



Original research article

## Envisioning and implementing wood-based bioenergy systems in the southern United States: Imaginaries in everyday talk

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## ABSTRACT

Bioenergy development in the Southern United States was said to promise a future with renewable energy, energy independence, expanded wood markets, and rural development. We view this vision of wood-based bioenergy as a sociotechnical imaginary involving a future where energy and rural development needs are met using sustainably-harvested local resources. While this vision has led to bioenergy development, it has not been universally shared and counter-narratives have circulated. Local people receive multiple messages and have diverse experiences with bioenergy, which affect how they interpret the imaginary. We use cultural models to examine the extent and ways that elements of the national bioenergy imaginary occurred in everyday talk in three communities where bioenergy plants had recently been developed. We show how local people articulated, responded to, and altered the national bioenergy imaginary while simultaneously drawing on diverse experiences, values, and other important social discourses. While local people had limited opportunities to alter the national imaginary, they contested and diluted it in ways that indicated that they were not fully in support of the imaginary and the development it spurred. Ultimately, this may hinder bioenergy development.

## 1. Introduction

A new interest in bioenergy, along with other renewable energy options, began to develop in the United States (U.S.) and Europe in the early 2000s. This new interest, which followed earlier attention during the 1970s energy crisis, was related to rising gasoline and natural gas prices, concerns about overdependence on foreign oil, and growing awareness and concern about the role of fossil fuels in climate change [1–3]. Wood-based bioenergy was seen as an important and accessible part of a renewable energy portfolio, particularly in the Southern U.S., for several reasons. One, wood is an ancient source of energy and has continued to be the leading source of renewable energy in numerous developed countries [4]. Two, biomass-based liquid fuels represent one of the only options for transportation fuels that can meet future metrics of environmental, social, and political sustainability [5]. Three, the Southern U.S. has extensive timberlands, a large and established forest product industry and infrastructure, and excess capacity due to downturns in pulpwood markets, and is seen as ideally suited for wood-based bioenergy for power generation and liquid transportation fuels [6,7].

Policies in both the European Union (E.U.) and the U.S. have promoted bioenergy in ways that spurred its development in the Southern

U.S. [8,9]. In the E.U., a series of energy directives mandated that 20% of each country's energy portfolio come from renewable sources, with woody biomass playing a role in meeting this target [9]. A wood pellet industry developed in the U.S. in response to E.U. renewable energy targets and subsidies for renewable electricity production [4]. In the U.S., the 2007 Energy Independence and Security Act (EISA) set ethanol targets that included phasing in increasing quantities of biofuels made from cellulosic feedstocks [10]. To meet this target, cellulosic bioenergy development was aggressively promoted by the U.S. Department of Energy and other federal agencies [11]. Additional incentives in agriculture, rural development, and forestry sectors also supported these goals [9], reflecting the fact that promotion of bioenergy was crafted as an effort to simultaneously address climate change, promote rural development, and achieve energy independence and security [6,12].

Developing a viable wood-based bioenergy industry in the Southern U.S., as with efforts to advance sustainable bio-economies elsewhere, clearly involves social as well as technological change [6,13,14]. Social issues have become increasingly important as bioenergy has been linked to rural development and is seen as a way to diversify the economic base of wood-dependent rural communities in the Southern U.S. [6]. Local economic development interests, supported by local media,

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have promoted bioenergy development as an alternative compatible with the existing forest product industry with important benefits for forest health [6,15,16]. While a variety of types and scales of wood-based bioenergy development exist, including home/community heating and cogeneration of electricity, national and international energy policies led to the emergence of wood pellets for electrical power and advanced biofuels as leading near-term options in the Southern U.S. in the early 2000s.

