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Harnessing Energy Markets to Conserve Natural Resources? The Case of Southern U.S. Forests

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HARNESSING ENERGY MARKETS TO CONSERVE NATURAL RESOURCES? THE CASE OF SOUTHERN U.S. FORESTS

BLAKE HUDSON*

ABSTRACT

Wood pellet production facilities have spread rapidly across the southeastern United States over the last decade, a market driven largely by electricity generators in Europe converting from coal-fired to wood pellet-fired boilers. This has raised concerns that non-timber values of southern U.S. forests are at risk and that CO₂ emissions from burning carbon-based products will continue to exacerbate climate change. One element left out of the analysis regarding whether wood pellet market development is a net environmental positive or negative, however, is the likelihood that forestland will be converted to non-forest uses if Southern landowners do not have adequate markets into which to place their timber. Southerners rely heavily on forest products industries for economic well-being. Yet traditional forest product markets have contracted in recent years. At the same time, forestland has increasingly been purchased by real estate investment trusts, often resulting in conversion of forestland to non-forest uses. With fewer markets to turn to, forest owners are increasingly divesting forestland or converting it to other uses, and southern states will face a new phase of deforestation if current trends continue. This Article calls for the inclusion of an additional element within the assessment of whether wood pellet energy generation is a net environmental positive or negative—namely, whether the failure to develop such markets could contribute to forest conversions that will both reduce forest ecosystem services in the South and leave more carbon dioxide in the atmosphere than would utilization of southern forests as an energy source. This Article further briefly outlines some baseline policy responses needed to address environmental concerns raised regarding wood pellet market development if the market continues to expand.

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Markets for forest products . . . make it more likely that land will stay as forest. The real threat of deforestation comes from the conversion of forests to non-forest uses.¹

I. INTRODUCTION

Society has historically viewed energy consumption as an activity that only exhausts natural resources, not one that contributes to natural resource production. The coal and oil burned to support modern society took millions of years to form and will not come back over human time scales.² The current development of natural gas, tar sands, deep-sea oil, and other fossil fuels tapped due to technological advancements will also be short-lived from a geological perspective. Society now looks to solar radiation and wind as sources of energy that can at least allow us to break even in resource use—once used for energy production, there are no fewer nor greater wind or solar resources available. There is currently one fuel source, however, the development of which has the potential to produce a net gain of natural resources and contribute to a cycle of resource restoration: forest biomass. Forests are unique among natural resources because they provide enough material for large-scale energy generation, yet they grow back rather quickly, particularly in the southeastern United States (or, the “South”). More importantly, using trees for energy can create markets that incentivize property owners not only to reforest areas cultivated for energy production, but to expand into and regrow forests on currently unforested lands—leading to a net gain in the resource.

1. Matthew Rivers, *Demand for Wood is Good*, LA. FORESTRY ASS’N: FORESTS & PEOPLE (Mar. 2015), <http://laforestry.com/News/ForestandPeopleIssues/ForestandPeople1stQtr2015.aspx> (follow “Opinion Piece: Demand for Wood is Good” hyperlink) [<https://perma.cc/Z4QH-7RJD>].

2. See *Types of Renewable Energy*, RENEWABLE ENERGY WORLD, <http://www.renewableenergyworld.com/rea/tech/home> [<https://perma.cc/NU6H-L8DB>].

A century and a half ago, wood supplied up to 90% of the energy needs in the United States.³ Today that number stands at 2%.⁴ But times are changing. Markets for “wood pellets” have exploded in recent years across the South, as electricity generators in Europe convert their coal-fired boilers and switch to wood pellets produced from southern U.S. forests. With electricity generation making up nearly 40% of total energy consumption in the United States (more than any other sector⁵), forests could potentially make a significant contribution to the United States’ renewable energy portfolio while at the same time creating incentives to achieve even greater gains in forest cover—important incentives since U.S. forests face the most uncertain future that they have faced in the last 100 years.

In the seventeenth century, forests covered approximately 46% of the U.S. land base.⁶ Rapid deforestation caused that number to drop precipitously, but today that number has rebounded to a relatively stable 33%, even as populations have risen.⁷ But new threats are on the horizon. Particularly threatened are the forests of the southeastern United States, which, ironically, is the region with the greatest potential for forest biomass production. Markets for other forest products have contracted in the South, with industries moving overseas and transferring land to real estate investment trusts or similar organizations.⁸ Individual forest owners are also divesting their forest holdings, and increasing fragmentation of the forest landscape has caused Southern forest owners to hold ever-smaller parcels.⁹ Increased forest fragmentation combined with robust economic growth in the South, rapid development of the southern landscape, and lax

3. Isabel F. Peres, Timothy A. Slating & Jay P. Kesan, *The Case for Vertical Integration in the Developing Bioenergy Industry*, 39 WM. & MARY ENVTL. L. & POL’Y REV. 575, 577 (2015).

4. *Biomass Explained: Wood and Wood Waste*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/energyexplained/index.cfm?page=biomass_wood [<https://perma.cc/EX7H-MN59>].

5. *U.S. Energy Facts: Explained*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/energyexplained/index.cfm?page=us_energy_home [<https://perma.cc/FFES-EFDJ>].

6. U.S. DEPT OF AGRIC., U.S. FOREST RESOURCE FACTS AND HISTORICAL TRENDS (Sonja N. Oswald & W. Brad Smith eds., 2014), http://www.fia.fs.fed.us/library/brochures/docs/2012/ForestFacts_1952-2012_English.pdf [<https://perma.cc/FY5Y-ZG6G>]. Forest cover by 1920 had been reduced by 43%, though forest resources have since rebounded to cover approximately 75% of their historical baseline. JAMES RASBAND ET AL., NATURAL RESOURCES LAW AND POLICY 1198-1200 (2d ed. 2009).

7. RASBAND ET AL., *supra* note 6.

8. See generally PETE STEWART, FOREST2MARKET, WOOD SUPPLY MARKET TRENDS IN THE U.S. SOUTH, 1995-2015, at 8 (2015), <http://www.theusipa.org/Documents/USSouthWoodSupplyTrends.pdf> [<https://perma.cc/QGX6-NUCK>].

9. See DAVID N. WEAR & JOHN G. GREIS, U.S. FOREST SERV., THE SOUTHERN FOREST FUTURES PROJECT: SUMMARY REPORT 62 (2011), http://www.srs.fs.usda.gov/futures/reports/draft/summary_report.pdf [<https://perma.cc/62BH-H5U9>].

land use regulations in the region create a perfect storm of forest destruction. Since 1953, the South has already lost 5% of its forests to urbanization,¹⁰ and the U.S. Forest Service projects that the southern United States alone could lose up to 13% of its forests over the next few decades if trends continue.¹¹ This loss of forest cover would have dramatic ramifications for not only biodiversity, water, soil, and other resources in the South, but also for global efforts to harness forests to combat climate change. The emergence of new markets, like wood pellets for energy, can provide important incentives to Southern forest owners to keep the South's vast forest acreage forested and, perhaps, to even expand forest coverage closer to pre-industrial levels.

Development of woody biomass markets is not without controversy. Concerns include, but are not limited to, the effects on forest health if trees are cultivated as a monoculture energy crop, the reliance of such markets on government subsidies in order to be cost-competitive with cheaper forms of energy like coal, and questions over whether burning woody biomass for energy production places society on a continued path toward a climate tipping point—even if carbon released from wood pellets is eventually recaptured by subsequent forest growth, will the CO₂ released in the short-term push greenhouse gas concentrations past a dangerous tipping point?¹²

Notwithstanding concerns over using forests for energy production, one component currently left out of each of these policy debates is what happens to forestland if it is not used as an energy source? In some areas, like the southeastern United States, failure to develop woody biomass markets could lead to even more severe greenhouse gas and other environmental impacts than burning wood for energy, since land is at an increased risk to be converted from forest to other developed uses, including agricultural, industrial, commercial, and residential.¹³ When forest conversion occurs, society loses the future carbon sequestration capacity of those forests while the carbon that was already stored becomes a source of greenhouse gases into the atmosphere. Yet assessment of conversion to non-forest uses in the absence of energy markets is left out of determinations of whether

10. STEVE BRATKOVICH ET AL., DOVETAIL PARTNERS INC., *FORESTS OF THE UNITED STATES: UNDERSTANDING TRENDS AND CHALLENGES* 5 (2012).

11. WEAR & GREIS, *supra* note 9 at 31.

12. Bill Schlesinger, *Biofuel Forests for the Future: Too Little, Too Late*, MILLBROOK INDEP. (Apr. 26, 2016), <http://www.themillbrookindependent.com/content/biofuel-forests-future> [https://perma.cc/6SVN-HFLR].

13. As one commentator noted, "if demand for forest products decreases there is a real danger forested land will be converted to other uses." Matthew Rivers, *Biomass for Energy is the Common Sense Option*, ECOLOGIST (June 5, 2015), http://www.theecologist.org/reply/2897163/biomass_for_energy_is_the_common_sense_option.html#sdfootnote1sym [https://perma.cc/J484-33BL].

wood pellet markets are a net environmental positive or negative. This Article calls for analysts to consider this additional factor when assessing the positives and negatives of wood pellet market development. This Article further briefly outlines potential policy responses needed to address the environmental concerns surrounding wood pellet market development that, if the market continues to grow, will allow it to tip toward a net environmental positive.

For clarity, there are a number of aims that this Article does not pursue. First, it does not intend to draw definitive normative conclusions about whether development of wood pellet markets is a net environmental positive or negative. It merely seeks to make the case that undertaking that analysis with integrity requires assessment of additional information, and that given a variety of factors, these markets could actually be crucial to preserving and even potentially expanding forest resources. As shown below, development of forest products markets has been critical to preserving and expanding southern forest resources in the past, and the history of southern forests may provide a glimpse into how new markets can do the same moving forward. Nonetheless, data on forest conversions to non-forest uses in the absence of wood pellet markets will need to be gathered in subsequent economic, forest management, and other subject area research. Second, this Article does not attempt to make normative claims regarding the varied scientific debates outlined below, particularly with regard to whether burning biomass for electricity increases or decreases harmful greenhouse gases over acceptable or unacceptable timeframes. Third, this Article does not mean to imply that wood pellet market development is the only way to preserve or expand southern forest resources. A wide range of policies could be undertaken at the federal or state levels to achieve the same result, in addition to a number of private initiatives available. Even so, given the lack of private forest policy development in southern states to date, wood pellet market development may be currently situated as the foremost opportunity (politically) of a suite of approaches aimed at preserving southern forests. Finally, this Article does not mean to imply that wood pellets could or should be seen as a silver bullet solution to non-fossil fuel electricity generation. Solar, wind, and other “cool renewables”—that is, those that do not involve burning material for direct conversion to energy¹⁴—are crucial alternatives that should make up most, if not all, electricity generation in the future, if and when feasible. But at present, and as discussed below, technological

14. JOEL B. EISEN ET AL., *ENERGY, ECONOMICS, AND THE ENVIRONMENT: CASES AND MATERIALS* 733 (4th ed. 2015).

and economic limitations are hampering complete reliance on those forms of alternative generation, hence this Article's focus on biomass.

With that context in mind, Part II highlights the unique status forests hold as perhaps the most versatile of all natural resources, with regard to both the ecosystem services they provide and their wide range of productive uses. This Part will then undertake a case study assessing the state of southern U.S. forests and the threats they presently face. Part III provides context for this Article's thesis by summarizing the history of southern forest market development and how current threats to southern forests highlight a potential to protect those forests through further diversification of forest product markets. Part IV will discuss the scientific and political complexity that complicates the role of wood pellets in providing one of those markets. Part V argues that policymakers should consider the important role of wood pellet energy markets in not only preserving southern forests, but in actually restoring and increasing overall stocks of the forest resource. After establishing that wood pellet markets may be a positive development for southern forests, this Article details a number of policy suggestions aimed at ensuring that energy production from woody biomass is properly carried out and balanced with the host of other goods and services that forests provide. Part VI concludes.

II. PROTECTING A CRITICAL RESOURCE: THE VALUE OF AND THREATS TO U.S. FORESTS

Forests provide a host of economic and environmental goods and services across geophysical and geopolitical scales, both locally and globally. Consider the following services provided by forests locally:

- a renewable source of building materials and associated jobs;
- a renewable source of paper products and associated jobs;
- clean air services that filter and trap air pollutants;
- clean water services that prevent nutrient and other non-point sources of pollution from entering waterways;
- protection of fisheries by mitigating eutrophication that leads to "dead zones;"
- flood control services;
- endangered and other plant and animal species habitat;
- regulation of local ambient air temperatures in urban and rural areas during the summer;
- energy cost savings for households and businesses;
- aesthetic values;

- cultural values; and
- recreational values.¹⁵

Forests, of course, are anchored to the land of individual property owners, whether private or governmental. But while forests have historically been considered a primarily local resource, the national and global importance of the aggregation of local forests is becoming increasingly apparent.¹⁶ In fact, we can conceive of forests being as fluid as oil and gas, or as transboundary as fish in the sea, at least in how they interact with the atmosphere. Consider the role of forests as a global climate regulator and major carbon sink or source.¹⁷ Though overall rates of global deforestation have slowed down in recent years,¹⁸ nearly 20% of yearly global carbon emissions over the last few decades have resulted from forest loss and degradation¹⁹—an amount greater than emitted by the global transportation sector each year.²⁰ As a result, protection of global forests is on the agenda of international negotiations related to climate and sustainable forestry.²¹

15. See *Ecosystem Services*, U.S. DEP'T OF AGRIC., FOREST SERV., <http://www.fs.fed.us/ecosystemservices/> [<https://perma.cc/TRK6-ZX3A>].

16. See Blake Hudson, *Federal Constitutions: The Keystone of Nested Commons Governance*, 63 ALA. L. REV. 1007, 1029-30 (2012).

17. See Blake Hudson & Jonathan Rosenbloom, *Uncommon Approaches to Commons Problems: Nested Governance Commons and Climate Change*, 64 HASTINGS L.J. 1273, 1275 (2013).

18. *World Deforestation Slows Down as More Forests are Better Managed*, FOOD & AGRIC. ORG. UNITED NATIONS (Sept. 7, 2015), <http://www.fao.org/news/story/en/item/326911/icode/> [<https://perma.cc/5EAJ-SZPH>].

19. ERIN C. MYERS, RES. FOR THE FUTURE, POLICIES TO REDUCE EMISSIONS FROM DEFORESTATION AND DEGRADATION (REDD) IN TROPICAL FORESTS 4 (2007), <http://www.rff.org/documents/RFF-DP-07-50.pdf> [<https://perma.cc/R7Y7N-853N>].

