than biofuels.[17]

Finally, while intuitively appealing, the empirical evidence is mixed at best on whether backcountry logging and preventative thinning effectively reduces fire risk[18], and indicates it may in fact increase the chances of uncharacteristic fire.[19] Furthermore, it is a mistake to conceive of national forests as uniformly overgrown thickets in need of preventative thinning to restore prior forest structure and fire

[17] See DOE "Billion Ton Study "estimate of only 1.5 million dry tons of national forest logging residue, under future optimistic conditions.

[18] See, Martinson, E. J. and P. N. Omi. 2003. Performance of Fuel Treatments Subjected to Wildfires, in Omi, P. N.; Joyce, L. A., technical editors. Fire, fuel treatments, and ecological restoration: Conference proceedings; 2002 16-18 April; Fort Collins, CO. Proceedings RMRS-P-29. Fort Collins, CO: U.S. Forest Service, Rocky Mountain Research Station. pp. 7-8. *See also* Carey, H. and M. Schumann. 2003. "Modifying Wildfire Behavior-The Effectiveness of Fuel Treatments." The Forest Trust. p. 16. Available at www.theforesttrust.org/images/swcenter/pdf/WorkingPaper2.pdf. p. 15 ("The proposal that commercial logging can reduce the incidence of canopy fire appears completely untested in the scientific literature"). *See also* Cram, D.S., T.T. Baker, and J.C. Boren. 2006. Wildland Fire Effects in Silviculturally Treated vs. Untreated Stands of New Mexico and Arizona. Research Paper RMRS-RP-55. Fort Collins, CO. U.S. Forest Service, Rocky Mountain Research Station. p. 1. ("information comparing fire behavior and fire effects on treated versus untreated forest stands following wildland fire remains largely anecdotal.")

[19] Martinson and Omi, *supra* note 1. p. 7. U.S. Forest Service. 2000a. Final Environmental Impact Statement for the Roadless Area Conservation Rule ("FEIS"), volume 1. Online at: http:/www.roadless.fs.fed.us/documents/feis. p. 3-110. Collins, B.M. et al. 2007. Spatial patterns of large natural fires in Sierra Nevada wilderness areas. Landscape Ecology 22:545-557. p. 554. Whitehead, R.J. et al. 2006. Effect of a Spaced Thinning in Mature Lodgepole Pine on Within-stand Microclimate and Fine Fuel Moisture Content, in Andrews, P. L. and B.W. Butler, comps., Fuels Management-How to Measure Success: Conference Proceedings. 28-30 March 2006; Portland, OR. Proceedings RMRS-P-41. Fort Collins, CO: U.S. Forest Service, Rocky Mountain Research Station. Online at http://www.fs.fed.us/rm/pubs/rmrs_p041/rmrs_p041_523_536.pdf. p. 529. Keeley, J.E., D. Lubin, and C.J. Fotheringham. 2003. Fire and grazing impacts on plant diversity and alien plant invasions in the southern Sierra Nevada. Ecological applications 13:1355-1374. p. 1370. FEIS, *supra* this note, Fuel Management and Fire Suppression Specialist's Report. Online at: http://www.roadless.fs.fed.us/documents/feis/specrep/xfire_spec_rpt.pdf. p. 21 ("Fahnstock's (1968) study of precommercial thinning found that timber stands thinned to a 12 feet by 12 feet spacing commonly produced fuels that 'rate high in rate of spread and resistance to control for at least 5 years after cutting, so that it would burn with relatively high intensity;'" "When precommercial thinning was used in lodgepole pine stands, Alexander and Yancik (1977) reported that a fire's rate of spread increased 3.5 times and that the fire's intensity increased 3 times"); id. At 23 ("Countryman (1955) found that 'opening up' a forest through logging changed the 'fire climate so that fires start more easily, spread faster, and burn hotter").

regimes. While evidence suggests some lower elevation, dry forests could benefit from restoration treatments, many other sites across the country, including lodgepole pine, spruce-fir forests, subalpine forests, piñon-juniper, mixed conifer systems, and ponderosa pine, are adapted to intense, stand-replacing fires, and in these dense stands preventative thinning is contraindicated.[20] The empirical evidence on both the efficacy and necessity of preventative thinning suggests it is still experimental, poses significant risks, is constrained to limited areas at best, and therefore should be pursued only on an investigational basis.

