2022

Forests as Fuel? An Investigation of Biomass' Role in a Just Energy Transition

Brianna Cunliffe
Bowdoin College

Forests as Fuel?

An Investigation of Biomass' Role in a Just Energy Transition

An Honors Project for the Program of Environmental Studies

by Brianna Cunliffe

Bowdoin College, 2022

ACKNOWLEDGEMENTS

This work is dedicated to the people and forests of the South. It owes its existence to the courage and generosity of those speaking out against biomass, who gave me the gift of their stories— I am humbled by their trust and hope this contribution can serve them beyond the page.

Research for this work was conducted on the unceded lands of the Lumbee, Cheraw, Waccamaw, and Pee Dee tribes, and it was written on Wabanaki land protected and enriched by their past and continuing stewardship. I honor Indigenous peoples' leadership in protecting our planet and commit to deconstructing settler lenses within my scholarship and activism.

My advisor, Eileen Johnson, offered unfailing encouragement and feedback. Committee members Connie Chiang and Laura Henry were endlessly generous with their time and insights – I am so grateful for their belief in this project and their generosity, mentorship, and warm support. Shana Starobin helped me fall in love with ethnography and learn to do it earnestly and ethically; I'm grateful for her continued guidance and the example she sets. The McKeen Center for the Common Good's Ladd Fund for Community Engaged Scholarship, as well as the Bowdoin College Faculty Scholars Fund, supported this research and made it possible for me to ground it in firsthand experiences and in-person conversations. Keri Powell, Conrad Schneider, and Johnathan Lewis helped me untangle regulatory text and environmental law. Sam Davis, Emily Zucchino, and the entire team at Dogwood Alliance welcomed me first as a summer fellow and continued to support my scholarship, as did the Southern Forests and Climate Coalition. I'm grateful to know them and for all their work they do. Kelsey Day and Megan Busbice held me through a Carolina summer of maps and public hearings, my Bowdoin family listened to my hope and despair, and my parents raised me to believe I could do something about it, and reminded me to always go back to the forest.

TABLE OF CONTENTS

Introduction

The air in Hamlet, North Carolina, is choked with dust. The burdens of the dozen polluters within ten minutes of the small town—odor and waste from a Purdue processing plant, coal ash flying off rail hub trains, smog from natural gas refineries and chemical manufacturers — already fell heavily on the bodies of its predominantly Black residents. In 2019, yet another industry made Hamlet its dumping ground. But this one called itself a renewable energy innovator. Enviva Biomass' Hamlet plant is one of dozens which started operating in Southern communities in recent years, producing wood pellets for an increasingly ravenous "green energy" market overseas in the EU and UK.[1] The plant offered around forty lower-wage jobs, and with them, brought constant noise, dust, and PM 2.5, which settles over residents already-overburdened with asthma and chronic disease: It coats their cars, their houses, their rocking chairs once used for barbecues now driven indoors.[2] In 2021, the state DEQ approved Enviva's request to triple production levels despite their repeated violations of the Clean Air Act, even after significant public outcry.[3]

The forests of the Southeastern United States are being logged at four times the rate of the Amazon, in part to fuel a wood pellet industry that has grown tenfold in the past decade.[4] Biomass giants process millions of tons of Southern timber each year in plants sited in low-income communities of color like Hamlet.[5] The wood pellets they produce are exported to Europe, where nations pursuing renewable energy targets burn them in lieu of coal or natural

[1] Stefan Koester and Sam Davis. "Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States", *Environmental Justice*. (Apr 2018) 64.
[2]NC Department of Environmental Quality, Division of Air Quality, Public Hearing on 6/28, (transcript accessed online on February 21, 2022). 1:21:45.
[3] NC Department of Environmental Quality, Permit Decision on Northampton Facility, 9/17 (electronic notice to public commenters, accessed on October 21, 2022).
[4] Jennifer Costanza, Robert Abt, Alexa J. McKerrow, and Jaime A. Collazo. "Bioenergy Production and Forest Landscape Change in the Southeastern United States." *GCB Bioenergy* 9 (5) (January 2017), 924.
[5] Koester and Davis, "Siting of Wood Pellet", 61.

gas—because despite the proven emissions they generate, under early IPCC and current EU carbon accounting frameworks, biomass is classified as a renewable energy source.[6] These governing bodies count biomass' carbon impact "where the trees are cut down, not where the material is burned", meaning accounting "doesn't factor in the carbon footprint of processing trees into pellets, shipping them across the ocean or burning them for fuel".[7] Under this framework, rule-makers count the carbon emitted by pellet burning, which studies show is higher than coal on a per-unit basis, as zero, and define the resource those pellets are sourced from as renewable, ignoring the devastated state of Southern forests.[8] Pro-biomass advocates emphasize that forests, unlike fossil fuels, do regenerate, citing increased forest shares in some biomass producing states as proof of its sustainability.[9] But this assumes that the spread of homogenous pine plantations compensates for the staggering loss of diversified primary forests integral to carbon storage and the well-being of the communities they surround, which take up to a century to regenerate even with best practices.[10] In the meantime, the ecological damage, carbon emissions and toxic pollutants generated by the harvesting, burning and production of biomass are enormously consequence to environmental justice and climate action in the present moment.

Enviva and its counterparts in the biomass industry position themselves as innovative champions of renewable energy, helping to displace dirty coal. They claim to be corporate good neighbors, bringing jobs and economic development to the often-struggling communities where

---

[6] Ketcham, Christopher. "Forests to Burn: The biomass-energy industry is a climate and environmental justice disaster", *Sierra* (Sierra Club, Jan/Feb 2021), 4.

[7] Lois Parshley. "Europe Met a Climate Target. But Is It Burning Less Carbon?" The New York Times, Dec. 2021

[8] Duncan Brack. "Woody Biomass for Power and Heat: Impacts on the Global Climate" Chatham House (Environment, Energy and Resources Department, February 2017) 2; Searchinger et al. "Assessing the efficiency of changes in land use for mitigating climate," 249.

[9] Enviva, "Seeing the Forest: Sustainable Wood Bioenergy in the Southeast United States" May 2020. https://www.envivabiomass.com/wp-content/uploads/white-paper-seeing-the-forest.pdf

[10] Sam L. Davis, *Treasures of the South: The True Value Of Wetland Forests,* Keylog Economics and Dogwood Alliance, (January 2020), 32.

they site their facilities. But when proposed facilities in places like Effingham, South Carolina promise only 10 local jobs in exchange for a facility which emits hazardous PM 2.5, volatile organic compounds, nitrous oxides, dust, and persistent noise, in a company where over half of facilities have "failed to keep emissions below legal limits or failed to install required pollution controls," communities are challenging that narrative.[11] The costs of Europe's imported 'green' energy are concentrated in communities where Black and Indigenous people and other people of color and low-income residents already bear disproportionately high burdens of toxins. Despite its claims to prioritize climate by serving as a "transition fuel", international media and local activists alike increasingly frame biomass complicit in pervasive patterns of environmental racism and extractivism deeply rooted in the landscape of the South—the very patterns many see as driving the current crisis in the first place.[12] As with coal, though, the economic power of corporate actors discourages accountability. Threats of economic loss and unemployment that fracture communities and siloed approaches to regulation that fails to considering the cumulative impact of intersecting environmental harms are all familiar factors that challenge local activist's attempts at resistance, but anti-biomass activists must contend with yet another barrier: the protections biomass' greenwashed image affords.[13] Nonetheless, Southern activists, often through community hubs like churches, fight not only against local injustice, but against biomass' contribution to the climate crisis, challenging dominant systems on multiple scales.

Biomass is a rapidly growing international industry with a complex supply chain. It is necessary to focus on a subset of the analytical possibilities to derive meaningful insights on its

[11] Sarah Mittlefehldt. "Wood Waste and Race: The Industrialization of Biomass Energy Technologies and Environmental Justice" *Technology and Culture*. (59 (4), 2018) 875.
[12] Danielle Purifoy."How Europe's wood pellet appetite worsens environmental racism in the US South" The Daily Climate, Jan 2020.
[13] NC Department of Environmental Quality, 12:45.

impact on communities in the US South and their work to protect the places they call home. This thesis focuses on production of wood pellets in facilities scattered across the Appalachian South. However, international regulatory and market structures drive these local changes and broader social forces contribute to structural inequality, so in order to understand local experiences, inquiry must extend across overarching socioecological systems. This framing aligns with the "envirotechnical regimes" approach from environmental history, a smaller unit of analysis within a socio-ecological systems approach.[14] Pritchard defines envirotechnical regimes as: "the institutions, people, ideologies, technologies, and landscapes that define, justify, build, and maintain a particular envirotechnical system as normative" (878).[15] Questions of norms, maintenance, and justification of different sources of energy are key in investigating whether biomass constitutes a departure from regimes reliant on fossil fuels. The non-neutrality of technology is especially salient here. As Pritchard states, "we can think about technology as politics: material enactment and assertion of power", describing how "technological change can reproduce, reinforce, and even amplify environmental injustice at multiple scales" (11).[16] Energy extraction has always been proof of this; this study looks to the dynamics of biomass as an ascendant technology which shapes and is shaped by systemic inequalities and ruptures between human and natural worlds.[17] As climate action grows ever more urgent, societies must attempt to renegotiate energy frameworks and imagine futures. Considering the envirotechnical totality of the biomass regime is essential to avoid replaying old failures with new machinery.

[14] Sara Pritchard and Carl Zimring, *Technology and the Environment in History* (John Hopkins University Press Baltimore, 2020) 11.
[15] Sara Pritchard, quoted in Mittlefehldt, "Wood Waste", 878.
[16] Pritchard and Zimring, *Technology*, 11.
[17] Pritchard and Zimring, *Technology*, 7.

Has biomass innovated under a “green” mantle within fossil-fuel based envirotechnical structures and maintained deep historical inequalities in the Appalachian South? If so, how, and how can understanding community resistance to a false transition provide insights into alternatives cultivating both climate action and social justice? Grounded in these questions, with a focus on centering equity and the lived experience of communities, Chapter 1 seeks to situate biomass within the historical contexts, legacies, and regimes which shape the human-inclusive ecosystems of Southern Appalachia and the Black Belt. Chapter 2 then analyzes biomass’ rise, behavior, impacts, and place within current rapidly changing energy regimes, emphasizing how biomass is maintained and promoted by regulatory frameworks at various institutional levels and how current governance and economic incentives create extractive, asymmetrical power relations between environmental justice communities in the American South and European nations benefitting from biomass expansion. Informed by this landscape in which biomass operates, Chapter 3 centers community experiences of harm and the voices of diverse stakeholders. It interrogates whether the biomass regime has ensured procedural or outcome justice, informed by participant-observation of recent public hearings in the Carolinas, and a series of semi-structured interviews on lived experiences of harm sparking grassroots and establishment resistance. As policymakers and advocates face the ongoing unsettled implementation of the biomass envirotechnical regime, essential questions remain: Who are the stakeholders, and what are the scales and mechanisms through which they are enacting dissent? How does the region’s history of activism shape their capacity to overcome obstacles? The totality of these components is intended to evaluate whether, as its consequences fall heavy on the bodies of vulnerable communities, biomass constitutes a departure from old exploitative regimes of energy production, and if not, whether resistance to it provides a blueprint for a new path forward.

Chapter 1: Historical Contexts & Legacies of Exploitation and Resistance

To understand whether biomass constitutes a continuity or divergence from past envirotechnical regimes, it is pivotal to understand the history of the relevant landscapes and those who resisted their exploitation. This chapter first traces the history of the 'working forests' of the South—the interwoven story of the living landscape and the human forces extracting value from them through labor—revealing how biomass maintains and intensifies extractive pressure (Section I).[18] The parallel history of energy extraction in Southern Appalachia serves as a case of asymmetrically empowered communities negotiating energy and technology and the effects of national policy and politics within extraction-reliant communities (Section II).[19] Sections III and IV examine persistent patterns of extraction across these two histories and interrogate how new technologies will interact with existing envirotechnical regimes and landscapes of injustice, as well as how past resistance impacts those opposing biomass today. This review of secondary sources and modern accounts contextualizes the rise of biomass and evaluate whether its envirotechnical regime constitutes a departure from past industries which have extracted the South's natural and labor wealth, or a continuation in a new technological and rhetorical form.[20]

As Kate Brown has said, "history occurs in place… not, as many historians believe, in time" (5).[21] This short work cannot convey the full complexity of Southern ecological history, but by laying out its broad contours, it aims to enable relational, place-based thinking. For environmental historians, the South's long agrarian history is a ripe analytical zone, since, as

[18] William Boyd. *The Slain Wood: Papermaking and its Environmental Consequences in the American South* (Baltimore: Johns Hopkins University Press, 2015) 34.
[19] Chad Montrie. *Making a Living: Work and Environment in the United States*. (Chapel Hill: University of North Carolina Press, 2008) 12.
[20] Tricia Shapiro. *Mountain Justice: Homegrown Resistance to Mountaintop Removal, for the Future of Us All*. (AK Press, 2010) 189.
[21] Drew A. Swanson. *Beyond the Mountains: Commodifying Appalachian Environments.* (University of Georgia Press, 2018) 5.

Okie explains, “in the South, man and nature were never unhitched”; Unlike the supposed wildernesses of the West, the South was a place with no “untouched” landscapes, where “environmental history *was* agrarian history” (6).[22] Diverse legacies of cultivation under various regimes, slavery key among them, do not constitute one narrative of a ‘southern way of life’ tied to the land, but it’s undeniable that the South maintained a more interconnected, albeit extractive, relationship with the ‘natural’ environment than the Northeast. At recurring cruxes of vulnerability, corporations took advantage of a desperate workforce and a hospitable political climate for polluters, with “economically impoverished areas such as rural Appalachia and the piney woods especially afflicted by the siren song of trading environment for jobs” (xii).”[23] Both rural Appalachia and these “piney woods” are key sites for considering the envirotechnical regimes and legacies of extraction characterizing Southern communities’ relationship to labor, value, and energy. The commonality between them is summarized bluntly by environmental scholar-activist Tricia Shapiro’s words: ‘The wealth extracted through logging and mining has long flowed out of the region rather than to the people who live here.”[24] Through addressing the interconnected histories of these two industries and the envirotechnical regimes which created and upheld them, this chapter illuminates the history of the South’s working forests, the history of extraction and resistance, and the point where the two converge with the rise of biomass.

I. The Working Forests of the South: Origin, Change, and Continuity

Informed by understanding of the political economy of race and class and the relationships between technology and labor in the cultivation, extraction, and processing of wood products, the history of the South’s working forests will illuminate a consistent treatment of both

[22] William Thomas Okie. *The Georgia Peach: Culture, Agriculture, and Environment in the American South*, (Cambridge Studies on the American South. Cambridge: Cambridge University Press, 2016), 4.
[23] Shapiro, *Mountain Justice*, 3.
[24] Ibid.

the communities and forests of the region as commodities to be exploited. What is a 'working forest', and how did it come to be the dominant model in the south? How does timber as a 'cash crop' interface with agrarian and industrial histories in the region, and how does it alter the human-natural relationship? As early as 1608, white settlers saw the Southeastern yellow pine belt as a limitless resource for fulfilling Europe's ravenous demand for timber. Extraction grew in scale and sophistication in the 18th and 19th centuries alongside the rise of an agrarian hegemonic class structure based on the plantation slavery system, but which endured long after emancipation. Left devastated by the Civil War, in the lowlands of the Carolinas and Georgia, generations of communities once oriented towards the production of cotton and tobacco still bore the burdens of agrarian class structure and perverse incentives of the sharecropping system; They faced shocking deficiencies in soil fertility, health outcomes and educational and economic opportunity,[25] As crops failed and labor fled North, the "severe degradation visited on the agricultural landscape was matched by a relentless assault on the region's forests" (3).[26] Opportunistic 'New South' boosters at the turn of the 20th century exploited this desperation, promoting industries like timber as a fix for the economic chasm carved by Sherman's March to the Sea.[27] Alongside industry, they successfully sold a narrative of pride and redemption and the South reclaiming its 'stolen' patrimony, playing on sore spots and stubborn regional secessionist tendencies left by Reconstruction—despite their own roots in northern metropolises.[28] The South's forests, first mined for European use, next capitalized upon by carpetbaggers, are understood not as ecosystems, but as value to be extracted from a periphery through the market.

---

[25] Boyd, *The Slain Wood*, 3.
[26] Suzanne Marshall. '*Lord, We're Just Trying to Save Your Water': Environmental Activism and Dissent in the Appalachian South*. (Gainesville: University Press of Florida, 2002), 17.
[27] Boyd, *The Slain Wood*, 78.
[28] Marshall, '*Lord, We're Just Trying to Save Your Water'*, 17.

In the resulting rush, the forest-lands of the South was sold out from the state at rock bottom prices— 75% was publicly held at the close of the Civil War, and 80% was in private hands by 1910— and what followed was "the most rapid and reckless destruction of forests known to history", what famed Southern author William Faulkner called the "slain wood'", the clearcutting of virtually all virgin forests in the southern Appalachians and the vast pineries of the coastal plains.[29] As smallholdings and tenant farms gave way to commercial and timber farms, 10 million acres (about half the area of Kentucky) of cropland was converted to timberland between 1948 and 1968 alone. Pine, the region's new top cash "crop," was "planted on millions of acres of degraded lands as if to cover and repair a harsher time" (41), with demand pressures accelerating by the year.[30] This post-Reconstruction relationship in which, as Boyd says, "outside capital concentrated on exploiting the region's plentiful natural resources and cheap labor with an often-brutal disregard for the South's long-term economic prospects", was especially blatant in areas of overlapping marginality, such as the rural, impoverished communities where forests became not precious resources, but fodder for the mill.[31]

a. Race and the "Work" of Forests: The Black Belt

It is necessary to be attentive to how different demographics and landscapes within the South experience their own unique (but interconnected) challenges and relationships to labor and capital. The lowland region of the Carolinas and Georgia are part of what some scholars refer to as the "Black Belt", both in reference to its fertile soil and the population who call it home.[32] The 'Black Belt' contains 43% of the US' rural poor, and "as a clear reflection of slave-plantation

[29] Boyd, *The Slain Wood*, 20.
[30] Ibid, 41.
[31] Ibid, 1.
[32] Ronald C. Wimberly "Sociology with a Southern Face: Why Are We Sociologists and What Are We Doing about It in the South?" *Social Forces 86*, no. 3 (2008): 883.

social, political and economic legacies", 90% of poor rural African Americans.[33] The paper industry reflected and helped drive these disparities: union mill jobs were reserved for whites, and 'woods work', informal and highly dangerous, was carried out by Black men, a structure deeply embedded in the political economy of race and class in the rural South.[34] Black bodies were denied collective bargaining and labor protections as a result of their status as un-unionized "contractors" and the Twelve Man Rule, which exempted companies with less than 12 employees (which included a vast majority of timber crews) from providing Fair Labor Standards Amendment (1950) protections.[35] Considering that logging has highest rate of occupational death and one in seven loggers experience disabling injuries, this systemic endangerment and exploitation "echoed the work regimes of plantation slavery" (73); Most 'woods workers' were former sharecroppers.[36] The New Deal's exclusion of Black southerners meant that "rural progress became white progress" in the 1930s (179).[37] As agriculture declined, toxic industries moved in, wages stagnated, and systemic disempowerment of Black citizens made the communities of the Black Belt "landscapes where inequality met natural abundance, to the capitalist's delight (108).[38] Corporations siting to exploit these systemic vulnerabilities were not challenged by regulatory regimes—if anything, they were enabled by them.

As pulp and textile mills, factories, timber operations, tobacco farms, industrial animal feedlots and countless other industries extracted value from these landscapes and exported it to distant metropolises or foreign nations, county and state officials and other governing bodies took permissive stances, "reproducing the dynamics and profitability of neo-plantation social

[33] Wimberley, "Sociology with a Southern Face", 887.
[34] Boyd, *The Slain Wood*, 33.
[35] Ibid, 81.
[36] Ibid, 73.
[37] Okie, *The Georgia Peach*, 179.
[38] Swanson, *Beyond the Mountains*, 35.

relationships" and creating "neoplantation struggles" for residents and communities.[39] A map of the 'environmental justice communities' biomass exploits today locates nearly all of them within the Black Belt (see figures appended), and it is key to be attentive to how disproportionate siting in these communities reproduces regimes of inequality which are alive and well today.[40] The racialized nature of this region's struggles must be recognize so that unique place-based struggles are not subsumed into discussions of general poverty. But the rhetorical treatment of the Black Belt as a region too often confines and denigrates, as Harris and Hyden say, "naturalizing poor and black agony and distress," devolving into a myth that: [41]

> "Black and poor subjects are disposable precisely because they cannot easily move or escape. However, the deep, rich history of counter-movements and mobilizations that include slave uprisings, the Underground Railroad, bi-racial farmers' movements, the 1960s Civil Rights movement evidence a capacity for agency and transformation that defy the motley discourses of those who would argue that the Black Belt is nothing more than a region to be used to exploit conditions of poverty and lack of education´.[42]

In evaluating the fraught history of the working forests of the South, it is necessary to be critical of how some histories naturalize the outcome of intertwined agrarian class systems, racial hierarchies and relationships of extraction and exploitation. These communities exhibit agency, ingenuity, and vibrancy in resistance to injustice throughout history and in the modern day, the ways in which both labor and environmentalism have consistently failed them.[43]

---

[39] Rosalind Harris and Heather Hyden. 2017. "Geographies of Resistance Within the Black Belt South." *Southeastern Geographer* 57 (1): 51.
[40] Koester and Davis. "Siting of Wood Pellet Production", 64.
[41] Harris and Hyden, "Geographies of Resistance," 2.
[42] Ibid.
[43] Harris and Hyden, "Geographies of Resistance," 51.

b. Forests working for whom: Sustainable and Thriving, or Fragile and Extractive?