20. *Id.* at 4; see also BRENT SOHNGEN, COPENHAGEN CONSENSUS CTR., AN ANALYSIS OF FORESTRY CARBON SEQUESTRATION AS A RESPONSE TO CLIMATE CHANGE 5 (2009), http://www.copenhagenconsensus.com/sites/default/files/ap_forestry_sohngen_v.2.0.pdf [<https://perma.cc/47YN-UJWV>]; Gert Jan Nabuurs et al., *Forestry, in CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE* 541, 557-58 (Bert Metz et al. eds., 2007).

21. CONSTANCE L. MCDERMOTT ET AL., GLOBAL ENVIRONMENTAL FOREST POLICIES: AN INTERNATIONAL COMPARISON 4-6 (2010) (“Most recently, realization of the significance of climate change impacts of greenhouse gas emissions from deforestation and forest degradation has brought renewed impetus to efforts to conserve and better manage forests globally.”); see also A. Angelsen, *REDD Models and Baselines*, 10 INT’L FORESTRY REV. 465, 466-67 (2008); T. Johns et al., *A Three-Fund Approach to Incorporating Government, Public and Private Forest Stewards Into a REDD Funding Mechanism*, 10 INT’L FORESTRY REV. 458, 459 (2008); A. Karsenty et al., *Summary of the Proceedings of the International Workshop “The International Regime, Avoided Deforestation and the Evolution of Public and Private Policies Towards Forests in Developing Countries” Held in Paris, 21-23rd November 2007*, 10 INT’L FORESTRY REV. 424, 424 (2008); K. Levin et al., *The Climate Regime as Global Forest Governance: Can Reduced Emissions from Deforestation and Forest Degradation (REDD) Initiatives Pass a ‘Dual Effectiveness’ Test?*, 10 INT’L FORESTRY REV. 538, 539 (2008).

While forest destruction is a substantial source of atmospheric carbon, one-third of global carbon emissions are absorbed by forests each year, making forests the planet's most significant terrestrial carbon sink.²² Preserving forests, therefore, has a multiplier effect on greenhouse gas regulation—forest destruction amplifies concentrations of carbon in the atmosphere since it constitutes both a source of carbon dioxide and the loss of a significant carbon sink.

As the bulleted list above demonstrates, forests are incomparable among natural resources for the wide-ranging utility they provide to society. Consider other natural resources subject to federal and state management policies. We have learned a great deal about the negative consequences of converting over half of all wetlands in the United States to developed uses²³ and of discounting the valuable ecosystem services they provide. What management options are available for wetlands to protect these services? The answer is pretty straightforward—we either allow developments to fill wetlands and destroy them, or we require wetland preservation. There are few, if any, viable options in-between those extremes.²⁴ The same holds true for biodiversity. Our options are to either allow species to be directly or indirectly killed—even if endangered or threatened with extinction—or to preserve them. There is not a particularly broad spectrum of uses otherwise.²⁵ In fact, the health of these and other resources are directly related to the protection of forests and the ways in which forests are managed. Wetlands, biodiversity, water and air quality, and the viability of fisheries are all in one way or another affected by how forests are managed.²⁶ But even when these resources are managed within the confines of managed forests, forests may still be utilized

22. *U.S. Forest Service Finds Global Forests Absorb One-Third of Carbon Emissions Annually*, U.S. FOREST SERV. (July 14, 2011, 8:30 AM), <http://www.fs.fed.us/news/releases/us-forest-service-finds-global-forests-absorb-one-third-carbon-emissions-annually> [<https://perma.cc/P4SC-32HV>].

23. David Moreno-Mateos et al., *Structural and Functional Loss in Restored Wetland Ecosystems*, 10 PLOS BIOLOGY 1, 1 (2012), <http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1001247> (follow “PDF” hyperlink) [<https://perma.cc/CM9H-MR39>]. The loss of important ecosystem services provided by wetlands can “make urban settlements more prone to disaster, amplifying the risks of climate change.” Gordon McGranahan et al., *The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones*, 19 ENV'T & URBANIZATION 17, 18 (2007), <http://eau.sagepub.com/content/19/1/17.full.pdf+html> [<https://perma.cc/M9C6-429D>].

24. Wetlands can, of course, be utilized for recreational activities like hunting waterfowl or for other productive uses such as aquaculture. See NAT. RES. CONSERVATION SERV., AQUACULTURE WETLAND RESTORATION (2011), http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_007889.pdf [<https://perma.cc/S3ZH-Y2QV>].

25. Many species are, of course, utilized, whether directly consumed as food or cultivated indirectly through the production of medicine based on natural sources, for example. See RASBAND ET AL., *supra* note 6, at 331.

26. See *Ecosystem Services*, *supra* note 15.

and otherwise consumed. Trees can be cut—and sometimes need to be cut—to create habitats that supply a full and healthy range of forest ecosystem services. In the meantime, the timber cultivated can be used as products valuable to society, whether for building materials or energy resources. The wide range of products to which forests can be put, coupled with the services they provide when utilized as a commodity, make forests one of the most versatile resources on the planet.

The United States alone contains nearly 8% of the world's total forest cover.²⁷ U.S. forests have a dynamic history, having returned to relatively stable levels just last century. Forests in the United States are roughly the same acreage as they were in 1910, even though harvesting rates have tripled over the same period.²⁸ Yet new threats are on the horizon, with a U.S. Forest Service report projecting a new and significant phase of deforestation in the southeastern United States over the coming decades if current trends continue. The U.S. Forest Service's Southern Forests Futures Project Summary Report (Futures Report)²⁹ highlights the tremendous pressure that southeastern U.S. forests will face in the coming decades. The four factors found by the Forest Service to "define the South's future forests"³⁰ include population growth, climate change,³¹ timber markets, and invasive species.³² Urban development, in particular, was "forecasted to result in forest losses, increased carbon emissions, and stress to other forest resources,"³³ including degradation of a variety of water ecosystem services such as flood control and water filtration—even to the point of threatening public health.³⁴ Population pressures in the

27. JACEK P. SIRY ET AL., GLOBAL FOREST OWNERSHIP: IMPLICATIONS FOR FOREST PRODUCTION, MANAGEMENT, AND PROTECTION, XIII WORLD FORESTRY CONGRESS 3 tbl.1 (2009).

28. Rivers, *supra* note 1.

29. See WEAR & GREIS, *supra* note 9, at 4. The Futures Report addresses thirteen southern states, including: Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Kentucky, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas. *Id.*

30. *Id.*

31. See *id.* at 27 (projecting that average annual temperatures are expected to increase in the region by 2.5 to 3.5 degrees Celsius by 2060).

32. See *id.* at 4.

33. *Id.* Since the 1970s, total forest area has been stable, but this stability is a result of agricultural lands being reforested at the same rate that urbanization has reduced forest cover. *Id.* at 15. While urbanization is expected to increase at even higher rates, conversion of agricultural lands to forests is not expected to continue. *Id.* at 31.

34. The Futures Report notes:

Strong population growth and associated urbanization has increased demand for water and challenged water availability in several areas Conversion of forests to urban and other land uses has resulted in a loss of natural buffering, increasing water pollution loads, elevating peak flows, and reducing base flows in affected watersheds. The consequences are more frequent and more severe flooding, lower stream flows during drought conditions, and water quality that

southeast are expected to “result[] in declines in forest cover, increases in demand for ecosystem service[s], and restrictions that complicate the ability to manage forests for the full spectrum of uses.”³⁵ Both population and economic growth have increased more rapidly in the southeast than any other region of the United States,³⁶ “with the resulting urbanization steadily consuming forests and other rural lands.”³⁷ The Futures Report projected that 30 to 43 million additional acres of southern land will be converted to urban development by 2060, while total forest losses could be as high as 23 million acres, or approximately 13% of all forestland in the South.³⁸ This is an amount roughly equivalent to all the forestland in the state of Georgia.³⁹ Of course, environmental damage is not the only cost of urban development, as it can also impact the economic stability of the southern forest industry.⁴⁰ The southern timber production sector contributed more than one million jobs and \$51 billion in employee compensation in 2009,⁴¹ and southern forests have been described as “the most intensively managed forests in the United States.”⁴² Most of the United States’ timber products are harvested from southern forests,⁴³ and “since 1986, if the South were compared with any other country, none would produce more timber than this one region of the United States.”⁴⁴

is degraded—sometimes to the point of threatening public health. . . . [T]he link between conversion of forest land to urban uses and degraded water quality in affected watersheds is well accepted.

Id. at 24.

35. *Id.* at 26.

36. From 1970 to 2010, population in the South grew by 88%, and disposable personal income more than doubled. *Id.* at 6 fig.2. Further, from 1990 to 2008, population in the South grew at a rate approximately one-third faster than the nation as a whole. *Id.* at 71. These pressures do not appear to show any sign of decreasing. Population in the South is expected to grow yet another 40% to 60% from 2010 to 2060. *Id.* at 12-13.

37. *Id.* at 5.

38. *Id.* at 35.

39. *Id.* at 31.

40. *See id.* at 62.

41. *Id.* at 17. The forest products industry generally “accounts for approximately 4 percent of the total U.S. manufacturing GDP, manufactures over \$200 billion in products annually, and employs approximately 900,000 men and women. The industry meets a payroll of approximately \$50 billion annually and is among the top 10 manufacturing sector employers in 47 states.” Jessica McFaul & Chuck Fuqua, *New Research Shows UK Wood Pellet Subsidies Distort the US Market for Wood Fiber*, AM. FOREST & PAPER ASS’N (Nov. 18, 2015), <http://www.afandpa.org/media/news/2015/11/18/new-research-shows-uk-wood-pellet-subsidies-distort-the-us-market-for-wood-fiber> [<https://perma.cc/L5HC-R4KU>].

42. WEAR & GREIS, *supra* note 9, at 29.

43. *Id.* at 5.

44. *Id.* at 17.

If the South is unable to forestall rapid urbanization of its forests, the carbon storage capacity of southern forests will be significantly reduced.⁴⁵ The amount of carbon sequestered in southern forests (including forest soils) is projected to reach a maximum in 2020⁴⁶ and then decline by as much as 5% by 2060.⁴⁷ The decline in carbon storage capacity “would be a challenge for carbon mitigation policies, presenting a dynamic baseline where a first order policy objective would be to stabilize rather than expand forest carbon stocks.”⁴⁸ So, without markets to incentivize Southern forest owners to maintain forests, it will be difficult to sequester additional amounts of carbon to combat greenhouse gas concentrations, much less prevent forest carbon stocks from dropping even further.⁴⁹

Markets are especially important to private forest owner incentivization, as there is a tremendous deficit of political will in southern U.S. states to formulate even basic forest management standards (to guide cultivation of forest resources),⁵⁰ much less policies aimed at harnessing forests to assist in climate change mitigation. States are reticent to place restrictions on private property rights in a region of the country where the vast majority of the forest resource is privately owned.⁵¹ In addition, political will to create such policies is undermined by countervailing incentives to promote rapid urbanization and sprawl.⁵² Population and associated economic growth have increased more rapidly in the South than any other region of the United States, “with the resulting urbanization steadily consuming forests and other rural lands.”⁵³ From 1970 to 2010, southeastern U.S. population grew by 88%,⁵⁴ and from 1990 to 2008, it grew at a rate about one-third faster than the nation as a whole.⁵⁵ Growth of southern urban regions does not show any signs of slowing down—

45. *Id.* at 34.

46. *Id.*

47. Robert Huggett et al., *Forecasts of Forest Conditions*, in THE SOUTHERN FOREST FUTURES PROJECT, TECHNICAL REPORT 17 (2011), <https://www.srs.fs.usda.gov/futures/reports/draft/pdf/Chapter%205.pdf> [<https://perma.cc/55WC-V4GW>].

48. WEAR & GREIS, *supra* note 9, at 34 (emphasis added).

49. *See id.*

50. The federal government maintains regulatory authority over the approximately 35% of forests it owns while state governments regulate the nearly 65% of forests owned by private individuals and subnational governments. *See* UNITED NATIONS ENV'T PROGRAMME, GLOBAL ENVIRONMENT OUTLOOK 3: PAST, PRESENT AND FUTURE PERSPECTIVES 110 (2002).

51. *See* Hudson, *supra* note 16.

52. *See* Blake Hudson, *Relative Administrability, Conservatives, and Environmental Regulatory Reform*, 68 FLA. L. REV. 1661, 1680 (2016).

53. WEAR & GREIS, *supra* note 9, at 5.

54. *Id.* at 6 fig.2.

55. *Id.* at 71.

population in the South is expected to grow yet another 40 to 60% from 2010 to 2060.⁵⁶

Combining population and economic growth with the pervasive culture of lax land use controls in the South exacerbates urban sprawl in the region. Southern cities dominate the rankings of the most sprawling urban areas of the United States. The country's most sprawling small, medium, and large metro areas are located in southern cities.⁵⁷ Eight of the ten most sprawling metro areas nationally are in southern states,⁵⁸ while seven of the top ten most sprawling large metro areas⁵⁹—all of the top ten most sprawling medium metro areas⁶⁰—and seven of the top ten most sprawling small metro areas are southern.⁶¹ In fact, of the 221 metro areas analyzed in a recent urban sprawl report, 38 of the 45 most sprawling regions of the United States are in the South.⁶² Forestland has been the number one target of conversion to urban developments in the South.⁶³ In the absence of a dramatic shift in governance culture in the southeast, and the adoption of stronger land use and forest conservation policies by state or local governments in the region, deforestation is likely to ensue unabated unless forest product markets

56. *Id.* at 12-13.

57. REID EWING & SHIMA HAMIDI, SMART GROWTH AMERICA, MEASURING SPRAWL 2014, at 4, 6-8 (2014), <https://www.smartgrowthamerica.org/app/legacy/documents/measuring-sprawl-2014.pdf> [<https://perma.cc/WHA4-5W5M>].

58. These include Kingsport/Bristol/Bristol, Tennessee-Virginia; Augusta/Richmond County, Georgia-South Carolina; Greenville/Mauldin-Easley, South Carolina; Baton Rouge, Louisiana; Nashville-Davidson/Murfreesboro/Franklin, Tennessee; Clarksville, Tennessee-Kentucky; Atlanta/Sandy Springs/Marietta, Georgia; and Hickory/Lenoir/Morganton, North Carolina. *Id.* at 6.

59. These include Houston/Sugar Land/Baytown, Texas; Richmond, Virginia; Birmingham-Hoover, Alabama; Memphis, Tennessee-Mississippi-Arkansas; Charlotte/Gastonia-Rock Hill, North Carolina-South Carolina; Nashville/Davidson/Murfreesboro/Franklin, Tennessee; and Atlanta-Sandy Springs/Marietta, Georgia. *Id.* at 7.