Policy-led efforts to develop a renewable energy system and promote rural development through wood-based bioenergy development can be usefully analyzed through the concept of sociotechnical imaginaries, which are powerful cultural resources that support and shape societal efforts to transition to new energy futures [14,17,18,19–21]. In the United States, energy imaginaries entailing energy security and energy independence have long been part of the rhetoric of politicians [22]. This language, which crosses party lines, dates back to the 1960s and 1970s [3,15,22] but intensified in the U.S. after the terrorist attacks of September 11, 2001. In 2006, George W. Bush lamented the United States' "addiction to oil," while in 2007, Barack Obama promoted freedom from the "tyranny of oil" [23]. This type of rhetoric evokes emotional reactions in citizens in support of alternate sources of energy and merges with environmental discourses about renewable energy reducing emissions and mitigating climate change, thus strengthening the power of a sociotechnical imaginary promoting bioenergy development [25]. Bioenergy imaginaries drove policy, for example in the U.S. Department of Energy's "Billion Ton" reports [26–28], which examined the feasibility of an annual supply of one billion tons of biomass as a feedstock for bioenergy and linked the need for energy independence and security with rural development. Non-governmental organizations also joined the effort, for example 25x25, which defines itself as "a diverse alliance of agricultural, forestry, environmental, conservation and other organizations that are working collaboratively to advance the goal of securing 25% of the nation's energy needs from renewable resources by the year 2025" [29]. The forest resources in the Southern U.S. were seen by various national and regional entities as integral to achieving energy independence and security, developing a national renewable energy portfolio to address climate change, and stimulating rural development.

Social science literature on wood-based bioenergy development in the Southern U.S. has been limited. Several studies found low levels of information and misconceptions about bioenergy and suggested the need for collaboration and local outreach [30,31]. Other studies examined perspectives of forestry professionals and forest owners, highlighting the importance of fitting bioenergy into existing wood production systems [1,32]. Bailey et al. [15] focused on the rural development potential of wood-based bioenergy development and the policies needed to ensure local benefits. If we view bioenergy promotion as a policy- and media- driven cultural phenomenon to meet a variety of energy, environmental, and rural development objectives, an important research question is the impact of national and regional energy and bioenergy imaginaries on local communities and landowners. Research on media framing of bioenergy is an important step in this direction, as media advance new discourses about bioenergy while also attempting to align their frames with the general public and thereby link bioenergy to larger cultural themes [33]. Dyer et al. [16] examined national, regional, and Alabama newspaper coverage and found that local coverage, in particular, is generally favorable when talking about bioenergy developments with potentially positive local economic effects. Although media frames may often be chosen to influence public and local opinion about bioenergy, we know very little about how they, along with the larger bioenergy imaginary, influence local people.

Eaton et al. [17] analyzed how actors in local communities in northern Michigan differentially framed national bioenergy imaginaries in support for or opposition to bioenergy development. They focused on local interpretations of the national bioenergy imaginary, specifically how a "wood for energy" frame was differentially keyed, as flat or

sharp, by actors in northern Michigan communities to either make it seem like an unproblematic, obvious choice or to emphasize risks, uncertainties, and complexities. Their analysis took an important step in asking how national sociotechnical imaginaries are interpreted and acted on where specific technological projects are unfolding [17]. Our goal in this paper is to build upon and expand this approach by drawing on our ethnographic research around bioenergy development in the Southern U.S. Strauss [34,35] advocated person-centered analyses of the cultural models that underlie imaginaries and showed how people bring their own experiences and diverse cultural models drawn from multiple opinion communities to their interpretation of the imaginaries and powerful discourses they receive through the media and opinion leaders. Here we draw on both Eaton et al. [17] and Strauss [34,35] to use cultural model and conventional discourse analysis to present and discuss the ways that local people talk about nearby bioenergy development in the context of the national bioenergy imaginary. Understanding local interpretations of bioenergy development, the interests and values that underlie these, and the ways that these lead to supportive or oppositional actions is necessary if bioenergy development is to be broad-based and collaborative, and to provide local benefits.

