Federal Forests, Biomass, and Ethanol: Energy Security Sabotaged

by Evan N. Turgeon

Evan N. Turgeon is a student at the University of Virginia School of Law (J.D. candidate, 2009).

Editors' Summary

Increasingly destructive wildfires in recent years prompted legislators to enact the Healthy Forests Restoration Act of 2003, which authorizes mechanical thinning fuel-reduction projects on federal forestland. Almost simultaneously, political pressure compelled legislators to combat rising oil prices, resulting in the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, which mandate significant increases in the domestic production of biofuels used for transportation. Since the trees, branches, and underbrush removed from federal forestland can be processed into ethanol, combining these policies seems natural.

> The natural resources must be developed and preserved for the benefit of the many, and not merely for the profit of the few.[1]
>
> —Gifford Pinchot, 1910

Increasingly destructive wildfires in recent years prompted legislators to reform federal forest policy, most notably in the Healthy Forests Restoration Act (HFRA) of 2003, which authorizes and funds mechanical thinning fuel-reduction projects on federal forestland. Almost simultaneously, political pressure compelled legislators to act to combat rising oil prices, resulting in the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, which mandate an increase in the domestic production of biofuels used for transportation. Since the trees, branches, and underbrush removed from federal forestland can be processed into ethanol, combining these policies seems natural, is feasible, and would generate significant benefits. However, no such synergy has taken place. Instead, special interest groups force energy and forestry policies benefitting the farm and timber industries at the expense of American citizens.

This Article explores the shortcomings of the government's current ethanol policy and the necessity of using federal forest biomass to produce the amount of biofuel the Energy Independence and Security Act mandates. Section I discusses the forces behind recent changes in federal forest and energy policies, and resulting legislative enactments. Section II provides an overview of what ethanol is and methods of producing it. Section III notes the myriad advantages of producing ethanol from federal forest biomass rather than from the farm-grown crops government policy currently endorses. Section IV discusses the political forces that work to thwart such a synergy. Section V concludes.

I. Pressures and Policies

A. Forest Fire Prevention

Many western U.S. states have experienced the most destructive fire seasons on record in the past decade.[2] Wildfires have killed numerous firefighters, destroyed hundreds of homes, [3] and burned an estimated 49 million acres.[4] Fighting these fires has cost the government more than $8.2 billion.[5] With respect to federal land, over 8.4 million acres burned in 2000, and 7.2

1. Gifford Pinchot, The Fight for Conservation 46 (1910).
2. Robert B. Keiter, *The Law of Fire: Reshaping Public Land Policy in an Era of Ecology and Litigation*, 36 Envtl. L. 301, 302 (2006) (citing H.R. Rep. No. 108-96, pt. 1, at 2 (2003)).
3. *Id.*
4. Robert D. Perlack et al., Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply 9 (2005).
5. *Id.*

million acres burned in 2002.[6] These figures are nearly double the 10-year average.[7] Unsurprisingly, forests have been hit particularly hard by these fires.[8]

These increasingly destructive fires are the product of the federal government's historical policy of near-total fire suppression. For the past half century, the federal government has sought to protect homes and timber interests by fighting wildfires at all costs.[9] Unfortunately, the government has been largely successful in this endeavor, allowing an enormous amount of vegetation, such as branches, brush, and even whole trees, to grow unchecked by fire—a phenomenon known as "fuel loading."[10]

As a result of this policy, contemporary forests are older, denser, less healthy, and more prone to larger and more intense fires than they would be under natural conditions.[11] Of the approximately 700 million acres of federal land managed by the U.S. Department of Agriculture's (USDA's) U.S. Forest Service and the U.S. Department of the Interior (DOI), federal researchers estimate that between 90 and 200 million acres of federal lands in the contiguous United States are at an elevated risk of fire because of abnormally dense accumulations of vegetation,[12] including an estimated 39 million acres of forestland.[13] In addition to the land itself, the heightened risk of wildfire also threatens over 22,000 communities.[14] Researchers believe that global warming may render forests even more susceptible to fire in coming years.[15]

However, fuel loads on federal lands are so huge that the simplest and cheapest fix, proscribed burning, can no longer be used safely. The huge amount of densely packed fuel in modern forests would enable any such burning to rage out of control, destroying entire ecosystem components as well as private property.[16] Therefore, if fuel is to be removed, it must be done mechanically by forestry crews.[17] Such mechanical thinning would remove some large trees, many small trees, and a great deal of branches, underbrush, and other organic material, known collectively as biomass.[18] In addition to safety, mechanical thinning enjoys several other advantages over proscribed burning: it enables foresters to protect select ecological resource values "such as endangered species habitat or critical domestic water sources"[19] from wildfire, and can be employed near at-risk communities and in remote areas alike.[20]

The high cost of fighting fires and increasing political pressure to protect communities pressured Congress to act.[21] In 2005 alone, Congress appropriated $2.5 billion to fight wildfires, an increase from $2.0 billion in 2000.[22] More intense wildfires have killed increasing numbers of firefighters in recent years, and private insurance costs for homeowners in at-risk communities have skyrocketed.[23] As a result, Congress passed the HFRA,[24] which authorizes and funds mechanical thinning projects to remove biomass from federal lands. The HFRA's stated purposes are "to reduce wildfire risk to communities, municipal water supplies, and other at-risk Federal land through a collaborative process of planning, prioritizing, and implementing hazardous fire reduction projects," to "improve the commercial value of forest biomass[,]" to protect watersheds, and to fight insect infestations and disease.[25] Note, however, that these stated purposes indicate that political pressure, rather than environmental concern, prompted the HFRA's passage.[26]

The expense of mechanical thinning drove legislators to subsidize industries that can use this biomass, thereby creating a demand for the material. Such a demand will increase biomass' market price, encouraging private companies to conduct fuel-reduction projects in exchange for the value of the material removed, or so the reasoning goes. The HFRA

6. Memorandum of Understanding Between Gale A. Norton, Sec'y of the Interior, Spencer Abraham, Sec'y of Energy & Ann M. Veneman, Sec'y of Agric., on Policy Principles for Woody Biomass Utilization for Restoration and Fuel Treatments on Forests, Woodlands, and Rangelands 2 (June 18, 2003) (on file with author).
7. *Id.*
8. For example, from 1986 to 1995, wildfires burned more than one-quarter of the Boise National Forest. Keiter, *supra* note 2, at 315.
9. *Id.* at 303.
10. *Id.* at 316; Perlack et al., *supra* note 4.
11. "Rather than burning the understory in Ponderosa pine forests, for example, fires are now regularly 'crowning' and consuming entire tree stands, not only disrupting historical ecological patterns and damaging valuable resources but also endangering nearby communities and creating complex, long-term restoration problems." Keiter, *supra* note 2, at 315.
12. U.S. Gov't Accountability Office (GAO), Federal Agencies Are Engaged in Various Efforts to Promote the Utilization of Woody Biomass, But Significant Obstacles to Its Use Remain 5 (2005) [hereinafter GAO Biomass].
13. Keiter, *supra* note 2, at 315. In Oregon, for example, federal forest scientists have identified 12.2 million acres in danger, most of which are federal forestland. Jim Bowyer, Biomass Energy and Biofuels From Oregon's Forests--Executive Summary (2006).
14. Keiter, *supra* note 2, at 314 (citing Urban Wildland Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire, 66 Fed. Reg. 43383, 43384 (Aug. 17, 2001)) (updating the previous list of communities at risk from wildfire and increasing the number of listed communities to over 22,000).
15. USDA, Woody Biomass Utilization Strategy 1 (Marcia Patton-Mallory ed., 2008).
16. GAO Biomass, *supra* note 12, at 6.
17. *Id.*; Bowyer, *supra* note 13.
18. GAO Biomass, *supra* note 12, at 6; Keiter, *supra* note 2, at 317-18.
19. Keiter, *supra* note 2, at 318.
20. *Id.*
21. *Id.* at 382.
22. *Id.* at 315 (citing U.S. GAO, Wildland Fire Management: Important Progress Has Been Made, But Challenges Remain to Completing a Cohesive Strategy 7-8, tbl. 1 (2005) (GAO-05-147); Carolyn Alkire, The Federal Wildland Fire Budget: Let's Prepare, Not Just React 8 (2004)). These figures include federal fire suppression funds as well as fire management funds for hazardous fuel reduction projects, etc.
23. Keiter, *supra* note 2, at 315.
24. Healthy Forests Restoration Act of 2003, Pub. L. No. 108-148, 117 Stat. 1887 (codified at 16 U.S.C. §§2103b, 6501-6591). Other initiatives such as the National Fire Plan, the Healthy Forests Initiative, and the Tribal Forest Protection Act of 2004 also seek to reduce wildfire damage by removing excess biomass from federal forests.
25. 16 U.S.C.A. §6501(1)-(5) (West 2008).
26. Keiter, *supra* note 2, at 344: "Judging from the HFRA's declared purposes, Congress perceives fire primarily as a political rather than ecological matter."