60. These include Little Rock/North Little Rock/Conway, Arkansas; Durham/Chapel Hill, North Carolina; Jackson, Mississippi; Knoxville, Tennessee; Columbia, South Carolina; Chattanooga, Tennessee-Georgia; Greensboro/High Point, North Carolina; Augusta/Richmond County, Georgia-South Carolina; Greenville/Mauldin-Easley, South Carolina; and Baton Rouge, Louisiana. *Id.* at 7.

61. These include Fort Smith, Arkansas-Oklahoma; Lynchburg, Virginia; Winston-Salem, North Carolina; Florence, South Carolina; Kingsport/Bristol/Bristol, Tennessee-Virginia; Clarksville, Tennessee-Kentucky; and Hickory/Lenoir/Morganton, North Carolina. *Id.* at 8.

62. *Id.* at 19-20.

63. LEON KOLANKIEWICZ, ROY BECK & ANNE MANETAS, NUMBERSUSA, VANISHING OPEN SPACES: POPULATION GROWTH AND SPRAWL IN AMERICA 11-12 (2014), <https://www.numbersusa.com/sites/default/files/public/assets/resources/files/vanishing-open-spaces-study.pdf> [<https://perma.cc/E7GD-SPPG>].

can fill the void and make it more profitable for forest owners to maintain forests than to convert land to non-forest uses.⁶⁴

While markets were critical to restoring forests across the South in the twentieth century (discussed in Part III), circumstances in recent decades have changed rapidly. Pulp and paper industries—long the anchor for forest preservation in the South—have increasingly moved operations overseas, leaving forest owners with fewer markets into which they may inject their timber.⁶⁵ In turn, these forest owners look to either divest their holdings or convert forests to other uses. Waiting to purchase much of the forestland divested from large timber companies or private individuals are Real Estate Investment Trusts (REITs),⁶⁶ and while some of these organizations may value conservation of the forest resource, many care more about the underlying land and its potential conversion to uses other than timber.

Pulp and paper divestiture has also exacerbated forest fragmentation. Though 86% of southern forests are privately owned, the parcels owned by individual private forest owners are increasingly smaller in size. Fifty-nine percent of all private forest owners own less than

64. Alabama's position on voluntary "best management practices" is emblematic of this governance philosophy. See MCDERMOTT ET AL., *supra* note 21, at 82. The Alabama Forestry Commission describes itself as the "lead agency for forestry in Alabama" but that it is "not an environmental regulatory or enforcement agency" and it "[avoids] environmental problems through voluntary application of preventative techniques." *Id.* Yet, as evidenced by the Futures Report's projected loss of up to 13% of the region's forests over the next fifty years, if given a choice between preserving a forest or managing it for the full range of ecological values, and cutting it down in the name of economic development and urbanization, voluntary choices are not likely to lead to "preventative techniques" that benefit forests. See WEAR & GREIS, *supra* note 9, at 35. Even so, most southeastern state administrative agencies operate similarly as "[t]he implementation of BMPs [Best Management Practices] . . . generally involves agencies not directly responsible for environmental regulation." MCDERMOTT ET AL., *supra* note 21, at 82. The U.S. federal government's forest policies are quite consistent on the 35% of forestland it owns, but state forest policies in the United States are grossly inconsistent. Some states maintain stringent basic forest management standards and others maintain none at all. McDermott et al., *supra* note 21, performed a comparative analysis demonstrating that southern U.S. states maintain some of the laxest forest regulatory policies in the world. See *id.* at 327 tbl.10.7. Though the McDermott study was limited only to regulation of timber extraction practices, other land use policies related to forest preservation are virtually non-existent in most southern states. Lax standards in the Southeast have implications for other resources beyond forests, particularly related to forest habitat critical to biodiversity protection. See *id.* at 82. Indeed, there is a sharp contrast between the regulatory standards for forests in the Southeast and the vast amount of biodiversity in the region. See *id.* at 90. Alabama, for example—the state that "[avoids] environmental problems through voluntary application of preventative techniques," *id.* at 82—also maintains the fourth highest number of listed threatened or endangered species under the ESA of any state in the United States, only trailing Hawaii, California, and Florida. U.S. FISH & WILDLIFE SERV., SPECIES REPORTS, http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrence.jsp [<https://perma.cc/8EEQ-4RCY>]; see also MCDERMOTT ET AL., *supra* note 21, at 94 fig.3.5.

65. STEWART, *supra* note 8.

66. WEAR & GREIS, *supra* note 9, at 60-62.

nine acres of forestland,⁶⁷ and family forest holdings in the region average only twenty-nine acres in size.⁶⁸ Scholars have cited the rise in second homes and vacation homes in southern forests, combined with associated increases in “access roads, utility rights-of-way, manicured lawns,” and an increasingly diverse range of management philosophies, as decreasing the ecosystem services provided by these forests.⁶⁹

Complicating matters, the age of forest landowners across the country is increasing, with an average age of 62.5.⁷⁰ Their children are becoming more urbanized and, as mentioned, the size of the parcels they own is shrinking. This “has state, federal and private experts fearing for the long-term health of millions of acres of American woodlands.”⁷¹ Small parcel forest owners “are less likely to invest in forest management plans,” it is more difficult to manage wildlife on smaller parcels, and the risk that small parcels will be developed and never return as a working forest is increased.⁷²

New markets can encourage landowners to maintain forestland, rather than convert it to other uses. Maintaining forestland not only provides a host of forest ecosystems services but also allows Southerners to maintain livelihoods. The South is historically the most poverty-stricken region of the country,⁷³ and forests have played a key role in mitigating this poverty.⁷⁴ Given the important environmental and economic role of forests in the region, attention to forest market development is critical to facilitate forests’ continued dual role in benefiting both the southern environment and its economy. The next Part discusses how forest market development was vital to turning the fortunes of southern forests around in the past, providing context for this Article’s call for a renewed focus on market potential to address the modern southern forest dilemma.

67. *Id.* at 62.

68. *Id.*

69. BRATKOVICH ET AL., *supra* note 10, at 8.

70. Wilson Ring, *Experts Fear for Long-Term Health of U.S. Forests*, WASH. POST (Dec. 7, 2014), https://www.washingtonpost.com/politics/experts-fear-for-long-term-health-of-us-forests/2014/12/07/0f37abf4-7e4b-11e4-81fd-8c4814dfa9d7_story.html?utm_term=.e31a5deeb7ee [<https://perma.cc/PJ6C-QKH5>].

71. *Id.*

72. *Id.*

73. Data from the 2010 U.S. census show that nine of the ten poorest states in the United States are in the southeast. See Les Christie, *America’s Wealthiest (and Poorest) States*, CNN MONEY (Sept. 16, 2010, 5:52 PM), http://money.cnn.com/2010/09/16/news/economy/Americas_wealthiest_states/ [<https://perma.cc/3GJ9-AUW2>].

74. See *supra* text accompanying notes 41-44.

III. LEARNING FROM THE PAST: HISTORICAL CONTEXT OF SOUTHERN FOREST MARKET DEVELOPMENT

When considering how otherwise consumption-oriented markets can be utilized to stimulate the reestablishment and preservation of natural resources, looking to the past is instructive. The historical narrative below concerns, importantly and not coincidentally, southeastern U.S. forests. This Part recounts the historical context of southern forest market development through the scholarship of Professor William Boyd, who has undertaken an important review of the history of southern forestry since the turn of the twentieth century.⁷⁵

By the dawn of the twentieth century, the southern states had exploited their forests almost out of existence, in what has been described as “probably the most rapid and reckless destruction of forests known to history” and what William Faulkner called “the slain wood.”⁷⁶ This prompted the federal government to initiate a series of federal studies and inquiries into the implications of southern deforestation,⁷⁷ driven primarily by concerns over a timber shortage in the nation. In fact, projections at the time were that the South would need to import timber to sustain a steady supply of wood.⁷⁸ The prospect of importing timber caused both alarm and contemplation of a variety of surprising policy responses. One federal government report actually investigated the possibility of a massive federal buyback of 224 million acres of private forests, an amount 10 million acres

75. William Boyd, *The Forest is the Future? Industrial Forestry and the Southern Pulp and Paper Complex*, in *THE SECOND WAVE: SOUTHERN INDUSTRIALIZATION FROM THE 1940S TO THE 1970S* 168 (Philip Scranton ed., 2001) [hereinafter Boyd, *The Forest is the Future*]; see also WILLIAM BOYD, *THE SLAIN WOOD: PAPERMAKING AND ITS ENVIRONMENTAL CONSEQUENCES IN THE AMERICAN SOUTH* (2016) [hereinafter BOYD, *THE SLAIN WOOD*].

76. Boyd, *The Forest is the Future*, *supra* note 75, at 174.

77. These include the U.S. Forest Service’s “Capper Report” detailing a potential timber shortage in the nation (Capper-Volstead Act, Pub. L. No. 67-146, ch. 57, 42 Stat. 388 (1922) (codified as amended at 7 U.S.C. §§ 291, 292 (2012))); the Weeks Law aimed at providing funding to state agencies to curb forest fires (Weeks Act, Pub. L. No. 61-435, ch. 186, 36 Stat. 961 (1911) (codified as amended in scattered sections of 16 U.S.C. (2012))); the Clarke-McNary Act of 1924 aimed at increasing fire protection and prompting states to change perverse tax incentives that were leading to forest destruction (Clarke-McNary Act, Pub. L. No. 68-270, ch. 348, 43 Stat. 653 (1924) (codified as amended at 16 U.S.C. §§ 568 to 570 (2012))); see also Boyd, *The Forest is the Future*, *supra* note 75, at 183-84); the McSweeney-McNary Forest Research Act authorizing the first nationwide forest survey to lay a foundation for policy reform (McSweeney-McNary Forest Research Act, ch. 678, 45 Stat. 699 (1928) (codified as amended at 16 U.S.C. § 581 (2012))); see also Boyd, *The Forest is the Future*, *supra* note 75, at 176); and the Forest Pest Control Act of 1947, which established federal and state cooperation to resolve forest pest and disease problems (Forest Pest Control Act, ch. 141, 61 Stat. 177 (1947) (codified as amended at 42 U.S.C. §§ 594-1, 594-2 to 594-5 (2012))); see also Boyd, *The Forest is the Future*, *supra* note 75, at 181).

78. Boyd, *The Forest is the Future*, *supra* note 75, at 174-75.

greater than the entire acreage of southeastern forests today.⁷⁹ The report explored this drastic step as a mechanism for “ensuring that the nation’s timberlands would be properly managed.”⁸⁰ Another proposed solution was federal prescriptive regulation of southern forests.⁸¹ In the 1930s, President Roosevelt described the “forest problem” as “a matter of vital national concern, and some way must be found to make forest lands and forest resources contribute their full share to the social and economic structures of this country, and to the security and stability of all our people.”⁸² As Professor Boyd describes, Roosevelt:

Evok[ed] images of “denuded” watersheds and “crippled” forest communities “still being left desolate and forlorn,” [and] urged the Congress to study the problem and propose legislation that would include “such public regulatory controls as will adequately protect private as well as the broad public interests in all forest lands.”⁸³

Going further, Roosevelt argued that “most of the States, communities, and private companies have, on the whole, accomplished little to retard or check the continuing process of using up our forest resources without replacement . . . it seems obviously necessary to fall back on the last defensive line—Federal leadership and Federal Action.”⁸⁴

The federal government never directly intervened in southern forest management, however, ultimately choosing federal financial assistance policies over prescriptive regulation. Professor Boyd describes the transformation of southern forests from virtual wasteland after the Civil War to one of the most productive commodity forests on the earth as involving three phases: (1) rationalization, (2) regeneration, and (3) intensification.⁸⁵

79. CRAIG HANSON ET AL., WORLD RES. INST., SOUTHERN FORESTS FOR THE FUTURE (2010), http://www.wri.org/sites/default/files/pdf/southern_forests_for_the_future.pdf [https://perma.cc/8ZVZ-LT7X].

80. Boyd, *The Forest is the Future*, *supra* note 75, at 187.

81. *Id.* at 187. The closest the federal government came to prescriptive regulation of private forestry is Article X of the Lumber Code of the National Industrial Recovery Act of 1933 (NIRA), ch. 90, 48 Stat. 195 (1933) (codified as amended in scattered sections of 15 U.S.C. and 40 U.S.C. (2012), which aimed to “commit[] the lumber industry to principles of conservation and sustained yield.” Boyd, *The Forest is the Future*, *supra* note 75, at 187. The Supreme Court ultimately found the entire statute unconstitutional on various grounds, including because “where the effect of intrastate transactions upon interstate commerce is merely indirect, such transactions remain within the domain of state power.” *Schechter Poultry Corp. v. United States*, 295 U.S. 495, 546 (1935).

82. Boyd, *The Forest is the Future*, *supra* note 75, at 188 (emphasis added).

83. *Id.* (emphasis added).

84. *Id.* at 189.

85. *Id.* at 171-72.

Rationalization aimed to make southern forests worthy of investment. While today urban development threatens southern forest resources, the primary problem stifling investment in the early twentieth century was fire. The “father” of the U.S. Forest Service, Gifford Pinchot,⁸⁶ declared that “[u]nless fires are checked, forestry in the Southern pineries will never appeal to men of good business sense.”⁸⁷ As an example of just how severe the fire problem was, a 1930s survey found that fires occurred on more than three-quarters of the state of Georgia’s total forest area.⁸⁸ The South led the nation in both the frequency and acreage burned by forest fires, accounting for 85% of all forest fires in the country in the 1920s and 1930s—even though it only contained around one-third of the nation’s total forest area.⁸⁹ The drivers of the fire problem were complex, with both economic and social dimensions. Nearly half of all fires resulted due to the “deep-seated cultural practice of annual woods-burning” that was “part of the very fabric of rural life in the South.”⁹⁰ It was effectively a cultural tradition for Southerners to routinely set the woods on fire, and not for silvicultural purposes. A number of federal studies and federal-state cooperative programs were critical to helping resolve the fire problem and make southern forests worthy of investment,⁹¹ as were state reforms of taxation policies that created perverse incentives to prematurely cut any timber not burned by fire.⁹²

After rationalization, the regeneration phase involved the reforestation and afforestation of degraded forest and agricultural lands. These efforts were led primarily by large industrial timber operators. The federal government provided support, with the Clark-McNary Act of 1924 providing funding to states and private property owners for forest planting on private lands.⁹³ A number of incentive programs resulted in forest regeneration proceeding apace, such as the Soil Bank Act of 1956⁹⁴ and the Conservation Reserve Program.⁹⁵

86. Tom Paulu, *Gifford Pinchot Was Father of U.S. Forest Service*, TDN.COM (June 27, 2008), http://tdn.com/lifestyles/gifford-pinchot-was-father-of-u-s-forest-service/article_bba03335-149a-5611-bbe4-392d0ac62eec.html [<https://perma.cc/4DTC-SWF6>].