In sum, none of three underlying assumptions related to producing biofuels from preventative thinnings reflect the best available science or pragmatic, on the ground scenarios. To contribute a negligible amount of fuel, we would have to risk further degraded forests, exacerbating fire risk, reducing carbon storage, increasing GHG emissions, and establishing an unsustainable industrial demand for continued commercial exploitation of vital public resources.

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[20] See Christensen, N, et al. 2002. Letter to President George W. Bush http://docs.nrdc.org/land/lan_07062801g.pdf; Romme, W. et al. 2006. Recent Forest Insect Outbreaks and Fire Risk in Colorado Forests: A Brief Synthesis of Relevant Research. Colorado State University, Fort Collins, CO. Online at http://www.cfri.colostate.edu/docs/cfri_insect.pdf. Schoennagel, T., T.T. Veblen, and W.H. Romme. 2004. The interaction of fire, fuels and climate across Rocky Mountain forests. BioScience 54: 661-676. p. 666. Romme, W., et al. 2003. Ancient Piñon-Juniper Forests of Mesa Verde and the West: A Cautionary Note for Forest Restoration Programs, in Omi, P. N.; Joyce, L. A., technical editors. Fire, fuel treatments, and ecological restoration: Conference proceedings; 2002 16-18 April; Fort Collins, CO. Proceedings RMRS-P-29. Fort Collins, CO: U.S. Forest Service, Rocky Mountain Research Station. Baker, W.L. and D.S. Ehle. 2003. Uncertainty in Fire History and Restoration of Ponderosa Pine Forests in the Western United States, in Omi, P. N.; Joyce, L. A., technical editors. Fire, fuel treatments, and ecological restoration: Conference proceedings; 2002 16-18 April; Fort Collins, CO. Proceedings RMRS-P-29. Fort Collins, CO: U.S. Forest Service, Rocky Mountain Research Station. p. 330.

The RFS correctly focuses primarily on biofuels from renewable cellulosic biomass

While the RFS requires 36 billion gallons of biofuels by 2022, only 28.5 of this is additional to the previous RFS and only about 24 is in addition to what the market would have almost certainly provided on its own. The new RFS requires that at least 22 billion gallons of the 36 billion total be "advanced biofuels," which are basically defined as not being ethanol from corn. As mentioned earlier, these advanced biofuels must provide at least a 50 percent reduction. Of the advanced biofuels, at least 16 billion must be from cellulosic feedstocks and at least 1 billion must serve as an alternative to petroleum diesel. The advanced biofuels from cellulosic feedstocks must provide at least a 60 percent reduction in GHG emissions.

Much has been written and said about the promise of advanced, second generation biofuels technologies. These technologies do appear poised to greatly increase the amount of biofuels we can produce and make it easier to produce them in a sustainable way. It is critical to realize, however, that these technologies will not be available overnight and just because we can produce biofuels sustainably does not mean that we will.

When I first started looking at biofuels in 2002, all of the cutting edge expertise was in academia and the national energy labs. You could talk to these experts and they would tell you where the technology stood. Over the last 2 years, however, all of the cutting edge research has moved into the private sector and is proprietary. So while it's now much harder to know where things stand, we know that a lot of investor dollars are being bet on near-term commercialization. The research is being driven by venture capitalists and private investors.

Combine these developments with the very impressive number of projects proposed in response to recent government solicitations, and it's hard not to believe that things are moving along quickly. Within the past year, New York issued a solicitation for two pilot cellulosic biofuels projects and DOE issued a solicitation for six small commercial scale cellulosic projects and seven more pilot scale cellulosic projects. All of these solicitations required significant private sector investment and a number of major market players responded. Cellulosic biofuels projects announced in recent weeks include a new pilot cellulosic plant in Nebraska that will be built by Abengoa, a plant using switchgrass as a feedstock that will be constructed in Tennessee by Mascoma and a commercial line of cellulose processing enzymes by Genencor. International developments include a recent announcement by Royal Nedalco in the Netherlands that it will skip the pilot scale and go straight to building a small commercial scale 50 million gallon a year cellulosic plant. There are also advances being made in radically different technologies including the use of microorganisms in existing ethanol facilities to produce fuels similar to gasoline such as biobutanol, bacterial and catalytic conversion of biomass into renewable diesel and gasoline, and the use of algae to make a synthetic diesel fuel.