## 2. Methods: multi-sited ethnography on bioenergy development

### 2.1. Research sites

In 2010, when enthusiasm for wood-based bioenergy development was very high [6], we began an ethnographic study of communities and landowners around major bioenergy plants in the Southern U.S. Our research was initially funded by the Southern Research Station of the USDA Forest Service to learn more about social aspects of bioenergy development as a complement to investments in technical research. We began with general research on bioenergy in the Southern U.S. and intensive research around the Range Fuels plant in Soperton, Georgia, which at that time was a promising cellulosic ethanol plant. Based on our initial research, in 2011/2012 we successfully competed for a U.S. Department of Agriculture grant in sustainable bioenergy in a program focused on socio-economic analysis of biofuel development on rural communities. By the time we submitted our proposal, the Range Fuels plant had ceased to operate and was preparing for foreclosure sale.

For our larger research project, we selected our three primary research sites based on stages of bioenergy development, two liquid fuel plants in different stages of development—one mature but less successful and one developing and promising success and one operating pellet plant. For the first, we continued to work around the Range Fuels plant as it suspended operations and was sold to LanzaTech to produce aviation or other drop-in fuels. This research site represented a community that had gone through initial excitement and disappointment, but had continued hope, around bioenergy development. For our second liquid fuel plant, we initially chose a promising proposed cellulosic ethanol plant, the Coskata plant in Boligee, Alabama, where the community was very engaged and enthusiastic about development. Shortly after our research began, Coskata terminated their Boligee development, and we substituted the nearby KiOR plant in Columbus, Mississippi. This plant was at the time the most advanced liquid fuels plant in the Southern U.S., and soon became the first plant to produce cellulosic fuel at a commercial scale. We completed our research around the KiOR plant just prior to its shutdown and bankruptcy in 2014. Its failure was likely due to technological difficulties and low gas prices, which resulted in the plant being unable to produce cellulosic crude oil at competitive prices.<sup>1</sup> For our third research site, we chose the newly opened Georgia Biomass wood pellet plant in Waycross, Georgia, which

<sup>1</sup> <http://www.biofuelsdigest.com/bdigest/2016/11/24/kior-the-story-of-a-company-gone-wrong-part-5-the-collapse/http://www.biofuelsdigest.com/bdigest/2016/11/24/kior-the-story-of-a-company-gone-wrong-part-5-the-collapse/> (accessed 6/19/2017).

**Table 1**

Distribution of interviews across research sites and stakeholder groups. (The totals for all stakeholder groups for each site exceeds the total interviews because at times several people from different groups were present at the same interview.)

		Soperton, GA <sup>a</sup>	Waycross, GA <sup>b</sup>	Columbus, MS <sup>c</sup>
Interviews		77	43	55
Stakeholder Groups	Energy	6	3	7
	Industry			
	Forest	9	13	8
	Industry			
	Landowners	19	5	8
	Community	22	11	10
	Leaders			
Community	26	14	13	
Members				
State and	7	4	13	
Federal				

<sup>a</sup> September 2011, March 2012, May 2012, January to April 2013, July 2013.

<sup>b</sup> September 1, March 2013, May to September 2013.

<sup>c</sup> October 2013, November to February 2014.

was shipping wood pellets to Europe for power generation and was then the largest wood pellet plant in the world. We chose this plant because, unlike the two liquid fuel plants, it was in full operation and actively purchasing wood at a large scale (about 250 truckloads per day, or 1 million metric tons annually<sup>2</sup>), adding this dimension to our research. Georgia Biomass was and continues to be a wholly-owned subsidiary of the German utility company RWE Innogy. The Georgia Biomass plant directly employs over eighty people and created over 300 indirect jobs.<sup>3</sup> However, during our research, there were frequent rumors that the plant would close, and it was advertised for sale in June 2014 as RWE shifted its focus to other renewables.