includes an entire title detailing such biomass-utilization grants to private industry.[27] On June 18, 2003, the Secretaries of the U.S. Department of Energy (DOE), the DOI, and the USDA signed a Memorandum of Understanding pledging to support the commercial use of biomass taken from federal forests, rather than burning it or leaving it on-site.[28] Continuing political pressure to follow through on this commitment is evident. In 2004, for example, the Western Governors' Association's Forest Health Advisory Committee reported that "the biomass is starting to pile up," and urged the Forest Service to use this material to further one of the National Fire Plan's goals: "[P]romoting community assistance, which includes woody biomass utilization."[29]

The government honored this commitment to industry. For fiscal years (FYs) 2004-2008, the HFRA authorized grants of $5 million per year to compensate owners of facilities that use "biomass as a raw material to produce electric energy, sensible heat, transportation fuel, or substitutes for petroleum-based products."[30] Under this provision, the Forest Service granted 17 small businesses a total of $4.1 million in 2008.[31]

B. Ethanol as Transportation Fuel

A simultaneous national problem, the rising price of oil, prompted a legislative solution that similarly benefits corporate interests: ethanol.

Oil's use as a transportation fuel has made rising oil prices a national concern. As President George W. Bush has repeatedly stated, the United States needs to curb its reliance on foreign oil.[32] In 2006, the United States consumed over 317 billion gallons of oil, of which almost 60% was imported.[33] Of all oil consumed within the United States, 68% was used as fuel for transportation.[34] While several non-petroleum options for electricity generation exist,[35] only one non-petroleum transportation fuel currently exists on a commercial scale: ethanol. Additionally, because increases in transportation costs are reflected in the prices of everyday goods, high oil prices contribute to the recent U.S. economic downturn. It should come as no surprise, then, that the government's alternative energy policy centers on producing cheap ethanol.

Congress passed two main pieces of legislation to this end. The major thrust to produce ethanol began in 2005,[36] when Congress passed the Energy Policy Act (EPAct).[37] The EPAct's most significant section is the Renewable Fuel Standard,[38] which mandates a gradual increase in the amount of renewable fuel mixed into transportation fuel sold in the United States. The standard mandates a level of 7.5 billion gallons in 2012, with future amounts to be determined thereafter, including 250 million gallons of cellulosic biofuels starting in 2013.[39] In 2007, the Energy Independence and Security Act (EISA) [40] more than doubled the EPAct's mandate, requiring 36 billion gallons of biofuels by 2022.[41] Of this amount, 15 billion gallons must come from corn-based ethanol and 21 billion gallons must come from advanced biofuels, of which 16 billion gallons must be cellulosic biofuels, such as cellulosic ethanol.[42] The EISA also requires that these biofuels be environmentally friendly. Advanced biofuels must achieve at least a 50% reduction in emissions, and new biofuel refineries funded by the act must emit 20% less heat-trapping gases than petroleum.[43] Massive funding accompanies these mandates,[44] but the EPAct and the EISA leave it to program administrators to develop specific programs to meet the acts' goals.[45]

Other changes in federal policy also promote ethanol. The Conservation Reserve Program,[46] which pays farmers for planting vegetative cover rather than crops on erodible and marginal land, was amended by the 2002 Farm Bill[47] to authorize farmers to instead plant crops that can be used to create ethanol on this land.[48] The proposed 2007 Farm Bill[49] includes additional tax credits for planting such crops. [50] Additionally, the Biomass Research and Development Act

27. Pub. L. No. 108-148, tit. 2, §203, 117 Stat. 1902 (codified at 16 U.S.C.A. §6531); The GAO noted that "[a] congressional committee report accompanying the [HFRA] directed the Forest Service 'to develop this program with the clear intent to make grants that will result in increased commercial use of biomass products, and which will thereby result in reduced overall hazardous fuels program costs.'" GAO Biomass, *supra* note 12, at 18.
28. GAO Biomass, *supra* note 12.
29. *Id.* at 35 (citing Western Governors' Ass'n Forest Health Advisory Comm., Report to the Western Governors on the Implementation of the 10-Year Comprehensive Strategy (2004)).
30. 16 U.S.C.A. §6531.
31. News Release, USDA, Agriculture Secretary Schafer Awards More Than $4.1 Million for Use in Woody Biomass Development (Mar. 7, 2008) (on file with author).
32. *See*, *e.g.*, President George W. Bush, State of the Union Address (Jan. 23, 2007) [hereinafter 2007 Address]; President George W. Bush, State of the Union Address (Jan. 31, 2006) [hereinafter 2006 Address].
33. Energy Info. Admin. (EIA), Basic Petroleum Statistics (2007), *available at* http://www.eia.doe.gov/neic/quickfacts/quickoil.html.
34. *Id.*
35. Coal, nuclear, hydroelectric, and wind power currently generate roughly 77% of the electricity in the United States. EIA, Net Generation by Energy Source: Total (All Sectors) (2008), *available at* http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html#_ftn3.
36. Maywa Montenegro, *The Big Three: The Numbers Behind Ethanol, Cellulosic Ethanol, and Biodiesel in the U.S.*, Grist, Dec. 4, 2006, http://grist.org/news/maindish/2006/12/04/montenegro/ (last visited Apr. 26, 2008).
37. Pub. L. No. 109-58, §1501, 119 Stat. 594 (2005) (amending Clean Air Act §211, 42 U.S.C. §7545 (1990)).
38. *Id.* §1501(a).
39. *Id.*
40. Pub. L. No. 110-140, §202, 121 Stat. 1492.
41. 42 U.S.C.A. §7545 (2007).
42. *Id.*
43. *Id.*
44. The EISA authorizes a total funding of $632 million, $743 million, $852 million, and $963 million for FYs 2007-2010, respectively. *Id.* §16231(b)(1)-(4). Of these amounts, $213 million, $377 million, $398 million, and $419 million are devoted to biofuels, including $100 million, $125 million, $150 million, and $150 million specifically to fund the construction of refineries. *Id.* §16232(d). Furthermore, the EISA authorizes and additional $500 million in grants for the production of advanced biofuels for FY 2008-2015. *Id.* §17022.
45. *Id.* §7545 (stating that "the Administrator shall revise the regulations" to reach these goals). In early 2007, Secretary Samuel W. Bodman raised the funding ceiling within his authority under EPA §932 of EPAct, awarding $385 million to six biorefinery projects. Press Release, U.S. DOE, DOE Selects Six Cellulosic Ethanol Plants for Up to $385 Million in Federal Funding (Feb. 28, 2007) (on file with author).
46. 16 U.S.C. §3831 (2007).
47. Farm Security and Rural Investment Act of 2002, Pub. L. No. 107-171, §1232(a)(7)(A), 116 Stat. 134.
48. Jared Wiesner, *A Grassroots Vehicle for Sustainable Energy: The Conservation Reserve Program and Renewable Energy*, 31 Wm. & Mary Envtl. L. & Pol'y Rev. 571, 579-80 (2007) (promoting such policy changes).
49. Food and Energy Security Act of 2007, H.R. 2419, 110th Cong. §9004.
50. Nancy Kubasek, *Has the Time Finally Come for an Environmentally Friendly Farm Bill?*, 36 Real Est. L.J. 343, 347 (2007).

(BRDA) of 2000[51] "directed the Secretaries of Agriculture and Energy to implement a 'Biomass Research and Development Initiative' under which the agencies would provide grants, contracts, and financial assistance for research on bio-based industrial products."[52] To carry out its provisions in FYs 2000-2005, the BRDA authorized an appropriation of $49 million per year, which was increased by the HFRA to $54 million per year.[53] Additionally, many states have banned the octane booster methyl tertiary butyl ether (MTBE) as a fuel additive, making ethanol the most attractive octane-booster option for gasoline blenders.[54] Overall, these federal mandates and initiatives have provided "a wealth of incentives for biofuels producers and consumers."[55]

C. Two Great Tastes That Would Taste Great Together

Considering that one federal initiative seeks a market for an enormous amount of biomass, and another federal initiative seeks an enormous amount of biomass for a market, why doesn't the government use biomass removed from forest thinning projects to create ethanol? As the remainder of this Article will discuss, the resulting benefits from such a synergy of policies would be enormous. Creating ethanol from *all* the biomass (including large trees) removed by fuel-reduction projects would reduce domestic oil consumption significantly, would avoid the problems inherent in using agricultural crops to create ethanol, and would benefit the environment greatly. However, the corporate interests responsible for the inefficiencies in the nation's biofuel policy currently prevent such harmony.