Evaluating whether the south's 'working forests' are sustainable, and who it is they sustain, demands a critical examination of much broader principles. As historian James Willard Hurst remarked in 1964, "The relations men establish among themselves to make land productive determine the quality, reach, and tempo of their lives. [It] is one of those which fix the framework of society."[44] The envirotechnical regimes governing the relations between humans and the forested landscapes of the South were marked by inequality and extraction and facilitated by technology and industrialization. Scientific and management decisions reacting to the scarcities of the early 20th century led to an approach that "treated the forest as crop rather than as mine" (11) creating a productive, organic machine via ecological simplification.[45] Fears of vanishing forests were allayed as tree populations standardized, planted according to a rapidly developing scientific set of principles reconceptualizing forests as frontiers of production to be optimized rather than as complex systems supporting many other aspects of living ecology.[46]

This shift made the South the "wood-basket of the world" but ensured its new 'crop' lacked the resilience and dynamism of vanished old-growth stands, especially in lowlands where vast monocultures served a "state directed project aimed at achieving control over nature in pursuit of economic development" (19).[47] Even as modern processing technologies emerged, many stakeholders were aware of the severe threat they posed, since "the South's forests were already the most intensely managed in the world, environmentalists warned they could not stand the stress of chip mills who chew up woods at a stroke".[48] But possibilities for regulating and

[44] Boyd, *The Slain Wood,* 51.
[45] Boyd, *The Slain Wood,* 11.
[46] Palmer, "Putting Forests to Work?", 142.
[47] Boyd, *The Slain Wood,* 101.
[48] Marshall, *Lord, We're Just Trying to Save Your Water*, xxiii.

slowing this growth were limited by both market pressures and political ones; labor and capital challenges faced by loggers made any barrier to 'moving wood' a threat to their ability to stay afloat. Even those with misgivings about clear cuts chafed at regulations they saw as irrelevant to their lives. In response to the Endangered Species Act, a logger recounted, "The environment—we needed to have done something. But when they talkin' bout the woodpecker and things like that—hell with it" (105).[49] He recounted how his small crew, terrified of losing a day's revenue and falling into severe debt, shot one such woodpecker so the regulators wouldn't find it and stop operations – a sobering example of top-down regulations operating in counterproductive ways on the ground.[50] This well-meaning attempt from above to alleviate the damaging tactics used in the forestry industry was rendered useless by the fact that few of the small unregulated contracted logging crews had the "requisite resources necessary to practice 'sustainable forestry'" (106), and few customers had incentive to press them to do so.[51] In the absence of successful grassroots environmental challenges, logging and simplification continued, concentrating power and achieving orderliness.[52] Whether that constitutes success hinges on the question: Is a forest simply a vast organic machine to be maximized for productivity? Is it one of many inputs to be transformed along a technological frontier into a variety of commodities? Why, then, have all forests not undergone similar simplifications? Opponents of pine plantations says "that's a fiber farm", not a forest. Are the two mutually exclusive? What, beyond trees, makes a forest?

Even from a purely economic perspective, the value of a diversified old growth forest's timber only accounts for a small part of its monetary worth, with ecosystem services—the non-

[49] Boyd, *The Slain Wood*, 105.
[50] Boyd, *The Slain Wood*, 106.
[51] Ibid.
[52] James Scott, "Nature and Space" in *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998) 13.

commodity ways forests provide values to human users—far greater. For wetland forests, which serve as pollution filters and flood mitigators, the total ecosystem services value per acre is 17 times greater than what timber alone would sell for in the market.[53] This metric includes incompletes attempts to monetarily value recreation and cultural significance; The role of forests in art, faith, and the public life of the mind suggests an importance unrelated to their utility as components of production. Are differences in forests' protected statuses driven by worthiness or attractiveness? Thriving recreation economies surrounding remaining old growth stands in Asheville and well-protected Maine pines that interfacing differently with demand suggest it is more a question of the political and social power and affluence of those who inhabit these various landscapes. Activists face an uphill battle against a status quo in which concerns about economic survival tend to stifle not just conservation, but any pushback against the treatment of both the resources and working bodies of vulnerable Southern communities as disposable.[54]

The old growth stands of the South have been replaced by young homogenous stands of trees as the landscape was pressed into service as a 'working forest,' with envirotechnical regimes imposing order, legibility, and market-oriented value production onto the ecosystem. The bodies doing this labor have been differentially affected by racial and class regimes, with labor hazards, consequences of clear cuts, and pollutants concentrated in the communities of the Black Belt and low-income South. The following section traces the intertwined history of energy also unfolding in the region and identifies biomass at the nexus where the two key narratives twine—where working forests become a source of energy, inequalities are entrenched, and extraction and exploitation get a new green facelift.

---

[53] Davis, *Treasures of the South,* 32.
[54] Marshall, Lord, We're Just Trying, 213.

II. Resistance, Extraction, and Regulation in the Appalachian South

Biomass constitutes a very recent answer to the question of how to power a society. Examining energy's role as a product and driver of historical change in producing communities and beyond contextualizes the world's current reckoning with undertaking a transition. Environmental historian Michael Camp insists on treating "energy as a historical concept rooted in a particular time and place", with care not to elide how "daily processes of producing energy affect the politics and identity of localities" and the lives of those in areas of intensive energy production revolve around national policies.[55] The coalfields of Appalachia and other sacrifice zones illuminate historical patterns and landscapes which have entrenched inequality through market forces and lax regulations and challenged resistance Insights from this landscape assist in untangles the envirotechnical regimes that have created our current reality and clarifies biomass' role in a rapidly approaching future.

a. Power, Labor, and Pushback in Coalfield Landscapes and Communities

With its strong presence in popular culture and its legacy of exceptionalism, Appalachia's regional identity may seem self-evident. But as Charles Swanson insists, "Appalachia as a cohesive place is just as much a conceit as the 'Solid South.' Appalachia was and remains many things, many places, many people, many natures" (4).[56] Yet these complexities and dynamisms are often sidelined entirely by the towering narrative of King Coal, which displaced Indigenous peoples and exploited the labor of immigrants and poor Whites. The rhetoric of wealthy outsiders has always described this extractive work as corrupting and demeaning.[57] This

[55] Michael Camp, *Unnatural Resources: Energy and Environmental Politics in Appalachia after the 1973 Oil Embargo,* (University of Pittsburgh Press, October 2019) 3.
[56] Swanson, *Beyond the Mountains*, 5.
[57] Swanson, *Beyond the Mountains*, 63.

narrative of Appalachian marginality and the pattern of industrial relations with the land through labor and exploitation links the envirotechnical regimes of two distinct regions.[58]

Industrialization as a process, as Pritchard and Zimring emphasize, was not merely technological: "coal fueled repetitive, linear motion to do work", reshaping both the ways in which Americans labored and the value inhering in the function of human bodies as producers (47).[59] Coal mines initially served as a liminal labor space in a region transitioning from agriculture towards extraction; miners, who worked largely by hand, also relied on their ties to existing sources of subsistence in the surrounding landscape.[60] When labor tensions arose, the gardens and hunting grounds Appalachian miners knew and cultivated freed them from reliance on company stores and scrip, ensuring that strikes could endure.[61] The mechanization and intensification of mining processes starting in the 1920 drove ever more strikes, triggering an "Appalachian antipathy towards supervised work" conducted under unsafe conditions with little personal autonomy, a structure at odds with previous ways Appalachians had derived value and subsistence from the landscape.[62] In framing congruent with an envirotechnical lens, Boyd describes the "labor process as the metabolic interaction between nature and society" (221), with mechanization amounting to a ravenous increase in appetite, rupturing old balances and generating devastating externalities—which fell most heavily on the landscapes most in need of the economic benefits they promised as compensation, a process which manifested in policy as the "race to the bottom", where regions competed to welcome polluter after polluter.[63]

---

[58] Swanson, *Beyond the Mountains*, 60.
[59] Pritchard and Zimring, *Technology and the Environment,* 47.
[60] Montrie, *Making a Living*, 73.
[61] Montrie, *Making a Living*, 85.
[62] Montrie, *Making a Living*, 82.
[63] Boyd, *The Slain Wood,* 222.

Like the current moment, the Carter Administration (1977-1981) was a time of "dramatic reconfiguration" of thought on the relationship between energy and the environment.[64] Believing even then that the world was "running out" of fossil fuels and that reliance on foreign gas and oil would lead to disaster, Carter challenged upward trajectories of consumption, attempting to induce "shared sacrifice" and reduction through national policy to avert a crisis.[65] It seemed the United States might check its growth-above-all mindset until Reagan and the GOP rejected the idea that "energy security required either government action or consumer sacrifice" (8).[66] This shift toward a regime of deregulation and market primacy came as repeated crises convincing many Americans that government oversight in the energy sector was an "insidious force prone to overreach and abuse" (9).[67] Increasing domestic coal production became pivotal, but doing so while "maintaining strict environmental standards" was "virtually impossible" (41); regulators allowed black lung and other ailments and externalities to plague generations of Appalachians.[68] Both groups that sought to challenge this pattern— environmentalists and organized labor— were hindered by external challenges, strategic failures, and at-times contradictory agendas.

Company consolidation, infighting, and the competitive rise of non-union Western mines reduced the once-formidable power of unions to fight back, and even Democrats, once labor champions, turned aside. [69] As Judith Stein argued, politicians replaced "assumptions that capital and labor should prosper together with an ethic claiming promotion of capital will eventually benefit labor" (69), which left working people feeling abandoned and hostile towards any government involvement. Counterintuitively, this aversion extended to environmental

[64] Camp, *Unnatural Resources,* 78.
[65] Camp, *Unnatural Resources,* 7.
[66] Ibid.
[67] Ibid.
[68] Camp, *Unnatural Resources*, 41.
[69] Camp, *Unnatural Resources*, 49.

regulations that theoretically most benefitted greatly burdened Appalachian communities. As 1970s' environmental regulations were attacked for their perceived role in depressing the economy and depriving Americans of jobs and reasonably priced gas, conservatives insisted (and still do today) on what they framed as "balanced" approach to protections, since "businesses engaging in dirty practices and unreasonable environmentalists each represented an equal threat to American life" (16).[70] Both popular policy goals independently, energy sovereignty and environmental objectives came "into stark, and sometimes disastrous, conflict", typically with the environment on the losing end (in no small part because the consequences fell predominantly on disempowered localities in Appalachia and beyond).[71] As national policies around energy threw communities into turmoil, most Appalachians failed to see environmentalists as allies, especially after the Endangered Species Act's 1971 veto of the Fontana Dam for the sake of the snail darter drove a fierce "critique of environmental tendencies to concentrate on the value of an obscure animal" (111).[72] Rightfully or not, as Tricia Shapiro describes in *Mountain Justice*, environmental activists, even those taking on topics like coal ash spills and mountaintop removal, were criticizes as outsiders who failed to recognize local realities. An outsider might wonder why the Martin County spill of 2000, "an event 30 times the magnitude of the Exxon-Valdez spill", received so little recognition even by environmentalists, but locals know the twin reasons: the absence of "pristine wilderness" and the presence of "hillbillies, denigrated for generations by American popular culture".[73] When it comes to environmentalism, robustly mobilized in national wonders or wealthy suburbs, "Americans made uncomfortable by (or perhaps feeling guilty for) the 'backwardness' of the southern mountains have looked away from

[70] Camp, *Unnatural Resources*, 16
[71] Camp, *Unnatural Resources*, 3.
[72] Camp, *Unnatural Resources*, 111.
[73] Shapiro, *Mountain Justice*, 192.

costs […] surrendered as a national sacrifice zone" (197), or, in the words of an Appalachian miner, "another country."[74] Inadequate government responses to corporate negligence apparently relied on both the "national media's lack of interest and the reputed ignorance of Appalachian locals", mirroring broader patterns of neglect and contempt for red-leaning rural areas in times of environmental disaster.[75] This relationship with the land, a "terrain of the mind as much as physical ground",' produces both wells of resilience (striking miners' gardens)and deep wounds (black lung and sludge pits), resulting in an uphill battle and few leverage points for activists seeking both economic and environmental justice.[76] Thus, Appalachia and the nation continued to endure "a political era defined by a deregulatory and anti-government mentality", an "an age of inequality" (116), and faith in the market grew fanatic as its consequences continued to land where race and class regimes meant they were cheapest.[77]

b. Sacrifice Zones: Concentrating Costs, Stifling Resistance

It was not only coal and timber that took advantage of landscapes devoid of protections thanks to the race to the bottom. Industries with "absentee owners and absentee governments who didn't have to live with the consequences of their work" (189) proliferated, from paper and pulp to manufacturing and chemical processing.[78] The market turned the absorptive capacity of the environment into a resource by many industries, and many Southerners accepted pollution and environmental degradation as the 'price of progress', taught as children to echo company lines about the rotten-egg odor permeating their towns: 'smells like money to me!' (150).[79] As Boyd identifies, "pollution, poverty, and political marginalization have long had a mutual

[74] Shapiro, *Mountain Justice*, 197.
[75] Ibid.
[76] Swanson, *Beyond the Mountains*, 8.
[77] Ibid.
[78] Swanson, *Beyond the Mountains*, 189.
[79] Boyd, *The Slain Wood*, 150.

affinity for one another" (152), with corporations siting toxic facilities in places where, for reason of race, class, rural status, local people have few other options and little recourse to press for reform.[80] Few wanted to challenge an industry that promised a prosperity that was in short supply; mills, mines, and factories "came to be seen as too valuable to the surrounding community to allow equitable relief to interfere with their operations" (159).[81] Lax regulatory regimes mean those seeking to resist pollution burdens in these "sacrifice zone" communities often must do so through notoriously ineffective and limited individual common-law nuisance suits, which require sky-high burdens of proof and almost always fail to enjoin production.[82]

Economic realities limit possibilities for resistance, creating fissures within communities reliant on and polluted by industry. When locals align with corporate interest to oppose regulation, as a resident describes, "what people say on tape feels like the party line—they may well believe what they're saying, but it has a canned quality" (192), as environmental protections are scapegoated for the loss of jobs.[83] Arguments for protecting working people by protecting corporations are undermined by the fact that employment tends to drop as production rises; As one Appalachian resident insisted, today, it's "all machines, no people" […] That machine doesn't pay taxes, buy in our local stores, it doesn't live in our community" (197).[84] Still, "using fear of loss of economic stability to divide the community" (60) is an effective corporate tactic to cow resistance, contributing to deep disillusionment, stasis, and isolation.[85] Historically, labor and environmentalism have worked both in tension and in tandem, concerned with various facets of peoples' rights to full and meaningful lives. But as Tricia Shapiro wonders in a town poisoned

[80] Ibid.
[81] Boyd, *The Slain Wood*, 159.
[82] Boyd, *The Slain Wood*, 155.
[83] Shapiro, *Mountain Justice,* 192.
[84] Shapiro, *Mountain Justice,* 197.
[85] Ibid.

by coal sludge, "dependent on work that poisons your neighbors, human and wild, that poisons even your own home and family, how free are you even to call your soul your own?" (358).[86] To extend the question: when we are dependent on forms of energy whose extraction breaks the backs of communities and environments they rely on, how free and prosperous can we truly be?

III. "An Ugly Synergy": Forests as Fuel and the Social Consequences of Energy

Energy change is not socially neutral: The rise of coal power streamlined the conversion of "millions of years of photosynthesis" into a regime pursuing intensification, one which was "marked and remains marked by major inequalities".[87] Energy and nature are transformed along the frontier of technology. Technology can seem like a simple timeline of innovations and changes, but Pritchard and Zimring suggest that its most relevant facet is its maintenance of certain systems over time. For coal, timber, industry, and biomass alike, Swanson reflects: "underneath new techniques and sophisticated language were relationships between economic power and nature that extended back more than a century" (197).[88] In warning of the "hidden social dynamics embodied in new energy technologies", Mittlefehldt warns that it is necessary to look beyond the physical processes in evaluating biomass.[89] It is doubtless an innovation— but that does not guarantee any positive consequence. As the only energy that relies on living metabolic processes, biomass is framed as a "return to the surface for energy" that industry advocates claim will incentivize long-term management of forestlands, following a logic of cultivation rather than extraction.[90] But how has this theory played out? Historical envirotechnical systems relying on forests as inputs "illustrate the deep contradictions (the

[86] Shapiro, *Mountain Justice*, 358.
[87] Pritchard and Zimring, *Technology and the Environment*, 49.
[88] Swanson, *Beyond the Mountains*, 187.
[89] Mittlefehldt, "Wood Waste and Race", 879.
[90] Palmer, "Putting Forests to Work?", 142.

metabolic rift) between capitalist imperatives and socio-ecological systems" (22), complicating assumptions that "natural" sources are not still extractive, even when mediated by cultivation.[91]

When forests are for optimizing, "natural entities are also understood and function as technological"(53).[92] The pervasive industrialization of nature, in which "biophysical processes get refashioned and pressed into service for industrial production", refutes the idea that an energy derived from organic matter gains any virtue from being "natural".[93] Seeing as biomass carried out on an industrial scale can occur in the same facilities as coal-firing and even generate some of the same pollutants in the same long-suffering communities, they may not care how far along in the decomposition process the carbon molecules are. As Mittlefehldt describes, "when major energy corporations began to build industrial biomass facilities, new energy technologies designed to run on renewable fuels became part of an entrenched fossil-fuel based power structure that maintains deep historical inequalities" (875).[94]This is not only true of biomass: all energy structures, implicitly or explicitly, make choices within regimes shaped by racism, income inequality, and geographic patterns of exploitation. [95] But rather than improving upon a fossil-fuel based envirotechnical regime which concentrates the consequences of energy production in places lacking political power, biomass has simply innovated within it.

Biomass is a modernization of an old principle—the use of wood matter to generate heat that supports human activity. What differentiates biomass from fossil fuels is the time scale on which the carbon released from its combustion can be reabsorbed—a question of thousands of years versus centuries, or, with absolute best practices, decades. Coal co-fired biomass plants

[91] Boyd, *The Slain Wood*, 221.
[92] Pritchard and Zimring, *Technology and the Environment*, 53.
[93] Ibid.
[94] Mittlefehldt, "Wood Waste and Race", 875.
[95] Koester and Davis, "Siting of Wood Pellet Production Facilities", 64.

may be able to phase out coal and emit less of certain pollutants (though not carbon). Because it doesn't require large-scale infrastructural change, able to be burned in the same fossil fuel facilities, many see it (in the same vein as natural gas), as a 'bridge fuel' making use of scrap material to affect an affordable transition, and it thus is able to leverage renewable designations and associated moral and market legitimacy to capture incentives and steamroll over objections.[96] Through reliance on biomass energy, the UK met its 2020 renewable portfolio targets for the Paris Accords, and although subsequent chapters and recent scholarship and news coverage are critical of the actual carbon consequences of this strategy, it has allowed for more rapid decreased reliance on coal and oil at minimal cost.[97] Despite the realities of biomass' emissions exceeding that of coal's, anti-biomass activists, unlike activists opposing mountaintop removal, must contend on entirely new fronts, engaging multiple dimensions of debate. Rather than opposing opaquely dirty practices of fossil fuel entities on their way out, anti-biomass activists must take on an industry that pitches itself as clean, green, innovative and ascendant. Rather than shuttling out a stubborn past and demanding reparations, they are attempting to arrest a vision of the future that is rapidly gaining steam and facing opposition accordingly.

~~Energy and nature are transformed along the frontier of technology. Technology can seem like a simple timeline of innovations and changes, but Pritchard and Zimring suggest that its most relevant facet is its maintenance of certain systems over time. For coal, timber, industry, and biomass alike, Swanson reflects: "underneath the new techniques and sophisticated language were relationships between economic power and nature that extended back more than a century" (197). Changes in the world's grid mix are not a neutral societal forces; as Mittlefehldt points~~

[96] "Biomass Energy", *National Geographic Encyclopedia Resource Library,* last modified September 2022, https://www.nationalgeographic.org/encyclopedia/biomass-energy/

[97] Parshley, "Europe Met a Climate Target", 3.

out, there are "hidden social dynamics embodied in new energy technologies" (877). Where does biomass fall? Does it constitute a departure from extractive industrial energy regimes? Some scholars argue that it does by its very nature and composition. In analyzing the 'labor' performed by organic matter, James Palmer identifies biomass as the only energy that relies on living metabolic processes, a "return to the surface for energy. Timber industry advocates echo Palmer's claim that biomass necessitates long-term management of forestlands, following a logic of cultivation rather than extraction. But how has this theory played out? Other envirotechnical systems relying on forests as inputs "illustrate the deep contradictions (the metabolic rift) between capitalist economic imperatives and socio-ecological systems" (222), complicating assumptions that a "natural" source can evade the pitfalls of extraction. Foresters of the antebellum South, too, attempted to turn a degraded landscape into a vast "organic machine". Histories of technology and the environment reveal that nature is not external to industrialization logics of extraction mediated through cultivation. Advances in management were guided by the pursuit of resources as ever more efficient tools; "in this sense, natural entities were also understood and function as technological" (53). The industrialization of nature, in which "biophysical processes get refashioned and pressed into service for industrial production", refutes the seeming exceptionalism of energy derived from living organic matter. Even proponents of biomass admit that problems of scale, too, complicate this narrative of innovation and progress, since biomass carried out on an industrial scale can occur in the same facilities as coal-firing and even generate some of the same pollutants in the same long-suffering communities. As Mittlefehldt describes, "when major energy corporations began to build industrial biomass facilities, new energy technologies designed to run on renewable fuels became part of an entrenched fossil-fuel based power structure that maintain deep historical inequalities"

~~(875). With all biomass plants in North Carolina sited in environmental justice communities with intersecting vulnerabilities of race and class, all signs indicate that this has come to pass. Admittedly, this is not necessarily a problem unique to biomass. All energy structures, implicitly or explicitly, make choices in a realm inherently shaped by racism, income inequality, and geographic patterns of exploitation and concentration of capital. But scholarly findings about its asymmetrical impact on communities of color are cause for serious caution: "Without careful attention to how different types and scales of renewable technology applications interact with existing sociopolitical dynamics and racial divisions, future energy decisions are likely to reproduce the inequalities of the past" (876). Biomass' persistent concentration of the negative consequences of energy production in places that lack political power is a continuity rather than a departure from fossil-fuel based envirotechnical regimes despite its narrowly renewable nature.~~

Biomass pitches itself just like the timber industry once did: an engine dragging the South into the future, all the while entrenching old inequalities in the "new nature" of the "New South". A prominent 1950s pulpwood booster claimed it would 'cut wisely, prevent fires, and grow more trees to build a better south' (37).[98] The rhetorical resemblance to biomass giant Enviva is evident in in the bold letters across its website: 'Displace Coal, Grow More Trees, Fight Climate Change'.[99] Biomass attempts to frame itself as co-creating benefits for ecosystems and communities, by improving upon natural carbon sinks by "optimizing vegetal labor" and aligning it with profitable production.[100] But seeing forests as "biorefineries" creates carbon conveyors rather than sinks, preferencing 'productive' trees and interrupting natural cycles of growth and decay—it is an innovation within an extractive system, not a socioecological

[98] Boyd, *The Slain Wood*, 37.
[99] Enviva, "Home", and "About Us", accessed April 28, 2022. https://www.envivabiomass.com/
[100] Ibid.

fix.[101]After all, biomass' disparate impact is not only in the presence of toxic facilities—it is also the absence of old-growth forest. The pattern of selling the forests of the South abroad first established with colonization has morphed, exacerbated by mechanization, but as Boyd remarks, "the basic social and legal relations that constitute logging remain unchanged", with timber funneled to nations unwilling to deplete their own virgin forests.[102] Wood pellet biomass' "green" energy continues to satisfy foreign demand at the expense of vulnerable communities—80% of US-South produced pellets feed industrial plants in the United Kingdom.[103] Classism, racial discrimination, and the distribution and exercise of "political power all worked to limit the capacity of some people to avoid the environmental hazards associated with industrial development" (15).[104] As long as some communities are denied this capacity, such industries remain persistently extractive, no matter how many trees are planted in their wake.