It is my understanding, however, that none of these projects will come on line until late next year at the earliest. Assuming a few of them perform very well, they could be expanded, but it is really the second generation plant that investors will consider a potential cookie-cutter model. Being optimistic, assume that we go into 2013 with three different technologies that can compete with corn ethanol or gasoline, each with an operating second generation plant of about 50 million gallon per year capacity. Even if the technologies are so promising that orders for more plants are actually placed in 2012, how fast will capital and engineering capacity flow into the sector? How long will siting and permitting lead times be? One billion gallons of capacity by 2016 seems reasonable to me assuming we have at least one clear success on line by 2010. Three billion would be absolutely fantastic. Such a result would require that by 2013 the cellulosic industry grows as fast as the corn ethanol industry grew from middle of 2006 to middle of 2007.

The ability to convert cellulose into fuels opens up the possibility of using new feedstocks such as cellulosic crops—including switchgrass—that use significantly less chemical inputs and water, agricultural residues and organic waste. However, as we discussed earlier, it is also possible to cultivate and harvest cellulosic biomass in extremely destructive and carbon intensive ways. One of the easiest ways to do cellulosic biofuels wrong is by harvesting feedstocks from inappropriate areas such as our public forests, old growth forests, or other imperiled and fragile ecosystems. While I'm not aware of any projects proposing to use such feedstocks, federal policies should not incentivize the future use of such feedstocks. Environmental safeguards and performance standards are necessary to ensure that federal policy promotes the best production standards for biofuels, such as well-managed cultivation of corn or switchgrass.

The studies required under the RFS will provide much needed guidance

I would like to emphasize the importance of the environmental studies included in the bill, an often overlooked feature of considerable importance.

We are learning everyday the varied impacts of biofuels, from land-use change, to invasive species spread, to water quality and quantity. These factors require careful study and ongoing monitoring, and the results and recommendations of the studies stand to provide critical input going forward. Biofuels, particularly next generation, are taking its first baby steps, and we must ensure that a cautionary approach is taken, while leaving open the possibility to learn as we go.

The RFS's environmental safeguards must be effectively implemented by EPA

While Congress deserves much credit for carefully crafting the standards, safeguards, and study provisions of the RFS, none of these will amount of a fill of beans unless they are aggressively and effectively implemented by EPA. EPA's task is complex. Tracking and enforcing the law's environmental safeguards will be challenging. EPA is up to the task but will require significant resources. Congress must make sure EPA is fully funded to both develop the implementing regulations and then carry out the enforcement and studies.

Our discussions with staff within EPA give us confidence that the agency is make real progress towards a workable, science-based set of regulations. Under EISA07, technically EPA should promulgate these regulations by the end of this calendar year. Given the genuine complexity of the issues that have to be addressed, this timing seems unrealistic, but given the progress that we see EPA making, we're confident that they're on track to finish the rules within a reason period. Nevertheless, we encourage Congress to monitor their progress closely to ensure that science rather than politics drives the resulting regulations.

The effectiveness of EPA's implementation of the RFS will entirely determine the law's success.

Congress should build on the foundation laid by the RFS

Congress should build on the foundation of the RFS by:

- ***Congress should adopt a low carbon fuel standard like California and Massachusetts are doing***

Adopting a low-carbon fuel standard (LCFS) that require progressive reductions in the average greenhouse gas emissions per gallon of all transportation fuels sold, as California and Massachusetts are planning to do. The LCFS is a technology-neutral, performance based approach to reducing the greenhouse gas emissions from transportation energy. This would be an important improvement over the technology specific, volume incentives and mandates that until recently dominated US biofuels policies.