III. About Ethanol

Before discussing the merits of such a proposal, however, it is necessary to briefly describe what ethanol is and how it can be produced.

A. What Ethanol Is

Ethanol is simply defined as ethyl alcohol, which is also known as grain alcohol.[56] Lacking the energy content of gasoline, ethanol must be mixed with gasoline to produce a fuel mix that can power an automobile. The most common mixture currently in production is E10, which consists of 90% gasoline, 10% ethanol.[57] Another blend that has gained popularity recently, in large part due to federal subsidies, is known as E85, consisting of 85% ethanol and 15% gasoline.[58] Although E85 contains less energy than gasoline, it is this mixture the government sees as the next step in energy independence. Meaningfully reducing U.S. gasoline consumption will therefore require an enormous amount of ethanol.[59]

B. Methods of Ethanol Production

All ethanol is chemically identical, but there are several different methods of generating it, and the resulting product is labeled according to the method employed. All commercial-scale processes use plant matter as an input, or "feedstock." Although one ethanol production process enjoys clear advantages over the others, the government funds suboptimal methods benefitting special interests at the nation's expense.

1. Corn Fermentation

Ninety-five percent of the ethanol currently produced in the United States is made from corn.[60] Creating ethanol from corn requires fermenting the simple sugars that can be found in the starch of corn kernels.[61] As Prof. L. Leon Geyer and colleagues explain:

> There are two common methods of ethanol production: dry milling and wet milling. As the most common method of ethanol production in the United States, dry milling occurs when the entire corn kernel is first ground into flour and the starch in the flour is converted to ethanol via fermentation. Conversely, wet milling is the process of separating the corn kernel into starch, protein, germ and fiber in an aqueous medium prior to fermentation.[62]

Under either process, however, a great deal of water and leftover non-sugar material must be removed from the fermented ethanol, which is a very energy-intensive process.[63]

Although corn fermentation yields ethanol, "it can use only a relatively small portion of each plant," which leaves a lot of biomass, such as corn cobs, leaves, and stalks (known collectively as corn stover), unused and wasted.[64] This inefficiency has prompted some critics to note that "corn harvests won't be large enough to meet either the 35 billion- or 60 billion-gallon targets"[65] set forth in the EISA. Others critics are more forceful. According to Prof. David Pimentel of Cornell, who chaired a DOE panel investigating the economic and environmental impact of ethanol production: "Abusing our precious croplands to grow corn for an energy-inefficient process that

51. 7 U.S.C. §7624 (2000) (amended 2005).
52. GAO Biomass, *supra* note 12, at 9.
53. Healthy Forests Restoration Act of 2003, Pub. L. No. 108-148, §201, 117 Stat. 1901 (codified at 7 U.S.C.A. §8101).
54. Zibin Zhang et al., Can the U.S. Ethanol Industry Compete in the Alternative Fuels' Market? 1 (2007); Montenegro, *supra* note 36.
55. L. Leon Geyer et al., *Ethanol, Biomass, Biofuels, and Energy: A Profile and Overview*, 12 Drake J. Agric. L. 61, 64 (2007).
56. Vinod Khosla, *My Big Biofuels Bet*, Wired, Oct. 2006, http://www.wired.com/wired/archive/14.10/ethanol.html?pg=1&topic=ethanol&topic_set=; Robert J. Samuelson, Op-Ed, *Blindness on Biofuels*, Wash. Post, Jan. 24, 2007, at A23.
57. Nearly one-third of all gasoline sold in the United States contains up to 10% ethanol. National Renewable Energy Lab., U.S. DOE, Low-Level Ethanol Fuel Blends (2005).
58. Geyer et al., *supra* note 55, at 63.
59. Additionally, because a gallon of ethanol contains roughly two-thirds the energy of a gallon of gasoline, (Samuelson, *supra* note 56) using E85 rather than E10 reduces gas mileage by approximately 26%.
60. Geyer et al., *supra* note 55, at 69; Montenegro, *supra* note 36.
61. *Supra* note 56.
62. Geyer et al., *supra* note 55, at 69.
63. Robert Rapier, *Cellulosic Ethanol Versus Biomass Gasification*, Cleantech.com, Nov. 2, 2006, http://media.cleantech.com/node/277 (last visited Apr. 26, 2008).
64. Montenegro, *supra* note 36.
65. Samuelson, *supra* note 56.

yields low-grade automobile fuel amounts to unsustainable, subsidized food burning."[66]

2. Cellulose Fermentation

> The fuel of the future is going to come from fruit like that sumac out by the road, or from apples, weeds, sawdust--almost anything. There is fuel in every bit of vegetable matter that can be fermented. There's enough alcohol in one year's yield of an acre of potatoes to drive the machinery necessary to cultivate the field for a hundred years.[67]
>
> —Henry Ford, 1925

Faced with corn fermentation's inefficiency, researchers have been searching for a commercially viable enzyme or acid treatment that can convert plant cellulose into sugar, which could then be fermented to produce cellulosic ethanol.[68] The discovery of such a catalyst would be of enormous value. The resulting process would allow refineries to use the entire corn plant,[69] or other energy crops such as switchgrass, miscanthus, or hybrid willow or poplar, which would yield much more fermentable sugar than do corn kernels alone.[70] Indeed, President Bush touted the potential yield advantages of cellulosic ethanol in his 2006 and 2007 State of the Union addresses.[71]

However, almost 83 years later, Henry Ford's future has yet to arrive. Researchers have not yet developed a commercially viable method for breaking down plant matter into the sugars required for fermentation. Unlike corn starch, plant matter is "bulky and materially complex,"[72] consisting of cellulose, hemicellulose, and lignin. Researchers have been trying to find or create an organism that can break down all of these materials at once.[73] Although costly "designer" enzymes have been developed to break down cellulose and hemicellulose into simple sugars, breaking down the lignin has been more difficult, and most researchers concede that lignin will instead be burned to produce the huge amount of energy needed to fuel the process.[74] In short, the government's cellulosic ethanol mandate in the EISA depends on researchers finding or creating an effective microorganism and mass producing it inexpensively enough to make cellulosic ethanol viable economically.[75] The DOE plans to invest $33.8 million over the next four years in four projects designed to develop such an enzyme.[76]

3. Biomass Gasification

A third method of creating ethanol, biomass gasification, differs significantly from corn and cellulose fermentation. Instead of using enzymes to ferment ethanol from sugars, biomass gasification is a thermo-chemical conversion process. Biomass is heated in an oxygen-free environment to produce a synthetic gas consisting of carbon monoxide and hydrogen. The gas is then passed over a catalyst that can convert it into any number of products, including ethanol and other alcohols.[77]

Biomass gasification enjoys many advantages over corn and cellulose fermentation. Gasification converts all of the non-mineral constituents of biomass to synthetic gas, while fermentation consumes only the sugars and leaves the rest of the biomass unused.[78] As a result, gasification yields much more ethanol per ton of biomass than does fermentation.[79] Because all organic matter contains carbon, biomass gasification produces ethanol from any organic matter, including not only corn, switchgrass, and sugarcane, but also wood chips, paper pulp, sawdust, animal manure, municipal sewage, or any number of other materials.[80] Additionally, minerals left ungasified can be collected and returned to the soil on which the biomass grew, thereby limiting soil degradation.[81] Furthermore, the process can also produce "synthetic petroleum products, fertilizer, plastics, and many other products,"[82] including synthetic gasoline.[83] And while breaking down cellulose and fermenting sugars with enzymes takes days, "thermal conversion breaks down organic matter and converts it to ethanol in minutes."[84] Perhaps most importantly, biomass gasification exists on a commercial scale right now, and is not dependent on future scientific innovation.