87. Boyd, *The Forest is the Future*, *supra* note 75, at 176.

88. *Id.* at 177.

89. *Id.*

90. *Id.*

91. These include the McSweeney-McNary Forest Research Act and the Forest Pest Control Act of 1947. *Id.*

92. The federal “Capper Report” and Clark-McNary Act were critical in getting states to address this issue. *Id.* at 187.

93. *Id.* at 186-87.

94. Soil Bank Act, ch. 327, 70 Stat. 188 (1956) (codified as amended in scattered sections of 7 U.S.C. (2012)). The Solid Bank Act resulted in the conversion of more than 2

These programs added millions of acres of forestlands where there previously were none.⁹⁶

The third and final phase, intensification, involved taking newly regenerated forestlands and making them even more productive through scientific advances, such as through genetic modifications to increase pest resistance and growth rates. The drive behind intensification was the sentiment expressed by the avid conservationist Aldo Leopold, who argued that the forest industry would be mistaken in assuming that all trees were equal. He argued that the study of tree genetics should drive industrial forest operations.⁹⁷

The three market development phases of rationalization, regeneration, and intensification—in no small part spurred by the threat of federal regulation—ultimately turned southeastern forests into what would become known as the “wood basket of the world.”⁹⁸ The forest products industry began a dramatic shift to southern forests in the 1930s, which Thomas Clark labeled the “grand march south.”⁹⁹ In only twenty years, the South shifted from a 15% share of the total U.S. woodpulp capacity to a 55% share. By 1990, the share had grown to 71%.¹⁰⁰ Pulp and paper firms largely moved toward a system of conservation, regeneration, and minimum standards for forest protection, and were actively engaged in encouraging nonindustrial private landowners to do the same.¹⁰¹ So committed was industry to reaping the economic benefits yielded by natural resource preservation that, in 1937, representatives of the pulp and paper industry crafted the “Statement of Conservation Policy of the Southern Pine Pulpwood Industry,” which committed the industry to promote selective cutting, forest restoration, and fire protection.¹⁰² The Southern Pulpwood Conservation Association even forged a motto of “[c]ut wisely, prevent fires, and grow more trees to build a better South,” which “symbolized the extent to which forest protection and forest regeneration were being framed in the language of moral duty.”¹⁰³

million acres of cropland into timber plantations between 1956 and 1960. Boyd, *The Forest is the Future*, *supra* note 75, at 192.

95. Between 1948 and 1968, nearly ten million acres of southern agricultural land were converted to timberland. Boyd, *The Forest is the Future*, *supra* note 75, at 192-93.

96. *Id.* at 192-93.

97. *Id.* at 194.

98. *Id.* at 172.

99. THOMAS D. CLARK, *THE GREENING OF THE SOUTH: THE RECOVERY OF LAND AND FOREST* 114 (1984).

100. Boyd, *The Forest is the Future*, *supra* note 75, at 170.

101. *Id.* at 190.

102. *Id.*

103. *Id.* (emphasis added).

With this context as a backdrop, it becomes clear that climate change may be characterized as the new fire problem. Given that federal or state prescriptive intervention into forest management and preservation of southern forests is unlikely in the near future, it may once again be up to consumptive markets to actually spur preservation of southern forest resources. The shift toward reforestation last century had strong economic drivers—to capitalize on southern forests' ability to provide economic growth to the nation as a whole and to provide an economically valuable resource necessary to development. But society does not rely on wood products the way that it once did, and a number of economic drivers today are running in the opposite direction. The pulp and paper industry's movement overseas and divestiture of landholdings has caused the loss of not only industrial focus on maintaining forests but also the loss of industry's influence on nonindustrial landowners to do the same. When big market players move out, smaller players are left with disincentives to preserve forestland and incentives to either convert forests to other uses or sell to parties who will do the same, such as REITs. This is where energy markets for forest products may be helpful. The development of such markets could possibly provide a much-needed counterbalance to other economic policies in the South that threaten forest resources. Even so, a number of scientific and political complexities must be assessed and worked through before determining the true potential of forest market development to protect southern forest resources. Highlighting these complexities is the purpose of the next Part.

IV. SCIENTIFIC AND POLITICAL COMPLEXITIES OF USING WOOD FOR ENERGY

As with any new environmental threat or emerging market, the environmental and economic impacts of wood pellet markets are fraught with uncertainty. Scientific understanding of forests' role in climate regulation, both as a carbon sink and as an energy source, is very much unsettled. Furthermore, the proper role of governments in supporting (some would say interfering) with wood pellet markets, the effects of wood pellet markets on other forest values and on competing markets (such as pulp and paper), and the potential for other renewable energy technologies to render wood pellet markets unnecessary are all factors complicating the assessment of wood pellet market viability. Though not exhaustive, this Part aims to highlight some aspects of that complexity—a necessary step before determining whether wood pellet market development is a net environmental positive or negative, and before discerning what policy-making targets should be for emerging wood pellet markets.

A. *Scientific Complexities*

Regarding the question of whether wood pellets are good or bad environmentally, one particularly complex question is at the threshold: Will burning wood pellets provide a net climate benefit or will it actually increase greenhouse gas emissions (at least in the short term)? Scientists are currently involved in a heated debate regarding the climate impacts of wood pellets. Wood pellet biomass is unique among renewables in the sense that solar panels, wind turbines, and hydropower harness power already generated by Mother Nature to produce energy, whereas biomass must be burned just like fossil fuels. Even so, when fossil fuels are burned there is no re-uptake of greenhouse gases by “new” fossil fuels (over human timescales at least). In contrast, as long as new vegetation replaces vegetation harvested for wood pellet production, forest biomass should constitute a closed loop energy system from a greenhouse gas perspective. Carbon dioxide is sequestered through the growth of trees, which are then burned for energy, releasing carbon dioxide. This carbon dioxide is then re-sequestered by a new crop of trees that will be utilized for energy production in the future, and so the cycle continues. In reality, of course, it is not as simple as it may sound.

There are many factors that affect forests’ role in greenhouse gas regulation, most of which relate to how forests are managed. Consider albedo, which is the amount of solar radiation reflected from the earth’s surface back into space.¹⁰⁴ The higher the albedo, the more reflective the surface of the earth is, and correspondingly, the cooler the planet is since higher amounts of radiation are not absorbed by the earth.¹⁰⁵ When a forest is cleared, albedo actually increases because there are no dark leaves to absorb heat. While we might expect increased albedo to provide a cooling effect, clearing the forest also leads to a loss of water vapor and reduction in evapotranspirative cooling.¹⁰⁶ As a result, a net gain in temperature is typically observed. Albedo is also affected by the age of the stand. A younger forest can have a higher albedo because more sunlight gets through to the reflective forest floor.¹⁰⁷ Importantly here, however, evapotranspiration remains intact. So, with higher albedo and healthy evapotranspirative processes, younger forests can have a cooling effect relative to more mature forests. Thus, forests managed for wood pellet produc-

104. *Albedo*, N.C. CLIMATE OFF., <https://climate.ncsu.edu/edu/Albedo> [<https://perma.cc/7F8E-SBV2>].

105. *Id.*

106. Kim Naudts et al., *Europe’s Forest Management Did Not Mitigate Climate Warming*, 351 *SCIENCE* 597, 598 (2016).

107. *Id.*

tion, which tend to be younger, could provide cooling benefits over unmanaged forests.¹⁰⁸

Tree type further complicates forests' role in greenhouse gas regulation—is the forest composed of primarily broadleaf or conifer trees? Conifers grow faster and can provide a higher carbon sink potential over shorter time frames,¹⁰⁹ but they tend to be darker and absorb more heat, reducing albedo.¹¹⁰ Conifers are also more water efficient and therefore have lower evapotranspiration, which, combined with reduced albedo, can lead to temperature increases relative to broadleaf.¹¹¹ Many broadleaf forests have been converted to conifers because the latter tend to be more commercially valuable.¹¹² As a result, even with a net gain in forest acreage, carbon sequestration value can be lost.

Both albedo and tree type were among a number of forest management factors forming the basis of a recent study in *Science* finding that forest management had actually contributed to a net loss of carbon from European forests since 1750, even though there has been a net gain of forest cover during that time.¹¹³ The primary reason was the transition from unmanaged broadleaf forest to managed conifer forest. The study's take-home was basically that while European forests are a carbon sink today—which is better than no sink at all—they are not as significant of a sink as they might have been. Some have been critical of the study, arguing that it is only one potential model¹¹⁴ and that since foresters have only recently focused on managing forests to address climate, the study's scope—looking back to 1750—limits its applicability to modern forest management. These critics argue that we have only just begun to consider how to use forests as a climate mitigation tool and that the changes made to forest management as a result can lead to managed forests that actually do sequester greater amounts of carbon than unmanaged forests.¹¹⁵

108. *But see infra* text accompanying notes 113-115.

109. *See infra* text accompanying notes 113-115.

110. *See infra* text accompanying notes 113-115.

111. Patrick Monahan, *Europe's Trees Have Been Warming the Planet*, SCI. MAG. (Feb. 5, 2016, 2:00 PM), <http://www.sciencemag.org/news/2016/02/europe-s-trees-have-been-warming-planet> [<https://perma.cc/53W8-T57S>].

112. Chelsea Harvey, *Forests Are Supposed to Help Stop Climate Change. These Forests Didn't*, WASH. POST (Feb. 4, 2016), <https://www.washingtonpost.com/news/energy-environment/wp/2016/02/04/forests-are-supposed-to-help-stop-climate-change-these-forests-didnt/> [<https://perma.cc/8T88-KFZF>].

113. *Id.*; *see also* Monahan, *supra* note 111.

114. Harvey, *supra* note 112.

115. *Id.* One critic argued “[o]bviously forest loss and forest degradation strongly contributed to greenhouse gas emissions until the 1950s . . . I find it not credible to combine 200 years of suspected negative contribution to climate change mitigation with 60 years of

Consider also that while unmanaged forests may sequester more carbon at any given point in time—since they have more carbon in living biomass, coarse woody debris, litter, and soil—carbon storage potential maxes out in an unmanaged forest as forest succession climaxes.¹¹⁶ For example, carbon capture has been found to fall in some U.S. forests from as much as 4 tons of carbon per hectare per year at age 50 to -1 ton per hectare per year by age 150¹¹⁷—a negative number because sequestration is maxed out and forest resources continue to decay. On the other hand, “harvest on a specific stand produces a temporary reduction in forest carbon, but supports an increase in the rate of carbon uptake over time.”¹¹⁸ Older forests are also at more risk of catastrophic disturbance and unscheduled loss of stored carbon, such as fires or insect and disease outbreaks.¹¹⁹ Since managed forests have lower carbon storage at any particular point in time, they create less of a carbon debt when a catastrophic event occurs.

The uses to which forest products are put play a further role in carbon flux. Houses in residential developments, for example, store a great deal of carbon, while energy production from wood pellets releases it immediately into the atmosphere. Pulp and paper and similar products lend themselves to shorter-term storage of carbon and are impacted by the effects of landfilling and recycling. Some studies have focused on the impacts of replacing building materials made out of steel and concrete with wood.¹²⁰ Carbon emission reductions occur by displacing certain non-wood products: wall studs, floor joists, covered floors, and clad walls.¹²¹

Another obvious, and in the aggregate, potentially significant, impact of forest management on greenhouse gas emissions is the fuel and fertilizer used to undertake forest management activities, the transportation of forest products, and the energy utilized to create

positive climate change mitigation through management and then claim that (based on combined 260 years) forest management does not work.” *Id.*

116. JIM BOWYER ET AL., DOVETAIL PARTNERS INC., *LIFE CYCLE IMPACTS OF FOREST MANAGEMENT AND BIOENERGY PRODUCTION* 5 (2011).

117. *Id.*

118. Bruce Lippke et al., *Life Cycle Impacts of Forest Management and Wood Utilization on Carbon Mitigation: Knowns and Unknowns*, 2 *CARBON MGMT.* 303, 310 (2011).

119. *Id.* at 309.

120. *Id.* at 312; see also Christian Lauk et al., *Global Socioeconomic Carbon Stocks in Long-Lived Products 1900-2008*, 2012 *ENVTL. RES. LETTERS* 1, 1 (“A so-far under-researched aspect of the global carbon budget is the accumulation of carbon in long-lived products such as buildings and furniture.”); Andrew H. Buchanan & S. Bry Levine, *Wood-Based Building Materials and Atmospheric Carbon Emissions*, 2 *ENVTL. SCI. & POLY* 427 (1999).

121. Lippke et al., *supra* note 118, at 312.

forest products of various types.¹²² Any resource management activity or market has a host of energy transaction costs associated with its operation.

Given the complex effects of forest management on greenhouse gas flux, two camps have emerged on the issue of wood pellets and climate, with starkly contrasting arguments. On the one hand, a study authored by Walker and Gunn, labeled the Manomet Study,¹²³ outlined a “debt then dividend” model of forest biomass energy use, whereby there was an initial surge of CO₂ (the debt) followed by a CO₂ sequestration dividend decades or even one hundred years into the future.¹²⁴ These scholars worry that the initial surge of CO₂ may push society past a greenhouse gas tipping point that renders later CO₂ sequestration gains inconsequential.¹²⁵ The claims of the Manomet Study are based, in part, on the premise that woody biomass is less energy dense than fossil fuels, thus requiring combustion of much more of it to achieve the same energy output, though this premise has been disputed by others.¹²⁶

Critics of wood pellet market development point to the Manomet Study and argue that the European Union’s climate rules maintain a “loophole” allowing the utilization of wood pellets by electricity generators. Europe’s 2009 renewable energy directive requires that at least 20% of energy consumption must be met from renewable sources by 2020.¹²⁷ These rules consider electricity generated by burning wood as a “carbon neutral” or “zero emissions” energy source.¹²⁸ Companies are only required to report the fossil fuels

122. BOWYER ET AL., *supra* note 116, at 7.

123. THOMAS WALKER ET AL., MANOMET CTR. FOR CONSERVATION SCIENCES, BIOMASS SUSTAINABILITY AND CARBON POLICY STUDY (2010), https://www.manomet.org/sites/default/files/publications_and_tools/Manomet_Biomass_Report_Full_June2010.pdf [<https://perma.cc/LT53-EGRA>].