The bioenergy plants we studied were sited based on proximity to underutilized forest resources and rural development needs [6]. They were associated with neither mill residues nor bottom-up community initiatives, but rather reflected efforts to develop a large-scale wood-based bioenergy industry in the Southern United States based on direct harvests from forestlands. Our pilot research on new bioenergy plants suggested that the community and landscape effects of the two different types of bioenergy plants we studied were likely to be very similar because they involved the same raw material harvested in mostly the same way, the plants were at similar scales, and the long-term viability of both pellet and liquid fuel plants were often viewed skeptically. It is important to emphasize that our research was conducted during a period that combined enthusiasm and uncertainty for large-scale bioenergy development in the Southern U.S. Ultimately, development of commercial-scale wood-based cellulosic fuel plants in the Southern U.S. has slowed dramatically, while export-oriented pellet plants have continued to operate under some uncertainty about the future of European renewable energy policies.

## 2.2. Methods

We chose a multi-sited ethnographic approach for the comparative perspective it provided and because, in an increasingly globalized and integrated world bounded, single research sites are often problematic [36,37]. Lassiter [38,p 93] notes that ethnographers now often conduct research in an “ever-changing, shifting, and multi-sited field.” Our study of the process of envisioning and implementing sustainable bioenergy involved actors and discourses found in multiple sites and

<sup>2</sup> <http://woodbioenergymagazine.com/blog/2011/largest-pellet-plant-opens-at-waycross/> <http://woodbioenergymagazine.com/blog/2011/largest-pellet-plant-opens-at-waycross/> (accessed 8/30/2017).

<sup>3</sup> <https://www.gabiomass.com/the-plant/> <https://www.gabiomass.com/the-plant/> (accessed 6/12/2017).

included multiple stakeholders, and therefore was well-suited to multi-sited ethnography where people, connections, associations, and relationships are followed across space and time [36]. We found that trajectories of bioenergy development and the processes which led to various outcomes were simultaneously discursive and material. We examined the ways that people talk about bioenergy using the concepts of cultural models and conventional discourses—common ways people talk and think about a topic [35,39]—situated within the context of commonly shared public cultural discourses and imaginaries linked to the promotion of wood-based bioenergy systems in the Southern U.S. This research reflected our interest in how everyday talk serves as a window into human values and their influences [40]. It also provided a framework for analyzing how both visions of the future are shared and debated among actors within a constantly shifting landscape of bioenergy development in the Southern U.S.

Our research was focused on the cultural models and conventional discourses of people near to or associated with the bioenergy development in our research sites. To examine cultural models and conventional discourses of bioenergy at the local level, we conducted ethnographic research that included participant observation and semi-structured interviews in three communities in Georgia and Mississippi with different types of bioenergy facilities. We spent three months living in each of three main field sites and interviewing many different stakeholders: landowners, community members, local development board members, school board members, local politicians, cooperative extension agents, loggers and others employed in the timber industry, and employees of bioenergy facilities. We took detailed notes during semi-structured interviews on both questions and responses and immediately transcribed them. We also transcribed fieldnotes about the location of the interview, relevant observations about the interviewee, and our reflections on the interview. We conducted about 175 interviews, lasting between thirty minutes and three hours (averaging about an hour) in these three sites (see Table 1). We participated in community activities and temporarily joined local organizations, where we participated in ongoing group activities and introduced ourselves as researchers interested in interviewing community members. In this way, we met directly and were introduced to a number of interviewees. We also attended local workshops, extension programs, and outreach efforts related to bioenergy.

We used NVivo qualitative analysis software to conduct content analysis of ethnographic data collected (transcripts of interviews and fieldnotes) in our three primary field sites and at bioenergy events (transcripts of formal talks and fieldnotes). We analyzed these datasets in order to examine cultural models and conventional discourse related to bioenergy development, forests, and communities and to identify some of the ways that phrases and ideas travel within and among different sets of actors and how they influence perceptions of bioenergy. In particular, we looked for traces of dominant social discourses, including key elements of bioenergy imaginaries, and looked for commonalities, differences, contexts, and patterns in the ways that these were expressed in our interviews.