While gasification projects have recently received some federal funding, fermentation refineries dependent on agricultural feedstocks continue to receive the lion's share. In 2007, the DOE granted a private company $76 million to construct a biomass gasification plant in Soperton, Georgia, which, when completed, will have the capacity to produce over 100 million gallons of ethanol per year using wood and wood waste from

66. News Release, Cornell News Service, Ethanol Fuel From Corn Faulted as "Unsustainable Subsidized Food Burning" in Analysis by Cornell Scientist (Aug. 6, 2001) (on file with author).
67. *Ford Predicts Fuel from Vegetation*, N.Y. Times, Sept. 20, 1925, at 24.
68. Range Fuels, *Face Off: Producing Cellulosic Ethanol: Sugar Platform Versus Thermo-Chemical*, http://www.rangefuels.com/Face-Off-Producing-Cellulosic-Ethanol (last visited Apr. 26, 2008).
69. Kubasek, *supra* note 50, at 347.
70. *See infra* Part III.B.
71. 2006 Address, *supra* note 32 (stating: "We'll also fund additional research in cutting-edge methods of producing ethanol, not just from corn, but from wood chips and stalks, or switch grass."); 2007 Address, *supra* note 32 (stating: "We must continue investing in new methods of producing ethanol using everything from wood chips to grasses, to agricultural wastes.").
72. Montenegro, *supra* note 36.
73. *Id.*
74. Mindy L. Baker et al., Crop-Based Biofuel Production Under Acreage Constraints and Uncertainty 17-18 (2008).
75. Geyer et al., *supra* note 55, at 73; Samuelson, *supra* note 56.
76. Press Release, U.S. DOE, Department of Energy to Make Available Up to $33.8 Million to Support Commercial Production of Cellulosic Biofuels (Aug. 27, 2007) (on file with author).
77. Range Fuels, *Face Off*, *supra* note 68. This gasification process has long been used to create ethanol, other alcohols, and petroleum products from natural gas, principally due to natural gas low cost and the fact that it can be piped directly into the facility. Rapier, *supra* note 63. However, rising natural gas prices and the government's goal of reducing dependence on foreign oil necessitates employing other inputs to generate these products.
78. Range Fuels, *Face Off*, *supra* note 68.
79. Rapier, *supra* note 63.
80. Khosla, *supra* note 56.
81. Range Fuels, *Face Off*, *supra* note 68.
82. *Id.* These side-products would complement the government's goal of producing biochemical to replace petroleum-based chemicals. *See*, *e.g.*, Bowyer, *supra* note 13.
83. Matthew L. Wald, *Fuel Without the Fossil*, N.Y. Times, Nov. 9, 2007, at C1.
84. Khosla, *supra* note 56.

Georgia's privately owned pine forests.[85] The project's first phase aims to produce 20 million gallons of ethanol per year.[86] However, of the six projects receiving DOE funding totaling $385 million in 2007, only the Soperton project and one other utilize any elements of biomass gasification, while the remaining four are traditional fermentation refineries dependent on agriculturally grown feedstocks.

IV. Ethanol From Forest Biomass: A Better Path

Many factors indicate that producing ethanol from agricultural feedstocks is unwise policy. Instead, legislators should devote all biomass removed during wildfire fuel-reduction projects on federal lands to renewable fuel production. Such a policy would provide a multitude of benefits.

A. American Farmland Cannot Meet the EISA's Biofuels Mandate

By 2022, the EISA mandates that the United States produce 36 billion gallons of renewable fuel.[87] Of this, 21 billion gallons must be advanced biofuels, which are defined as fuels not derived from corn starch.[88] Of these advanced biofuels, 16 billion gallons must further qualify as cellulosic biofuels--biofuels derived from plant cellulose.[89]

Let's first assume that cellulosic ethanol will not become commercially viable, and that corn will supply the entirety of the EISA's mandate for non-advanced biofuels, totaling 15 billion gallons of ethanol. If a bushel of corn produces 2.79 gallons of ethanol,[90] almost 5.4 billion bushels of corn will be needed to produce the 15 billion gallons of ethanol that the EISA allows to be derived from corn. As of 2006, U.S. farmland produced 11 billion bushels of corn.[91] If production levels remain constant, in 2022, the United States would devote nearly one-half of all corn grown domestically to ethanol production. This would wreak havoc on national and international food markets.[92]

Now let's assume that cellulosic biofuels do become technologically viable, and non-corn energy crops completely replace corn as an ethanol feedstock. Cellulosic ethanol refineries compute inputs by the ton of bone-dry material. One of the theoretically highest yielding feedstocks is giant miscanthus, which is believed capable of providing up to 18 tons of biomass per acre per year.[93] In laboratory trials, researchers have successfully obtained yields of 70 gallons of ethanol per ton biomass. [94] If the technology becomes commercially viable, under these circumstances it would take almost 514 million tons of biomass grown on 28.6 million acres of cropland to produce the EISA's required 36 billion gallons of ethanol.[95] In 2002, the U.S. Census of Agriculture indicated that about 938 million acres of land were classified as agricultural, and that 303 million of those acres were harvested.[96] Clearly, devoting 28.6 million acres to energy crops would require farming a great deal more land, especially considering that food demands are likely to rise over time as the U.S. population does. Assuming that the farmland currently in use is the most productive land, growing energy crops would likely require farming more than 28.6 million additional acres to obtain the required yields. Although this would greatly increase the value of farmland, such a change would also pose a variety of serious problems.

B. Potential Effect on U.S. Fuel Consumption

Against the grim forecast for biofuel produced from agricultural feedstocks, the advantages of using biomass from federal forest thinning projects become apparent. A study published by the DOE and the USDA assessed how much biomass could be produced sustainably on timber and other forestland, public and private.[97] The study suggested that despite the "substantial scope for expanding biomass resource base from forestlands,"[98] 70% of the material removed from forest thinning projects would go to timber mills to be made into "higher-value products," and only the remaining 30% would be available for conversion into ethanol.[99] Taking environmental concerns into account,[100] the study concluded that federal forest fire reduction projects would yield only 18 million tons of biomass annually.[101]

However, this study relies on a flawed assumption. Obviously, only non-merchantable material on privately owned forestland will be devoted to ethanol production. However, there is no legitimate reason for this to be the case for federal forestland as well. Although large trees are currently more valuable as lumber than as biomass, "[e]conomic return cannot be used as the sole yardstick for measuring public benefit from federally owned property."[102] Why should timber companies receive the sole benefit of resources belonging to U.S. citizens?

85. Press Release, DOE Selects Six, *supra* note 45; Range Fuels, *Our First Plant*, http://www.rangefuels.com/our-first-plant (last visited Apr. 26, 2008).
86. Wald, *supra* note 83.
87. 42 U.S.C.A. §7545.
88. *Id.*
89. *Id.*
90. Geyer et al., *supra* note 55, at 74.
91. *Id.*
92. *See infra* Part III.C.
93. Rich Pyter et al., *Giant Miscanthus: Biomass Crop for Illinois*, *in* Issues in New Crops and New Uses: Proceedings of the Sixth National Symposium 39, 42 (J. Janick & A. Whipkey eds., 2007) (citing yields over 40metric tons/hectare (t/ha) in some climates). *See also id.* at 41 (noting that these yields are reached only after three to five years, depending on soil fertility).
94. Rapier, *supra* note 63.
95. Biomass gasification facilities have attained yields of 114 gallons per ton in practice, and researchers theorize that an output of 230 gallons per ton is possible. Rapier, *supra* note 63. Using existing technologies, employing gasification would reduce the amount of additional land required to under 17.5 million acres.
96. Nat'l Agric. Statistics Serv., USDA, 2002 Census of Agric. 1, tbl. 8 (2002).
97. Perlack et al., *supra* note 4, at 5.
98. *Id.* at 6.
99. *Id.* at 13.
100. Operational accessibility is further limited by the need to avoid adverse impacts to soil and water. Steep slopes, sensitive sites, regeneration difficulty, or lack of adequate resource information may exclude an area from operational treatments. *Id.* at 12.
101. *Id.* at 51, tbl. A.7.
102. Christopher McGrory Klyza, Who Controls Public Lands? Mining, Forestry, and Grazing Policies, 1870-1990, at 98 (1996). *See* Richard W. Behan, Plundered Promise: Capitalism, Politics, and the Public Lands 160 (2001) (noting that "[f]ree markets are scarcely free: They are driven by public policies . . . .").

In deciding between national energy security and timber company profits, the choice should be clear.

Devoting federally owned merchantable biomass to ethanol production, rather than to private industry, would yield significant benefits. Under such a regime, national forest and other public lands could provide up to 60 million tons of biomass per year.[103] If this material were converted into ethanol using biomass gasification, it would yield 6.8 billion gallons of ethanol per year using existing conversion rates, and 13.8 billion gallons if conversion becomes as efficient as researchers theorize is possible.[104] Such an amount would represent a huge step toward reaching the EISA's cellulosic biofuels goals.

Producing an additional 6.8 billion gallons of ethanol per year from federal forestland would have a significant effect on U.S. fossil fuel consumption. As it currently stands, the Energy Information Administration (EIA) projects that by 2022, the United States will consume a total of 339 billion gallons of liquid fuels.[105] Seventy-two percent of this amount, 245 billion gallons, will be used for transportation. [106] E85 use is projected to blossom from 38 million gallons in 2008 to 17 billion gallons in 2022, dropping motor gasoline consumption from 143 billion gallons in 2008 to 135 billion gallons in 2022.[107] The EIA also projects that net oil imports will decrease during this period, from 155 billion gallons in 2008 to 151 billion gallons in 2022.[108]

Supplying 6.8 billion gallons of ethanol from federal forestland would provide the ethanol for an additional 8 billion gallons of E85, which has the potential to further decrease gasoline consumption by an additional 4 billion gallons yearly.[109] Although the overall consumption of liquid fuels for transportation is projected to increase 12% from 2008 to 2022,[110] the production of ethanol, especially from renewable, carbon-neutral sources such as our nation's forests, would not only compensate for the growth in demand for transportation fuels, but would reduce the use of oil for transportation overall.