The plight of the South is not an accident of neglect; Extraction from its vulnerable communities and landscapes has been active and systemic since first "federal and state government sold their public lands—millions of acres for a song [and] the south's mineral and forest wealth were carried off in steamships and railcars".[105] In the Black Belt, this was accompanied by Jim Crow paternalism and disenfranchisement; in Appalachia, rigidly segregated company towns stifled both labor and racial solidarity.[106] The pivotal scholarship pioneered by Robert Bullard on environmental justice—the simple truth that, as he remarked, "all Americans do not have the same opportunities to escape the ravages of environmental toxins" – is particularly relevant to the South, "given the region's long history of poverty and

[101] Palmer, "Putting Forests to Work?", 145.
[102] Boyd, *The Slain Wood,* 99.
[103] Palmer, "Putting Forests to Work?", 23.
[104] Boyd, *The Slain Wood,* 15.
[105] Okie, *Georgia Peach,* 89.
[106] Ibid, 167.

racial discrimination, its headlong rush to industrialize and the accommodating stance of business-friendly state and local governments" (214).[107] Communities experiencing these injustices are persistently pacified with false claims of remediation and economic trade-offs, as corporations insist that a clumsily filled-in mine rights a wrong and that a spindly pine plantation replaces a thriving forest. The industries here chronicled intersect in insidious ways. Biomass has risen by making claims about displacing an already-dying coal industry still all-too present in the South's landscape and grid mix. Shapiro describes the intersection between mountaintop removal and logging extractions as follows: "Where the two creeping catastrophes meet, an ugly synergy is created: If there's little point in saving trees for their potential gain in value, there's even less point in saving any when the land is about to be blown up under them." The story of this ugly synergy—a synergy of racial and agrarian class structures, of corporate greed and environmental injustice, of 'working forests' and sacrifice zones—is a complex and interconnected one. But despite its claims to the contrary biomass is not a novel set of relations between people and the land, but rather, an innovation within extractive fossil fuel envirotechnical regimes, entrenching and profiting off unsustainable inequality in the name of green energy.

[107] Boyd, *The Slain Wood*, 214.

Chapter 2: Current Biomass Envirotechnical Regime

Informed by the context Chapter 1 provides, Chapter 2 describes and analyzes the biomass envirotechnical regime itself. It lays out the trajectory of biomass' growth (I) and discusses scientific regimes informing the demand spike associated with international adoption of biomass as a "carbon neutral" fuel (II). Section III takes stock of the political regimes and interests within the United States that influence policy design and incentive structures. Continuing to narrow the inquiry, section IV discusses the regulatory regimes and state-and-community-level postures that govern processing plants and interface with growth and violation. Section V takes on economic and rhetorical regimes governing biomass corporations transcending scales before closing with an attempt at synthesis and the integration of current key developments (VI).

I. Roots and Emergence of International Biomass Market

Burning wood for power is not new to industry. From their inception, timber-based manufacturing plants used scrap wood material as fuel to help run machinery; environmentalists didn't object, since the alternative was either incinerating the waste or dumping it into rivers.[108] However, beginning in the 1980s, small plants began using that waste to produce wood pellets for wood stoves to heat American homes. Although any sort of combustion generates its own issues of local pollution, biomass household heating does have some advantages over fossil-fuel infrastructure link-ins: avoiding transit costs and emissions, controllable atmospheric impacts, and delinking individuals and businesses from an energy apparatus many view as unjust and unreliable. In places like Maine, where timber is plentiful and cold and blackouts make reliable heating a necessity, many citizens eagerly pursue alternatives to fossil fuel methods of staying warm. But as interest in (and subsidies for) renewable energy proliferated, developers began to

[108] Mittlefehldt, "Wood Waste and Race", 892.

see the renewable classification of burning wood waste as an opportunity on a much bigger scale and began boosting biomass co-fired electricity plants—however, even with subsidies, most US plants didn't prove viable due to their expense and inefficiency (especially in competition with plummeting wind and natural gas prices).[109] What did become profitable was exporting biomass raw materials to nations with more ambitious climate targets and hotter alternative energy markets: the member states of the European Union, the UK (then) chief among them.

Opponents of biomass are generally not troubled by its role in generating heat energy for households; as Keri Powell of Powell Environmental Law says, "little wood stoves are not massively contributing to climate change. What we're dealing with now are giant former coal plants in the UK and Asia that are now burning massive amounts of wood." [110] In the past fifteen years, the dominant biomass regime has shifted from small-scale heat generation to industrial electricity production— a critical shift, since burning wood is fairly efficient at generating heat (combined heat-and-power plants achieve efficiencies of 80%) but far less so at generating electricity (power-only plants achieve only 20% efficiencies).[111] Especially for rural residents familiar with heating with wood, biomass seems like an intuitive energy source, yet scaled up for industrial electricity generation, it generates critical problems: expansion means moving from the use of waste wood to harvesting living forests, and its inefficient burning means ever-increasing tons of carbon in the atmosphere.[112] But these hurdles are unlikely to staunch its rise, because as technology allows production levels to increase and as demand is continuously created by green

[109] Mary Booth and Brett Leuenberger, "The Bioenergy Boom from the Federal Stimulus: Outcomes and Lessons", *Partnership for Policy Integrity*, Oct 2018. https://www.pfpi.net/Bioenergy-and-the-Stimulus-Oct.pdf 12.
[110] Keri Powell, "On Legal Levers in the Biomass Fight", Interview by author. January 31, 2022, 22:23.
[111] US Department of Energy's Federal Energy Management Program, "Biomass for Electricity Generation", report via the *National Institute of Building Sciences*, 3.
[112] Bill Moomaw, and Mary Booth. "Should we get our electricity by burning trees?" Lecture at Williams College, Jan. 2011, Accessed March 2 2022, https://sustainability.williams.edu/files/2011/02/BillMoomaw-Biomass.pdf

designations, its growing scalar regime remains an immensely profitable one. Biomass now accounts for 35 percent of the EU's total renewable energy inputs, though actual delivered electricity is lower because the conversion of "inherent to useful energy" is "extremely inefficient" (102).[113] In consequence, U.S. exports of wood pellets rose 59% since 2016, with sales approaching $1 billion a year.[114] Europe's triumph in meeting energy targets set by international agreements has been a much-trumpeted bright spot in a bleak climate action landscape. But that triumph, along with the profitability of the biomass industry, is predicated on the designation of wood pellet energy as carbon neutral. Without this designation, 60% of the UK's renewables portfolio and billions of dollars of international-agreement-driven biomass demand would no longer exist— and there is considerable uncertainty as to its validity.[115]

II. Scientific Regime: Debate about Carbon Science and Accounting

How can biomass project an image of itself as an environmental savior when studies find that "carbon dioxide released per unit of produced during combustion is greater for woody biomass than for coal" (105)?[116] Largely due to the fact that in key carbon accounting frameworks like the EU's, the carbon generated at the smokestack is not attributable to biomass; evaluation of its carbon impacts are confined to tracked changes in land use in hopes of avoiding double-counting carbon at two in its cyclical life.[117] Most experts consider this approach deeply misguided, but belief in its validity, as well claims that biomass-driven increases in forestry will lead to net gains in global carbon offsets now or in the future, is a key part of what sustains the regime.

---

[113]Bill Moomaw. "Myth of Carbon Neutrality of Biomass", Report to the *Intergovernmental Panel on Climate Change*, January 2011, Accessed March 23, 2022. 3.

[114] David Boraks. "Enviva plans to double production as it lands its first U.S. deal", *WFAE*, Jan. 2022, 1.

[115] Christopher Galik, and Robert Abt. "Sustainability Guidelines and Forest Market Response: An Assessment of European Union Pellet Demand in the Southeastern United States*." GCB Bioenergy* 8 (3) 2016; 658.

[116] Moomaw, "Myth of Carbon Neutrality of Biomass", 4.

[117] Timothy Searchinger, Staven Hamburg, Jerry Melillo, William Chameides, Petr Havlik, Dan Kammen, Gene Likens, et al.. "Fixing a Critical Climate Accounting Error." *Science* 326 (January 2009), 314.

Biomass advocates claim that the demand biomass creates can drive up forest acreage and thus offset the massive emissions its burning generates by facilitating natural carbon capture. But not all forests are created equal—not in ecosystem services, contribution to quality of life, and especially not capacity to store carbon. The many imprecisely understood ecological processes involved make evaluating the quantitative impact of landscape change immensely complex and its results controversial. Proponents of biomass trumpet the fact that the Carolinian forest stock has increased in recent years, but this metric fails to reflect the widespread conversion of mixed primary succession forests to pine plantation monocultures.[118] Here as elsewhere, forest "stocks" — measured by acre or by head of sapling— have gone up while actual forests that enrich ecosystems and communities have declined.[119] Constanza et al. found that in almost all cases when biomass demand drives up harvesting, even if replanting increased forest stock, the 'stock" was "composed of more intensively managed forest and less habitats supporting biodiversity".[120] Most analyses also ignore the role of downed wood debris, which promotes healthy forest succession and biodiversity and accounts for up to 20% of total biotic carbon storage.[121] As Moomaw puts it, "the baseline of carbon in plants and soils displaced by biomass needs to be accounted for"; and takes decades to centuries to replace. [122] 2014 modeling indicated that even with good faith attempts to furnish biomass demand (estimated at far below current levels) sustainably, expansion still results in trade-offs detrimental to ecology and carbon storage.[123]

---

[118] NC Department of Environmental Quality, Division of Air Quality, Public Hearing on 6/28, (transcript accessed online on February 21, 2022). 1:21:45.
[119] Searchinger et al, "Fixing a Critical Climate Accounting Error," 316.
[120] Jennifer Costanza, Robert Abt, Alexa J. McKerrow, and Jaime A. Collazo. "Bioenergy Production and Forest Landscape Change in the Southeastern United States." *GCB Bioenergy* 9 (5) (January 2017), 924.
[121] Shawn Fraver, Amy Milo, John Bradford, Laura Kenefic, Chris Woodall, and John Brissette. "Woody Debris Depletion Through Decay: Implications for Biomass Carbon Accounting." *Ecosystems* 16 (7): (2015) 1262
[122] Moomaw, "Myth of Carbon Neutrality," 6.
[123] Costanza et al., "Bioenergy Production and Forest Landscape Change," 937.

Even if industry claims that no land is being clear cut to supply biomass (challenged by recent GIS work and investigations by Clark University and the SELC) are true, biomass demand still has considerable influence over logging's incentives and practices.[124] The ability to sell traditionally undesirable timber materials for biomass shifts the landscape: What biomass' proponents advocate is true: the economics of biomass make forests more profitable. But it also makes the destruction of those forests more profitable and encourages practices detrimental to biodiversity and carbon storage. With "waste wood" now an added source of value, logging operations shift from taking out select hardwoods or pines for sawmills to clear cutting, and forest regrowth's potential to offset biomass emissions is limited. Nepal, Wear and Skog estimate regrowth could offset at most 78% of burn-generated carbon within 50 years (which notably, although it is "close", is not carbon neutral), but in the same model, where new biomass development displaces cleaner coal-burning or natural gas systems, "the net C emissions offset would be 46–52%".[125] Put plainly: Because burning biomass is less efficient than fossil fuels, when it replaces them, net efficiencies fall, and carbon offset potentials fall too. Biomass advocates claim biomass will displace coal, first through being cofired with it, and then, theoretically, eliminating it entirely—this data renders that theory of transition problematic at best.[126] What's more, these calculations estimate that these limited offsets would happen on a 50-year timeline— which, in the face of the climate crisis is dangerously distant. These closed-circuit analyses consider the isolated processes of biomass extraction and use in power production. But much energy is demanded by linkages between these two processes and the

[124] "Southern Environmental Law Center and Clark University, "Satellite images show link between wood pellet demand and increased hardwood forest harvesting." https://www.southernenvironment.org/wp-content/uploads/2022/03/Biomass-White-Page.pdf, (April 2022), 4.

[125] Prakash Nepal, David N. Wear, and Kenneth E. Skog. "Net Change in Carbon Emissions with Increased Wood Energy Use in the United States." *GCB Bioenergy* 7 (4): (2015) 820.

[126] International Renewable Energy Agency. "Biomass for Heat and Power Technology Brief", published by the *Energy Technology Systems Analysis Programme (ETSAP), of the International Energy Agency*, 1.

global nature of the market. From logging trucks, trains and ships, transportation emissions alone are staggering, these plus "the fossil fuel process energy used to cut, chip, pelletize, and dry the wood pellets […]is estimated at 15- 20%" of the energy biomass generates, but under current frameworks, none of these "count" towards evaluating industry claims to carbon neutrality.[127] Confidence in these life cycle carbon analyses is rare due to its diffuse supply chain, and even these only track emissions, not even beginning to account for other air pollution, such as PM 2.5, "toxic VOCs," Hazardous Air Pollutant particles, ash, and heavy metals.[128]

Searchinger et al pin down the problem: "Certainly, biofuels save emissions from burning fossil fuels, but if all they do is substitute emissions from burning biomass, that does not provide any benefit. To be better in an emissions-related sense, biomass must be 'additional'. [Biomass] only reduce CO2 if its generation results either in more CO2 absorbed from the atmosphere or less CO2 emitted to it".[129] In other words, the only biomass regime that would achieve carbon neutrality, let alone reduce emissions, would source only from forests it created that would not otherwise exist— a young pine forest sown in a former parking lot, cut responsibly, and then replanted. This is not, though, the current reality. Rather than creating forests, biomass is destroying them, and that fact coupled with the cumulative emissions from land use change, production and refinement, and combustion, makes any global benefit, carbon or otherwise, a dubious prospect.[130] The neutrality designation is no trivial error. It is already causing bioenergy crops to displace forests and influencing energy policy set to determine climate outcomes.[131]

---

[127] Moomaw, "Myth of Carbon Neutrality", 3.
[128] Dimitriou Roberts, and G. A. Ormondroyd. "VOC Emissions from the Combustion of Low-Grade Lignocellulosic Waste." *International Wood Products Journal* 9 (January 2018), 151.
[129] Keith A. Smith and Timothy D. Searchinger. "Crop-Based Biofuels and Associated Environmental Concerns." *GCB Bioenergy* 4 (5) (2012), 497.
[130] Smith and Searchinger, "Crop-Based Biofuels", 485.
[131] Searchinger et al. "Fixing a Critical," 1271.

A quorum of scientists reject biomass' carbon neutrality claims, as do many advocates, nonprofits, and citizens. Its proponents lean into models' uncertainty, relying on the validity of reforestation offsets. Some walk a middle line, admitting that biomass is not currently carbon neutral, but that its expansion could lead to key innovations known as Bioenergy with Carbon Capture and Storage (BECCs). A favorite of those who doubt global capacity to reach net zero emissions, BECCs proposes coupling industrial pellet-burning biomass plants with advanced systems removing carbon from the atmosphere and storing it underground.[132] A hazard of relying on this strategy to meet energy goals is that, as Donnison et al identify, it "doesn't address environmental and social implications of BECCS at the regional scale"; its costs and benefits are highly "spatially discrete", with plant size and sourcing driving huge differences in ultimate impact on welfare; The longer nations wait to reduce their emissions by switching to renewables, the greater the need for carbon removal, and the greater the "human health impacts as a result of air pollution and ecotoxicity" (588).[133] Even in an optimistic scenario, "for the UK, meeting Paris Agreement targets through reliance on BECCS is likely to result in a significant welfare loss" (586). [134] That is, assuming it is even possible—a successful implementation of this system has yet to occur.[135] So much justification for biomass leans on the future—future carbon capture, future reforestation. But Moomaw reminds us that the discount rate applies: any future benefit of carbon uptake must be discounted relative to what is being released right now, because of the critical nature of current atmospheric composition to averting climate disaster.[136]

---

[132] Caspar Donnison, Robert Holland, Astley Hastings, Lindsay Armstrong, Felix Eigenbrod, and Gail Taylor. 2020. "Bioenergy with Carbon Capture and Storage (BECCS): Finding the Win-Wins for Energy, Negative Emissions and Ecosystem Services--Size Matters." *GCB Bioenergy* 12 (2017), 586.

[133] Donnison et al, "Bioenergy with Carbon Capture and Storage (BECCS)", 586.

[134] Donnison et al, "Bioenergy with Carbon Capture and Storage (BECCS)", 592.

[135] Anita Shepherd, Mike Martin, and Astley Hastings. "Uncertainty of Modelled Bioenergy with Carbon Capture and Storage Due to Variability of Input Data." *GCB Bioenergy* 13 (4) (January 2021), 691.

[136] Moomaw, "Myth of Carbon Neutrality", 6.

Extensive review of the materials and consultation with experts in both law and climate science supports this thesis' assertion that (at least on the time scale relevant for climate action) biomass is not carbon neutral, and therefore not a true departure from old fossil fuel regimes. But the uncertainties are such that reasonable people, and by proxy, organizations and regulatory bodies, disagree over whether it can generate global net benefit. This lack of certainty is alarming, considering the ravenous rate of the biomass regime's growth, the unequal, devastating concentration of its consequences, and the considerable subsidies and incentive structures supporting its development. Due to biomass' carbon neutral designation, "carrots" intended for true renewables drive its expansion as well as, and sometimes in place of, solar and wind. In 2018, the European Academies Science Advisory Council warned EU president Juncker:

> "The legal mandate to record biomass as contributing to EU renewable energy targets has had the perverse effect of creating demand for trees to be felled in order to burn them for energy. Importing pellet biomass is leading to increased emissions with no guarantee of when (or even if) the additional carbon released would be offset by forest regrowth."

The vicious and unintended cycle is this: subsidies for renewables stoke the biomass boon, and biomass demand drives up timber prices, ensuring more trees currently storing carbon will become biomass feedstock, heightening the threat to both the forests and communities of the South and the planet's endeavor to eliminate emissions and avert climate disaster.

III. Political and Procedural Regimes: US Federal Posture towards Biomass

When Powell Environmental Law's 2017 investigation, "Dirty Deception: How the Wood Biomass Industry Skirts the Clean Air Act", was published, 21 pellet mills emitted 16,000 tons of "health threatening air pollutants"— over 2,500 tons of particulate matter, 3,200 tons of nitrogen oxides, 7,000 tons of volatile organic compounds, and 3.1 million tons of greenhouse

gases—every year.[137] The numbers have only risen since: seven new plants have opened or received construction permits, and existing plants have ratcheted up production. Yet the only action federal government has taken is to include the following clause in an appropriations bill:

> "Forest biomass carbon dioxide emissions from a facility that combusts forest biomass for energy, ***do not require regulation, control, or action*** if— (1) the Secretary determines timberland carbon stocks in the relevant region are stable or increasing […] (c); or (2) the forest biomass is derived from— (A) mill product manufacturing residuals; (B) harvest residues; (C) biowaste (including used wood products); or (D) forest management activities that are conducted— (i) to increase yield; or (ii) to maintain or enhance forest health."

Known as the "Collins Rider", this clause was introduced by timber state senators hoping to "recognize biomass as a renewable energy source".[138] Many groups believe it was written by the forest lobby; Dave Tenny, president of the National Alliance of Forest Owners (NAFO), stated "NAFO worked very closely with Senators Collins, King, and Klobuchar on the language".[139] The rider, which passed in 2018, has not, as many feared, translated into significant policy incentives, but it has forestalled any federal pushback against biomass growth. Environmentalists objected to how the Collins Rider essentially forced the EPA to treat biomass as carbon neutral despite an EPA task force's finding that burning wood can have significant net emissions, and the conclusions of the "Affordable Clean Energy" rule that burning biomass emits more CO2 than fossil fuels, and that co-firing biomass with coal degrades a power plant's efficiency.[140]

---

[137] Patrick Anderson and Keri Powell, "Dirty Deception: How the Wood Biomass Industry Skirts the Clean Air Act" Environmental Integrity Project, http://www.environmentalintegrity.org/wp-content/uploads/2017/02/Biomass-Report.pdf (April 2018) 3.