## 3. Theory: linking bioenergy imaginaries to cultural models

Jasanoff and Kim [18,19] introduced the notion of “sociotechnical imaginaries” as powerful cultural resources that support and shape societal efforts to transition to new energy futures. The concept of sociotechnical imaginaries builds on a broader literature on social imaginaries [41–43] and connects these to technological development [18,44]. Sociotechnical imaginaries are “collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects” [19,p 190]. Imaginaries have material outcomes in that they guide government policies and investment in science and technology toward a future energy system. Visions and the policies built upon them influence trajectories of technological development, channel public expenditures,

and shape the inclusion or exclusion of citizens in the benefits and costs of technological development [18]. They are also social, cultural, and moral in that they are imbued with visions of what is good or desirable for society and that they result in actions that reconfigure patterns of life and work, as well as the allocation of benefits and burdens from energy systems [18,19,44]. While sociotechnical imaginaries are generally seen as emanating from states, they are not specific policy agendas but rather shared understandings that set desirable goals, articulate feasible futures, and create political will and public resolve to attain these visions [18].

Imaginaries are considered “group achievements” and are collectively held [45], but recent research has shown that they can be contested [46] and can emerge from below the “seats of power” [45,page 20; see also 21, 24]. Imaginaries are increasingly viewed as dynamic, unfolding historically through individual actions, shaped by powerful actors but requiring support from coalitions, and subject to contestation and replacement by alternatives [46–49]. Much like cultural models, imaginaries can be broadly shared or differentiated, with the latter indicating greater cultural complexity [39]. Such complexity includes the extent to which imaginaries and related cultural models are shared [39]; their role as powerful social discourses used by ideologists to influence public opinion [34]; and how cultural models, as elements of imaginaries, appear in and influence the talk and action of everyday people [35]. Recent research on energy imaginaries has explored their complexity, reinterpretation, and contestation [20,22,50,51]. Here we seek to connect the literature on sociotechnical imaginaries to anthropological literature on cultural models as a way of increasing our understanding of the role that imaginaries may play in local places where they have spurred concrete bioenergy development.

Eaton et al. [17,pp 227–228] drew our attention to the concept of sociotechnical imaginaries for bioenergy derived from woody biomass with their observation that:

Imaginaries for bioenergy derive from state actors who envision a future where energy and economic interests will be met with homegrown resources ...providing ‘green’ means to address salient social problems such as the nation’s dependence on foreign and domestic fossil fuel supplies, climate change, pollution, environmental degradation, national energy security, and (rural) economic depression. The term *imaginary* connotes the way these visions provide an attainable end goal, or collective vision of a feasible, desirable future social order, provided by technological projects.

This view of bioenergy as addressing a set of multiple and loosely related issues that include energy independence and security, rural development, and climate change and other environmental issues has been common in discourse across various types of wood- and crop-based bioenergy development in the U.S. [50,52,53]. As such, it can be considered the dominant national bioenergy imaginary—connecting social and technological realms, promulgated by powerful interests, and embodying a clear moral and environmental vision of a future involving bioenergy. Yet this bioenergy imaginary has not gone uncontested, and researchers have increasingly explored its variations and influence. Bain and Selfa [52] note that, beginning in 2008, bioenergy in the form of ethanol production from agricultural crops in the U.S. Midwest began to be questioned in terms of its ability to mitigate greenhouse gases and seen as having negative effects on food prices and food security. Burnham et al. [50] described two wood-based bioenergy models, a regional approach and a community approach, that have emerged in the Northeast U.S., with different sub-niche advocates contesting and shaping bioenergy imaginaries around issues of scale of development and land use. Kulcsar et al. [53] discussed the role of powerful interests in communities in shaping perceptions of bioenergy development as economically positive in spite of limited job creation while at the same time downplaying negative environmental impacts. As noted, Eaton et al. [17] focused how actors in northern Michigan communities framed bioenergy in ways that made it seem either unproblematic and

obvious or highly problematic and risky.