C. Agricultural Land—A Tale of Two Outputs

The finite amount of land available for cultivation makes producing ethanol from agriculturally grown feedstocks problematic. Crops grown on American agricultural land go to two primary uses: (1) food (including animal feed); and (2) fuel. The increased demand for corn to make ethanol has caused corn prices to increase dramatically in recent years. The government's future energy policy, which contemplates a heavy use of agricultural feedstocks to produce ethanol, is likely to have two effects. First, increasing demand for and prices of biofuels and the steady demand for food would push farmers (both inside and outside the United States) to increase the amount of land under cultivation.[111] Second, food prices will increase as food crops compete with energy crops for land.[112] While benefitting farmers,[113] these trends will cause an increase, rather than a decrease, in greenhouse gas (GHG) emissions worldwide, and will wreak havoc on national and international food markets. This injustice should compel legislators to promote an energy policy that does not rely on agricultural feedstocks.[114] Gasifying biomass from HFRA fuel-reduction projects requires no land conversion and minimal additional energy expenditures beyond the fuel already slated for consumption in removing biomass and delivering it to lumber mills, and would impose no burden on world food markets.

1. Carbon and Land Conversion

Carbon sequestration explains the increase in GHGs. Plants remove carbon dioxide (CO_2) from the air through photosynthesis, and sequester the carbon as woody biomass. When a plant decomposes or is burned, the carbon is re-released into the atmosphere as CO_2. This process results in no net gain or loss in carbon on the earth's surface and in its atmosphere. Oil also contains carbon, but carbon that was sequestered millions of years ago. Pumping oil to the surface of the earth and burning it results in an increase in the amount of carbon on the earth's surface. Since plants absorb a constant amount of CO_2, most of the CO_2 released from burning oil stays in the earth's atmosphere, contributing to global warming. Accordingly, promoting the use of biofuels rather than oil has been seen as an environmentally friendly practice.

However, despite the EISA requirement that biofuels result in a net decrease in life-cycle GHG emissions,[115] producing biofuels from agricultural feedstocks would actually increase the amount of CO_2 in the atmosphere. Clearing land requires removing and destroying the native vegetation, thereby releasing the carbon stored in those plants into the atmosphere.[116] This initial increase in carbon from land conversion is called "carbon debt." In some areas, researchers have concluded that the carbon debt amounts to 17 to

103. *See supra* note 102.
104. Rapier, *supra* note 63.
105. EIA, *Annual Energy Outlook 2008 With Projections to 2030 (Revised Early Release)*, tbl. 11, http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html (last visited Apr. 26, 2008).
106. *Id.*
107. *Id.* Diesel use is also projected to increase 20% to 66 billion gallons over this period. *Id.*
108. These figures do not assume the difference will be made up by drilling in Alaska, as annual crude oil production from Alaska is projected to drop from 11 billion gallons in 2008 to 10.3 billion gallons in 2022. *Id.*
109. This assumes that E85 reduces gas mileage by one-third (Samuelson, *supra* note 56) and that an additional 1.2 billion gallons of gasoline will be needed to provide the 15% gasoline in E85.
110. EIA, *Outlook*, *supra* note 106.
111. Timothy Searchinger et al., *Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions From Land Use Change*, 319 Science 1238, 1238 (2008).
112. Maarten Chrispeels & Steve Kay, Op-Ed, *The Promise of Biofuels: Hype or a Real Solution?*, San Diego Union-Trib., Feb. 17, 2008. *See Corn . . . Fuel . . . Fire! U.S. Corn Subsidies Promote Amazon Deforestation*, Smithsonian Tropical Research Inst., Dec. 17, 2007, http://www.stri.org/english/about_stri/headline_news/news/article.php?id=736 (last visited Apr. 26, 2008) [hereinafter Smithsonian] (stating that rising soy and beef prices in Brazil have contributed to Amazon deforestation).
113. Samuelson, *supra* note 56.
114. This was the position urged by 10 prominent ecologists and environmentalists in their February 2008, letter to President Bush. Elizabeth McGowan Washington, *Biofuels Are No Panacea, Senators Warn*, Waste News, Feb. 18, 2008, at 21, *available at* 2008 WLNR 3513601.
115. 42 U.S.C.A. §7545.
116. Joseph Fargione et al., *Land Clearing and the Biofuel Carbon Debt*, 319 Science 1235, 1235 (2008); Searchinger et al., *supra* note 112, at 1238.

420 times the annual GHG emission reductions achieved by using the resulting biofuels.[117] According to the previous calculation, fueling cellulosic ethanol plants with miscanthus would necessitate cultivating an additional 28.6 million acres of land in order to meet the EISA's mandate,[118] which would impose a substantial carbon debt upon the environment. These effects would be replicated throughout the world.[119] Furthermore, even if excess cropland became available due to more efficient farming techniques, growing energy crops on excess lands foregoes the carbon sequestration benefit the lands would provide if left to grow wild.[120]

Additionally, fossil fuels are consumed in the process of producing ethanol. Although corn and cellulosic ethanol plants would generate some heat and electricity by burning the leftover biomass not converted into ethanol, fossil fuels are required to fertilize, harvest, transport, and heat the biomass, as well as to distil the ethanol from its aqueous solution and to dry the leftover material so that it can be burnt.[121] As a result, corn and cellulosic ethanol provide only 26 and 80% more energy, respectively, than are required for their production.[122] While the USDA argues that "[o]nly about 17 percent of the energy used to produce ethanol comes from liquid fuels, such as gasoline and diesel fuel,"[123] ethanol plants typically run on coal or natural gas, thereby contributing carbon to the atmosphere.[124]

2. Food Market Effects

Producing ethanol from agricultural feedstocks also increases food prices, burdening world food markets. Already, the government's corn ethanol program has had such effects. In recent years, the increasing demand for and price of corn has decreased U.S. exports significantly.[125] As a result, tortilla prices in some parts of Mexico tripled or quadrupled between August 2006 and January 2007, leaving Mexico's poor, who have traditionally subsisted on tortillas, facing hunger.[126] In the United States as well, food staple prices have increased steadily in the past few years.[127]

Researchers hold U.S. government policy directly responsible for these food market effects.[128] Commenting on the cellulosic fuels mandate in the EISA, researcher Mindy L. Baker noted: "If the cellulosic mandates in the act are designed to avoid the feed-versus-fuel trade-off, our results suggest it will actually exacerbate the situation by inducing even higher feedstuff costs than under the regime with only corn ethanol in production."[129] Considering the finite amount of land in the United States, "it is impossible to increase the amount of *each* crop devoted to energy *and* maintain the same level of consumption of each commodity for food uses such as feeding livestock."[130] Increasing the amount of land devoted to ethanol production would only exacerbate these effects, thus increasing world hunger.

D. A Counter to Cost Concerns

As it currently stands, cost-efficiency concerns limit the production of ethanol from biomass.[131] However, the reasons for this are cyclical. No facilities currently exist for the use of woody biomass as an ethanol source. This limited demand results in a low value for biomass. The low value of biomass provides little incentive for the private sector to produce a large, steady stream of the material.[132] Without the assurance of such a steady stream, investors have little incentive to build facilities that would use woody biomass.[133] The lacks of supply and demand reinforce one another, presenting a chicken-or-egg dilemma.