[138] Mary S. Booth, "Status of amendments that would force EPA to treat bioenergy as carbon neutral, and the urgent need for legislative opposition", *Partnership for Policy Integrity*, (June 2016) 12.

[139] Dr. Mary S. Booth, "The Great Biomass Boondoggle", *The New York Review*, (Oct 14, 2019) 4.

[140] Ibid.

Though its signaling troubles anti-biomass activists, the rider has not affected market conditions drastically, since it only alters incentives at the power-generating stage. While biomass-fired utilities do exist in the US, the far larger industry is wood pellet for use in importing nations, where despite pushback from international activists, biomass' renewable status remains codified.

Issues of both transnational environmental equity and domestic environmental justice have not received the federal consideration they deserve. With their own forests tightly protected by "strictures," Europe feeds its growing demand for biomass by harvesting the less regulated, "less valuable" forests of the US South. Market forces exploiting the less-protected are nothing new; as Chapter I lays out, this "race to the bottom" has already had massive consequences in vulnerable communities, where federal intervention is pitifully rare. The Title VI committee of the EPA is meant to ensure that no recipient of federal funds engages in marginalizing practices of disparate treatment disparate outcomes, but their massive backlog and consistent inaction mean they fail in that mandate.[141] The biomass industry receives loan guarantees, support, or outright subsidies upwards of $600 million from federal agencies, and every single wood pellet plant in the Carolinas is sited in a marginalized community.[142] The lack of any Title VI action to challenge the exploitation of some of the most burdened populations and the most carbon-rich, biodiverse wetland forest ecosystems points to a disconnect between bureaucracy and reality.[143]

IV. Statutory and Regulatory Regimes: State-Level (failures in) Enforcement

State regimes governing biomass production are characterized by disjointedness, uncertainty, and possible regulatory capture. In the absence of definitive climate change law, the Clean Air

---

[141] Environmental Protection Agency, "Title VI and Environmental Justice", https://www.epa.gov/environmentaljustice/title-vi-and-environmental-justice#titlevi , accessed on Feb 6, 2022.

[142] Stefan Koester and Sam Davis, "Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States", *Environmental Justice*, V11, No 2, (2018) 1

[143] Davis, *Treasures of The South,* 2.

Act acts as an umbrella regulation for airborne pollutants (including carbon dioxide), delegating enforcement to the states. Wood pellet biomass processing plants should be subject to two regulatory processes: a Title V operating permit and a major source review.[144] But designation as a major source— one that releases above a state-determined threshold of pollutants— triggers a host of reviews, responsibilities, regulations, and restrictions. From the industry perspective, it is smart to avoid. To do so, CATF's Johnathan Lewis and Powell Environmental Law's Keri Powell say, biomass companies seek "synthetic minor" designation, an arrangement where a facility with the capacity to produce at major source levels voluntarily limits production so that its emissions stay below that benchmark, allowing it to be permitted as a "minor" source— thus, a "synthetic minor."[145] This evasion of proper classification, enabled by industry-friendly state regulatory agencies like NC's DEQ, is troubling—which the EPA itself recognized in a 2021 report—not least because minor sources have different, less stringent requirements for control technology.[146] Yet an even greater problem emerges: these voluntary limits are set by estimated levels of production that *should* meet air pollutant benchmarks, not by actual levels of pollutants released, and estimates have often been wildly wrong.[147] In one case, Georgia Biomass emitted "over 1,000 tons per year of VOCs, whereas the facility and the state previously believed the entire facility emitted less than 250 tons per year" — all while being permitted as a "minor" source.[148] Even in cases where emissions were accurately tracked, over half of US plants either failed to keep emissions below legal limits or to install required pollution controls.[149]

---

[144] Clean Air Act section 112 (r) (1).
[145] Powell, "On Legal Levers in the Biomass Fight"; Lewis, "CATF, Federal Policy, and Biomass",
[146] US EPA Office of the Inspector-General, "EPA Should Conduct More Oversight of Synthetic Minor-Source Permitting to Assure Permits Adhere to EPA Guidance", Report No. 21-P-0175, July 8, 2021
[147] Keri Powell, "On Legal Levers in the Biomass Fight", Interview by author. January 31, 2022, 45:02
[148] Anderson and Powell, "Dirty Deception", 6.
[149] Koester and Davis, "Siting of Wood Pellet Production Facilities", 17.

These rogue emissions are of critical concern: medical journals have found that "reducing PM 2.5 by just 1 microgram per cubic meter throughout the United States could save 12,000 lives each year. Many wood pellet mills emit 60 to 80 tons per year of PM 2.5, even after installing controls" (76).[150] In communities already impacted by other industries and suffering from disproportionate rates of chronic illness, potential health impacts are magnified.[151] Beyond everyday violations, exceptional hazards loom: in 8 of the 15 largest plants, fires or explosions broke out due to spontaneous pellet combustion, or irresponsible storage or dust management.[152] This is not because adequate technology to control these hazards is not available. Some, notably an Arkansas plant, employ "extremely effective VOC controls capable of reducing emissions by 90 to 95%", preventing the formation of hazardous smog posing severe threats to children, the elderly, and those with lung diseases, and also dramatically reducing hazardous air pollutants linked to severe health effects including cancer.[153] But laxer states and companies less concerned about compliance mean that despite the widespread availability of such controls, massive plants operate without them: In North Carolina, dryers at two Enviva Biomass emit nearly six times more VOCs and 50 to 60 times more HAPS than comparable facilities with control systems.[154]

A just regulatory regime not only must protect citizens from harm, but also provide opportunities for them to speak up when they feel their rights are being challenged—this is procedural justice, and there are major shortcomings in the current paradigm. Beyond its bearing on statutory obligations, a facility's permitting status also impacts the public's ability to engage

[150] Anderson and Powell, "Dirty Deception", 6.
[151] Koester and Davis, "Siting of Wood Pellet Production Facilities", 14.
[152] Anderson and Powell, "Dirty Deception", 6.
[153] Ho Kim, Yong et al., "Mutagenicity and Lung Toxicity of Smoldering vs. Flaming Emissions from Various Biomass Fuels: Implications for Health Effects from Wildland Fires," *Environ Health Perpect*. 126(1) (Jan. 2018),1345. ; Ibid.
[154] Anderson and Powell, "Dirty Deception", 22.

and act. Synthetic minors designation allows corporations to dodge some required public hearings, but all industrial operations must obtain a Title V operating permit, and under the CAA, individuals have the "opportunity to request" a legislative hearing (which, despite the name, is not before an elected body, and consists of no cross-examination, rather, timed, targeted comments from registered speakers).[155] That request can be (and occasionally is) denied; many wood pellet plants would have been built without either hearing or community notification, if not for the lawsuits and alarm-sounding carried out by the Southern Environmental Law Center, Powell Environmental Law, Dogwood Alliance, and other nonprofit and advocacy groups.[156] Yet even when hearings do occur, this is not procedural justice in and of itself. Hearings tend to be narrowly focused on minutia— for instance, at a July Hamlet plant hearing, whether Enviva had to install fugitive dust control devices—and they can be poorly attended or co-opted by industry representatives or those who parrot their talking points. They are also painfully long and often inaccessible to members of vulnerable communities (by nature of time, location, and convoluted scientific content). As Chapter 3 reveals, many local stakeholders believe that they are largely if not entirely performative. Even overwhelming opposition (over 90% of written comments opposed a new Enviva plant, Dogwood Alliance found) seems to have little bearing on state regulatory decisions, with all facility permit applications approved regardless of public outcry.[157]

State institutions are not alone in facilitating (and some posit, being captured by) the biomass industry. Many decisions impacting facility prospects are made by county or municipal officials: questions of budget, zoning, subsidy, and more. In the struggling rural areas biomass chooses to operate in, local governments desperate for tax revenue tend to bend over backwards to attract

[155] Clean Air Act section 112 (r) (1).
[156] Powell, "Dirty Deception", 3.
[157] Emily Zucchino, email to author, February 2, 2022.

multi-million-dollar industries, irrespective of their potential environmental impact. That tendency is only amplified when biomass companies pitch their industry as left-behind communities' way in to a brave new "green" future, and decision-makers employ incentives like TIFs (Tax Increment Finance) to attract plants, sometimes to disastrous effect. Northampton County paid Enviva Biomass $360,556.70 directly and provided half a million toward water, sewer, and gas lines, recognizing too late that it had over-incentivized and raising taxes to cover the cost.[158] As a result, one of the state's poorest counties now has its third highest property tax rate, having gained, 50 jobs, hundreds of tons of PM2.5, and higher fiscal burdens than ever.[159]

V. Economic and Rhetorical Regimes: Corporate Greenwashing

Corporations behave according to a tangled international regime, influenced by financial institutions, government regulators, normative institutions (voluntary organizations or commitments), and other stakeholders. Aiming to minimize risks and transaction costs in an increasingly information-sensitive and socially conscious market, they increasingly perform or enact Corporate Social Responsibility, or CSR (a set of actions or gestures towards benevolent conduct on the part of a corporation). For the international biomass envirotechnical regime, reputation is everything—biomass' designation as "green" or renewable directly creates their market share. Without it, the entire supply chain crumbles, or at least becomes far less profitable without essential subsidies and the urgent international demand created by importing states' pursuit of renewable portfolio targets. On the local level, however, the biomass industry's reputation and public opinion on its conduct are of limited importance to corporate bottom line. This renders biomass distinct from traditional fossil fuel players: Oil companies, cognizant of

[158] Majlie de Puy Kamp, "How Marginalized communities in the South are paying the price for 'green energy' in Europe", *CNN*, July 2021, 1.
[159] de Puy Kamp, "How Marginalized communities", 4.

constant scrutiny, have developed robust strategies including charitable donations, listening sessions, and employment programs to keep outrage at bay and preempt local mobilization.[160] Typically, these kinds of CSR good-neighborly buildouts will only happen under duress or with pushback from stakeholders, normative institutions, financial entities, or governments (and it often takes more than one).[161] In rural North Carolina, where community opinion has no fiscal impact and local grievances have not (at least not yet) been able to influence other stakeholders, corporations get away with the bare minimum. Biomass' claim to renewable status, though false, insulate it from the scrutiny applied to the fossil fuel industry. Most of its shareholders likely know nothing about externalities and take corporate claims about positive impact at face value, corroborating them through "green" industry lists and other such markers and certificates. The performativity of CSR enables the continuation of calls for a false "balance" between efforts to mediate the consequences of industry and the "unreasonable" demands of environmentalists.

Biomass' international "green reputation" and carbon neutrality claims are big leverage points in terms of regime stability, a space where there's significant vulnerability to biomass being caught out. Decisionmakers, both governmental and financial, operate on beliefs that can be swayed by press and norm-making institutions; signs of a changing tide, including a rise in international critical press coverage and a prominent UK list of green firms' decision to eject biomass giant Drax, may give investors pause.[162] But community-level concerns such as hiring practices, charitable conduct, and treatment of neighbors, are unlikely to mobilize the momentum needed to challenge this billion-dollar industry. Using CSR as a lever locally can generate small

[160] Stimpson, Stephanie, Jay Todesco, and Amy Maginley. "Strategies for Risk Management and Corporate Social Responsibility for Oil and Gas Companies in Emerging Markets." *Alberta Law Review* 53 (2) (2015): 259.
[161] Professor Laura Henry, personal communication to the author, March 7, 2022.
[162] Jillian Ambrose, "Drax dropped from index of green energy firms amid biomass doubts", *The Guardian*, Oct 2021, 4.

concessions— corporations donating turkeys at thanksgiving or restricting truck traffic— but not systemic change. Often, rewards companies by protecting their reputation, as they simulate compliance marginally exceeding the law in order to insulate themselves from scrutiny. In March 2022, Enviva announced its endowed scholarship at NC A&T University, the largest Historically Black College or University in the nation, even as local community groups struggled to hold the corporation accountable for what they see as blatant environmental racism.[163]

The transparency from corporations, partners, and regulators that policy relies on does not always materialize, with little to no consequences for misleading statements or outright violations. For instance, many biomass burners are now built with "bypass stacks" to vent emissions when the main stack (equipped with required pollution controls) malfunctions. These "bypass stacks" have no required controls, and anecdotal evidence from facility neighbors suggests they are used startlingly often, despite the fact that they are often not even included within the blueprints of the facility submitted with permit applications.[164] Deception extends, too, to sourcing: Biomass giants, notably Enviva, claim to operate solely off wood waste offcasts of other industrial activities, and to reforest at rates that put them "in the green." But no policy could contain, as Moomaw says, "an enforceable or verifiable requirement that trees be planted that would absorb carbon equal to that released through combustion," and even if there were only if the tree grew back instantly would this part of the energy cycle be "carbon neutral" in the present tense.[165] Despite their claims, CATF's Johnathan Lewis says, "The industry has not shown any capacity or interest in building supply chains focused just on waste. Aggregating waste is difficult and expensive".[166] Even Professor Bob Abt of NC State, a woody biomass

[163] "Enviva Gives $250,000 Endowed Scholarship For Nation's Largest HBCU", *Black Enterprise,* March 30, 2022.
[164] Keri Powell, "On Legal Levers in the Biomass Fight", Interview by author. January 31, 2022, 5:23.
[165] Moomaw, "Myth of Carbon Neutrality of Biomass", 3.
[166] Johnathan Lewis, "CATF, Federal Policy, and Biomass", Interview by author. January 18, 2022, 40:12.

proponent, admits "logging residuals alone may be unable to meet demand," which will drive up timber prices and removals and compromise forest resources.[167] Stacks of hardwood trees behind plants are ignored or treated nonsensically by official permitting documents: "Although there are no logs processed on site, the facility is permitted to operate a log chipper and de-barker", reads a DAQ permit for Enviva's Hamlet site.[168] Despite this evidence hiding in plain sight, it has taken civilian investigations to force corporations to admit their sourcing claims are not genuine.

A March 2022 SELC report using satellite analysis "contradicts or otherwise highlights the misleading nature of many of the [biomass] industry's main arguments": Geospatial analysis and photographic evidence found that not only did hardwood forest harvesting in the sourcing area of three of its facilities increase sharply after Enviva arrived, those harvests exceeded growth, resulting in net loss of forest cover. [169] Overall, from 2016 to 2018, Enviva's 3 mills consumed nearly half of all wood from hardwood forest clearings in the area, driving destruction of key wetlands in these socioeconomically vulnerable landscapes as well as sharp declines in pivotal carbon sinks. This report confirms for scientific institutions what communities have long known: that the overwhelming majority (approx. 84%) of hardwood harvested for biomass comes from large diameter whole trees and not wastes, residues, and low-value crooked or diseased trees, as the industry claims.[170] Alan Dater and Lisa Merton's documentary "BURNED: Are Trees the New Coal?" records citizen investigators wading through Carolina cypress bottomland swamps to reach clear cuts, following log trucks back to Enviva plants.[171] Guerilla monitoring took place as citizens searched for answers when corporate claims contradicted their lived reality. I

---

[167] Robert Abt, Karen Abt, Frederick Cubbage, and Jesse Henderson."Effect of Policy-Based Bioenergy Demand on Southern Timber Markets: A Case Study of North Carolina." *Biomass & Bioenergy* 34 (12) (2010) 1679.
[168] North Carolina DAQ, "Application Review for Enviva Pellets Northampton Permit No. 10203T06".
[169] SELC, "Satellite Images Show Link", 6.
[170] Ibid.
[171] Alan Dater and Lisa Merton, "BURNED: Are Trees the New Coal?", 2017, Marlboro Films, LLC.

followed suit with a 6am visit to the Sampson County Enviva plant, where the "responsibly repurposed wood waste" was nowhere to be seen— just departing open-back trucks trailing dust and fumes and inbound trucks careening through residential neighborhoods full of large-diameter hardwood timber on its way to be chipped, heated, pressed, treated, and burned, in the name of green energy. Attempts to impose "sustainable" sourcing guidelines is futile since there is no evidence that corporations will comply—such initiatives only legitimize deceptive rhetoric.[172]

VI. Towards a Synthesis & Discussion of Current Developments

` Uncertainties within the technological biomass regime can act in corporations' favor, but they also create precarity. CATF's Johnathan Lewis remarks that "The industry is built on what, if I were an investor, I would think are pretty shaky foundations," hinging on a designation of carbon neutrality relying on belief in promised carbon removal technology, "a lot of contingent noneconomic arguments propping up demand".[173] Either it is unknown to investors, or this shakiness is overridden by the allure of a rapid transition technology that does not entail decreased consumption. Politics follows the money: the timber lobby holds power across party lines. The Collins Rider, named for Maine's Senator Susan Collins and co-introduced by Senator Angus King is proof of this. In eastern North Carolina, where any job is a "good job" and timber history permeates political and economic systems, the state has provided $7 million in direct incentives to pellet plants since 2007, including over $1 million for the Hamlet plant alone.[174]

It is an understandable dilemma: presented with a rare energy politics win-win, many want to believe. As Powell reflects: "Some politicians have already been convinced by the industry that biomass is good and green. It's such a convenient solution that we have this homegrown energy

[172] Galik and Abt, "Sustainability Guidelines", 671.
[173] Johnathan Lewis, "CATF, Federal Policy, and Biomass", Interview by author. January 26, 2022, 9:04.
[174] David Boraks, "NC's growing pellet industry fuels climate debate", WFAE, Jan 2021, 3.

here. They don't want to let that go".[175] The prospect of a domestic, job-creating technocratic solution relying on familiar infrastructure and supposedly plentiful resources is a powerful draw for both governments and markets. In January 2022, Enviva, world's top pellet producer (and worst CAA violator in the industry), announced it would double production capacity by building eight new plants per year, driven by "because of strong demand in Europe and Asia" and its first domestic customer, an "unnamed company that plans to turn pellets into aviation fuel".[176] This comes despite blows to solubility from bad PR (Enviva reported a loss for 2021, with shares down 5% before this announcement), a testament to the troubling durability of biomass' rise.[177]

The world must rapidly achieve carbon neutrality to avoid climate and ecological breakdown, a feat that is impossible without, as Booth insists, "vast restoration and expansion of the world's forests, [which] could also address another crisis, the extirpation of the world's species."[178] True climate solutions lie in afforestation, not using forests as fuel; solar power, not inefficient co-opted photosynthesis. But these solutions are less unfamiliar; they require compromise, systemic change, and new infrastructure— and biomass does not. The urgency of the race for a transition has allowed the biomass regime to rocket forward and eat up large shares of green markets and subsidies in lieu of true renewables like wind and solar, despite its dubious carbon balance impacts and proven negative impacts on environmental and social justice and forests. Biomass diverts effort, funding, and political will away from true solutions and thus endangers the entire endeavor of an energy transition, let alone a just one. Communities on the ground are enacting resistance accordingly, despite stark barriers. Chapter 3 centers their voices, considering both the

[175] Keri Powell, "On Legal Levers in the Biomass Fight", Interview by author. January 31, 2022, 16:55.
[176] Anderson and Powell, "Dirty Deception", 41. ; Boraks, "Wood pellet maker Enviva", 4.
[177] Ibid.
[178] Booth, "Status of Amendments", 15.

syntheses and tensions that arise when profoundly place-based movements are also pivotal for climate, and must simultaneously combat an adversary shrouding itself in green rhetoric.

Chapter 3: Community Experiences of Injustice and Landscapes of Resistance

The plant grinds, ceaseless. The noise and smoke spew night and day, from smokestacks and trucks alike. When I pull over a half-mile from the Enviva plant in Hamlet, North Carolina, the air smells sour and the noise of the plant sets my teeth on edge. Knowing it contains PM2.5 and carcinogenic VOCs, I cannot stop staring at the constant plume of white smog emerging from two chutes, mingling with the overcast sky. Within a ten-minute drive of the historically Black community of Dobbins Heights, I have passed factory poultry farms, two chemical producers, five manufacturing sites, the massive West Rock paper plant, a natural gas compressor, and a half-dozen unlabeled, unlisted industrial lots filled with piles of raw materials. This is no warehouse district, though: it's a community. There is a church for every polluter; there is an elder care complex and a middle school within earshot of the grinding plant. Trucks are constantly barreling down residential roads at 60mph or more, I've been tailgated by 18-wheelers spewing wood chips from their uncovered backs. The CSX rail hub and its freight trains run parallel to the highways, and along the mix of interstates and back roads I've been driving for the past hour, I've spotted over fifty clear cut sites, many of them a half-mile long, some of them still smoking from slash-and-burn techniques, massive piles of brush resembling moonscapes.

Enviva's plume rises above cotton fields, piles of young pines visible beside the chippers which will break the logs down, the boilers and chemical treatments and compressors that will eventually transform them into pellets. They never let anyone into the plants—not concerned plant neighbors, not even CBS reporters, and certainly not this undergraduate researcher. But even from a distance, it's clear that it's a far cry from the massive state-subsidized solar array gleaming in the neighboring field, separated from the neighboring dilapidated collection of ivy-covered trailers by a barbed wire fence. This is how it stands, in the rural communities of the

South whose labor and ecology fuels biomass' ravenous expansion: contradictions and exploitations in landscapes haunted by histories of racism and neglect, relegated to the periphery.