The national bioenergy imaginary outlined above has not been universal, and individuals and organizations have promoted counter-narratives.<sup>4</sup> One example is the tendency to see biofuels as a scam, selling an unviable product to enrich its proponents [25]. Government subsidies for biofuels, ranging from those for the Range Fuels plant [54] to military spending on the Great Green Fleet, a military effort to develop alternatives to conventional fuels [55], have been criticized as wasteful government spending. A second major counter-narrative has revolved around environmental impacts, as questions about renewability and carbon neutrality were raised [56,57]. Environmental groups have maintained that bioenergy threatens to push forests—valuable for sustainable forest products, tourism, and as cultural resources—to the brink of disaster by causing irreparable harm through deforestation and degradation [58]. Environmental and conservation organizations have also expressed concern that bioenergy can also potentially lead to soil erosion, decreased water quality and quantity, and conversion and deterioration of wildlife habitat in exchange for only modest greenhouse gas reductions [56].<sup>5</sup>

Recent work on imaginaries has shifted away from viewing them as uniform and homogenous to paying more attention to processes of contestation and the ways that differing values and interests may produce alternative imaginaries and counter-narratives [14,20,21]. Similarly, Strauss [39] cautioned against homogenizing and reifying imaginaries, and stressed the importance of locating them in concrete actors, social contexts, and material conditions. Smith and Tidwell [51] noted that Strauss [39] and Jasanoff and Kim [18] drew on different underlying intellectual traditions in their conceptualization of imaginaries. But, concurring with Strauss [39], they advocated for greater study of the ways that sociotechnical imaginaries circulate more widely in society as they are “criticized, taken up, and reframed by ordinary people” [51,p 331]. Strauss [339] suggested that viewing imaginaries as structuring new ways of thinking is closely related to anthropologists’ conception of cultural models as shared, implicit schemas of interpretation [39,59]. Cultural models are studied through text analysis, often of transcripts of talks with research subjects, sometimes through analysis of metaphors, and generally by identification of shared elements of individuals’ mental models [40,60,61]. Notably, cultural models can be analyzed for diversity (some are coherent and shared, for example, while others show disagreement and conflict), as well as for motivating force (or lack thereof) [34,60,62], which makes them well suited for looking for traces of national imaginaries in local discourse. Strauss [35] coined the term “conventional discourse” to describe a type of cultural model—comments from multiple sources that convey the same assumptions using similar rhetoric to present a simplified view on a topic. Conventional discourses are compact mental schemas that are easy to repeat, and they represent accepted ways of thinking and talking within a particular opinion community [35]; these qualities make them relevant to bioenergy imaginaries. They often repeat common expressions that are linked to shared ideas in particular opinion groups, but are often fluid with people often mixing and matching expressions from the variety of different opinion groups with whom they interact [35]. Using conventional discourse analysis, Strauss [35] explored the nuances of public opinion by showing how people mixed diverse ideological positions in complex ways when they talked about issues, drawing from different and sometimes competing public

<sup>4</sup> These counter-narratives are likely themselves underpinned by environmental and small government imaginaries, but such an analysis is beyond the scope of this paper.

<sup>5</sup> A third major counter-narrative has focused on public health and environmental justice. Supplying pellets to Europe’s wood-burning power generating plants has been referred to supporting “biomass incinerators” by opponents [63]. Interpreting biomass power plants as incinerators calls attention to air pollution concerns related to burning wood, and it has raised environmental justice concerns when these plants are located near minority communities [64,65]. We do not address this here because we did not find this to be a major community issue in our three primary study sites due to the nature of the bioenergy plants there, although it has arisen elsewhere in the U.S. South [65].

discourses or imaginaries that were or were not related to the topic at hand.