124. Though even this depends on what use is being made of wood pellet biofuels. As one author noted, “[w]hile the study found that the displacement of coal and natural gas electricity by woody biomass would only be beneficial from an emission perspective after twenty-one and ninety plus years, respectively, the study concluded that emissions benefits could be found after just five years of the displacement of oil-fired thermal and CHP by woody biomass.” Carla Santos & Alisha Falberg, *Light My Fire: The Use & Policies of Woody Biomass as a Heat Source*, 15 SUSTAINABLE DEV. L. & POL’Y 41, 43 (2015).

125. See Schlesinger, *supra* note 12.

126. See Dan Haugen, *Does Burning Wood Instead of Fossil Fuels Increase GHG Emissions?*, MIDWEST ENERGY NEWS (May 10, 2013), <http://midwestenergynews.com/2013/05/10/does-burning-wood-instead-of-fossil-fuels-increase-ghg-emissions/> [<https://perma.cc/P4Q8-XTFT>].

127. John Upton, *Pulp Fiction: The European Accounting Error That’s Warming the Planet*, CLIMATE CENTRAL (Oct. 20, 2015), <http://reports.climatecentral.org/pulp-fiction/1/> [<https://perma.cc/N7JV-7MVZ>].

128. *Id.* The Intergovernmental Panel on Climate Change, for its part, seems to have added more nuance to its understanding of the “neutrality” of forest biomass, having “repeatedly denied in its reports the automatic consideration of biomass as ‘carbon neutral’ ”

burned to manufacture and transport the wood pellets.¹²⁹ The key difference between Manomet and European Union accounting for wood pellet CO₂ is likely attributable to what type of carbon life cycle analysis approach is utilized and whether or not it accounts for reuptake by new forest regrowth. While critics assert that the European Union's rules maintain no requirement that wood pellets be sourced from sustainably managed forests,¹³⁰ at least some wood pellet companies claim to be independently audited to ensure sustainable management and to ensure that they achieve emissions savings of 80% as compared to coal.¹³¹

On the other side of the debate are scholars such as Lippke¹³² and Strauss,¹³³ who have challenged the Manomet Study and raised the prospect that there may not even be an initial carbon debt. These scholars focus on the forest system as a whole, rather than a particular stand of trees, and they also more directly account for fossil fuel emissions displacement.¹³⁴ Lippke argues that the total carbon storage from a sustainably managed forest that is producing a variety of products placed into the stream of commerce will exceed carbon accumulation in an unmanaged forest over time.¹³⁵ Lippke also focuses on the overall carbon storage and emission offset gains when modeling accounts for substitution of fossil fuels in energy production. According to this model, the carbon debt of burning wood pellets quickly gets outweighed by, first, present stores of carbon in forests maintained as forests; second, the dividend gained later when carbon that was released is re-sequestered; and finally, perhaps most important, the fossil fuel emissions forgone through displacement by wood pel-

because: "(1) in any time period there may be CO₂ emissions and removals due to the harvesting and regrowth of bioenergy crops; (2) land use changes caused by biomass production can also result in significant greenhouse gas fluxes; and (3) there may also be significant additional emissions which are estimated and reported in the sectors where they occur." Santos & Falberg, *supra* note 124, at 43 (citing *IPCC Task Force on National Greenhouse Gas Inventories (TFI), General Guidance and Other Inventory Issues*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, <http://www.ipcc-nggip.iges.or.jp/faq/faq.html> [<https://perma.cc/MF7Z-LC6T>]).

129. Upton, *supra* note 127.

130. *Id.*

131. Rivers, *supra* note 13; see also DRAX GRP. PLC, SMART ENERGY SOLUTIONS: ANNUAL REPORT AND ACCOUNTS 5 (2016), <https://www.drax.com/wp-content/uploads/2017/03/Drax-Group-plc-annual-report-and-accounts-2016-Smart-Energy-Solutions.pdf> [<https://perma.cc/NSL2-HQA7>].

132. Lippke et al., *supra* note 118, at 303.

133. WILLIAM STRAUSS, FUTUREMETRICS, HOW MANOMET GOT IT BACKWARDS: CHALLENGING THE "DEBT-THEN-DIVIDEND" AXIOM (2011), <http://futuremetrics.info/wp-content/uploads/2013/07/Manomet-Got-it-Backwards.pdf> [<https://perma.cc/5LGZ-DHJK>].

134. BOWYER ET AL., *supra* note 116, at 11.

135. Lippke et al., *supra* note 118, at 311.

lets. As Lippke and his coauthors argue, “[w]hile much has been made about this time sensitivity—that burning wood is worse than letting it decay—the longer-term benefits of sustainable wood production displacing fossil fuel emissions rotation after rotation far outweighs any short-term impact.”¹³⁶

Strauss similarly asserts that Manomet ignores the life cycle of carbon accumulation and that Manomet is “strictly about combustion.”¹³⁷ Strauss argues that what was considered by Manomet as a debt should instead be properly viewed as harvesting a credit of previously accumulated carbon.¹³⁸ The key for Strauss is that at a landscape level the forest system can be accumulating carbon over time through better management, and that the appropriate timeline for carbon accounting does not start the moment the tree is harvested.¹³⁹ Strauss actually formulated a “dividend then benefit” model, whereby forest cultivation and subsequent combustion of wood pellets stays below the zero net carbon level as the closed loop of forests and fuel cycles through.¹⁴⁰ By observing from a system perspective rather than a single stand of trees, Strauss argues that improvements in management of the forest system cause net carbon held in the forest to increase with growth in forest yield and the use of dedicated energy crops.¹⁴¹ Whereas metric tons of carbon stored in an unmanaged forest can reach succession climax, a host of managed forest products are being put into carbon storage uses and are being managed in an increasingly efficient and sustainable manner.¹⁴²

Another key to the Manomet/Strauss/Lippke debate is that the relative efficiency of burning wood versus fossil fuels depends very much on the efficiency of the boilers in which they are burned. Technology plays a role in the efficiency question. Drax Biomass, for example, claims to achieve the same level of efficiency within its wood pellet boilers as it does within its coal-fired boilers.¹⁴³ Drax argues this improved efficiency cuts their carbon emissions by over 12 million tons.¹⁴⁴ Other analysts dispute this number, arguing that Drax boilers release 15 to 20% more carbon dioxide burning wood than when burning coal.¹⁴⁵ Some have argued that the reason for higher

136. *Id.* at 317.

137. STRAUSS, *supra* note 133, at 2 n.6.

138. *Id.*

139. *Id.*

140. *Id.*

141. *Id.*

142. *Id.*

143. Interview with Richard Peberdy, Drax Biomass (Oct. 12, 2015).

144. Rivers, *supra* note 1.

145. Upton, *supra* note 127.

CO₂ attributable to wood pellet burning is that utilities must burn a lot more wood than coal to generate the same amount of electricity.¹⁴⁶ Other studies have arrived at different conclusions. The EPA's bio emissions methodology concludes that wood pellets have a greenhouse gas emissions rate 35% higher than natural gas (which is undoubtedly cleaner burning) but 14% less than coal.¹⁴⁷ While some have been critical of the EPA's stance that forest biomass is carbon neutral,¹⁴⁸ others say the EPA's numbers do not go far enough, arguing that the EPA's methodology does not adequately take into account CO₂ uptake by regrown forests. Upon that accounting, woody biomass plants generate only 4% of the emissions of a coal plant.¹⁴⁹

Regardless of the veracity of scientific claims on any side of the debate, the Manomet, Strauss, and Lippke studies demonstrate the complex nature of determining the impact of wood pellet energy market development on climate. How does wood pellet production change forest operations? Will foresters cut more trees than they would have otherwise, leading to more emissions in the short term since those trees would have otherwise sequestered carbon longer? On the other hand, removing those trees opens up the forest, allowing the planting of new trees that will begin removing CO₂ from the atmosphere. Will woody scrap that would have taken years to decay, and some of which would have been sequestered even longer in the soil, be used to make wood pellets? What fuel will wood pellets be displacing? If displacing solar and wind, then certainly there can be a net increase in CO₂ emissions. If replacing natural gas or coal, the answer is less clear. In short, as noted in a recent report, "[t]he degree to which [a] biomass energy system can reduce carbon emissions compared to fossil fuels is directly related to establishment and management of harvesting regimes, forest types, fuel transport, and efficiency."¹⁵⁰ The products for which commercial timber substitutes, including in the energy sector, and the way in which forests are managed will have the overall biggest impact on the utilization of forests for climate mitigation.¹⁵¹ If the environmental issues surrounding wood pellet mar-

146. See *supra* text accompanying note 145.

147. BOWYER ET AL., *supra* note 116, at 7-8.

148. Letter from Kevin P. Bundy et al., Ctr. for Biological Diversity, on Request for Correction of Information Disseminated by the Environmental Protection Agency Regarding Emissions from Biomass Combustion in the Inventory of U.S. Greenhouse Gas Emissions and Sinks, to EPA 1 (July 28, 2010), http://www.biologicaldiversity.org/programs/climate_law_institute/global_warming_litigation/pdfs/CBD_DQA_Petition_072810.pdf [<https://perma.cc/5YAU-SZBK>]. The EPA is reassessing its carbon neutrality stance and is developing a biogenic accounting framework. See Santos & Falberg, *supra* note 124, at 43.

149. Lippke et al., *supra* note 118, at 317; see also BOWYER ET AL., *supra* note 116, at 7.

150. Haugen, *supra* note 126.

151. Lippke et al., *supra* note 118, at 314.

ket impact on climate are confusing, a primary contributor is the nascent stage of scientific research and the multitude of factors that must be considered when modeling wood pellet effects on the environment. As described in the next Section, however, a number of political complexities also complicate the potential role of wood pellet markets in helping conserve southern forests.

B. *Political Complexities*

While science forms an empirical foundation for policy, the question of how policy should be formulated in response to scientific facts is a political question. A number of issues demonstrate the political complexity of determining the environmental wisdom of developing wood pellet markets, ranging from the level of government involvement in supporting market development, to the proper balance of forest crops versus natural forests, to relative competition with other actors in the market (like pulp and paper), to whether we should instead focus on the development of other forms of alternative energy. Each of these political complexities is discussed in turn below.

1. *The Role of Government Subsidies in Market Development*

As one commentator stated, “The wood pellet trade wouldn’t exist were it not for . . . generous subsidies.”¹⁵² Wood pellet demand in Europe is being propped up almost entirely by subsidies driven by European Union and individual nations’ climate policies. Wood pellets are four times more expensive than coal, so without subsidization it is doubtful wood pellet demand would remain stable.¹⁵³ Consider that Drax Biomass maintained fuel costs for the first half of 2015 of \$62 per megawatt-hour without subsidies, but \$36 per megawatt-hour with subsidies.¹⁵⁴ By some accounts of Drax’s \$700 million profits in 2014, \$550 million was the result of U.K. green energy subsidies, which are generated by levying a tax on electricity bills.¹⁵⁵ Many have criticized European subsidies as a massive market distortion that places the southern U.S. economy¹⁵⁶ on shaky ground. If the subsidies are removed—which could easily occur as U.K. governments change, for example—then a great deal of sunk costs accrue in the South,

152. Upton, *supra* note 127; see also STEWART, *supra* note 8, at 8.

153. Upton, *supra* note 127.

154. *Id.*

155. *Id.*

156. SPENCER PHILLIPS, DOGWOOD ALL., WOOD PELLET MANUFACTURING: RISKS FOR THE ECONOMY OF THE US SOUTH (2015), <https://www.dogwoodalliance.org/wp-content/uploads/1999/11/finaeconreport2015.pdf> [<https://perma.cc/PM8A-RTJX>]; McFaul & Fuqua, *supra* note 41.

where market expansion is occurring rapidly. Critics of subsidies argue that they create a boom and bust market in the South that “will leave communities with stranded assets, denuded forests and diminished job and other economic prospects long before the hoped-for reductions in greenhouse gas concentrations have a chance to occur.”¹⁵⁷

Indeed, Great Britain’s exit from the European Union (Brexit) has raised concerns about what will happen to the United Kingdom’s commitment to addressing climate change. Renewable energy policies, such as those aimed at wood pellets, are squarely within the center of Britain’s climate change commitments. Regardless of the debate about whether wood pellet markets are good or bad for southern forests or the climate, Brexit could have dramatic ramifications for market development. Many of the climate targets the United Kingdom maintains are driven largely by European Union goals. But, in the wake of Brexit, and in a move that shocked many, the U.K. government decided to shutter its Department of Energy and Climate Change.¹⁵⁸ The department will be merged into an expanded Department of Business, Energy and Environmental Strategy. Many see the replacement of the word “climate” with the word “business” in the department’s title as an ominous sign for England’s prior commitment to the Paris Agreement.¹⁵⁹ In fact, there is a high correlation between Brexit supporters and climate change deniers. A new group has even emerged called “Clexit” (Climate Exit) to push for the United Kingdom’s withdrawal from the Paris Agreement.¹⁶⁰ Even if the United Kingdom decides to continue subsidizing wood pellet renewables in its electricity sector, the United Kingdom’s exit from the European Union has likely undermined its ability to influence other European countries in that direction. This could reduce the scope of the wood pellet market globally, which in turn could reduce timber market opportunities in the southeastern United States and put southern forests at increased risk of conversion.

Government subsidies are only one component of a complex market environment. One of the higher profile cases of wood pellet pro-

157. PHILLIPS, *supra* note 156.

158. Jhesset E, *UK Government Shuts Down Climate Change Department in Major Reshuffle*, NATURE WORLD NEWS (July 17, 2016, 4:06 AM), <http://www.natureworldnews.com/articles/25344/20160717/uk-government-shuts-down-climate-change-department-major-reshuffle.htm> [<https://perma.cc/57PZ-WL7L>].

159. U.N. Framework Convention on Climate Change, Adoption of the Paris Agreement, U.N. Doc. FCCC/CP/2015/L.9/Rev.1 (Dec. 12, 2015), <http://unfccc.int/resource/docs/2015/cop21/eng/109r01.pdf> [<https://perma.cc/39ZW-TQLB>].