No biomass plant in a Southern poor minority community has ever been denied a permit, even in the presence of overwhelming community opposition; No project in US history has ever been denied a permit on environmental justice grounds.[179] Held beside the lived experiences of injustice articulated by stakeholders, this indicts a regulatory paradigm that is clearly inadequate. It points to the suffocating endurance and prevalence of the envirotechnical regime of industrial energy generation in which it is acceptable for some communities to be treated as dumping grounds. Even when multiple overlapping incentives exist for the termination of a practice (in the case of biomass, cascading benefits both on the local scale and for the climate globally), the inertia of systemic and statutory regimes constrict the window of opportunity for resistance. This chapter explores the: Who are the stakeholders involved in community action surrounding biomass? How do they perceive the industry and of regulators, of the critical dimensions of these practices harms, and of their own power? What can we then surmise about biomass' place in the lineage of exploitative envirotechnical regimes, and actors seeking alternatives?

Methods:

The biomass envirotechnical regime is changing hourly; due to its novelty, scholarly works on its justice impacts are spars. In representing the lived experience of stakeholders understand them, I triangulate, support, and ground truth my assertions through three primary methods:

1. Participant-observation at public hearings:

[179] Marshall, "Lord We're Just Trying", 32.

I attended virtual public hearings for biomass facilities within my focus states, constituting 9 cumulative hours of testimony. As a participant-observer, I took field notes and corroborated them with official DEQ transcripts. All data here used is part of the public record on NCDEQ/ SC DHEC web pages, and participants consented to participate in the recorded sessions.

2. Ethnographic interviews:

Under an IRB exemption and conditions of anonymity, I conducted nine interviews ranging from 30-90 minutes in length with stakeholders involved in the biomass envirotechnical regime. My sampling prioritized outreach to individuals who spoke at hearings (seven of nine interviewees) and built upon previous relationships within organizing communities. It attempted to center the perspectives of impacted communities, as well as to gain the insights of those leading grassroots activism groups focused on biomass, but also includes representatives of conventional nonprofits and more distant neighbors. This limited data is not posited to be universal or representative, but to provide useful support and nuance. I refer to interviewees by their role to provide context without rendering them identifiable. My approach to coding these interviews was both inductive and deductive within an envirotechnical framework with emphasis on perceptions of power.

Seeking scholarly balance and fair treatment of all stakeholder perspectives, I made repeated attempts to reach out to individuals who had represented the pro-biomass perspective at the public hearings I observed or in other public forums. Overtures to non-corporate supporters (county commissioners and town council members on record supporting the project, rural economic development boards, USIPA, the Carolina Forestry Association, and others either generated no response or a few tentative offers to speak eventually retracted despite assurances of anonymity. Inquiries to Enviva's representatives were redirected to corporate headquarters, which declined my request to visit their sites, citing COVID-19 as the reason, and responded to

my request for an interview by providing me a link to their website, 2021 CSR report and press release. Forced to treat this absence as a data point in and of itself, I represent the pro-biomass position based on public statements, white papers, and quotes in media.

3. Site Visits and Observations:

I employed site observation and ground-truthing by physically visiting four different sites of biomass production and the surrounding communities in North Carolina. Traveling by car, I began recording my observations within a half-hour of the official listed address of the plant according to the NCDEQ. I took note of clear-cuts or recent replant sites visible from the roads, indicators of economic conditions and infrastructure investment levels, hubs of community or vulnerability (churches, elder-care facilities, schools, soup kitchens, etc.), truck traffic, operations of other polluters, and, most critically, the appearance, behavior, and set-up of the plants themselves. Visible emissions, noise pollution, odor, traffic, and presence of debris were at the center of these observations. To the extent possible, I verified insights through photo, video, and sound recording. Overall, the plants were difficult to identify and access, with multiple listed addresses for different purposes and entry-points and intimidating private property postings. In one instance, I was told by site employees to leave while parked in turnabout on the road to the plant. I am conscious of the limitations of my positionality as a visitor rather than a resident, and the anecdotal nature of my observations (detailed GIS work like Clark University's in partnership with the SELC estimates acreage and impact of clear cuts, my observations only speak to their visibility to neighbors). Nonetheless, I think it important to see these patterns firsthand and affirm these claims as an observer, a scholar, and community member. These grievances are real and critical; this much is clear from any time spent watching the consequences of the biomass regime settle on already-struggling communities.

I. "Suffer and Die": Community Experiences of Harm

Previous chapters laid out historical context and data on the origin, quantities and impacts of the pollutants generated by the biomass envirotechnical regime. This section focuses on how communities holistically experience the presence and operation of these plants, and while some articulations tracked with what was expected—an emphasis on health and quality of life impacts from dust and smog—others added social and psychological nuances. Disproportionate pollution burdens manifest most grimly in premature deaths, a pattern articulated plainly and repeatedly by community members in hearings, interviews, testimonies, and pleas, like the response of a minority health worker in an impacted community to questions about chronic health conditions:

> "The cases are escalating. You got children that had been diagnosed with asthma that are now adults that are still suffering. You have cancer— we have one of the highest rates of cancer in the state, and we have diabetes, heart disease, all these other health issues. People work in these [biomass] plants all their lives and retire, with no kind of severance, with no kind of health insurance, no 401k to take care of themselves, they just suffer and die."

At the center of residents' complaints is not inconvenience or nuisance, but death. The most vulnerable, children and the elderly, live and breathe near these plants. Senior care centers and churches dot the landscape well within sight and sound of the plants' plumes. Those who spoke at public hearings and in interviews offered deeply personal anecdotes backed up by data health impacts from known toxins, primarily PM 2.5, VOCs, HAPs, showing their systemic and disproportionate impact on people of color and other vulnerable populations.[180]

---

[180] Christopher W. Tessum "PM 2.5 polluters disproportionately and systemically affect people of color in the United States". *Science Advances* (2375-2548), 7 (18) (April 2021), 1.

Biomass industry defenses focused on their compliance with discharge limits, seeing their adherence to these limits as a source of pride and legitimacy.[181] But even if these statements accurately represented plant behavior (which Chapter 2 calls into question), communities do not see compliance as the key issue. The history of environmental justice reveals that often, the pollution levels and industrial patterns that create catastrophically unequal protection have been perfectly legal. This makes it difficult to mount challenges within current regulatory frameworks, and accounts for the lack of faith many impacted community members have in regulators—they'd never prioritized their health before, so why would they start now? Despite their lack of expectations that such participation would lead to the disruption of the biomass regime, many impacted community members submitted written comments and spoke at virtual Title V hearings concerning various permitting issues. At these hearings, those speaking in opposition focused on three main harms perpetuated by the biomass regime: public health impacts, deforestation and ecological harm, and broader climate impacts. Figure 1 depicts the relative amount of time each interviewees spent on these topics—it visualizes the extent to which different stakeholders focused on each dimension of harm, from Deforestation, Carbon Storage, Biodiversity, and more. The largest category, Community Experiences of Harm, are broken down into different dimensions including Economic Impacts, Impacts on Community, and Toxins Impacting Health. Biomass is unique among environmental justice concerns in that its impacts stretch beyond local embodied impacts to harm global ecosystems. Most if not all interviewees were conscious of both dimensions, even if they focused on one or the other; their lifelong dwelling and acute connection to the landscape allowed them to track changes in air and watersheds.

[181] Enviva, "Seeing the Forest: Sustainable Wood Bioenergy in the Southeast United States" May 2020. https://www.envivabiomass.com/wp-content/uploads/white-paper-seeing-the-forest.pdf

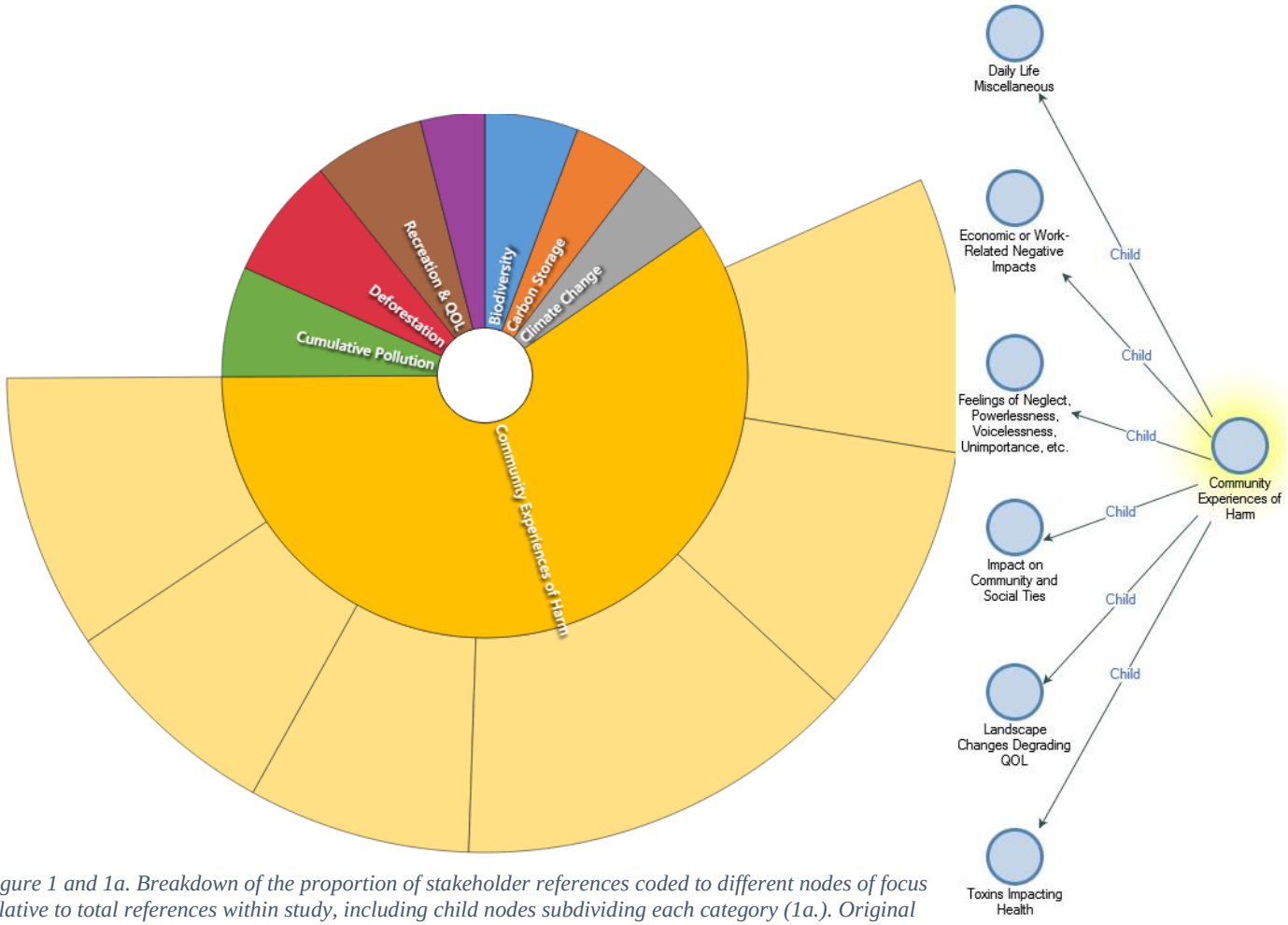


Figure 1 and 1a. Breakdown of the proportion of stakeholder references coded to different nodes of focus relative to total references within study, including child nodes subdividing each category (1a.). Original data from ethnographic interviews, coded and visualized with NVivo (Version 11).

The landscape is no stranger to logging, but locals nonetheless see a more damaging paradigm emerging. An interviewee connected to the timber industry who has ridden the "back roads of Eastern North Carolina for many years and being somebody [who] loves the woods, I'm so alert to clearcutting. It has accelerated hugely in the last five years." He attributes this clearly:

> "The wood pellet industry has driven this clear-cut logging to a huge degree. Some might have been cut anyway for saw timber, but if you cut only for saw timber, well, the woods will be messed up, but there wouldn't be any reason for to cut it all down to the ground. It might be a mess, but at least there would be some left. The sites clear cut around here, it looks like a giant lawn mower ran through. Everything's down to the stumps."

When replanting does occur, which my observations suggest is seldom, it is in uniform rows of skinny pine devoid of underbrush and plant and animal life. One landowner roused to biomass action by threat to his own cherished woods lamented, “You can't replant biodiversity, you know. It’s something that has to happen”. He offered me a list of the 40+ species of trees on his woodlot as an example of the main species, “and that's nothing compared to the fungi and everything else, you know insects and birds and so on, that grow there. We need more, putting the spotlight on what's really what's really being destroyed.” This harm is more than just the physical processes hindered by deforestation: Interviewees expressed grief for lost biodiversity and the previous richness of landscapes that sustained communities and recreators.

Biomass stakeholders link these clear cuts to other observed changes in the land, as one interviewee said, “Everyone knows these places are everywhere, that nothing's growing up there, all the sludge after a rain comes down the holler makes the creek gross and unhealthy.” For other interviewees, too, dramatic and disturbing weather events illuminate biomass and other polluters’ impacts on watersheds and ecosystems, as one advocate says, “the last couple of years, the algae blooms have gotten really bad,” confiding his suspicion that the clear cuts are at least partially to blame. A fourth-generation North Carolinian farmer and landowner concurs, stating: “water quality issues are most obvious when we have a big flood of things come rushing out of the farmland, the captive animal feeding operation [sic] waste ponds, and how long it takes that to clear out and the fish kills that occur from it. The wood pellet industry [doesn’t] make it obvious their impact on the water, but I know it is there.” He contrasted these changes with the thriving fisheries his ancestors relied on and his attempts at oyster watershed restoration.

These ecological changes, in the minds of stakeholders, are not separate from abstract climate impacts, but inherently interconnected. One interviewee, a teacher, retiree, and resident

of a vulnerable coastal community, after talking about how biomass makes “all the climate feedback loops worse,” described an anecdote where she attempted to attend public hearing and found the roads impassable due to tidal blooding, recalling being told “your car is going to have a foot of water in the bottom,’ so I left. I'm just constantly reminded, living in Wilmington, of the problem of flooding, and what trees mean for that, all the trees that are being cut down.” The threads of public health, ecosystem harms and climate change are of course, fundamentally interconnected. But they are not experienced on the same time scales and levels of urgency by all stakeholders, which has important implications for movement narratives, regimes, and dynamics.

In the hopes of understanding who participants are and what their priorities are, it is key to disaggregate and split apart these threads, identifying who is focused on what, and why. The public hearings, as mentioned in the previous chapter, often draw industry supporters as well as provide a platform for corporate performance and self-promotion. Conversely, they often, with the aid of advocacy organizations and activists, fill up with those recruited to put their opposition on record. The comments given are often adaptations from pre-shared talking points, tailored to a regulatory and media audience. Especially at a “call-in” virtual public hearing without video or any of the typical enriching ethnographic context, public hearings are limited in their capacity to get at positionality, causal threads, and other key nuances. Interviews illuminated stakeholder perspectives with more detail and nuance, as reflected in the figures: Figure 2 makes it clear that local impacts outpaced climate concerns and concerns about deforestation or biodiversity, but critically, the attention paid to each differ by stakeholder group.

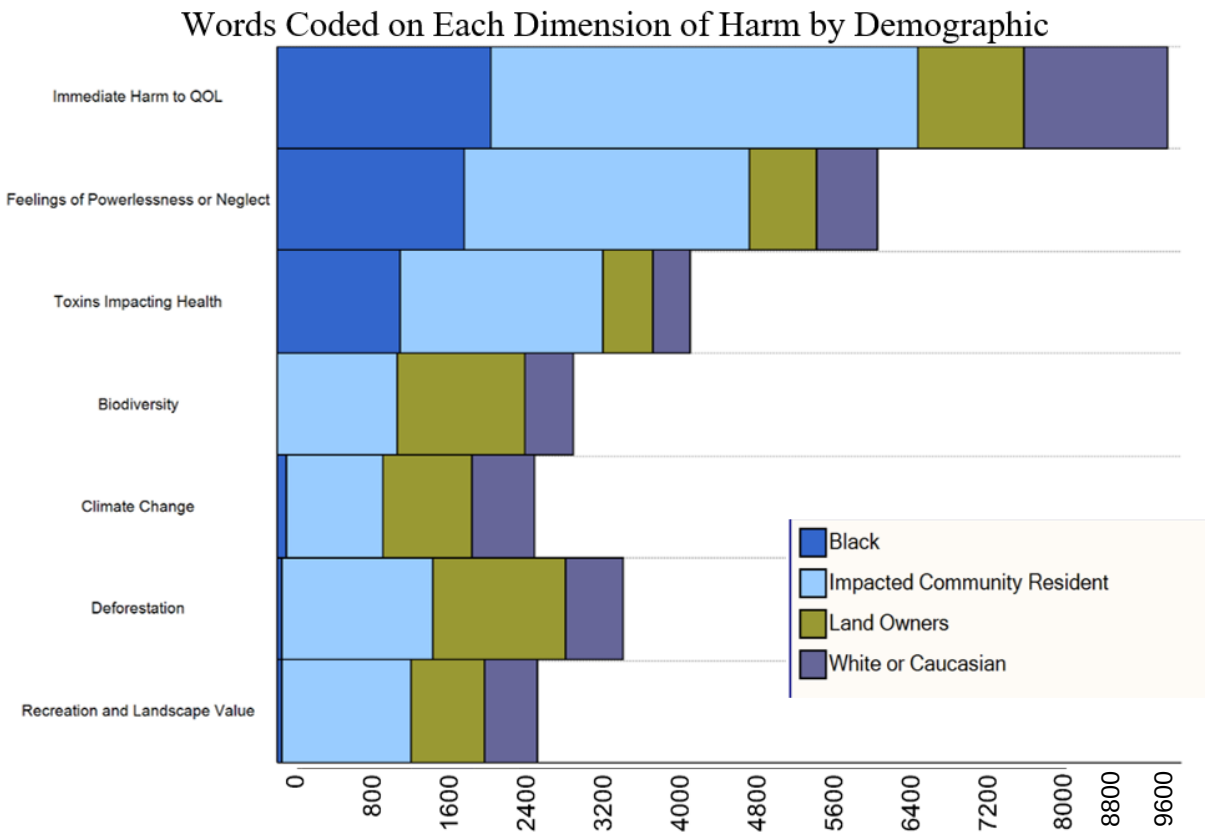


Figure 2. Words Coded to Each Key Concern Node, broken down by Demographic Category (generated from original interview data in NVivo (V.11))

The overlapping and imprecise nature of these demographic categories as well as my small sample size means that this analysis is not intended to be treated as quantitative truth. Still, it is important to note that these trends run in almost perfect inverse of one another: and BIPOC individuals and members of impacted communities mentioned harms and equity issues far more than other stakeholders; those on the ground talked about climate and deforestation comparatively less. Only members of impacted communities and non-white individuals mentioned equity impacts. Besides sharp divergences in focus of concerns, another key insight emerging from interviews was the disconnect between talking points and lived experience. Residents in impacted communities spoke emphatically about the hazard created by truck traffic, as an interviewee from Dobbins Heights, the historically Black community beside Enviva's Hamlet plant remarks:

> "There's a lotta truck traffic and noise, and dust, and chips falling off the trucks, because they don't have any covering on 'em, the chips are falling out, the dust's flying out and all the trucks, you know they burn diesel. All the smoke is coming out the pipes of the truck. They run 200 trucks a day, something like that. All that pollution, even the truck pollution alone, along with the dust and noise and all of that, at the same time."

Other interviewees corroborated this, as did my own observations of nonstop open-back and logging trucks going well over speed limits in school zones and residential areas. It is an impact area that for understandable strategic reasons, doesn't become talking points or the subject of lawsuits, but it is one of the most urgent areas people identify in which the biomass regime is harming their quality of life. It is also an impact area an outsider wouldn't think to assess.

Another key insight made visible by these interviews involves the consequences of repeated toxic burdens, facility sitings, and regulatory failures on social ties and emotional landscapes within communities. Strikingly, even more than people mentioned toxins impacting their health or changes in landscape they observed, they spoke about feelings of neglect and powerlessness. One interviewee living in a frontline community who works with a minority health initiative summarizes the psychological impact of a new plant's approval despite public outcry:

> "[It's about] the consistent way that they are putting these factories in our communities. Even in the year 2022, they're still doing the same thing. It has mentally impaired the community. Because they see that everything that they have worked for, that they have marched for, all these years and, here comes Effingham Pellets right at the center of their Black and Brown community in 2022. They're discouraged. They're tired. I have spoken with several residents from Effingham who attend church with me and they said we just don't have a voice anymore, because we have done this so long, and there is nothing changed."

This is an essential reminder that harms move beyond devastating impacts on bodies in vulnerable communities and ecosystems surrounding zones of extraction to reshape the way individuals relate to one another and to their systems of governance. Much like neglected coal towns, environmental justice communities feel that their exploitation and place on the periphery renders them outsiders to America and its promised prosperity and basic human rights.

II. "We have enough pollution already": Economic/Environmental Justice & Cumulative Impact

The psychological harms to these frontline communities are a product of the biomass regime, but also the myriad regimes of inequality and exploitation that enrich many industrial actors at the expense of areas treated as "sacrifice zones." A plant neighbor put it this way:

> "So this is the way it is down here: across the street from where I live is a railroad track. A little bit above is the CSX station, across the street is Enviva, and behind that the International Tie Disposal. So within a mile radius, we have those, plus Duke Energy plus Piedmont gas plus Dupont, Trinity Chemical Manufacturing. Six or seven impact industries and another one coming. So it's all those impacts put together."

These cumulative impacts go unaddressed, a trend exacerbated by citizens' lack of available leverage to challenge the status quo. Elected officials in rural struggling areas question, as one organizer puts it, "'Can I speak out against this industry bringing an economics benefit to my county?' It's an easy argument for representatives from urban areas to make when they're only seeing the negatives of that industry, not getting any of that that tax base." This acknowledges that elected officials in some ways are trapped—but their harmed constituents insist that doesn't excuse them failing their obligations to the people. One frontline community organizer describes being shut out by officials: "They didn't want to hear any presentation, any stats, they will not take any calls, the plan for the plant was already in place and there was nothing that we could do.