The above discussion leads to the question of whether and how various aspects of dominant sociotechnical imaginaries are re-configured and reimagined by individuals as they move into everyday talk, calling our attention to the experiences and agency of individuals in (re)interpreting and expressing concepts found in imaginaries. This can involve reshaping imaginaries to better reflect local interests [51], the development of sub-niche imaginaries to promote different stakeholder visions [50], or social movements that contest dominant imaginaries and promote new ones in broad public spheres [46]. But shifting to a people-centered approach based on cultural models and conventional discourses opens up an even wider range of possibilities. For example, Pfeffer, Schelhas and colleagues [60,66] used cultural models to analyze the different ways that local people seek to advance or defend their own livelihood interests in the face of powerful international conservation discourses and related conservation areas. The results were complex, including contestation, appropriation, and re-interpretation of discourses, as well as showing significant gaps between local talk and behavior [60,66]. Due to power differentials, everyday talk may have limited ability to shape sociotechnical imaginaries themselves, but may still indicate everyday resistance that inhibits the necessary collaborative and multi-scale efforts that bioenergy development requires. As state-originated sociotechnical imaginaries lead to material developments, the ultimate fate of both the imaginaries and material developments will depend on and reflect the ways that people talk and act in local places.

#### 4. Results

Discussions about bioenergy take place on multiple levels simultaneously. While a coherent and optimistic bioenergy imaginary in which bioenergy solves multiple problems is articulated, debated, and contested at the national level, different actors at the local level are hearing and sharing various elements of these national discussions in the context of their own experiences. It is not clear to what extent local experiences move upward to influence national imaginaries, but we argue that local experience may shift the meaning of national imaginaries and change the way they influence behavior. In this section, we present results from our ethnographic research that show how elements of imaginaries were promoted at those sites and then how they were expressed in a variety of ways through cultural models and conventional discourses.

##### 4.1. Energy security

Energy independence and security were key elements of the national bioenergy imaginary and related discourse. Speaking at the DOE Biomass 2011 Conference and Webinar, Secretary of Agriculture Vilsack stated, “We buy oil from people who would do us harm. We need to be more efficient in energy we use. We have to tap our own resources.” Similarly a Georgia state employee promoting bioenergy development said, “Look at the Middle East nightmare. We need it [e.g., liquid fuels].” Speakers at local workshops further referenced the hostility of people in this region to the U.S., for example, “Energy independence is high on my list. Every gallon [we] produce is one gallon we’re not importing from places where they don’t like us very much.” At a local workshop promoting bioenergy feedstock development, several speakers explicitly noted the link between dependence on foreign oil and threat of harm to U.S. citizens at home and abroad, especially to members of the military stationed in these oil-rich and politically unstable areas. One speaker noted that in order to “get this oil crisis solved,” it was necessary to “connect the U.S. energy policies and the dead troops. All Congressmen should see all those bodies at Andrews Air Force Base.” Noting bioenergy as a potential solution, another said “I have no desire to send our young men and women to

fight so we can drive SUVs and pickups.”

Reducing dependence on foreign oil and energy independence were powerful justifications in local discourse. One forester said: “I’d love for us not to be so dependent on foreign oil. ... I’d like to see it work. Be independent of Saudi Arabia and Iran and all that crap.” It can be tempered, however, by concern for gas prices and skepticism regarding the economics of new bioenergy development and how bioenergy policy might directly affect prices of energy products such as gasoline for consumers, as this quote from community official indicates: “Yes, it’s great to reduce our dependence on foreign oil, but it comes down to ye old pocketbook.” More commonly, local discourses endorse energy independence and describe the need for a sustained effort for new technology development in the context of the new industries that are coming to their towns. One local development official explained that people need to understand the global power dynamics regarding energy, despite the domestic political power of the oil and gas lobby in the U.S.:

The Middle East has the oil, and they have a lot of power over the U.S. They have us hostage. When renewable energy makes progress in the U.S., they drop the price of oil, and gas prices drop. They’re smart, but we can outsmart them. But I don’t know if we have the gumption to do it... Congress is a bunch of do-nothings. The oil and gas lobby just has to whimper, and Congress asks: ‘what do you need?’ ... People are not aware that the U.S. could face a real dilemma if we offend the Middle Eastern countries. If they cut off oil to us, it would put us back into the 20 s and 30s. I’m exaggerating, but I’m exaggerating to make a point. People don’t realize that we don’t have a Plan B, other than bioenergy.