160. Dana Nuccitelli, *Rejection of Experts Spreads from Brexit to Climate Change with ‘Clexit’*, GUARDIAN (Aug. 8, 2016, 6:00 AM), <https://www.theguardian.com/environment/climate-consensus-97-per-cent/2016/aug/08/rejection-of-experts-spreads-from-brexit-to-climate-change-with-clexit> [<https://perma.cc/7SMR-UBSL>].

ducer failure is the insolvency of a company known as German Pellets. The company blamed its economic woes on the sudden drop in oil prices (making wood pellets less competitive in the market), lower pellet revenues (because of two warmer than usual winters), and bad investments made by the company.¹⁶¹ These factors demonstrate how government involvement in wood pellet market growth is very much dependent on factors as wide ranging as weather, oil prices, and the investment choices made by companies receiving subsidization. German Pellets' U.S. subsidiaries also filed for bankruptcy, citing construction delays and cost overruns at its Louisiana plant in La Salle Parish.¹⁶² In statements made after it declared bankruptcy, the company insisted its circumstances were unusual and the market for wood pellets was strong in the power generation and pellet-fired heating sectors. But again, even if true, this strength is largely due to government subsidization, and the German Energy Wood and Pellet Association has called for additional government support to increase the use of biomass heating.¹⁶³ The German Pellets case has had direct ramifications for its U.S. operations, both in Texas¹⁶⁴ and Louisiana, and their continued existence is in question as the insolvency proceedings move forward.¹⁶⁵

Of course, oil and gas enjoyed its share of subsidization in its market youth, and still enjoys a high rate of subsidy today (largely in the form of tax breaks).¹⁶⁶ The same can be said of other renewable energy markets, such as solar and wind.¹⁶⁷ It remains to be seen whether subsidies for wood pellets are on politically stable or shaky ground, and that question largely depends on how climate-conscious policymakers perceive the scientific questions surrounding biomass as an energy source. If they continue to perceive that wood pellet-generated energy is a net positive for the climate, then they are more likely to continue subsidization. But, as described in Part V, a commitment to market subsidization will be needed, at least in the short term, if the South is to maintain stable investments

161. Erin Voegele, *German Pellets Files for Insolvency*, BIOMASS MAG. (Feb. 11, 2016), <http://biomassmagazine.com/articles/12902/german-pellets-files-for-insolvency> [<https://perma.cc/99GJ-BEH8>].

162. *Louisiana Wood Pellet Maker Enters Bankruptcy Protection*, GREATER BATON ROUGE BUS. REP. (Feb. 22, 2016), <https://www.businessreport.com/article/louisiana-wood-pellet-maker-enters-bankruptcy-protection> [<https://perma.cc/99WZ-CH87>].

163. Voegele, *supra* note 161.

164. *Id.*

165. GREATER BATON ROUGE BUS. REP., *supra* note 162.

166. *See infra* note 255.

167. *See* Mary Hutzler, *Subsidizing American Energy: A Breakdown by Source*, INST. FOR ENERGY RES., <http://instituteeforenergyresearch.org/studies/energy-subsidies-study/> [<https://perma.cc/CXT9-TB9M>].

in the market and if the market is to have a chance to facilitate forest preservation.

2. *Natural Versus Managed Forests: Striking a Balance*

Understandably, many environmental groups are concerned that demand for wood pellets will cause forest managers to run roughshod over other forest ecosystem services by converting otherwise natural (or unmanaged) forests into monoculture plantations—effectively creating a cash crop of trees.¹⁶⁸ The science is clear that ecosystems can decline under managed forest regimes depending on how they are managed, resulting in biodiversity loss and negative water quality impacts.¹⁶⁹ Forests are home to 80% of the world's terrestrial biodiversity.¹⁷⁰ Water quality impacts are tied directly to soil impacts, as increased management activities loosens soils, leading to erosion, changes in water body temperature, and eutrophication of waterways (creating dead zones where fish cannot survive).¹⁷¹

Environmental groups have recently sued forest-to-bioenergy projects, arguing that existing forest management policies or private certification schemes are not enough to prevent negative environmental impacts from forest biomass cultivation.¹⁷² To date, while courts have found that environmental groups maintain standing to bring such claims, those claims have been unsuccessful.¹⁷³

While concerns over the environmental effects of converting natural forests to managed forests are justifiable, the South already maintains 70% of all the forest plantations in the country,¹⁷⁴ and nearly 20% of southern forests are already plantations.¹⁷⁵ This does not mean, of course, that the balance of industrial versus unmanaged forests in the South is optimally struck, but it at least means that

168. See Lippke et al., *supra* note 118, at 304 (“[C]arbon mitigation impacts on ecosystem services affecting their non-market values can be significant. This may justify greater efforts to protect certain habitat that might be at risk if focusing only on carbon mitigation”); see also *Criteria & Indicators for Forest Sustainability*, U.S. DEPT OF AGRIC., FOREST SERV., <http://www.fs.fed.us/research/sustain/criteria-indicators/> [<https://perma.cc/4585-466A>].

169. See, e.g., Jody M. Endres, *Barking Up the Wrong Tree? Forest Sustainability in the Wake of Emerging Bioenergy Policies*, 37 VT. L. REV. 763, 766 (2013).

170. *Forest Habitat*, WORLD WILDLIFE FUND, <http://www.worldwildlife.org/habitats/forests> [<https://perma.cc/439C-LJ3B>].

171. See MCDERMOTT ET AL., *supra* note 21, at 15.

172. *Klein v. U.S. Dep't of Energy*, No. 2:11-cv-514, at 32-34 (W.D. Mich. Dec. 11, 2012), *rev'd in part, aff'd in part*, 753 F.3d 576, 578 (6th Cir. 2014).

173. See *Klein*, 753 F.3d at 585.

174. BRATKOVICH ET AL., *supra* note 10, at 6.

175. Chris Woolston, *Biomass Boom: Threat or Opportunity for Southern Forests?*, BIOENERGY CONNECTION, <http://www.bioenergyconnection.org/article/biomass-boom-threat-or-opportunity-southern-forests> [<https://perma.cc/VV3P-AL4W>].

development of wood pellet markets would not mark a dramatic shift in current uses or current acreage of working versus unmanaged natural forests. The robust development of the pulp and paper industry in the South, described in Part III, already established a vast managed forest landscape. Clearly this landscape is not the “natural,” pre-industrial forest landscape some would hope for, but it is at least preferable to the cut-over, burned-over, and otherwise poorly managed southern forest landscape in existence just after the Civil War. In other words, maintaining managed forests rather than natural forests is better than maintaining no forests at all.¹⁷⁶

Furthermore, this would not be the first time some environmentalists have claimed doom and gloom for southern forests at the hands of a forest products industry. In the 1980s and 1990s, wood chip mills exploded across the South. Accusations by some environmental non-governmental organizations (NGOs) were that those mills would lead to “massive . . . clearcutting across the South,”¹⁷⁷ with others calling such mills “measles” on the landscape that would lead to “unprecedented forest destruction.”¹⁷⁸ Of course, this destruction at the hands of chip mills never occurred, and they did not “put undue burden on forest resources in the South.”¹⁷⁹

Even so, some have argued that a proliferation of additional monoculture, plantation-style forests will be necessary to produce woody crop biomass at scale.¹⁸⁰ Widespread conversions to monocultures certainly remain a possibility, especially considering that wood pellets are only one type of energy product yielded by forests. Cellulosic ethanol and numerous other forms of biomass might be cultivated from forests to fuel the transportation and other sectors, meaning demand for forest products could increase rapidly and synergize with other market sectors.¹⁸¹ The U.S. Department of Agriculture found that nearly 11 million acres of U.S. forests could be tapped to produce 2.8

176. Alistair Osborne, *Greens Can't See Wood for the Trees*, TIMES (Dec. 15, 2014, 12:01 AM), <http://www.thetimes.co.uk/tto/business/industries/utilities/article4297217.ece>.

177. Danna Smith, *The Infestation of Chip Mills in the Southern U.S.*, SYNTHESIS/REGENERATION 15, Winter 1998, <http://www.greens.org/s-r/15/15-17.html> [<https://perma.cc/M5TV-KAA9>].

178. *Id.*

179. STEWART, *supra* note 8, at 20.

180. Endres, *supra* note 169, at 768 (citing G.A. Tuskan, *Short-Rotation Woody Crop Supply Systems in the United States: What Do We Know, and What Do We Need to Know?*, 14 BIOMASS & BIOENERGY 307, 311 (1998)).

181. See Robert Rapier, *A Cellulosic Ethanol Milestone*, FORBES (Apr. 26, 2016, 4:59 PM), <http://www.forbes.com/sites/rpapier/2016/04/26/a-cellulosic-ethanol-milestone/>.

billion gallons of advanced biofuels by 2022.¹⁸² The past is not a reliable predictor of the future, and even though past concerns raised about forest product markets never came to fruition, a scaled-up demand for wood pellets and other fuels could place a greater strain on southern forests than they have ever seen. It would, no doubt, be a far larger market than those developed for wood chips, considering the overall proportion of energy demand attributable to electricity generation and transportation fuels. So, if not developed properly, future forest biomass markets could very well lead to the mismanagement of currently managed forests or further destruction of natural forests for the sake of creating managed forests.

One aspect of the natural forest question regards the degree to which wood pellet companies will be pursuing primary timber. Drax Biomass notes that 4.4 million tons of forest and sawmill residues are generated each year, but only 10% of those residues are actually used.¹⁸³ Drax claims that its goal is to make better use of residues, effectively recycling otherwise discarded material. While this may be true today, the relative use of primary versus secondary or discarded wood products depends on whether the wood pellet energy market expands and, if so, how rapidly. It also depends on forest management techniques, since a certain amount of forest litter resulting from timber extraction processes should be left on the ground to prevent erosion, provide habitat for species, replenish nutrients in forest soil, and otherwise assist in the reforestation process. Drax claims that it only purchases biomass from sustainably managed sources,¹⁸⁴ which presumably would account for forest litter and other silvicultural considerations. Nonetheless, as highlighted in Part V, government policy must ensure that demand for forest biomass does not unduly strain natural forest preservation.

3. *Pulp and Paper: Necessary Competition or a Threat?*

One of the most difficult political issues faced by wood pellet market entrants in the South is a potentially contentious relationship with the pulp and paper industry, which fears that wood pellet producers will raise the price of timber through competition. Some of this competition may be purely market driven, but wood pellet market entrants gain some competitive advantage because of the subsidies described above. At least one study has shown that subsidies

182. U.S. DEPT OF AGRIC., A USDA REGIONAL ROADMAP TO MEETING THE BIOFUELS GOALS OF THE RENEWABLE FUELS STANDARD BY 2020, at 5-6 (2010), http://www.usda.gov/documents/USDA_Biofuels_Report_6232010.pdf [<https://perma.cc/JWZ6-658Z>].

183. Rivers, *supra* note 1.

184. *Id.*

allow wood pellet producers to pay from two-to-five times the going rate for wood products, which increases cost for pulp and paper.¹⁸⁵ American Forest and Paper Association President and CEO Donna Harman argues that these subsidies are “market-distorting” and give pellet producers a competitive advantage when purchasing wood residues.¹⁸⁶ Harman argues that “[w]ithout these large subsidies, it would be uneconomic for industrial wood pellets to be shipped from the U.S. to U.K. power plants. They would lose money if they had to compete in an unsubsidized market.”¹⁸⁷ Analysts have argued that the increased price of forest products due to subsidized pellet manufacturing will threaten job retention and creation in other, more stable markets like lumber and paper manufacturing.¹⁸⁸ These other markets may move elsewhere (displacement), may begin importing timber from other regions of the globe that have poor forest management practices (leakage), or may shut down altogether.¹⁸⁹

Of course, these arguments have come from unsurprising sources, primarily pulp and paper advocates and those concerned about environmental impacts of wood pellet energy generation. That does not render the arguments immaterial, but does add a lens through which to assess their weightiness. The truth is that the pulp and paper industry has had a long history of virtual monopoly on timber prices in the South. Pulpwood is much cheaper than saw timber, and the pulp and paper industry—through both direct ownership of forestlands (vertical integration) and long-term contracts with private forest owners—have leveraged the market for lower timber prices. They flood the market with pulpwood cut at relatively young ages, decreasing the price per unit of timber.¹⁹⁰ On the one hand, competition from another market entrant could be good for Southern forest owners, driving up the price of their product and providing even more incentive for maintaining forestland. The question becomes whether a scaled-up wood pellet market that provides forest owners a higher price for timber would be a net benefit when weighed against a potential retreat by pulp and paper industries from the South. Pulp and paper sees pellet markets as eroding margins due to price increases and the diversion of timber into export markets.¹⁹¹ And it may very

185. See McFaul & Fuqua, *supra* note 41.

186. *Id.*

187. *Id.*

188. PHILLIPS, *supra* note 156, at 1-2.

189. *Id.*

190. See Blake Hudson, *Promoting and Establishing the Recovery of Endangered Species on Private Lands: A Case Study of the Gopher Tortoise*, 18 DUKE ENVTL. L. & POL'Y F. 163, 203 (2007).

191. STEWART, *supra* note 8, at 19.

well be that if timber prices climb too high and too fast, then pulp and paper mill closures, or shifts toward importation of wood products, could provide a net loss of markets into which private forest owners could inject their timber. If the South begins to hemorrhage more pulp and paper mills than it gains in wood pellet plants, then it could exacerbate the forest preservation problem by providing fewer market outlets for forest owners and hastening forest conversion. So the timing and pace of wood pellet scaling up and price changes will play a critical role in whether a market competitor to pulp and paper can actually provide a renewable energy resource and incentivize forest owners to maintain forestland.

Even so, it seems that the tightening of international forest standards, which are impacting even forest practices in the developing world, will make shifting operations overseas or importing timber from overseas less viable alternatives for pulp and paper. Consider, for example, Norway's recent decision to refuse to import any product that contributes to deforestation in its place of origin.¹⁹² Proliferation of these types of policies internationally could make it more expensive for pulp and paper mills to operate overseas or to import timber from overseas. If pulp and paper industries are forced to "stay home" and ultimately face increased competition from wood pellet producers over timber resources, then forest owners and the southern forest landscape could benefit both economically and environmentally.

At present, wood pellet operators are going out of their way not to encroach on the primary forests which pulp and paper taps for its products. Of all pine pulpwood removals in the South in 2014, only 6.2% went to wood pellet production.¹⁹³ From 1995 to 2015, the pulp and paper industry saw a net loss of fourteen mills, while sixteen pellet mills began operating during the same period.¹⁹⁴ Seventy-two percent of export pellet mills are located within sixty-five miles of a closed pulp and paper facility,¹⁹⁵ demonstrating that pellet mills are not so much encroaching as they are stepping in to fill a void left by pulp and paper. At least one report found that the impacts of export

192. Katie Pohlman, *Norway Becomes World's First Country to Ban Deforestation*, ECOWATCH (June 8, 2016, 2:28 PM), <https://ecowatch.com/2016/06/08/norway-bans-deforestation/> [<https://perma.cc/4ABU-4WAW>].