They refuse to even sit down with us to discuss what this plant and the impact on the Black and Brown Community. That's what concerns me, these *elected officials* did not want to hear us."

This willful blindness extends up to state and even federal levels, as an interviewee said, "Because it's taking place in Eastern North Carolina and any job in Eastern North Carolina is a good job, they're kind of hands off." Impacted communities on both class and racial peripheries bear the burdens of the biomass regime in exchange for promised economic benefit, and yet, as an organizer and interviewee explains, "these counties are still the poorest in the state. Industries have not changed that. In Northampton County, the poverty rate actually *increased* after Enviva moved in, and then you're looking at a landscape that's degraded to the point that it's going to make it less attractive for other industries to move in. There's these dwindling economic benefits over the long term. But I know that's a hard sell to make to people who need money and who need jobs now." Trapped in the calculus of short-term destitution versus long-term degradation, the choice to welcome the biomass regime may seem justifiable and rational. Many interviewees describe, though, that what jobs these industries provide, which they admit pay better than some others around, are so few in quantity and hazardous in quality that they simply are not worth it, as one community health advocate and plant neighbor states, "The fumes they spit, the risk that they are to the community for just 10 jobs! Those that work in these plants, they have histories of cancer. Brain tumors. All kind of health issues. So, what are you doing even for your ten workers? What kind of life span will they have, inhaling those fumes every day?". Others also challenge Enviva's theoretical employment numbers as inaccurately high and level accusations about their hiring practices prioritizing outsiders. Reviews on Indeed (26 one-star reviews and one five star one) help triangulate the accuracy of these complaints, excerpts from which follow:

> "It will chew you up and spit you out!"; "Being cussed out with extreme vulgarity"; "Slavery is alive here for all but the elite site leader and corporate chiefs" ; "Stay away, snake pit"; "they don't care about your safety"; "Terrible Culture/Toxic Environment"; "no job security at all"; "the environment is very dusty and you will be exposed to all byproducts"; "You all suck, and everyone knows it"; "KPI driven under the cloak of caring"; "They don't walk the walk", and "Management is terrible. Most supervisors aren't even in the same state."[182]

Of course, disgruntled ex-employees have reasons to represent things this way—these testimonies are yet another attempt to pin down the elusive and ever-unfolding biomass corporate regime. But the rates of unemployment in the target areas do not provide incentive for employee retention or the cultivation of mutually beneficial relationships. Concurrently, the marginality of the landscapes and polities where the biomass regime takes place allows for corporations and their allies in power to behave according to different, less stringent rules. The lengthy list of superfund sites and uncleaned, un-replanted clear cuts left to fester by the underfunded agencies or delinquent industries supposed to remediate them is par for the course, as one rural resident and economic developer commented: "when reclamation happens, people are very surprised. The expectation is the company will get away with it." That was certainly the case in Effingham, where another interviewee describes being so frustrated by lack of government action to assess hazards that her group took matters into their own hands:

> "We still have in this community condemned manufacturing plants, and we don't know where all that waste is going or what those buildings have inside. We counted, went around to all the plants no longer operating in Florence County, and it was about ten still had waste

[182] "Enviva Employee Reviews" Indeed.com, Accessed April 2022. https://www.indeed.com/cmp/Enviva/reviews

material inside. That's the reason we were so adamantly against Effingham Pellets, because of what was already here and what's still right here sitting in our neighborhoods."

These widely divergent degrees of protection from cumulative environmental impacts are hardly a surprising story. However, it is essential to locate biomass within this pattern, not as a divergent and exceptional "green neighbor" or a rising tide that lifts all boats, but as a continuation of the concentration of burdens on the most vulnerable. Notably, although global markets and even some environmentalists accept biomass regimes' claims to benevolence and renewable legitimacy, stakeholders on the ground wholeheartedly reject them.

III. "A Death Threat": Perceptions of Industry as a Dishonest Bad Actor

The only positive reference made to the industry in over ten hours of interviews concerned improvements they made after being required to do so by law. One plant neighbor summarized stakeholders' posture towards industry: "I view them as a bad company, as a death threat, because of all the pollution. I just wish they wasn't here. I view them as a destroyer, for taking our breath away, taking down all the trees, dust, less oxygen. It's a threat to the whole community and myself." Identifying Enviva within a lineage of exploiters despite their supposed green designation was a common thread, as one interviewee with climate ties remarked:

> "Everything [the industry] does is the best example we have of greenwashing, with all their advertising. Biomass has been a disaster from the get go and it's just appalling […]. Enviva is doing just what the fossil fuel industry did for years and years and years. They had the facts, they knew that burning fossil fuels was killing people and they continued anyway. That's exactly what Enviva is doing. And the emissions are worse than coal!"

Similarly, community members expressed that they were extremely unimpressed with attempts at performing responsibility through charity. The message seemed to be that Enviva could sponsor

all the Little League teams they want: As long as they continue to harm the community with their emissions and what an interviewee calls their "don't care attitude", they will never be viewed as a corporate good neighbor. There was similar scorn, cynicism, and distrust regarding their compliance: "[they say] this is a good intentioned self-reporting system. Yeah, brought to you by the same people that say pellets are made from twigs and fallen limbs. You think you're going to rely on those people to tell you the truth?" Dishonesty and profit-driven lack of concern for communities are at the center of activist perceptions of biomass—but is that how most people on the ground feel? And can these perceptions travel up supply chains and have real impacts on a billion-dollar market? A look at biomass social movement and organizing provides insights.

IV. "Way back to my Ancestors": Social ties, awareness, and resistance:

The conversation surrounding biomass is a conversation centered around community: it is the most mentioned organizing unit, highlighting the importance of stakeholders' strong connections to place. One interviewee began his answer on observed changes by saying "my connection with the woods and the forest goes way back to my ancestors," and all but one other participant expressed similar connections to place going back generations. Most people in hearings and interviews located the source of their legitimacy within their ties to the land and region— this "born and raised" identity seemed incredibly pivotal when juxtaposed with the polluters who come from away. My positionality as someone likewise "born and raised" in southeastern North Carolina (and the additional layer of connection, in some cases, of having previously interacted with interviewees as a representative of a trusted partner group), although not residing in a directly impacted community, created a higher baseline of trust and rapport than I believe would have been available to someone considered an "outsider."

Interviews also revealed that stakeholders' involvement in biomass activism came about through word-of-mouth recruitment and social ties. Every single interviewee describes hearing about biomass from a friend, neighbor, colleague, or nonprofit—at church, at a town hall meeting, from a nephew, cousin, or fellow PTA member. Members of the Southern Forests and Climate Coalition and the Concerned Citizens of Richmond County recounted how their groups, informal and volunteer-based, arose out of these connections. The history of this movement (or, potentially more accurately, these many place-based movements) is a history of conversations; 'I met x and x had talked to y who connected us to w and we all decided to do something about it.' People do not seem to spontaneously get involved with or happen upon the biomass cause. Knowledge among the general population, even those attuned to other environmental issues, is low (but advocates may soon change this; mainstream news coverage increased significantly even over the course of 2021). This tracks with my own experience—I grew up 45 minutes from a plant and less than three miles from the shipping domes, and didn't know biomass existed, let alone was being harvested, processed, and freighted in my backyard until 2021. The idea that the biomass and wood pellet industry is operating under cover of public ignorance is a theme many interviewees raise as a dimension of its injustice, as one landowner and forester comments:

> "The fact is that when you talk to people, they have no idea that this this is even going on, because it's taking place in such remote areas [and] we're all really used to the [timber] business in eastern North Carolina so it's not unusual to see logging trucks on the roads all the time, but if they were told where those are going I think a lot more folks would be anti."

An interviewee who lives less than a quarter mile from an Enviva facility described the plans for the plants as having come in "under cover of night," another said that when she knocked on doors in her community near Wilmington pellet storage facilities suspected to be emitting VOCs,

"half the people I talked to didn't know the domes were there, honest to God," let alone what was in them. But the idea that if only more people simply knew about biomass' exploitation, it would be solved, though resonant with many, has not been borne out, as an organizer commented:

> "At that time [2014], I was like, we're cutting down our forest to be burned for energy? This doesn't make any sense. No way anyone in their right mind can support that. Maybe naively, I thought, we just need to tell people what's going on, educate people, there's no way the industry can continue. Here we are, 8 years later and it's unfortunately continuing to grow."

Many see both initial lack of awareness and persistent lack of attention and action as a consequence of dominant attitudes toward the characteristics of the impacted landscapes and communities—what Janisse Ray describes as "among the mobile homes, junked cars, pine plantations, clear cuts and fields […] among the lost forests".[183] Regions already written off as "brownfields" by regulators thanks to other polluting industries, depopulating rural towns left behind by notions of the New South's progress, landscapes with no flashy recreational value and with electoral districts gerrymandered into stagnant and listless politics.[184] These cross-cutting issues of equity are difficult to untangle: the South as a region broadly being exploited by prosperous nations interested in greening their grids, all while that exploitation's consequences within the South itself are unevenly distributed along old fault lines of race and class.

How stakeholders viewed these dynamics, predictably, varied according to positionality: Black respondents were acutely concerned with the disproportionate impact of this industry on "Black and Brown communities," while other respondents couched talk of equity mostly in terms of class or region/place "southeastern North Carolina," or "struggling," "low-income," or "rural"

---

[183] Janisse Ray, *Ecology of a Cracker Childhood,* (Minnesota: Milkweed Editions, 1999), 4.
[184] Ibid.

towns. Still respondents expected these asymmetries in regulation, as one industry interviewee remarked on an out-of-state facility: “because they were in the Adirondacks, they had such strict air permits. [In this low-income community], it's a lot less strict than it would be in a national park, of course.” The “of course” is pivotal—many accept as natural or logical that different landscapes deserve (or at least receive) different levels of protection. This deserves interrogation, as does conventional wisdom that pollution is “worth it” for low-income people painted as willing or even eager to compromise their environment and quality of life for paltry benefits.

The idea of “shipping it off overseas” was the most frequent expression of this relationship. It’s effective rhetoric that has “caught on, used by various groups of stakeholders, from official messaging to casual conversation. This expression of outrage mirrors early pushback against timber trade, harnessing indignation and pride particularly present in rural areas and in areas that feel that enough has already been taken from them. But extractive regimes and cumulative burdens facing frontline communities were not the issues before the DEQ as they issued the verdicts allowing biomass expansion to continue at full steam.

V. Procedural Injustice: Experiences of Rulemaking and Participatory Processes

Three-hour-long public hearings stretching until after 9pm filled with technicalities, procedural detail, and minutia exhaust even professional policymakers. Still, over forty citizens attended each hearing I observed despite expressing huge frustration with them in other forums. One interviewee put it bluntly when asked about community consultation: “[NC]DEQ is supposed to oversee that. I don't think they do a very good job at all.” Another describes having such a disheartening experience that she has disowned the participatory process altogether:

> “We don't deal with [NC]DEQ. DEQ promise to help us, to help the group, they're supposed to be here to help the people. Instead, DEQ helps the plants, they help Enviva. And I called

> ‘em on this, and I told them they was liars, because they supposed to be helping the Community. But more over all, I think someone is getting paid under the table to push these stuff under our eyes. A lot of stuff is hid. The DEQ, they have these public hearings and meetings and we go to them, and we all complain, more complaints than not. And that’s what the little local community has to say, and other people come from outside, like Enviva and all them join in in the meeting, it's like the meeting is for Enviva. So DEQ just go ahead on and do the permits and everything, no matter what we say. They're really not on our side.”

At these hearings, there was a clear respect and friendliness between DEQ staff and Enviva and other industry representatives that failed to extend to community members. This pattern is understandably enraging for those who felt their lives were on the line and they were not being listened to. Worse still, statements were made which were either provably untrue or severely misleading, with no cross-examination, no questions, no way for participants to correct the record except by using their testimony to belatedly rebut their predecessors. Several citizens were cut off or muted in the middle of sentences when they ran over the two-minute limit. Notably, this only happened to layperson speakers, never to those representing corporations or nonprofits, who instead either successfully timed their comments to the limit or were given a warning and allowed to finish their thought. At the DEQ (North Carolina hearings), attendees who had not pre-registered were given the opportunity to comment once all registrants had finished; with DHEC (South Carolina), they were not. Most comments failed to meet the criteria that would render them “relevant” since only a few mentioned specific air quality indices. Fascinatingly, comments given by Enviva and other corporate speakers were also “irrelevant”, focusing on Enviva’s role in the community and their green image. Corporate speakers spent more “airtime” (300 vs. 50 words) on work with Habitat for Humanity than on fugitive dust

control, the actual focus of the hearing. This choice, despite their full comprehension of what is or is not relevant to DEQ permitters, reveals the regime's view of hearings not as checks on their power, but as spaces in which to perform compliance and social responsibility.

Regime actors recruit and "inform" supporters to effectively coopt these meetings. This is clear to observers when, as at the Northampton hearing, USIPA, Carolina Loggers Association, and Enviva all commented using the same statistics and language.[185] This practice of using others as spokespeople (what scholars and activists often call "astroturfing") extends to non-professional and industry groups as well. Six commenters belonging to organizations receiving Enviva donations invalidated others' concerns and cast complainers as ungrateful; some see this as being paid off to endure and endorse pollution. Actors' participation is rational, though divisive— a speech that costs them little, except perhaps the good will of their neighbors, in exchange for desperately needed funds. This pattern eerily mirrors the history of corporate towns, raising issues with corporations as public good providers, and the fault lines that arise in communities when economic and environmental justice are pitted against one another.

Thus, corporation garners praise and support in these public forums, and a battle of narratives ensues: is biomass a corporate bad actor or a 'good neighbor'? It depends on your vested interest. And, ultimately, within the regulatory context, it doesn't seem to matter: Despite their sharp divergence on other fronts, interviewees had strikingly similar views of the public hearings they participated in: better than nothing, but with no real impact on the decision to be made. When asked if she thought public hearings despite large turnout would stop the plant, one interviewee did not equivocate: "No. I appreciated the opportunity to voice our concerns and hopefully it will stop future plants like from coming to this area, but it was already a done deal, it

[185] NCDEQ Permit Hearing Transcript.

was already put in stone, so no." Another organizer with seven years of experience in the space confirmed this view: "The frustration for me is that public engagement doesn't seem to influence the outcome. Companies already have been offered grants from Commerce, counties have already approved facilities, and the public participation step seems to be an afterthought. However, we still organize to attend those meetings to be on the public record on opposing the industry." The utility of the participatory process was less an opportunity to intervene in a democratic system and more as an organizing flashpoint, a media draw, a way to at least enter grievances into the public record, even if nothing was to be done about them. The other identified merit of public hearings was as the basis for legal challenges:

> "The main thing that's happened out of that [public hearing participation] due to the good work of SELC and the Powell Environmental Law firm is to try to get the emissions in those air permits as well defined and as tight as they can be and hammer away on how the monitoring is done, and then, when there've been violations- and there have been at virtually every one of these plants- these good environmental lawyers can hold their feet to the fire. But we all have to write those comment letters and appear at the hearings so they know that we're there. In some cases, they would have issued permits without even having a hearing. But the SELC and others said hell no you're not, you're going to have a hearing, and during tough COVID times, you have to make it available online."

White respondents, men, and landowners were more likely to see their participation as impactful and their voices as important to elected officials, as Figure 3 demonstrates, though even these groups were circumspect about the participatory process, concurring with the majority that what was said in hearings was never going to override regulators' decisions. In a similar vein, Figure 4 displays that those occupying positions of racial, gender, or economic privilege

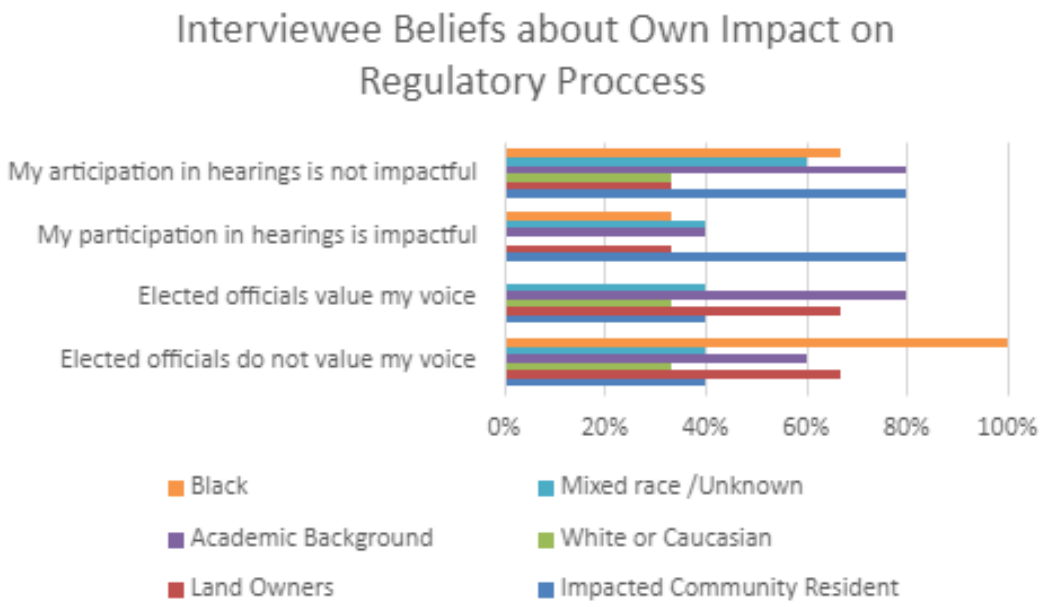


Figure 4 Bar Graph Displaying Percentage of Interviewees with quotes reflecting certain beliefs about their own impact on the regulatory process, created from original data in NVivo (v.11) and Excel (n = 9).

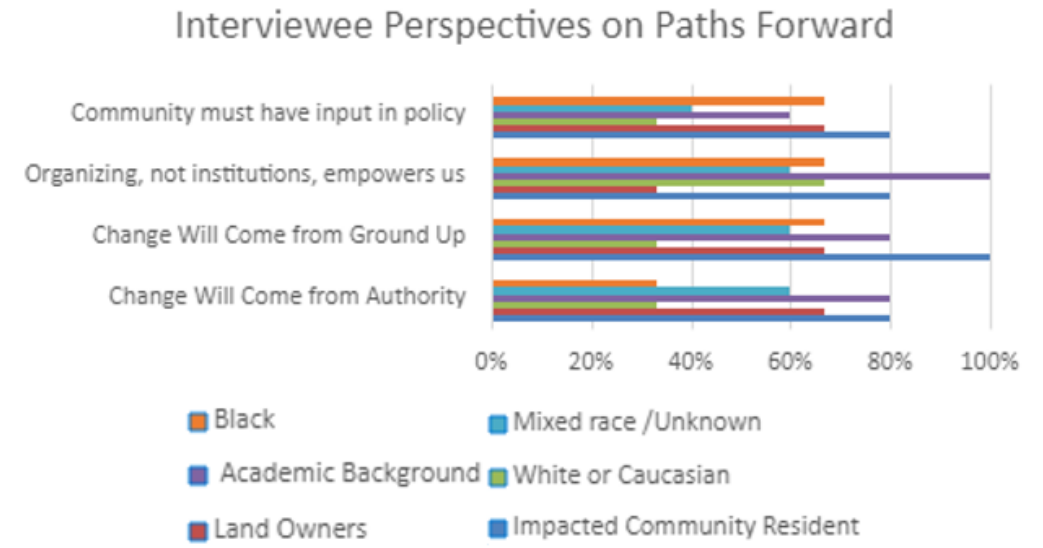


Figure 3 Bar Graph Displaying Percent of Interviewees whose interviews contained quotes reflecting certain visions for paths forward, created from original data in NVivo (version 11) and Excel (n=9)

were more optimistic about regulatory and institutional regimes being the source of change. Yet even traditionally powerful actors were dubious about the ability of long-defective structures to deliver a better future. Some hearing testimony was incredibly eloquent and moving, but possibilities for dynamism are severely limited by the structure of this participatory regime, as are the scope of the requests that can be made of those in power. In the hearing focused on the Enviva Hamlet facility's request to ratchet up production levels, organizers knew based on prior experience that permission was unlikely to be denied outright. Rather than solely asking for a denial of the permit (which was, as triangulated by interviews, the real desire of most stakeholders involved), they softened the demand by requesting the installation of fugitive dust controls as a minimum harm reduction. Those enacting resistance must navigate a landscape of strong emotions, hard

realities, and deeply flawed envirotechnical regimes. Institutions and regulations as they currently exist cannot stop biomass expansion; they will not make decisions that threaten plants' operations. But they do contain modest mechanisms for harm reduction and correcting the most grievous misconduct. One interviewee involved with frontline coalitions and nonprofits summarized the bargain:

> "Ideally, I would like to see all of these plants shut down, but realistically, I think what we can hope for in the shorter term is stronger pollution control, making the companies invest what they should be investing in protecting the community. At the local level there's a lot of room for Enviva to clean up their act and install stronger pollution and dust controls and, ultimately, I hope that political pressure against the industry starts to have a trickledown effect where it's not making sense for the industry to expand any more. I don't think [this strategy] is a long-term model, but I think it can do a lot of damage in the meantime."