Only government subsidies and import tariffs have broken this cycle and created a market for corn ethanol. The government has long provided massive subsidies and tax incentives to corn farmers,[134] funds ethanol research,[135] and pays for the construction of corn ethanol refineries.[136] Additionally, the federal government levies a $0.54 tariff on imported ethanol in order to make homegrown ethanol competitive

117. *Id.*
118. *Supra* Part III.B.
119. One study "calculated that an ethanol increase of 56 billion liters, diverting corn from 12.8 million ha of U.S. cropland, would in turn bring 10.8 million ha of additional land into cultivation. Locations would include 2.8 million ha in Brazil, 2.3 million ha in China and India, and 2.2 million ha in the United States." Searchinger et al., *supra* note 112, at 1238. *See also* Smithsonian, *supra* note 113.
120. Searchinger et al., *supra* note 112, at 1238.
121. Geyer et al., *supra* note 55, at 71.
122. Montenegro, *supra* note 36. Some researchers are more skeptical still, maintaining that this ethanol has a negative energy return. *See*, *e.g.*, Chrispeels & Kay, *supra* note 113; Geyer et al., *supra* note 55, at 71-72. However, "the consensus within the scientific community supports the findings of USDA." Geyer et al., *supra* note 55, at 72.
123. Hosein Shapouri et al., USDA, The Energy Balance of Corn Ethanol: An Update 4 (2002).
124. Montenegro, *supra* note 36.
125. Searchinger et al., *supra* note 112, at 1238.
126. Manuel Roig-Franzia, *A Culinary and Cultural Staple in Crisis: Mexico Grapples With Soaring Prices for Corn and Tortillas*, Wash. Post, Jan. 27, 2007, at A01.
127. Miriam Marcus, *U.S. Food Prices Pork Out*, Forbes.com, Mar. 30, 2008, http://www.forbes.com/markets/2008/03/30/food-price-commodity-markets-equity-cx_mlm_0328markets39.html (last visited Apr. 26, 2008).
128. Smithsonian, *supra* note 113 (quoting Smithsonian Tropical Research Institute staff scientist William Laurance, stating that "evidence of a corn connection to [increasing Amazon deforestation for use as cropland] is circumstantial, but it's about as close as you ever get to a smoking gun").
129. Baker et al., *supra* note 74, at 22-23.
130. *Id.*
131. GAO Biomass, *supra* note 12, at 3.
132. *Id.* at 38; Perlack et al., *supra* note 4, at 12; Robin P. Silverstein et al., *Biomass Utilization Modeling on the Bitterroot National Forest, in* Fuels Management—How to Measure Success: Conference Proceedings 673-88 (Patricia L. Andrews & Bret W. Butler eds., 2006).
133. GAO Biomass, *supra* note 12, at 36; Silverstein et al., *supra* note 133, at 686.
134. From 1995 through 2005, corn producers received $51.2 billion in subsidies, which is double that received by producers of wheat, the next highest subsidy recipient, at $20.9 billion. Geyer et al., *supra* note 55, at 76. The Volumetric Ethanol Excise Tax Credit, created by the American Jobs Creation Act of 2005, provides ethanol producers a tax credit of $0.51 per gallon. *Id.* at 66; Montenegro, *supra* note 36.
135. Wiesner, *supra* note 48, at 586 (noting that "[t]he current technology used to create biopower products from biomass, including fuel and other products, has been developed largely through support provided by the federal government"). *See*, *e.g.*, 42 U.S.C.A. §17032 (West 2007) (authorizing $25 million per year for FYs 2008-2010 to fund research in certain states); 42 U.S.C.A. §17035 (authorizing university-based research grants totaling $25 million).
136. *See* 42 U.S.C.A. §16232(d) (West 2007) (authorizing a total of $525 million for FYs 2007-2010 to fund the construction of ethanol refineries). *See also* Press Release, DOE Selects Six, *supra* note 45.

with imports from abroad.[137] However, while industry reaps the benefits of these huge payouts, the market for corn-based ethanol is artificial, inefficient, and not economically viable in the absence of subsidies, tax credits, and tariffs.[138] Researchers estimate that in 2022, producing the amount of cellulosic ethanol mandated by the EISA would require a federal subsidy of $1.86 per gallon, largely because food and fuel compete for agricultural land.[139]

Gasifying biomass from federal forestland would likely provide a net savings over the government's current corn ethanol subsidies. Federal funding for biomass gasification facilities able to utilize forest biomass would overcome the chicken-or-egg dilemma.[140] The resulting increase in demand for biomass would raise its market price and thereby provide private sector incentives to conduct fuel-reduction projects and supply the resulting material to refineries. The HFRA's funding of $760 million per year and the EISA's $3.19 billion appropriation for FYs 2007-2010 could combine with private funding to enable the construction of such facilities.[141] Rising biomass prices would also encourage timber companies to sell unused biomass to refineries, and would encourage private landowners to undertaken more fuel-reduction projects than they otherwise would,[142] further decreasing the risk and severity of wildfires. Additionally, biomass gasification's efficiency and output advantages[143] make biomass-based ethanol a more attractive candidate for federal subsidies.[144]

Utilizing all the biomass removed from fuel-reduction projects would lower biomass costs. Commentators have noted that harvesting and transporting biomass is the greatest cost constraint to its use.[145] Transporting whole trees as well as smaller-gauge material would reduce transportation costs per ton. Transportation costs would further decrease as the number of biomass processing facilities increases.[146] Furthermore, harvesting both large and small materials in one pass would decrease harvest costs,[147] and the development of a biomass market may increase the development and availability of specialized and more cost-effective harvesting equipment.[148]

Firefighting expenditure savings resulting from fuel-thinning projects must also be considered in computing the true cost of forest biomass. Congress has historically funded federal firefighting efforts "off-budget on an as-needed basis."[149] Because wildfires have historically been seen as acts of God rather than the product of deliberate government policy choices, politicians have reaped the political benefits of forestry policy while writing off the costs. Determining the true cost of forest biomass requires taking firefighting savings into account. Rather than redistributing taxpayer savings to private timber companies by permitting them access to the most valuable proceeds of fuel-reduction projects, savings should be used to fund the biomass ethanol industry.

E. Environmental Benefits

Gasifying biomass from federal forestland would enjoy several environmental benefits over the government's current policy of producing cellulosic ethanol from agricultural feedstocks. All environmental consequences must be considered when determining whether a reduction in vehicle emissions justifies biofuels' use.[150]

1. Soil Quality

When organic material is harvested and removed to an ethanol processing facility, minerals and soil nutrients, which otherwise would return to the soil as the biomass decomposed, are removed from the area as well. However, residue retention plays an important role in ecosystem health; it "conserves soil and water, moderates temperature, provides food and habitat for soil fauna (earthworms), recycles plant nutrients, and enhances biodiversity by providing habitats for wildlife."[151] Many studies have concluded that the removal of biomass has negative consequences for the land, such as degradation of the soil, water and wind erosion, increased water loss due to runoff and evaporation, nutrient loss, higher soil temperatures, decreased carbon sequestration rates, and lower microbial, fungal, and earthworm activity.[152]

Cellulosic ethanol plants using corn stover or other energy crops are prone to these consequences. Yearly collec-

137. Zhang et al., *supra* note 54, at 5; Baker et al., *supra* note 74, at 19-20.
138. Zhang et al., *supra* note 54, at 14; Geyer et al., *supra* note 55, at 76.
139. Baker et al., *supra* note 74, Abstract.
140.
> Some agency officials believe that their agencies are limited in their ability to fully address these obstacles, and that additional steps beyond the agencies' authorities will be required to increase woody biomass utilization. Such steps include subsidies or tax credits to offset the costs involved in using woody biomass and federal or state policies requiring the use of renewable energy sources. . . .

GAO Biomass, *supra* note 12, at 4.
141. 16 U.S.C.A. §6518 (West 2003); 42 U.S.C.A. §16231(b)(1)-(4).
142. *See* USDA, Woody, *supra* note 15, at 1; Keiter, *supra* note 2, at 318.
143. Rapier, *supra* note 63.
144. *See* Keiter, *supra* note 2, at 382 (noting that "[d]irect subsidies may be necessary to bring new commercial biomass facilities on-line to utilize the brush and small diameter trees that are being removed"); Baker et al., *supra* note 74, at 23-24. These subsidies already exist. *Id.* (codified at 16 U.S.C.A. §6531)). The available federal grant funds are intended to offset the costs involved in purchasing the necessary biomass for the facility. *Id.* (codified at 16 U.S.C.A. §6531(a)). An argument can be made that traditional refineries are less expensive to construct, and that minimizing the distance biomass must travel to reach a refinery necessitates the construction of the greatest number of refineries possible. A biomass gasification plant is estimated to cost $120,000-$140,000 per barrel of capacity per day, while a fermentation plant is estimated to cost only $20,000-$30,000. EIA, *Annual Energy Outlook 2006 With Projections to 2030 (Revised Early Release)*, http://www.eia.doe.gov/oiaf/archive/aeo06/index.html (last visited Apr. 26, 2008). However, biomass gasification's increased efficiency over fermentation mitigates its initially higher construction costs.
145. Perlack et al., *supra* note 4, at 12.
146. *See id.* at 34.
147. *See* Bowyer, *supra* note 13.
148. Perlack et al., *supra* note 4, at 36.
149. Keiter, *supra* note 2, at 315.
150. USDA, Woody, *supra* note 15, at 2.
151. R. Lal, *Soil Carbon Sequestration Impacts on Global Climate Change and Food Security*, 304 Science 1623, 1623 (2004).
152. Soil Quality Nat'l. Tech. Dev. Team, USDA, Crop Residue Removal For Biomass Energy Production: Effects on Soils and Recommendations 2 (2006). Geyer et al., *supra* note 55, at 75. "Removal of agricultural residues from farmland has additional negative consequences, including . . . and crusting, which decreases agronomic productivity, lowers crop yields per unit input of fertilizers and water, and ultimately renders cropland unsustainable." Humberto Blanco-Canqui et al., *Corn Stover Impacts on Near-Surface Soil Properties of No-Till Corn in Ohio*, 70 Soil Sci. Soc. Am. J. 266, 266 (2006). *See also* Lal, *supra* note 152.

tions of corn stover or other agricultural biomass feedstocks would deplete the soil quite quickly.[153] With respect to corn, researchers estimate that only 30 to 40% of the stover could be removed annually without damaging the land.[154] And because cellulosic ethanol plants leave a great deal of biomass (lignin) unused, there is no practical way to return nutrients to the soil. Rather, increasing amounts of fertilizer are needed. As a result, producing ethanol from agricultural feedstocks and crop residues is essentially robbing Peter to pay Paul.