193. STEWART, *supra* note 8, at 9-10. A report commissioned by the U.S. Endowment for Forestry and Communities, National Alliance of Forest Owners (NAFO) and the U.S. Industrial Pellet Association (USIPA) found that of the 3.3% of wood removed for all markets in the South in 2014 pellet exports represented only 0.08% of the total inventory. Carlton Owen, Gretchen Schaefer & Christopher Hughes, *U.S. Wood Pellet Export Market No Threat to U.S. Southern Forests*, BUS. WIRE (Nov. 18, 2015), <https://www.businesswire.com/news/home/20151118006320/en/U.S.-Wood-Pellet-Export-Market-Threat-U.S.>

194. STEWART, *supra* note 8, at 12.

195. *Id.* at 12.

pellet mill openings has had minimal impacts on wood fiber prices in the South and wood pellet demand has driven price changes very little.¹⁹⁶ Nonetheless, the question remains whether, if energy demand from renewable wood pellets increases enough, it will benefit forest owners long subject to pulp and paper's virtual monopoly on timber prices and will incentivize protection of the forests that they own.

4. *Electricity Demand: If Not Wood Pellets, Then What Renewable Source?*

The final political complexity concerns how exactly society will shift most quickly to renewables while maintaining a steady supply of energy. Energy demand requires energy system stability and reliability, and at certain points during a day or during a season of the year, demand fluctuates greatly. Baseload plants, which are particularly suited for a resource like wood pellets, require an identifiable quantity of fuel for operation. Peaker plants, which meet peak demand when it spikes at both predictable and unpredictable times,¹⁹⁷ are less suited for traditional fuels used in baseload plants and run primarily on natural gas.¹⁹⁸ One of the benefits of burning fossil fuels for electricity, and in particular coal and natural gas, is that it is known just how much energy exists in the pile of coal waiting to be deposited into the boiler or natural gas in the pipe leading to a plant. No other energy source today approximates that certainty and provides the same stability as fossil fuels in smoothing out supply in response to demand like a large, known quantity of wood piled up outside the boiler.

Storage technology for wind and solar simply are not available at scale yet. As Eisen and his coauthors note, while extensive advanced battery design research is underway, "progress is slow."¹⁹⁹ Indeed, the European Union's focus on biomass is in part driven by the fact that while more expensive than coal or natural gas in the absence of subsidies, wood pellets are cheaper than solar and wind. Without sufficient battery technology, electricity plants "can't produce a steady supply of around-the-clock electricity" with solar and wind.²⁰⁰ As one Drax official remarked, electricity cannot be stored at scale, and in

196. *Id.* at 14-16.

197. See Jeff St. John, *Dueling Charts of the Day: Peaker Plants vs. Green Power*, GREEN TECH MEDIA (Jan. 17, 2014), <https://www.greentechmedia.com/articles/read/dueling-charts-of-the-day-peaker-plants-vs.-green-power> [<https://perma.cc/CCZ3-ZCYY>].

198. The cycling on and off of these plants causes strain on the hardware and can shorten the lifespan of the plant if the appropriate fuel is not used.

199. JOEL B. EISEN ET AL., *ENERGY, ECONOMICS AND THE ENVIRONMENT* 67 (4th ed. 2015).

200. Upton, *supra* note 127.

order for electricity plants to respond quickly to changes in demand, “[b]iomass generation is almost unique as a renewable since it can both perform as a 24x7 provider but is also flexible [and] capable of being rapidly flexed to match demand. Most other renewables are weather-dependent and therefore cannot fulfil that vital function.”²⁰¹ As a result, “[w]hen you look at the whole system-cost basis, we would say biomass conversion is one of—if not the—cheapest renewables on the system.”²⁰²

In short, if not biomass, then what? Until technology catches up with the energy needs of society it seems that keeping the lights on requires the continued use of either fossil fuels or woody biomass—and only the latter can be part of a closed loop greenhouse gas system, as new biomass re-sequesters CO₂ released during energy generation.

V. WOOD PELLET MARKET POLICY SUGGESTIONS

In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber, or energy from the forest, will generate the largest sustained mitigation benefit.²⁰³

As noted in the Introduction, a century and a half ago, wood supplied up to 90% of the energy needs in the United States,²⁰⁴ but only 2% today.²⁰⁵ The tide is now turning. The European Union holds three-quarters of the world’s installed capacity of solar, and yet wood has surpassed both solar and wind as a source of renewable energy.²⁰⁶ Wood is rapidly replacing coal in Europe as a means of providing heat and electricity. Nearly half of Europe’s renewable energy comes from wood, and in 2014, Europe produced as much energy from wood pellets as it would have from burning 620 million barrels of oil.²⁰⁷ Exports from the United States to Europe doubled between 2012 and 2013, and pellet output in North America grew from less than a mil-

201. Rivers, *supra* note 13.

202. Upton, *supra* note 127.

203. See Lippke et al., *supra* note 118, at 303 (citing INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP III CONTRIBUTION TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, MITIGATION 69 (Bert Metz et al. eds. 2007)).

204. Isabel F. Peres, Timothy A. Slating & Jay P. Kesan, *The Case for Vertical Integration in the Developing Bioenergy Industry*, 39 WM. & MARY ENVTL. L. & POL’Y REV. 575, 577 (2015).

205. *Biomass Explained*, *supra* note 4.

206. *The Fuel of the Future*, ECONOMIST (Apr. 6, 2013), <http://www.economist.com/news/business/21575771-environmental-lunacy-europe-fuel-future> [<https://perma.cc/59RX-3ULF>].

207. Upton, *supra* note 127.

lion tons in 2003²⁰⁸ to 11 million in 2014,²⁰⁹ a full one-third of that being exported from the United States.²¹⁰ The United Kingdom alone imported 3.3 million tons of pellets in 2013.²¹¹ In addition to the United Kingdom, Denmark, France, the Netherlands, Sweden, Germany, and Belgium are all in the market for wood pellets, and a full 80% of wood pellet demand is from European buyers.²¹² The South in particular is poised to increase export capacity to 10.8 million tons of wood pellets in order to keep up with projected European demand.²¹³ By some accounts, demand for wood pellets will increase globally from 29 million metric tons today to nearly 49 million metric tons by 2019.²¹⁴ And it is not only international demand spurring the growth of wood pellet markets. Distributed wood pellet generation in homes across the United States is becoming more popular as well, especially in the northern latitudes where it is used for heating during the winter.²¹⁵

At the same time, instability in demand for home construction, combined with pulp and paper company divestment of forest holdings and departure to overseas sites, have fundamentally altered the location and viability of operational mills, and forestland ownership has become increasingly fragmented.²¹⁶ This opens the door wide for new market entrants to enter southern forests to potentially forestall conversion of those forests to other uses, which presents both challenges and opportunities for southern forests. As noted in Part III, today climate change is the new fire problem, and could potentially bolster wood pellet markets and conserve southern forests as countries look to reduce greenhouse gas emissions and convert to renewable sources of energy. Wood pellet markets have expanded rapidly at the same time that pulp and paper mills have been closing down, filling a critical void for Southern forest owners. Within the context of the scientific and political complexity outlined in Part IV, this Part details a number of policy suggestions for policymakers to take into account if wood pellets do come to be viewed as an environmentally sound means of shifting toward a reliable source of renewable energy that

208. Melanie Torbett, *Pellets Poised to be a Growing Louisiana Export*, LA. FORESTRY ASS'N: FORESTS & PEOPLE (Mar. 2015), <https://www.laforestry.com/News/ForestandPeopleIssues/ForestandPeople2ndQtr2015.aspx> (follow "Pellets Poised to be a Growing Louisiana export" hyperlink) [<https://perma.cc/N4DA-KL2F>].

209. STEWART, *supra* note 8, at 8.

210. *Id.*

211. Torbett, *supra* note 208.

212. *Id.*

213. STEWART, *supra* note 8, at 14.

214. Voegelé, *supra* note 161.

215. Torbett, *supra* note 208, at 5; *see also* Santos & Falberg, *supra* note 124.

216. STEWART, *supra* note 8, at 8.

might protect—and even increase—forest health across the United States, and in particular in the South.

A. *Account for Potential Forest Conversion in Life-Cycle Analysis of Forest Biomass as an Energy Source*

One of the biggest holes in the assessments of those analyzing the growth of wood pellet markets is the failure to model potential conversion of forests to other uses. The wood pellet market's potential role in curbing forest conversion to other uses must be factored into carbon accounting in a more robust manner. Wood pellets may offer an important opportunity at a crucial time for Southern forest owners to inject their products into profitable markets so that they will maintain forestland. Analysts should take a cue from the Futures Report,²¹⁷ and combine analysis presented in that report with analysis from reports on urban sprawl.²¹⁸ A resulting assessment could project how wood pellet markets might mitigate potential forest losses, if at all. Only then can an accurate accounting be given for the overall net greenhouse gas impacts of forest management, cultivation, and use as an energy source.

In fact, consider the United States' portion of the Deep Decarbonization Pathways Project (DDPP), which "is a global collaboration of energy research teams charting practical pathways to deeply reducing greenhouse gas emissions in their own countries."²¹⁹ The analysts crafting the report see no role for biomass in the electricity generation sector in any of its deep decarbonization scenarios. The DDPP has reserved biomass use for the transportation sector and for on-site cogeneration, such as when a paper mill burns biomass to power its own operations.²²⁰ The thinking seems to be that there are other technologies available to generate electricity, such as wind and solar, and that precious biomass resources should be scarcely utilized. But this overlooks the analysis undertaken in Part IV.B.4. that technology has not yet arrived to allow other forms of renewables to supply a steady and predictable electricity supply. It also overlooks the fact that deeply decarbonizing our economy may necessarily include releasing some carbon into the atmosphere, if it means that doing so will increase a corresponding, offsetting carbon sink through the

217. See WEAR & GREIS, *supra* note 9.

218. See EWING & HAMIDI, *supra* note 57; see also KOLANKIEWICZ, *supra* note 63.

219. DEEP DECARBONIZATION PATHWAYS PROJECT, <http://deepdecarbonization.org/> [https://perma.cc/KCU2-EM7B].

220. See JAMES H. WILLIAMS, BENJAMIN HALEY & RYAN JONES, POLICY IMPLICATIONS OF DEEP DECARBONIZATION IN THE UNITED STATES 14, 87 (2015), http://deepdecarbonization.org/wp-content/uploads/2015/11/US_Deep_Decarbonization_Policy_Report.pdf [https://perma.cc/ML7B-9SJT].

maintenance and potential expansion of forests from which biomass is cultivated—it is better to live in a world of vast forests cultivated for fuel than to supply 100% of our electricity through wind and solar but have no forests.

In short, in the absence of a dramatic political shift in lax forest management and land use regulatory philosophy in the South, any analysis of decarbonizing energy systems must account directly for the potential conversion of forests to non-forest uses if forest biomass markets are considered as part of national and global energy portfolios.

B. Ensure Reforestation, Sustainable Forest Management, and an Appropriate Balance of Managed Monocultures and Natural Forests

[O]ne of the key debates surrounding forests' role in bioenergy systems will be how existing government policies will protect forest ecosystems and carbon sequestration adequately in light of increased bioenergy demand.²²¹

Policymakers at the federal, state, and local levels should be actively engaged in ensuring that forests cultivated for wood pellets are, first, managed sustainably; second, reforested; and third, do not result in a net loss of natural forests. Burning forest products today in the name of renewability while not ensuring replacement or sustainable management of those resources is a gamble that could have severe climate change impacts. Such a gamble could also negatively impact a number of other goods and services, such as biodiversity and water quality. Regarding developments in Europe, critics argue that “[t]he EU has encouraged the burning of wood for electricity, without any rules to ensure that the debt to the climate is repaid—such as requiring that forests used for pellets are replanted or allowed to fully regrow.”²²² And discussions of how to ensure protection of forest values in light of potential wood energy uses have been strangely absent in international negotiations on climate.²²³

A number of approaches might be taken simultaneously to ensure reforestation and sustainable forest management. In the absence of prescriptions, federal or state subsidies might be utilized. One cue might be taken from how the Renewable Fuel Standard in the federal Energy Policy Act treats forest biomass.²²⁴ The Act defines “renewa-

221. Endres, *supra* note 169, at 778.

222. Upton, *supra* note 127. It is not clear that the EU could do this on lands outside its borders as it could be seen as violation of the GATT. So it may be that bilateral trade agreements are needed to incorporate these types of considerations.

223. *Id.*

224. The Energy Policy Act of 2005, Pub. L. No. 109, 119 Stat. 594, § 201(a)-(b) (codified at 42 U.S.C. §§ 15801-16538 (2012)); Clean Air Act, 42 U.S.C. § 7545(o) (2012).

ble biomass” as fuel harvested from trees or residues from actively managed forest plantations on privately- or state-owned forestland cleared before the Act was passed.²²⁵ Operators must provide documentation demonstrating that forest material was not cultivated from land converted to a monoculture plantation after the Act was passed.²²⁶ This step is taken to ensure that the plantations in place do not expand into or are not created out of currently existing natural forests.²²⁷ Slash or pre-commercial thinnings (as opposed to primary timber) may also be utilized from state or private forests as long as they are not derived from forests designated as critically imperiled, imperiled, or rare according to the State Natural Heritage Program.²²⁸

It should be remembered, however, that the United States does not have a national energy policy related to low carbon fuel standards or a national renewable portfolio standard, which makes incorporating sustainable forest management into such a standard unavailable at the national level at present. States may do this, of course, but the result may be a mishmash of forest management approaches (as we see with prescriptive regulation).²²⁹

Other biomass-related federal programs provide similar policy controls. The 2008 Farm Bill’s Biomass Crop Assistance Program (BCAP) was the first federal subsidy program for energy biomass.²³⁰ It provides financial assistance for the growth of forest biomass crops, but only for “renewable biomass” cultivated from “eligible land.” Eligible land includes only non-industrial private forestlands, and candidates must demonstrate a forest stewardship management plan or the equivalent that assesses impacts on soil, water, and re-

225. 42 U.S.C. § 7545(o)(1)(I)(ii) (2012).

226. 40 C.F.R. § 80.1454(d)(2)(i)-(vi) (2016).

227. Of course, this is not to say that the current mix of plantation or natural forests is optimal. It may be that the host of forest values needing protection would not be compromised by the creation of additional pine plantations. In fact, today’s southern hardwood forests, often considered “natural” southern forests, only exist because of commercial logging practices early in the nation’s history combined with centuries of fire suppression. The longleaf pine ecosystem, 97% of which has been destroyed, once covered virtually the entire southeastern United States. The “natural” hardwood forests we see today only exist because longleaf pines were commercially logged and subsequent suppression of fire allowed hardwoods to move onto highlands from lower lying watersheds. The longleaf pine ecosystem, in turn, bears a much stronger resemblance to today’s monoculture pine plantations than to “natural” hardwood forests blanketing large portions of the modern southern forest landscape. See U.S. Dep’t of Agric., *Restoring a Disappearing Ecosystem: The Longleaf Pine Savanna*, SCI. FINDINGS, May 2013, <https://www.fs.fed.us/pnw/science/scif152.pdf> [<https://perma.cc/AJ85-T567>].