At this hearing, this strategy meant rallying speakers around insistence that Enviva install fugitive dust controls—but even this watered-down demand did not stick. Regulators approved the permit expansion and declined to require any additional controls, citing compliance with existing regulations, a surprise inspection that did not observe dust discharges, and the lack of a "substantive complaint" about fugitive dust as rationale for their decision. This flies in the face of the perspective of stakeholders on the ground, who report cars and porches coated with dust. Many have called to report such incidences, which then leads us to wonder what exactly is considered a "substantive complaint"— quantifiable proof of the existence of dust? The Louisiana 'bucket brigades' provide precedent for this—knowing they wouldn't be taken seriously unless they could furnish proof of the toxins they believed were in their air, they

ingeniously jerry-rigged buckets to take readings of illegal benzene levels.[186] This may be what it would take, but it ought not to take massive mobilizations of citizen scientists for the lived experience of a community to be treated as substantive. Consensus about the reality of harms was also fractured by astroturfed commentary. The president of a community college system partnering with Enviva to fund its "training programs," derided other speakers as overly critical and inspired by outside environmentalists, stating of the nearby campus, "neither I nor anyone else at this college has made any complaint about any dust." Though carefully worded to avoid outright denial of such dust's existence, it is clearly intended to override others' claims. Whether or not the statement was coordinated with Enviva, it certainly benefitted their case.

I visited Hamlet on a clear day with a breeze and strove to avoid confirmation bias. Vacant agricultural fields without cover crops, the weak, sandy soil of surrounding pine plantations, emissions from nearby plants- all of these could contribute to or cause the appearance of dust that I began to see as I drove closer to the plant. But observing piles of uncovered, unenclosed woodchips refuse, and what I can only describe as dust, attributing the vague tinge in the air to any other source seemed like a stretch. The cars parked in Dobbins Heights and especially those in the driveways of houses beside the plant had a thin coating of dust over them. The inspector, according to the DEQ record of the event, arrived at 9:30 am and spent only about an hour observing, a strategy which seems unlikely to entirely rule out the possibility of problematic emissions, especially in light of the fact that, as one interviewee puts it, "everybody knows they do that [referring to the release of dust] at night". The DEQ certainly doesn't seem to know another thing that "everybody" knows, which is that Enviva's pollution isn't the only thing

[186] Conrad Schneider, conversation with the author, December 2022; Louisiana Bucket Brigade, "History and Accomplishments", https://labucketbrigade.org/about-us/history/

clogging the air in Hamlet. Regulation at the permitting stage is inherently— and some argue, unavoidably— siloed off in its nature: that is, apart from certain ambient air quality compliance requirements, it considers potential new sources in isolation. Enviva's increased emissions may not bump the EPA monitor up the road in Clinton out of compliance and prompt remediation; On their own, they may not trigger major source thresholds. But they contribute to a cumulative environment driving health indices below state averages, where interviewees have witnessed worsening rates of asthmas and cancers in their professional and personal lives. Violating Title VI as well as government's moral obligations, enabling biomass further concentrates the worst health outcomes in landscapes equipped with the least conventional resources to deal with them.

They constitute a miscarriage of procedural justice. But even beyond this, these hearings and the entire framework in which they operate feels useless and futile to stakeholders on the ground because they contain no mechanism to check these plants' operations for the commonsensical reasons that they are unjust and cause harm. All action hinges on thresholds determined by static cost-benefit analyses and monitored at stations in different neighbors and narrow definitions of compliance that provide industry with a ready and ironclad defense. The current regulatory regime's rigidity and limited ambition are, in this context, critical shortcomings. For a rule-making body that truly prioritizes public health, if compliance with existing regulations still generates harms, then not only is corrective action still required, but the entire regulation ought also to be subject to overhaul. Participants in these hearings know this to be true and call upon rule-makers to make it so despite the constraints of structure. Acutely aware that fact-based appeals are futile, many attempted to sway regulators by appealing to their humanity instead, addressing them "as individuals that took an oath to serve the people", sharing stories of loved ones lost to illness, framing their decision in terms of human cost, as one participant told DEQ

staff, [if you grant this permit], “you are in violation of a moral principle to do no harm, you will be legislating suffering”. These are striking rhetorical strategies. But is it humanity that writes permits? DEQ actors themselves often operate with hands tied— by regulatory capture, by the text of air quality regulations, by the decisions already made by zoning or county commissions.

Many stakeholders enter these participatory spaces with an awareness of these damning loopholes, or at the very least, an acute sense of unfairness and futility. Especially those who subscribe to narratives of a government that serves its people, it seems like the demonstrable truth of the following comment alone would be grounds for denial: “burning wood for fuel is killing people. it’s that simple. it’s wrong. this facility, no matter its size, will contribute to the premature death of people in our community.” But that premature death is deafeningly absent from any of the dozens of permits — every single one of which, even those sought by the worst violators in the industry, has been approved without even a single modification or concession.

VI. Grassroots power and opposition movement formation

When the institutional channels for pursuing change are unacceptably narrow or blocked entirely, stakeholders will turn to other forms of power and action. Organizing around spaces outside of state control aligns with the dynamics of the coalitions involved in resistance to the biomass regime. Word of mouth informal recruitment in community spaces like churches, clubs, and more, as well as unifying place-based emotions cultivates a network of strong and weak ties with high levels of trust between members. Groups contributing insights to this work (notably, the Concerned Citizens of Richmond County, the New Alpha Community Development Group, the Southern Forests and Climate Coalition, and the Whitney Bunts Foundation) are composed of friends, neighbors, coworkers, ministers and congregations, entrepreneurs and caregivers, and as multi-issue groups, many center issues of racial and economic as well as environmental justice.

They consciously avoid adopting NIMBY attitudes towards facilities and instead locate biomass' unjust conduct within broader systemic issues coalescing to oppress BIPOC, low-income, and rural communities. Small, largely-volunteer coalitions are enriched by deep commitment but challenged by the limited capacity of many members, working individuals with obligations to families and community work. Collaborations with larger nonprofits in this advocacy space aim to provide resources in order to amplify voices on the front lines, allowing informal coalitions to become vocal spokespeople from firsthand experience, their legitimacy and credibility backed by traditional powerful actors (notably, here, the Southern Environmental Law Center, the Center for Policy Integrity, and Dogwood Alliance). If carried out ethically and conscientiously, this model may help to bridge critical disconnects and lead to more policy and narrative victories.

These coalitions hold demonstrations and forums, media and informational campaigns, seeking to raise consciousness and correct the public record. They've succeeded in forcing errors and generating bad press for corporations like Drax and Enviva, as one organizer comments: "when I began working on biomass, they were really selling themselves as using waste wood. That has completely changed. Now when you look at Enviva's own sourcing information, they have been forced to admit that they are primarily logging whole trees to be burned for energy." Interviewees in this work have told their stories to the New York Times, CNN, the Charlotte Observer, the Guardian; their advocacy in Robeson County has caused London-based Active Energy Renewable Power (AERP) to abandon their planned facility despite a permissive regulatory regime and a half-million-dollar state grant, a victory attributable to grassroots effort from within the impacted predominantly Black and Indigenous community.[187] Despite being shut

[187] Melba Newsome, "Active Energy Renewable Power Pulls Up Stakes in Robeson County", The Coastal Plains Environmental Advocate, March 31, 2022

out of a meaningful participatory process, these stakeholders continue to advocate in fierce and ingenious ways to protect their communities, simultaneously pushing for a livable global future.

VII. Divergences, challenges, and possibilities:

This chapter has sought to identify stakeholders and amplify their voices, acknowledging the importance of honoring local knowledge and lived experience as a dimension of procedural justice. There are no monoliths here, but some major threads and their implications bear examination: It is helpful to think of stakeholders in terms of two loose groups, first, the "near neighbors"— those who live within the impact range of these plants' most immediate consequences, such as PM 2.5 emissions, noise pollution, and truck traffic. These groups bear the brunt of the health and psychological impacts. Other stakeholders, "far neighbors," are also North Carolina residents, and are also directly impacted by biomass, albeit in a different, less acute way: they live near the clear-cuts, witness the landscape as it changes, experience biomass' pressures on landowners, feel the consequences of deforestation, watershed degradation, and the harder-to-quantify broader air quality concerns that travel across the state. Of course, all parties feel the impacts of the climate crisis— of heat waves, of droughts, and of worsening hurricanes that wrack the state. People care about the issues that touches their lives most immediately; It is intuitive that near and far neighbors respond to biomass differently. But for those seeking to mount powerful broad-coalition resistance, it is also critical to create solidarity between them.

When they convened on biomass, Chatham House's UK-based collection of scholars and fiercely focused on IPCC rulemaking and carbon capture schemes, devoting a few minutes only to on the ground pollution impacts. The IPCC was never even mentioned in these interviews. It was only mentioned once in over ten hours of hearings— by Enviva's Head of Sustainability in defense of their green image. Climate was more prevalent in hearings, mentioned by a quarter of

commenters— but it was baked into the comments advocacy groups like Dogwood Alliance and the Southern Environmental Law Center helped prepare, so this isn't the best barometer of actual priorities and beliefs. In interviews without talking points, climate was almost an afterthought, mentioned only 11 times (for context, other types of community impacts numbered in the hundreds), with focus varying sharply between different groups, as displayed in Figure 5.

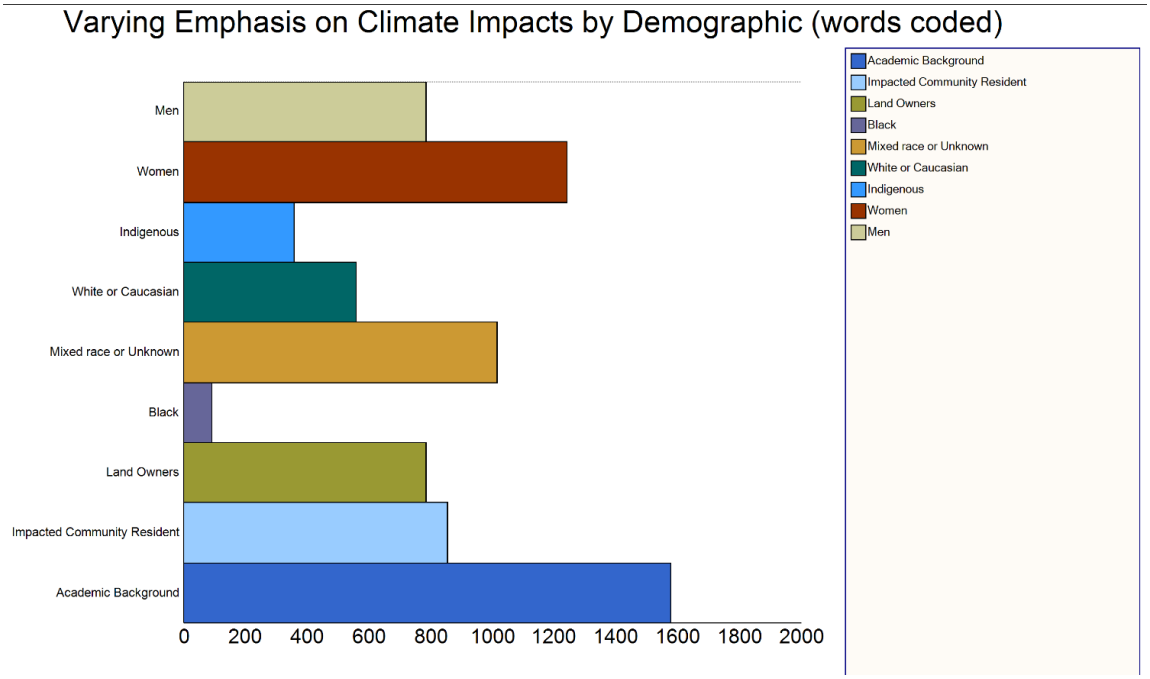


Figure 5. Amount of words coded to climate impact nodes for all interviews within each demographic group, some of which overlap, visualizing emphasis variation between different groups of stakeholders. Original data from interviews, figure generated in NVivo (Version 11)

This snapshot of the amount of words coded in one focused conversation is presented not to claim that people of color or impacted community residents do not care about climate; on the contrary, on issues of decarbonization and government action these groups often display even greater concerns than their whiter or more protected counterparts.[188] But what rises to the fore is a disconnect between the priorities of academics and other policy powerholders and those experiencing the more immediate consequences of this regime. Attention to this disconnect is crucial, especially since biomass does not force a choice between repairing local harms or

[188] Neil Lewis Jr. "Why Many Americans Underestimate Who Is Most Concerned About The Environment", Five Thirty Eight, November 2021, 5.

addressing the climate crisis— it is a rare and pivotal case where the two goals align, so movements must not splinter themselves. Chapter 1 relayed how resistance to coal was testament to the pitfalls of perceiving frontline communities as self-interested, or, when they do speak out, as unideological, limited in their aims.[189] But this lacks nuance—just because communities must keep their jobs to put food on the table does not mean they are blind to broader impacts. Foregrounding climate in anti-biomass messaging is a savvy tactic by activist-academics to enlist a broader group of stakeholders and transform a local fight to a global movement. But on the ground, when stakeholders worry about asthma attacks or trucks barreling into parks, about plant fires or rising property taxes or a loved one developing cancer, is it any wonder that their demands have nothing to do with carbon?

Those who speak out already risk much. They risk losing corporate donations to their charities, risk already-slim shots at a job at the plant, risk angering their neighbors who make their living as part of the industrial economy, not because they want to work amidst suffocating dust and constant grinding, but because it is better than the alternative of not having a job at all. They have been let down and locked out of the modest benefits of current efforts at transition—the barbed wire around solar panels speaks to that. Their choices are limited, their ability to push back is limited, by circumstances shaped by systemic oppression. This extends up to elected officials and planners who are misled by corporations or whose revenue-desperation sidelines green ethics, and who refuse to hear their own constituents, even competing to welcome plants. Carbon accounting rhetoric will not make much of a difference to this fundamental calculus. Within the current flawed system, many believe all that can be done is to ratchet up costs until producers' bargain becomes a rotten one. But in the meantime, as lawsuits and hearings churn

---

189 Dan Charles, **"**Europe Is Burning U.S. Wood As Climate-Friendly Fuel, But Green Groups Protest" *NPR Morning Edition*, December 2019

on, so do the grinding, spewing plants—and so do the raised voices of those mounting their courageous opposition, occasionally managing, despite the odds, to bring them to a grinding halt.

Conclusion: Envisioning Alternate Futures

Injustice mars every step of biomass' life cycle and supply chain. From the razing of less-protected forests and pineries of the rural South to feed the plants, to the siting of those plants in environmental justice communities, to the burning of the ultimate product which profits wealthy nations while contributing to ever-worsening and asymmetrical climate impacts. The regimes which built and maintain this paradigm, too, are permeated by inequity—lack of procedural justice and disregard for the lived experiences and insights of those in frontline communities. Through markets, hearings, subsidies, and many other mediums, powerful entities push a portrait of biomass that is clean, green, ingenius, and benevolent. Through storytelling, direct action, institutional channels and grassroots organizing, those on the ground reject that narrative.[190]

No matter what draws them to the local and globally networked biomass fight—whether it's threats to the lands of their ancestors, whether it's their own health, the health of loved ones or solidarity with those on the front lines— those involved do not tend to equivocate. Burning trees for fuel, they say, is ridiculous, unacceptable, and damaging. They engage in the regulatory game of harm reduction when necessary (for example, commenting to support fugitive dust collection, or pressing already-operating companies to be marginally better neighbors) but in informal arenas and on the streets, their wishes are clear: the industry dismantled and held accountable for its deceptive and exploitative conduct. When asked what a better future for her community would look like, one resident put it plainly: "That looks like Enviva gone. Some of the other ones, too, but Enviva─ that's who's to blame, and it makes it better, if they are gone."

The mechanisms stakeholders identify for achieving this vary. Some (those who estimated their power and the importance of their voices to decision-makers more highly), see a path within

[190] Adel Alamo. "The Biomass Baddies Failing Forests, Climate, And Justice", *Dogwood Alliance,* March 21, 2022

the existing regulatory framework: subjecting the industry to NEPA review, stricter review processes, altering timber severance taxes. The most frequently cited institutional solution is ending or altering subsidies—stopping government support for biomass and redirecting funds towards protecting ecosystems, as one interviewee says: “we need subsidies to keep land in forest. God knows we subsidize everything else!” However, many are skeptical about paths forward through existing codes, as one interviewee notes, “there already are laws, but so many of them are being flagrantly ignored or somehow beaten through a loophole.” Exceptionalism —the perception that somehow the marginal landscapes of Southern Appalachia and the Black Belt are exempt from protections guaranteed all Americans—is still alive and well.

Some see exposure, transparency, and citizen monitoring as a potential antidote, as one interviewee insists: “Enviva should allow the public to at least go through the building, check the filters, the pollution control model— they should give us permission to at least do that, even though we don't want them here. They became a dangerous neighbor. So they should give us a chance at least to come in and see what they really all about. I don't think it's fair we can't check to make sure that they’re doing right by us.” Others echo this for sourcing, emphasizing the secrecy and inaccessibility of clear cuts, calling “for the public to have access to land that has been cut.” Most stakeholders, though, acknowledge that awareness is not enough. They call for new mechanisms to integrate their knowledge and priorities, oversight, review committees, or just being heard by those supposed to represent them: “Before you sit down with builders, you need to sit down with the Black and Brown community and listen. Go to cities that already have plants, talk to the residents. Put policies in place to address their concerns.” Interviewees insisted on centering community knowledge; with outside activists “here six months and they're shocked,

they had no idea, but if you are raised in a place, outside all the time, in the water all the time, you know what it was like and what has happened here. Get in touch with those people."

The consequences of this regime as described here indicate a need for change on two levels— both the immediate physical level, through alleviating the pollution burdens of biomass in impacted communities, and the broader systemic level, through subjecting a siloed-off, equity-blind regulatory framework, which despite participatory mechanisms, ignore the voices and experience of the most vulnerable stakeholders. When stakeholders on the ground talk about dust, regulators say they only regulate PM 2.5. Academic use terms like 'regimes of inequality' and 'regulatory aversion' to articulate the very same thing community members say when they express frustration that after all these years of fighting for justice, corporations like Enviva keep dumping, and no one stops them. The gap between lived truth and what regulators and academics take seriously is not merely a curious puzzle. It is a pivotal shortcoming of our systems of knowing and shaping community destiny. It creates a vicious cycle where civic-minded individuals attempt to participate, then, feeling disempowered and ignored, withdraw from the frameworks, leaving them farther from truth and from serving people over corporations.

Many of the actions, protests, and demonstrations against biomass sitings in predominantly Black communities used language echoing that of Black Lives Matter protests sparked by Eric Garner's murder at the hands of police, holding signs and chanting "we can't breathe." By using this language, they locate the biomass regime's assault on their environment and lung tissue along a continuum that also contains police brutality, racist profiling, and more— suffering and wrongful death driven by systemic racism and inequality. Rather than being an isolated incident to be handled via regulatory frameworks, permits, and hearings on a case-by-case basis, stakeholders identify biomass as one manifestation of a larger problem— a system that treats

communities as disposable, resources as there for the exploitation, and profit as power. Activists draw on a deep well of strength used for generations to resist racism, inequality, and exploitation, but they also run up against the same punishingly durable barriers to change.

There are innumerable polluters operating in frontline communities; there are many new methods of power generation that make up a larger part of the grid mix. Why, then, does biomass matter? The climate policy answer is that a haphazard, ill-informed transition predicated on misleading and inaccurate data endangers not just the profits of stakeholders, but the world's ability to combat the existential threat climate change has already begun to pose. Biomass further serves to reveal the cracks and inadequacies of our current system of regulation. As a Supreme Court case debates the ability of the EPA to even regulate carbon dioxide, multi-modal and multi-scalar polluters like biomass, difficult if not impossible to track all the way through their supply chain (especially with dishonest producers intervening and obscuring) challenge regulatory paradigms, carbon accounting frameworks, and life cycle analyses. It raises questions about what constitutes a way of powering our society considered renewable, how "green" statuses are earned or exploited. It could be viewed as a case study, a textbook wicked problem, a sort of parable. But it also must not be sterilized as hypothetical when the reckoning is here and now. It is a reckoning both with the solar panels and smokestacks rising above cotton fields, neither of which have alleviated the systemic inequalities contributing to the hardships of the people who live in the dilapidated mobile homes across the street. The landscape of the South is rife with contradictions, which is both challenge and rich ground from which to imagine something new. We have failed in many key ways thus far, but that does not have to be the final verdict. It cannot be. The forests and people of the South are not mere fuel for the world's wealthy to grow even more so. To keep the lights on at their expense would be entrenchment of a

fundamentally broken system due for eventual collapse. This path is not yet locked in: The possibility and the responsibility to free ourselves from the extractive paradigm faces us now. And it is of enormous consequence not just for the near and far neighbors of these plants, but for us all: as Adel Alamo, organizer with Dogwood Alliance, put it: "Losing a forest may be a local issue, but burning a forest is a global one."[191]

The IPCC's Working Group III's April 2022 report, in a departure from its 2018 conclusions, walked back their high reliance on BECCs for mitigation scenarios, deemphasizing carbon capture technologies and other technocratic solutions and seriously speaking to their risks and uncertainties. With more input from social scientists than ever before, the report also looked to center low-demand pathways, critically engaging with myths perpetuated by energy companies about fuel's linkages to progress, poverty alleviation, and just futures. What people demand, the report emphasizes, is services—not primary energy or resources in and of themselves. So, if those needs can be met in ways that do not require combustion, then the "demand" for fossil fuels doesn't exist at all. On the demand side alone, the IPCC states with high confidence that strategies that either avoid or shift demand or improve efficiencies can reduce 40-70% of emissions across all sectors while attaining a decent living standard for all people.[192] Environmental economist Julia Steinberger, a contributing author to chapter 5, emphasizes the falseness of this assumedly imperative link between economic growth and demand: "As soon as you start questioning it, you realize that it's a god with clay feet. That you can actually do a lot

[191] Alamo, "The Biomass Baddies" 4.