Gasifying non-agricultural feedstocks, such as forestland biomass, would mitigate these soil quality issues. Compared to the 30-40% of biomass that could be removed sustainably from cropland, up to 85% of excess forest biomass could be removed sustainably,[155] resulting in a much more efficient process. Additionally, the above ethanol production calculations[156] assume that forests would only be entered once every 30 years,[157] significantly lessening soil degradation as compared to yearly removals of agricultural feedstocks. Moreover, although nutrients would initially be removed from the soil, the biomass gasification process consumes almost all plant material, leaving only a small amount of unreacted carbon and all minerals as residue.[158] This concentrated mixture could then be returned to forest soil.

2. Water Consumption and Pollution

A great deal of water is consumed and polluted in the cultivation of agricultural feedstocks. Not only must many energy crops be irrigated directly, but energy crops such as corn and switchgrass require a great deal of pesticides and nitrogen fertilizer.[159] These chemicals do the environment two major injuries. Not only does "the release of nitrous oxide by soil bacteria" negate the carbon sequestration that takes place in photosynthesis,[160] thereby negating GHG reduction goals, but nitrogen fertilizer and pesticide runoffs promote excessive plant growth and decay in surrounding watersheds--a phenomenon known as eutrophication.[161]

The government-sponsored corn ethanol program has already caused eutrophication. Ethanol subsidies have expanded corn acreage in the United States, leading to an estimated 210 million pounds of nitrates from agricultural runoffs entering the Mississippi River every year.[162] These nitrates have caused a massive algae bloom in the Gulf of Mexico, which consumes so much oxygen that the area surrounding the Mississippi delta cannot support sea life, leading to the area being known as the dead zone.[163] Researchers state that "it would take a 55 percent reduction in the nitrogen levels of the Mississippi in order to decrease the size of the dead zone[,]" and that under the EISA's biofuels mandate, "nitrogen pollution in the Mississippi River would increase by 10 to 19 percent if corn-based ethanol were used as the source of the fuel."[164] As one researcher succinctly stated: "The U.S. energy policy will make it virtually impossible to solve the problem of the dead zone."[165]In contrast, producing ethanol from federal forest biomass would avoid these deleterious effects, requiring no artificial irrigation, no fertilizer. Moreover, while cellulosic ethanol plants require a large amount of water in which to dissolve and ferment biomass, gasification uses only one-quarter of this amount on average.[166] This would further make gasification attractive to areas susceptible to water shortages, such as the American West.

F. Public Support

Several commentators have raised concerns about using national forest biomass as source of alternative energy. Commentators have suggested that expanding the market for biomass would allow market forces to dictate the forest management strategy used, thereby encouraging excessive mechanical thinning[167] or road-building in previously roadless areas.[168] Environmentalists may fear that the government will reduce forest protections in order to meet the nation's growing demand for fuel, and would argue that forest restoration goals should predominate over the needs of the biofuels industry in determining the amount of biomass removed from federal forests.[169]

However, given the available options, environmental groups likely would support utilizing biomass removed from federal forests to produce ethanol. Adequate protections for federal forests do exist. Unlike projects on private timberlands, forest management proposals on federal land are subject to protective

153. With respect to corn stover, harvest logistics present additional difficulties. According to Iowa State researcher Stuart Birrell: "One-pass harvest experiments have slowed combines to about 60 percent of normal harvest speed, too slow to suit farmers." Bill Hord, *The Future Is Not Now for Biomass Ethanol Industry*, Omaha World-Herald, Mar. 27, 2007, *available at* http://www.omaha.com/index.php?u_page=1208&u_sid=2354471 (last visited Apr. 26, 2008). Furthermore, cellulosic ethanol plants require a steady stream of feedstocks throughout the year (GAO Biomass, *supra* note 12, at 4) while the corn harvest happens only once yearly. As a result, the "logistics of collecting and storing a million tons of corn stubble each year for an ethanol refinery are mind-numbing." Hord, *supra*. Biomass on forestland, on the other hand, can be stored outdoors and removed almost anytime throughout the year.

154. Zia Haq, EIA, Biomass for Electricity Generation 6 (2002); Soil Quality, *supra* note 153, at 2.

155. Perlack et al., *supra* note 4, at 13.

156. *Supra* Part III.B.

157. Perlack et al., *supra* note 4, at 13.

158. Range Fuels, *Face Off*, *supra* note 68.

159. Additionally, many of these chemicals are themselves derived from fossil fuels. Montengero, *supra* note 36.

160. Chrispeels & Kay, *supra* note 113 (citing Jeff Severinghaus, University of California at San Diego, Scripps Institution of Oceanography).

161. Geyer et al., *supra* note 55, at 75-6 (citing Alice Friedman, *Peak Soil: Why Cellulosic Ethanol, Biofuels Are Unsustainable and a Threat to America* (Apr. 10, 2007), http://www.culturechange.org/cms/index.php?option=com_content&task=view&id=107&Itemid=1 (last visited Apr. 25, 2008) (defining eutrophication as low oxygen in bodies of water)).

162. Mongabay.com, *Corn Ethanol Is Worsening the Gulf Dead Zone*, http://news.mongabay.com/2008/0310-ethanol.html (last visited Apr. 26, 2008).

163. *Id.*

164. *Id.* (citing Simon D. Donner of the University of British Columbia in Vancouver and Christopher J. Kucharik of the Center for Sustainability and the Global Environment at the University of Wisconsin-Madison).

165. *Id.* (quoting Donner).

166. While corn ethanol fermentation yields a solution comprised of 15-20% ethanol with the remainder wastewater, cellulosic ethanol fermentation yields a solution of only about 4% ethanol with 96% wastewater. R-Squared Energy Blog, *Cellulosic Ethanol Reality Check*, http://i-r-squared.blogspot.com/2006/11/cellulosic-ethanol-reality-check.html (last visited Apr. 26, 2008).

167. GAO Biomass, *supra* note 12, at 43.

168. *Id.*

169. Bowyer, *supra* note 13; GAO Biomass, *supra* note 12, at 43.

legislation enforceable by private litigation.[170] Additionally, the HFRA stipulates that endangered species, biodiversity, watershed, and old growth limitations guide how projects are designed.[171] Furthermore, since Congress has already authorized fuel-reduction projects that will result in a great deal of biomass being removed, environmental groups would likely support using this material to reduce the nation's dependence on fossil fuels, rather than to provide timber companies with a source of lumber.[172]

V. Corporate Interests Shaping National Policy

In light of the sizeable potential benefits, why aren't these policies working together already? The immediate answer is easy: the EISA requires that the alternative biofuels it mandates be derived from feedstocks grown on nonfederal land.[173] This clause clearly prevents any such synergy. But why this requirement?

The explanation lies in public choice theory. Corporate interests exercise enormous power in Washington. Through political action committee[174] lobbying,[175] corporations fund politicians' election campaigns in return for policies and legislation favorable to their interests.[176] Additionally, unelected officials employed by federal agencies enjoy numerous perks and excellent job opportunities as a result of their close and congenial relationships with corporate lobbyists.[177] As a result, corporations' interests take precedent over the public's when the time comes to draft legislation and formulate policy.[178] The fear of this very phenomenon is what prompted Gifford Pinchot's to insist that "[w]here conflicting interests must be reconciled the question will always be decided from the standpoint of the greatest good for the greatest number in the long run."[179] In practice, however, exactly the opposite is the norm. When "[t]he choice lies between the convenience of the lumbermen and the public good,"[180] the lumbermen win.