228. 42 U.S.C. § 7545(o)(1)(I)(iv).

229. Endres, *supra* note 169, at 832.

230. Food, Conservation, and Energy Act of 2008, 7 U.S.C. § 8111 (2012).

lated resources.²³¹ The 2014 Farm Bill amended the BCAP to designate as eligible only those materials (1) produced as a byproduct of a preventive treatment that is removed to reduce hazardous fuel or to reduce or contain disease or insect infestation; (2) harvested in accordance with the Healthy Forests Restoration Act of 2003 on federal land; and (3) delivered to a qualified biomass conversion facility to be used for heat, power, bio-based products, research, or advanced bio-fuels.²³² Another such program is the Federal Cooperative Forestry Assistance Act (FCFAA), which funds forest stewardship management planning.²³³ This program requires that forest owners adhere to U.S. Forest Service standards and that they assess soil, water, biodiversity, and other aspects of resource management in their plans.²³⁴ The FCFAA also specifically contemplates bioenergy generation and requires a development plan consistent with the National Association of State Foresters' guidelines, which encourage sustainability.²³⁵ The program places particular emphasis on monitoring to ensure that stated goals are carried out.²³⁶

A handful of state laws may be instructive as well. California state law maintains a requirement that property owners seeking to convert three contiguous acres or more to non-forest acreage must apply for a Timber Conversion Permit.²³⁷ Oregon, Washington, and Maryland²³⁸ all also maintain relatively stringent forest management and preservation statutes.²³⁹ Even so, most states, particularly in the southeast, do not maintain even basic forest management standards, much less forest preservation ordinances.²⁴⁰ Critics of wood pellet markets are, therefore, rightly concerned about the fragmentation of forest policy

231. *Id.* § 8111(c)(3)(B)(iii).

232. Agriculture Act of 2014, Pub. L. No. 113-79, § 9011, 128 Stat. 649, 933 (2014) (codified as amended at 7 U.S.C. § 8111(a)(6)).

233. Cooperative Forestry Assistance Act of 1978, 16 U.S.C. §§ 2101-2114 (2012).

234. *Id.* § 2103a(f); USDA FOREST SERV., FOREST STEWARDSHIP PROGRAM NATIONAL STANDARDS AND GUIDELINES 4-6 (2009), http://www.fs.fed.us/spf/coop/library/fsp_standards&guidelines.pdf [<https://perma.cc/77XM-3NWZ>].

235. NAT'L ASS'N OF STATE FORESTERS, STEWARDSHIP HANDBOOK FOR FAMILY FOREST OWNERS 1 (2d ed. 2009), <http://www.stateforesters.org/files/NASF-Stewardship-Handbook-print.pdf> [<https://perma.cc/H9NZ-GC7K>].

236. *Id.*

237. CAL. CODE REGS. tit. 14, §§ 1104, 1104.1 (2016).

238. *See, e.g.*, The Maryland Forest Conservation Act, MD. CODE ANN., NAT. RES. §§ 5-1601-12 (establishing requirements for forest conservation plans); Washington County, Md., Forest Conservation Ordinance (Nov. 18, 2014) (establishing a county-wide plan for forest preservation); *Forest Conservation Ordinance*, WASHINGTON CTY., MD.: DEP'T PLANNING & ZONING, <http://washco-md.net/planning/forest.shtm> [<https://perma.cc/8RZ5-LV9B>].

239. *See* Blake Hudson, *Dynamic Forest Federalism*, 71 WASH. & LEE L. REV. 1643 (2014).

240. *See* MCDERMOTT ET AL., *supra* note 21, at 83.

in the United States,²⁴¹ leaving one to question what level of government should be responsible for ensuring that forests are regrown and managed sustainably. It seems unlikely that the federal government will step in with any forest management prescriptions, especially in the current political climate. It may also be that states are unlikely to do the same. Yet in light of wood pellet market development in the South, renewed calls for state programs modeled on those in California, Washington, Oregon, and Maryland are warranted.

States may regulate not only forests themselves, but also the biomass that might be cultivated out of those forests. Massachusetts, for example, regulates biomass that may be utilized to fulfill its renewable portfolio standard by type. Eligible biomass includes residues,²⁴² thinnings,²⁴³ forest salvage,²⁴⁴ and non-forest derived residues (such as trees removed from conversion to agriculture or other uses). Material derived from old growth forests and forest litter (including roots, stumps, decaying trees, and snags) may not be considered.²⁴⁵ The regulation focuses heavily on soil quality and establishes a number of requirements to maintain soil quality and prevent erosion.²⁴⁶ Massachusetts also maintains requirements separate and apart from the RPS, including requirements that forest harvesting above a certain volume must be conducted pursuant to an approved cutting plan under the Forest Cutting Practices Act²⁴⁷ and in compliance with the Best Management Practices Manual.²⁴⁸ The manual provides guidance on how to conduct forest operations while engaging in planning and establishing parameters for access roads and trails, landings, sedimentation runoff, stream crossings, wetlands, vernal pools, rare and

241. See Upton, *supra* note 127.

242. Defined as “[t]ops, crooks and other portions of trees produced as a byproduct during the normal course of harvesting material” and as “[o]ther woody vegetation that interferes with regeneration or the natural growth of the forest, limited to locally invasive native species and non-native invasive woody vegetation.” 225 MASS. CODE REGS. § 14.02 (2016).

243. Trees that are “weak or have low vigor” and “[t]rees removed during thinning operations, the purpose of which is to reduce stand density and enhance diameter growth and volume of the residual stand.” *Id.*

244. Defined as “[d]amaged, dying or dead trees” due to weather events or disease, as well as trees removed to reduce fire hazard, but it does not include those trees removed due to competition. *Id.*

245. *Id.*

246. *Id.*

247. MASS. GEN. LAWS ch. 132, §§ 42, 44 (2013).

248. DAVID B. KITTREDGE, JR. & MICHAEL PARKER, MASSACHUSETTS FORESTRY BEST MANAGEMENT PRACTICES MANUAL 1 (3d prt. 1999), <http://projects.geosyntec.com/npsmanual/fact%20sheets/MA%20Forestry%20Best%20Mgt%20Practices.pdf> [<https://perma.cc/QA4L-JJRD>].

endangered species, chemical management, prescribed burning and wildfire, site closure, aesthetics, fire hazard, and water quality.²⁴⁹

In addition to subsidies or prescriptions, private certification schemes provide yet another mechanism through which wood pellet working forests may be preserved, managed, and balanced with natural forests. Under the Forest Stewardship Council²⁵⁰ standards, a party may not convert natural forests to plantations or other uses unless very limited forest management will occur, the forest is not designated a forest of High Conservation Value, and the conversion promotes “clear, substantial, additional, secure, [and] long term conservation benefits across the forest management unit.”²⁵¹ But what constitutes a “conversion” or a “plantation” is not always clear.²⁵² One shortcoming of private certification schemes is that “[i]ndirect land-use change that leads to deforestation . . . cannot be dealt with effectively through certification and, instead, must be addressed through stronger land-use controls.”²⁵³ Hence, there is a need for greater land use regulatory protections at the federal and state levels if natural and managed wood pellet forests are to be maintained and sustainably managed.

C. Ensure That Wood Pellet Market Investments Do Not Undermine Other Markets and That They Advance Wood Pellet Market Certainty

Third and finally, policymakers should balance investments in wood pellet markets with investments in other sectors, but also should commit to those investments to facilitate market certainty. Policymakers can achieve these goals by (1) ensuring that continued investments in wind and solar are not undermined by the expansion of wood pellet investments; (2) committing to subsidization (if chosen) as an instrument to invest in the wood pellet industry; and (3) balancing wood pellet market development with other markets important to forest preservation, like pulp and paper.

While developing wood pellet markets may provide a number of co-benefits, such as incentives to preserve forest resources, a truly

249. *Id.*

250. FSC UNITED STATES, <https://us.fsc.org/en-us> [<https://perma.cc/XEB3-V4WY>].

251. FOREST STEWARDSHIP COUNCIL, FSC-US FOREST MANAGEMENT STANDARD (v1.0) § C6.10 (2010), us.fsc.org/download.fsc-us-forest-management-standard-v1-0.95.pdf [<https://perma.cc/XM6G-CTM8>].

252. At least one author posted that “[o]ne proposed definition for conversion to plantation is that conversion has occurred if modifications to the structure and function of a forest, due to management activities, significantly reduce the complexity of the forest system or when natural or semi-natural forest (excluding significantly degraded semi-natural stands) transforms into permanently non-forested areas or plantations.” Endres, *supra* note 169, at 825.

253. Endres, *supra* note 169, at 827.

renewable future will rely on a portfolio of renewable energy options to meet global demand. Solar and wind have made great gains in recent years, and these gains should not be undone for the sake of wood pellets. Solar and wind are becoming cheaper to produce, and while “[g]overnment subsidies have helped wind and solar get a foothold in global power markets . . . economies of scale are the true driver of falling prices.”²⁵⁴ While it is true that technology is not currently scaled up to allow solar and wind to meet total demand in a predictable way, it remains that burning wood pellets emits carbon dioxide into the atmosphere. The long-term hope, of course, is that society can meet most of its energy demands with wind and solar and other non-greenhouse gas emitting sources of energy, so investments in those cleaner energy sources should be maintained and even accelerated.

Similarly, and just as with debates surrounding wind and solar, arguments will continue regarding whether government subsidization is the appropriate way to kick-start or continue wood pellet market development. Regardless, for wood pellet markets to succeed at present, and for them to provide the resource replenishment gains highlighted by this Article, governments will need to commit to any subsidization schemes they start. Otherwise, investment instability may very well cause the market to collapse. Obviously, the United States cannot control the United Kingdom’s commitment to wood pellet subsidization—there is little more than advocacy that U.S. policymakers can undertake to affect other nations’ commitment to renewable investments. In order to continue investment in solar and wind and commit to wood pellet subsidies if they are utilized domestically, however, U.S. policymakers might take a cue from the fossil fuel industry and make such subsidies permanent within the United States or state tax codes. The fossil fuel industry enjoys many permanent tax breaks, including the Intangible Drilling Costs Credit and the Percentage Depletion for Oil and Gas Wells Credit, among others.²⁵⁵ Analysts have noted that it is almost impossible to reverse

254. Tom Randall, *Wind and Solar Are Crushing Fossil Fuels*, BLOOMBERG (Apr. 6, 2016, 5:00 AM), <http://www.bloomberg.com/news/articles/2016-04-06/wind-and-solar-are-crushing-fossil-fuels> [<https://perma.cc/8KYK-RWSE>].

255. These include the domestic manufacturing deduction for fossil fuels, expensing of exploration and development costs for hard mineral fuels, capital gains treatment for royalties of coal, deduction for tertiary injectants, exception to passive loss limitation for working interests in oil and natural gas properties, enhanced oil recovery (EOR) credit, and the marginal wells credit. See U.S. DEPT OF STATE, FOSSIL FUEL SUBSIDY REFORM, PROGRESS REPORT ON FOSSIL FUEL SUBSIDIES, <https://www.treasury.gov/open/ Documents/USA%20FFSR%20progress%20report%20to%20G20%202014%20Final.pdf> [<https://perma.cc/U37E-3J96>]. The U.S. Department of State even maintains a website devoted to fossil fuel subsidy reform, and it details executive efforts to reduce fossil fuel subsidies both domestically and internationally.

permanent subsidies in the tax code, requiring congressional action, and no fossil fuel tax credit has been removed by Congress to date.²⁵⁶ So, as one commentator put it, “if you can’t beat them, join them.”²⁵⁷ Renewables have been stymied by what are known as “stop/start subsidies” that prevent stable investment environments.²⁵⁸ Yet investment certainty will be necessary to maintain an all-of-the-above renewable energy portfolio based on solar, wind, and emerging wood pellet markets. Permanent tax code status at the federal or state levels provides more certainty than stop/start subsidies. The obvious downside is that governments, and particularly the federal government, seem to expand subsidization programs ad infinitum without removing previously enacted subsidy programs, which is obviously not sustainable for a fiscally responsible government. Nonetheless, market certainty will be important if wood pellet markets are to gain a foothold and succeed. Given the difficult environmental challenges society faces in the context of climate change, it seems to be an appropriate time to phase out fossil fuel subsidies to achieve goals that better balance meeting both energy needs and climate change mitigation goals (such as expanding the forest base).

Finally, in the context of subsidization and market development, policymakers should look at policies aimed at incentivizing wood pellet market development in tandem with incentives for pulp and paper, to maximize market potential. To the extent that price affects the viability of pulp and paper to remain a market option in the South, subsidies and other incentives may need to be shifted to maintain the optimal mix of market options. While subsidization is a delicate policy goal, as governments can and do make mistakes when interfering in markets and “picking winners,” so to speak, subsidies have been a useful tool for spurring desirable market growth in certain sectors. An outcome that would not be desirable, however, is for Southern forest owners to have even fewer markets into which to input their timber on balance because wood pellet market subsidization drove out an even greater proportion of pulp and paper producers. As a result, if subsidization is chosen as a policy instrument, policy-makers will need to be sensitive to the balance between all markets critical to incentivizing Southern timber owners to maintain forestland.

256. See Susan Kraemer, *A Closer Look at Fossil and Renewable Energy Subsidies*, RENEWABLE ENERGY WORLD (June 10, 2015), <http://www.renewableenergyworld.com/articles/2015/06/a-closer-look-at-fossil-and-renewable-energy-subsidies.html> [<https://perma.cc/PHC7-ECVT>].

257. *Id.*

258. *Id.*

VI. CONCLUSION

Forests are critical to both the environmental and economic well-being of Southern U.S. citizens. While conventional—or, “convenient”—environmental wisdom might caution against burning southern timber for energy, the issue is not being assessed as critically as it should be. At the least, a thorough assessment would evaluate the potential conversion of forests to non-forest uses when determining whether wood pellet energy market development is environmentally desirable. This is especially true given the unique characteristics of forest ownership (mostly private) and governance culture (lax) in the South. In a region of the country where markets speak louder than most other forms of resource management, we would do well to consider the incentives that wood pellets can provide Southern timber owners to preserve and even expand forest acreage. Failing to do so would truly be missing the forest because we are fixated on the trees.