The way a LCFS works is that the full lifecycle GHG emissions from the fuels each oil company is selling are added up and divided by all the energy in that fuel. This becomes the company's average fuel carbon intensity. Overtime under the LCFS, the oil companies have to reduce this average carbon intensity by mixing in sources of transportation energy with lower lifecycle GHG emissions. In California, which was the first to move towards a LCFS and is now in the process of developing the regulations, the goal of the LCFS is to require a 10 percent reduction in carbon intensity by 2020. In other words, a company could replace all of their current fuel with an alternative that has 10 percent lower lifecycle GHG emissions, or half with a 20 percent lower alternative, and so on. The LCFS rewards the sources of energy that have the lowest lifecycle GHG emissions. Just as importantly, it penalizes high carbon fuels such as liquid coal.

This is in contrast to the original RFS, which was a simply volume mandate that almost totally ignored how the biofuels were produced. Our current tax credits for ethanol and biodiesel and our import tariff on ethanol are similarly blunt, ignoring the impacts or benefits of the fuels' lifecycle. While the current RFS is the first step towards setting performance based requirements, it is still a volume mandate for a specific set of fuels and these standards are floors. Electricity and natural gas can't be used to comply and there's no incentive for producing biofuels that perform better than minimum standards.

- ***Congress should pass comprehensive climate legislation adopting a carbon cap and trade system***

It is much harder to get biofuels right in the context of a broader economy where greenhouse gas emissions are not regulated. In order to meaningfully level the field between oil and renewable fuels and encourage the economy-wide changes in practices needed to drive a sustainable transportation sector, we need comprehensive approach to global warming. In addition to a low carbon fuel standard this should include an economy-wide carbon cap and trade system. Senate bill S.2191, the Lieberman-Warner bill, includes both, Congress should pass this bill and the President should sign it as soon as possible.

- ***Congress should reform our existing biofuels tax credits and tariffs into a single technology-neutral, performance based incentive***

As I mentioned earlier, our existing biofuels tax credits and import tariffs are blunt, volume based policies that try to pick winners and in doing so fail to encourage the most beneficial practices and technologies. For instance, the volumetric ethanol excise tax credit (VEETC) gives a fixed tax credit of $0.52 per gallon of ethanol regardless of how the ethanol is produced. Furthermore this tax credit is unavailable to butanol or biomass derived synthetic gasoline. Similarly the biodiesel blending tax credit is awarded on a per gallon basis regardless of whether the biodiesel is derived from palm oil grown in just cleared rainforests or waste grease diverted from a landfill. It's also not available to synthetic diesel. And our ethanol import tariff is similarly blunt.

All of our biofuels tax credits and tariffs should be re-crafted into a single technology-neutral performance based incentive. Building off of the lifecycle GHG accounting protocol being developed for the RFS, it would be relatively easy to link these incentives to improved GHG emissions, but I suggest that we go further. After all the RFS already starts us down the path towards biofuels with better GHG emissions and there are plenty of other ways that biofuels can help or hurt our environment. I recommend that we use the tax credits and tariffs to encourage water efficiency, reduced water pollution, better soil management, and enhanced wildlife management. Developing accurate and workable accounting metrics for these impacts would be a non-trivial challenge, but many of the tools we have developed to implement farm bill conservation programs could be used here.

As the RFS ramps up the existing tax credits will become extremely expensive and could well end up increasing water pollution, soil erosion and degrading the modest wildlife habitat provided by our crop lands. While the farm bill is the best place to deal with agriculture's environmental impacts on a broad basis, our biofuels policies should be exacerbating these challenges. Furthermore, while the RFS will drive improvements to the performance of biofuels from new facilities, a revamped tax credit could drive improvements to our existing production. It's time to start paying for performance from our biofuels producers.

Conclusion

Renewable fuels hold great promise as a tool for reducing global warming pollution, breaking our dangerous oil addiction, and revitalizing rural economies, as long as appropriate standards and incentives are used to shape the nascent bioenergy industry to provide these benefits in a sound and truly sustainable fashion. Congress deserves credit for the foresight it showed in starting to build these standards and safeguards into the new RFS. We should build on this foundation by making over the rest of our biofuels policies to be technology neutral and performance based. I look forward to working with the EPA to implement the RFS and with the Committee to continue to improve our biofuels policies.