[192] Creutzig, F., J. Roy, Devine-Wright, J. Díaz-José, F.W. Geels, A. Grubler, N. Maïzi, E. Masanet, Y. Mulugetta, C.D. Onyige, E. Perkins, A. Sanches-Pereira, E.U. Weber, 2022: Demand, services and social aspects of mitigation. In IPCC, 2022*: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.007

better with a lot less. There's nothing preventing us from doing a lot better and using a lot less, including resolving poverty and deprivation around the world."[193]

The "nothing" preventing us is comfort, politics, and inertia—the same nothing that is driving forward a new proposed biomass plant in Adel, Georgia, which would result in the clearcutting of 32,000 acres of forest in surrounding states every year, and generate 2.4 million tons of carbon dioxide annually –the equivalent of 473,000 more cars on the roads every year— to furnish European "demand" which could be satisfied by innovation, efficiency, and reduction while creating co-benefits and without even a single tree burned or case of asthma worsened.[194] This is the counterproductive trap the world risks falling into as we look to energy transition: innovating within old systems without acknowledging the harms that come not just from physical carbon molecules, but from the set of extractive relations that shape and maintain a spatially unjust world. The answers to countering biomass' rabid growth and its devastating consequences are at once very complicated and very simple. They would mean a refashioning of our set of relations with the land, with energy, with one another, an ambitious, comprehensive, actual transition. And at the most basic level they would mean this: no more.

It is an old call, and one that has yet to come to fruition—but the shoulders on which those who resist biomass stand may make all the difference. The iterative learning of generations of inhabitants of these marginalized landscapes and communities—the woods workers, coal mining unionists, Warren County activists, mountaintop removal demonstrators, Black Lives Matter advocates, Indigenous riverkeepers and water defenders, and mutual aid networks— needs to be

---

[193] Amy Westervelt, "Debunking Demand (IPCC Mitigation Report, Part 1) IPCC Mitigation Report 2022 Analysis —Part One: Debunking Demand, an Ode to Chapter Five." *Drilled* by Critical Frequency, April 5, 2022.

[194] dogwood vicki data

valued and recognized. The story of Southern forests and communities is not and cannot be one of passive helpless landscapes being subjected to dumping and exploitation, but of ingenious and resilient communities doing what they can with the tools available to them against power structures that are all too durable. Their courage and contributions cannot be discounted and must be carried forward; as one interviewee articulates: “The young people need to get more involved with environmental justice and climate change. The elders are the wisdom, but the young people are the energy and the strength. Everybody get involved, research, be part of a commission, be part of a board, anything that gets your voice heard and let's shut it down”.

From the mire of uncertainty, the voices of those on the frontlines and their devoted allies within institutions of science and education make their call clear: Correcting the record on biomass, removing the “carbon neutral” designation that drives its growth and gives it license to pollute, and by doing so, finally acting according to the lived wisdom of impacted communities, respecting their right to self-determination, hearing what they ask for: A voice, for healthy air to breathe, for an economy that doesn’t sacrifice their well-being, and for standing, thriving forests—and not as fuel.

WORKS CITED:

Abt, Robert, Karen Abt, Frederick Cubbage, and Jesse Henderson.“Effect of Policy-Based Bioenergy Demand on Southern Timber Markets: A Case Study of North Carolina.” *Biomass & Bioenergy 34 (12)* (2010).

Alamo, Adel. “The Biomass Baddies Failing Forests, Climate, And Justice”, *Dogwood Alliance,* March 21, 2022

Ambrose, Jillian. “Drax dropped from index of green energy firms amid biomass doubts”, *The Guardian,* Oct 2021.

Anderson, Patrick and Keri Powell, “Dirty Deception: How the Wood Biomass Industry Skirts the Clean Air Act” *Environmental Integrity Project,* http://www.environmentalintegrity.org/wp-content/uploads/2017/02/Biomass-Report.pdf (April 2018)

Biomass Energy”, *National Geographic Encyclopedia Resource Library, l*ast modified September 2022, https://www.nationalgeographic.org/encyclopedia/biomass-energy/

Booth, Mary S. “The Great Biomass Boondoggle”, *The New York Review,* (Oct 14, 2019)

Booth, Mary S. “Status of amendments that would force EPA to treat bioenergy as carbon neutral, and the urgent need for legislative opposition”, *Partnership for Policy Integrity*, (June 2016)

Booth, Mary, and Leuenberger, Brett.“The Bioenergy Boom from the Federal Stimulus: Outcomes and Lessons”, *Partnership for Policy Integrity*, Oct 2018. https://www.pfpi.net/Bioenergy-and-the-Stimulus-Oct.pdf

Boraks, David. “Enviva plans to double production as it lands its first U.S. deal”, *WFAE,* Jan. 2022,

Boraks, David. “NC’s growing pellet industry fuels climate debate”, *WFAE*, Jan 2021, 3.

Boyd, William. *The Slain Wood: Papermaking and its Environmental Consequences in the American South, (*John Hopkins University, Baltimore, 2015).

Brack, Duncan. “Woody Biomass for Power and Heat: Impacts on the Global Climate” *Chatham House* (Environment, Energy and Resources Department, February 2017).

Camp, Micheal. *Unnatural Resources: Energy and Environmental Politics in Appalachia after the 1973 Oil Embargo,* (University of Pittsburgh Press, October 2019)

Charles, Dan. “Europe Is Burning U.S. Wood As Climate-Friendly Fuel, But Green Groups Protest” *NPR Morning Edition*, December 2019

Costanza, Jennifer, Robert Abt, Alexa J. McKerrow, and Jaime A. Collazo. “Bioenergy Production and Forest Landscape Change in the Southeastern United States.” *GCB Bioenergy 9* (5) (January 2017), 924.

Creutzig, F., J. Roy, Devine-Wright, J. Díaz-José, F.W. Geels, A. Grubler, N. Maïzi, E. Masanet, Y. Mulugetta, C.D. Onyige, E. Perkins, A. Sanches-Pereira, E.U. Weber, 2022: Demand, services and social aspects of mitigation. *In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.007

Dater, Alan, and Merton, Lisa. "BURNED: Are Trees the New Coal?", 2017, *Marlboro Films, LLC.*

Davis, Sam. *Treasures of the South: The True Value Of Wetland Forests,* Keylog Economics and Dogwood Alliance, (January 2020), 32.

de Puy Kamp, Majlie. "How Marginalized communities in the South are paying the price for 'green energy' in Europe", *CNN,* July 2021, 1.

Donnison, Caspar, Robert Holland, Astley Hastings, Lindsay Armstrong, Felix Eigenbrod, and Gail Taylor. 2020. "Bioenergy with Carbon Capture and Storage (BECCS): Finding the Win-Wins for Energy, Negative Emissions and Ecosystem Services--Size Matters*." GCB Bioenergy 12* (2017), 586.

Environmental Protection Agency, "Title VI and Environmental Justice", https://www.epa.gov/environmental justice/title-vi-and-environmental-justice#titlevi , accessed on Feb 6, 2022.

Enviva Gives $250,000 Endowed Scholarship For Nation's Largest HBCU", *Black Enterprise,* March 30, 2022.

Enviva, "Home", and "About Us", accessed April 28, 2022. https://www.envivabiomass.com/

Enviva, *Seeing the Forest: Sustainable Wood Bioenergy in the Southeast United States.* May 2020.

"Enviva Employee Reviews*" Indeed.com,* Accessed April 2022. https://www.indeed.com/cmp/Enviva/reviews

Fraver, Shawn, Amy Milo, John Bradford, Laura Kenefic, Chris Woodall, and John Brissette. "Woody Debris Depletion Through Decay: Implications for Biomass Carbon Accounting*." Ecosystems 16* (7): (2015) 1262

Galik, Christopher, and Abt, Robert. "Sustainability Guidelines and Forest Market Response: An Assessment of European Union Pellet Demand in the Southeastern United States." *GCB Bioenergy 8 (3)* 2016.

Harris, Rosalind and Hyden, Heather. 2017. "Geographies of Resistance Within the Black Belt South." *Southeastern Geographer 57* (1).

Henry, Laura. Personal communication to the author, March 7, 2022.

Ho Kim, Yong et al., "Mutagenicity and Lung Toxicity of Smoldering vs. Flaming Emissions from Various Biomass Fuels: Implications for Health Effects from Wildland Fires," *Environmental Health Perspectives.* 126(1) (Jan. 2018).

International Renewable Energy Agency. "Biomass for Heat and Power Technology Brief", published by the *Energy Technology Systems Analysis Programme (ETSAP),* of the International Energy Agency, 1-21.

Ketcham, Christopher. "Forests to Burn: The biomass-energy industry is a climate and environmental justice disaster", *Sierra* (Sierra Club, Jan/Feb 2021).

Koester, Stefan, and Sam Davis, "Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States", *Environmental Justice,* V11, No 2, (2018) 1

Lewis, Neil Jr. "Why Many Americans Underestimate Who Is Most Concerned About The Environment", *Five Thirty Eight,* November 2021, 5.

Louisiana Bucket Brigade, "History and Accomplishments", https://labucketbrigade.org/about-us/history/

Marshall, Suzanne. '*Lord, We're Just Trying to Save Your Water': Environmental Activism and Dissent in the Appalachian South*. (Gainesville: University Press of Florida, 2002), 17.

Mittlefehldt, Sarah. "Wood Waste and Race: The Industrialization of Biomass Energy Technologies and Environmental Justice" *Technology and Culture.* (59 (4), 2018) 875.

Montrie, Chad. *Making a Living: Work and Environment in the United States*. (Chapel Hill: University of North Carolina Press, 2008) 12.

Moomaw, Bill, and Booth, Mary. "Should we get our electricity by burning trees?" Lecture at Williams College, Jan. 2011, Accessed March 2 2022, https://sustainability.williams.edu/files/2011/02/BillMoomaw-Biomass.pdf

Moomaw, Bill. "Myth of Carbon Neutrality of Biomass", Report to the Intergovernmental Panel on Climate Change, January 2011, Accessed March 23, 2022. 3.

NC Department of Environmental Quality, Division of Air Quality, Public Hearing on 6/28, (transcript accessed online on February 21, 2022). 1:21:45.

Nepal, Prakash, David N. Wear, and Kenneth E. Skog. "Net Change in Carbon Emissions with Increased Wood Energy Use in the United States." *GCB Bioenergy* 7 (4): (2015) 820.

North Carolina DAQ, "Application Review for Enviva Pellets Northampton Permit No. 10203T06".

Okie, William Thomas. *The Georgia Peach: Culture, Agriculture, and Environment in the American South,* (Cambridge Studies on the American South. Cambridge: Cambridge University Press, 2016).

Parshley, Lois. "Europe Met a Climate Target. But Is It Burning Less Carbon?" *The New York Times,* Dec. 2021

Powell, Keri. "On Legal Levers in the Biomass Fight", Interview by author. January 31, 2022, 22:23.

Pritchard, Sara and Zimring, Carl. *Technology and the Environment in History* (John Hopkins University Press Baltimore, 2020) 11.

Purifoy, Danielle. "How Europe's wood pellet appetite worsens environmental racism in the US South" *The Daily Climate,* Jan 2020.

Ray, Janisse. *Ecology of a Cracker Childhood,* (Minnesota: Milkweed Editions, 1999), 4.

Roberts, Dimitrou, and G. A. Ormondroyd. "VOC Emissions from the Combustion of Low-Grade Lignocellulosic Waste." *International Wood Products Journal* 9 (January 2018), 151.

Scott, James. "Nature and Space" in *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998) 13.

Searchinger, Timothy, Staven Hamburg, Jerry Melillo, William Chameides, Petr Havlik, Dan Kammen, Gene Likens, et al.. "Fixing a Critical Climate Accounting Error." *Science* 326 (January 2009), 314.

Shapiro, Tricia. *Mountain Justice: Homegrown Resistance to Mountaintop Removal, for the Future of Us All.* (AK Press, 2010).

Shepherd, Anita, Mike Martin, and Astley Hastings. "Uncertainty of Modelled Bioenergy with Carbon Capture and Storage Due to Variability of Input Data." *GCB Bioenergy* 13 (4) (January 2021), 691.

Smith, Keith A. and Timothy D. Searchinger. "Crop-Based Biofuels and Associated Environmental Concerns." *GCB Bioenergy* 4 (5) (2012), 497.

Stimpson, Stephanie, Jay Todesco, and Amy Maginley. "Strategies for Risk Management and Corporate Social Responsibility for Oil and Gas Companies in Emerging Markets." *Alberta Law Review* 53 (2) (2015): 259.

Southern Environmental Law Center and Clark University, "Satellite images show link between wood pellet demand and increased hardwood forest harvesting." https://www.southernenvironment.org/wp-content/uploads/2022/03/Biomass-White-Page.pdf, (April 2022), 4.

Swanson, Drew. *Beyond the Mountains: Commodifying Appalachian Environments.* (University of Georgia Press, 2018) 5.

Tessum, Christopher W. "PM 2.5 polluters disproportionately and systemically affect people of color in the United States". *Science Advances* (2375-2548), 7 (18) (April 2021).

US Department of Energy's Federal Energy Management Program, "Biomass for Electricity Generation", report via the *National Institute of Building Sciences*.

US EPA Office of the Inspector-General, "EPA Should Conduct More Oversight of Synthetic Minor-Source Permitting to Assure Permits Adhere to EPA Guidance", *Report No. 21-P-0175,* July 8, 2021

Weeks, Vicki. "Biomass Fight Rages on in Adel, GA" *Dogwood Alliance*, June 2021, https://www.dogwoodalliance.org/2021/06/biomass-fight-rages-on-in-adel-ga/ 5.

Westervelt, Amy. "Debunking Demand (IPCC Mitigation Report, Part 1) IPCC Mitigation Report 2022 Analysis —Part One: Debunking Demand, an Ode to Chapter Five*." Drilled* by Critical Frequency, April 5, 2022.

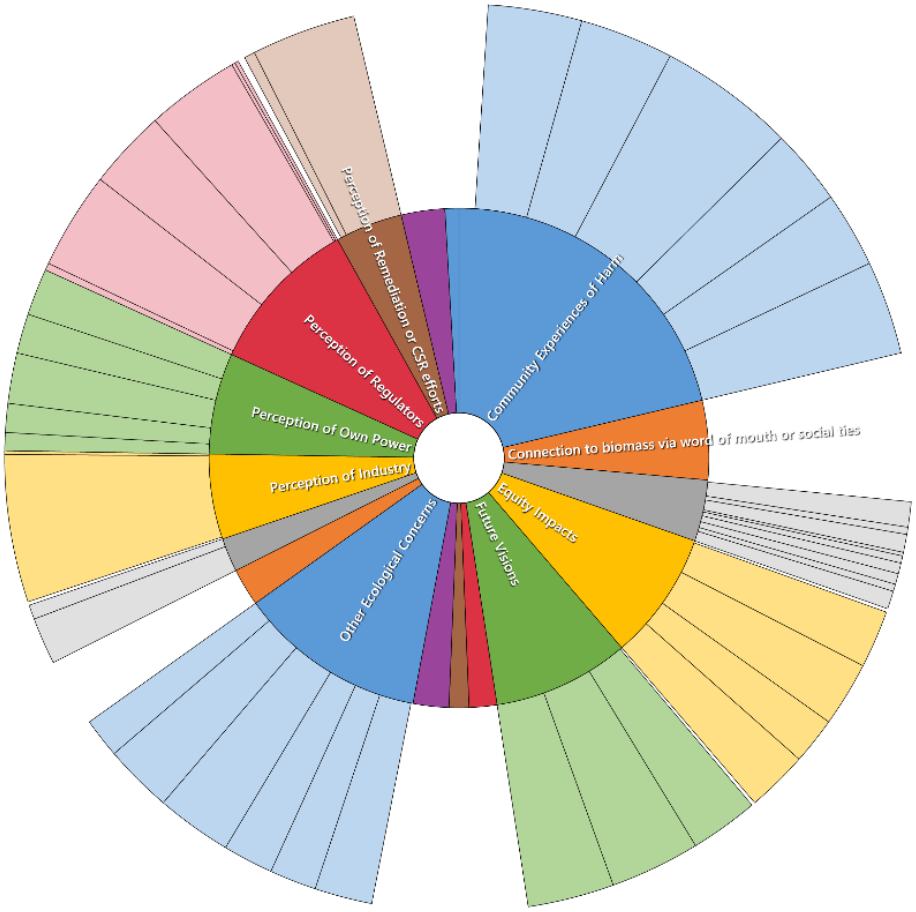
Wimberly, Ronald C. "Sociology with a Southern Face: Why Are We Sociologists and What Are We Doing about It in the South?" *Social Forces* 86, no. 3 (2008): 883.

Appendix A) Codebook in NVivo

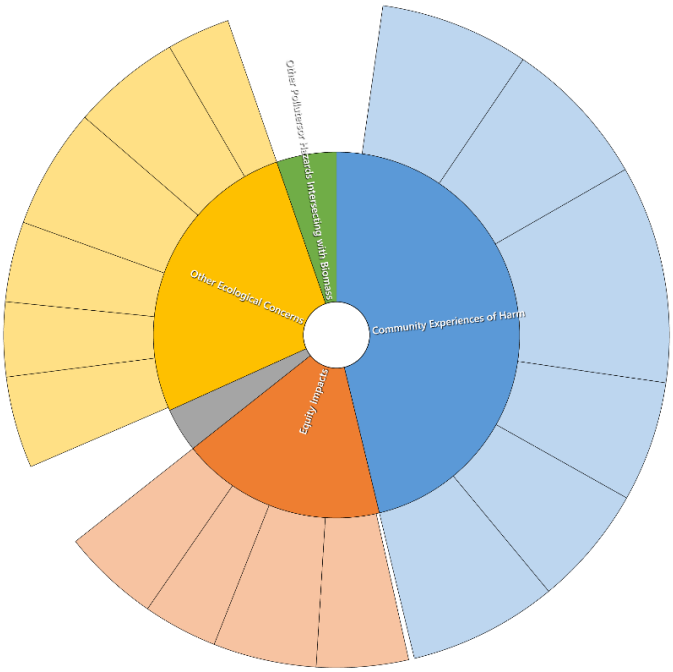
Nodes

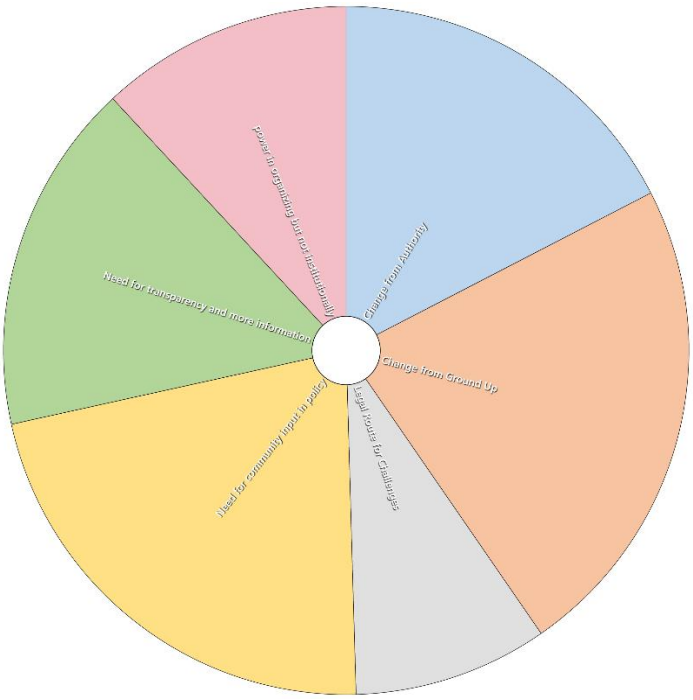
Name	Files	References
Community Experiences of Harm	8	166
Daily Life Miscellaneous	7	26
Economic or Work-Related Negative Impacts	7	26
Feelings of Neglect, Powerlessness, Voicelessness, Unimportan	7	38
Impact on Community and Social Ties	6	21
Landscape Changes Degrading QOL	8	21
Toxins Impacting Health	8	26
Connection to biomass via word of mouth or social ties	7	40
Cumulative Pollution	7	19
Demographics	1	1
differences between far and near neighbors	4	7
Equity Impacts	1	1
Class-Based	6	16
Intersectional	5	18
Race-Based	3	13
Regional-Based	6	17
Future Visions	1	1
International Forces and Equity Issues	7	14
Legal Route for Challenges	5	10
Need for transparency and more information	4	18
Other Ecological Concerns	8	95
Biodiversity	4	16
Carbon Storage	6	13
Climate Change	7	14
Deforestation	6	21
Recreation & QOL	7	19
Watershed Impacts	6	11
Participation	0	0
Perception of Industry	1	1
Perception of Own Power	0	0
Perception of Regulators	0	0
Perception of Remediation or CSR efforts	1	2
Ties to the Land	7	22

Appendix B) Breakdown of amount of content by theme (Generated in NVivo)



Appendix C) Supplementary/ Alternative Visual Aids:





Appendix E) Interview Guide

- Where do you live? How long have you lived in this community?
- What is your occupation [or, if more salient, role in the community]?
- What is your connection to the wood pellet industry?
- Have you observed changes in the quality of air, water, and the general environment in your community? If so, please describe these changes, when they occurred, and how they have impacted your or others' quality of life. Are they linked, in your view, to the wood pellet industry?
- How do you view the wood pellet industry and its practices? How does it engage with your community?
- How do the benefits of having this industry nearby (such as employment and growth) compare to the costs you've experienced?
- Have you brought any concerns about this to the NC Department of Environmental Quality [substitute appropriate state body], your representatives, or other authorities? If so, how were they received? Were you satisfied by the action taken?
- Do you believe your government is adequately protecting your community and holding the wood pellet plants accountable? If not, what needs to change?
- When you envision a just future for your community, what does that look like? What support would be necessary to get there?