This bias helps explain both the method of ethanol production favored by the government as well as restrictions in biofuels legislation. Federal support for ethanol fermented from agricultural feedstocks is likely the product of farm and timber industry lobbying.[181] The farm industry has no desire to see waste materials used to produce ethanol, or ethanol overlooked entirely in favor of synthetic gasoline, since such policies would reduce the demand for and price of corn and other farm-grown energy crops.[182] Similarly, the timber industry, already facing hard times,[183] likely would oppose any policy forcing timber companies to compete with ethanol refineries for use of the nation's timber. Developing an infrastructure based around fermentation refineries dependent on farm-grown feedstocks, rather than biomass gasification facilities capable of using a variety of materials, coincides with both industries' interests. The USDA and the DOE have been more than happy to oblige.[184] Indeed, "[i]t seems that corporations have bought the political system, and turned it to prey on society at large."[185]

A proposed amendment to the EISA, the Renewable Biofuels Facilitation Act (RBFA),[186] purports to remove the EISA's restriction on using biomass from federal land, supposedly in

170. With the passage of NEPA, the ESA, and related laws, Congress imposed explicit substantive and procedural obligations on the public land agencies whenever they contemplated removing trees, whether to reduce potential hazardous fuel loads, ignite prescribed fires, or salvage fire-damaged timber. Long wary of the Forest Service's well-documented penchant for harvesting commercial timber, environmental organizations have mounted an effective litigation campaign to dampen the agency's enthusiasm, targeting both fire-related and other timber projects that were perceived as threatening environmental values.

Keiter, *supra* note 2, at 332 (citing Behan, *supra* note 103, at 151-58 (describing the 1960s' controversy over the management of the Bitterroot National Forest); David A. Clary, Timber and the Forest Service 183-88 (1986) (describing the Forest Service's history of clear-cutting); Paul W. Hirt, A Conspiracy of Optimism: Management of the National Forests Since World War II 245-51 (1996) (detailing the controversy over clear-cutting in the 1960s)).

171. Keiter, *supra* note 2, at 379 (citing 16 U.S.C.A. §6512).

172. *See id*. at 320 (stating that delivering the proceeds of mechanical fuel removal to timber companies "raises serious environmental concerns and evokes heated opposition from anti-logging groups").

173. 42 U.S.C.A. §7545 (West 2007).

174. Behan, *supra* note 103, at 179 (stating that political action committees have ensured that "[t]he financial pipeline from political interests to political campaigns is now straight and direct, and all the valves are open").

175. *Id.* at 185, claiming:
The Washington law firm is the mechanism, if a single one can be isolated, by which benign politics was transformed, and through which corporate capitalism turns public policy to its advantage. The most influential, most experienced, best connected lobbying talent is for sale, and corporate America has cornered it. It is not used to further the interests of the nation at large.

176. *Id.* at 160 (explaining that "[c]orporations utilize political action committees to dominate the financing of political campaigns, and thus the political system is conditioned by economic interests"). *See also id.* at 186 (citing William Greider, Who Will Tell the People: The Betrayal of American Democracy 259 (1993) (noting that 70% of campaign contributions come from corporate sources)).

177. Behan, *supra* note 103, at 22.

178. *Id.* at 8, 160 (noting that "[c]orporate interests have evolved ever more refined means of preying upon the wealth and assets of the public at large. To serve their own ends, corporate interests have co-opted the political system. . . ." and "American people have become subservient to their economic and political institutions." *See generally* Greider, *supra* note 177; Daniel Hellinger & Dennis R. Judd, The Democratic Façade (1991).

179. Klyza, *supra* note 103, at 73 (citing Letter from James Wilson, Sec'y of Agric., to Gifford Pinchot, Chief of U.S. Forest Serv. (Feb 1, 1905)).

180. Pinchot, *as quoted in* Klyza, *supra* note 103, at 16-17 (quoting Samuel T. Dana, Forest and Range Policy 212, 208 (1956)).

181. Political action committees (PACs) are hard at work for these industries. In the 1993-1994 election cycle, for example, grain producers Cargill and Continental Grain contributed $105,497 to PACs, and reaped benefits of approximately $238 million for export enhancement in return. Similarly, timber companies Weyerhaeuser and Georgia Pacific contributed $58,982, and reaped salvage logging benefits of $19 million. Behan, *supra* note 103, at 180, tbl. 1.

182. Samuelson, *supra* note 56 (calling corn farmers the U.S. ethanol program's "main beneficiaries").

183. Dale Bosworth & Hutch Brown, *After the Timber Wars: Collaborative Community-Based Stewardship*, 105 J. Forestry 271 (2007), *available at* http://www.fs.fed.us/news/2007/briefings/11/stewardship.shtml (noting that timber harvests "peak[ed] at 12.7 billion board feet in 1987[,]" but that "[i]n the 1990s, national forest timber harvest plunged to prewar levels, where it has leveled off at about 2 billion board feet per year") (internal footnote omitted).

184. The vast majority of the DOE ethanol refinery funding has gone to fund agricultural feedstock-dependent refineries. *See* Press Release, DOE Selects Six, *supra* note 45.

185. Behan, *supra* note 103, at 186. *See also* Klyza, *supra* note 103, at 16 (noting the reason for putting national resources under executive control originally: "Politicians and the public were not to be trusted with these decisions; they were not knowledgeable enough and were often swayed by special interest pressures.").

186. H.R. 5236 110th Cong. (2008). The language of this House act is identical to a provision included in the Senate's version of the 2007 Farm Bill which passed on December 14, 2007. Food and Energy Security Act of 2007, S. 2302, 110th Cong. (2007).

order to increase the volume of material available to produce cellulosic ethanol.

However, far from providing the nation energy security, this proposal merely illustrates the impossibility of addressing national and international problems while placating special interests. The RBFA stipulates that only biomass unusable by the timber industry could be used to produce alternative fuels.[187] Thus, the Act would first provides timber to the timber industry, and then use the leftovers to address the nation's energy crisis. The industry forces at play here are evident. As one of the bill's co-sponsors, Rep. Stephanie Herseth Sandlin (D-S.D.), stated: "[The RBFA will] provide an economically viable outlet for forest byproducts that could revitalize the local economies of hundreds of small forest communities across the country."[188] The EISA excluded a potentially valuable source of biomass, but the RBFA would only correct this to the extent that national energy needs don't infringe upon timber industry profits.

The ethanol debacle raises serious concerns beyond forestry and energy policy as well. Criticism of special interest groups externalizing costs and undervaluing federal land's aesthetic and recreational values is par for the course among environmentalists. But this case illustrates a different phenomenon. The government's forestry and energy policies show entrenched industries' huge political advantage over newer industries. The likelihood that such power is common is cause for alarm. Special interest groups' ability to stifle competition among industries *other than their own* suggests that the U.S. political system disadvantages up-and-coming industries. In a world where multinational companies can base their operations in any country they choose, this aspect of the U.S. political system would render the United States unattractive to new industries. If it continues long term, this trend could threaten U.S. ability to compete on a global scale.

VI. Conclusion

Corporate interests are responsible for the inefficiencies in the nation's forestry and energy policies. Legislators painted the HFRA, the EPAct, and the EISA in broad strokes, and left the implementation to the USDA, knowing its industry bias full well.[189] As some commentators have noted, when policies are incompatible, "greater local political influence may prevail over sound policy."[190] As much as happened in this case, as farm and timber industries have turned the current ethanol industry into "a classic government boondoggle, benefitting selected constituencies and providing few genuine public benefits."[191] This favoritism now works to prevent an effective synthesis of forestry and energy policies.

The technology and resources now exist to formulate complementary forestry and energy policies that would benefit the nation as a whole. Legislators have the opportunity to kill two birds with one stone. It would be a shame if corporate interests caused them to miss intentionally.[192]

187. H.R. 5236 110th Cong. §2.

188. Press Release, Rep. Stephanie Herseth Sandlin, Herseth Sandlin Introduces Bill to Fix Biomass Definition in Renewable Fuels Standard (Feb. 7, 2008) (on file with author). *See also* Press Release, Rep. Greg Walden, Bipartisan House Coalition Introduces Legislation to Fix Biomass Definition in Renewable Fuels Standard (Feb. 7, 2008) (on file with author) (quoting Rep. Mike Ross (D-Ark.) as stating that "[t]he timber industry in South Arkansas plays a major role in the overall economic well-being of our state," and that he is "proud to join this bipartisan group committed to help sustain timber-related jobs across this nation").

189. Behan, *supra* note 103, at 3 (noting that "[w]e have deliberately chosen to dedicate the federal lands not to public purposes but to the production of private wealth").

190. Edna Sussman, *Reshaping Municipal and Country Laws to Foster Green Building, Energy Efficiency, and Renewable Energy*, 16 N.Y.U. Envtl. L.J. 1, 23 (2008).

191. Samuelson, *supra* note 56.

192. Press Release, DOE Selects Six, *supra* note 45.