This viewpoint reiterates the opinion that energy independence is not just desirable but indeed a matter of national survival. To counter the power that oil and gas lobbies have over policymakers, bioenergy proponents must produce a strong argument that bioenergy development deserves at least as much attention and funding as fossil fuel industries. A key component of this argument relates to the potential economic development that bioenergy can bring to rural areas.

##### 4.2. Rural development

Rural development was frequently highlighted by bioenergy promoters in local communities. At a workshop promoting bioenergy feedstock development, a speaker said, “We would see prosperity return to rural America. Let’s get all those idle acres planted.” At a meeting of a local association, a speaker from KiOR said, “We’re about rural America. We come to places like Columbus and take feedstocks and convert them to fuel. ... Everywhere KiOR can build a plant, it can stimulate the local economy.” Correspondingly, the need for rural development was widely acknowledged by people in towns that have seen local businesses and jobs decline as trees have replaced farms and transportation improvements have shifted jobs and shopping opportunities to larger regional centers. Local people talk about closings of wood products mills and factories and their pursuit of any development that would bring jobs, ranging from manufacturing to prisons. As one community member said, “The only jobs are at the school. People work, bank, shop, and eat out of town. It’s difficult to get a long-term employer even though we have a good location near the interstate with good roads.” The desire for development was so strong that several people noted that they would take anything short of hazardous waste. In one community, someone said, “This area will take almost any kind of development. The only thing people here fought was a large waste facility on the river.” Similarly, a prominent community member in another town said, “Development would be good, but not something like a hazardous waste dump.” Local community members are desperate for any development that does not threaten public safety; bioenergy, for the most part, fulfills this requirement.

However, experiences with bioenergy development in communities

where it took place on the ground inspired both hope and disappointment. A community leader in one town said, “My vision for [town name] is more economic development, a diversified job market—high tech if possible.” One county official noted that a new forest products industry would be very helpful for the county because it could match available resources with employment opportunities; he stated, “We desperately need jobs here; there’s a lot of wood and a lot of unemployed people.” A state official involved in matching bioenergy development with communities described his experience at a public meeting related to a bioenergy plant: “People were eager for markets. The hard part was being able to leave – people just kept wanting to talk. They were excited about rural development.”

Both community members and landowners expressed interest in increased job opportunities and added income for farmers and forest owners. After plants were built, however, many local people complained that the local bioenergy development failed to create the jobs that the companies had promised. Community members frequently complained that in addition to the fact that fewer jobs than expected were created, local people were often not hired in the jobs that did become available. One person said of a bioenergy plant formerly operating in his town, “That’s the one thing I fault them for, that they brought in labor from other areas.” Similarly, another community member stated:

But the jobs haven’t worked out as well as we hoped. ... We expected to see more local employment... but they imported people from Michigan and didn’t use local qualified people. That was not right.

Similar complaints were raised about the contribution of the bioenergy plants to wood markets, as well as the ways that increases in these markets would benefit some community members and not others. Community members without large landholdings felt that large landowners, who were also often community leaders, were promoting bioenergy as a means to obtain personal gain. This exacerbated underlying class tensions within communities. One forest owner without much acreage said, “I mean, everyone would benefit from bioenergy, but not to the extent of the big landowners. They can sell directly to the plant.” However, the perceived benefits to large landowners did not materialize, as the wood markets did not change enough to benefit landowners in the ways that companies had promised. As one forester said, “Some people are not happy with the way they came in and presented themselves. It’s true they brought some jobs. But they didn’t help with thinnings. It was misleading.”

In addition to the perception of unequal benefits to community members based on landholdings, we also noted perceived racial biases in the towns which led community members to make direct statements about the inequitable distribution of benefits from bioenergy development. As in many rural areas in the Southern U.S., there are ongoing racial inequalities, and minority hiring issues were an issue in racially divided towns in which bioenergy facilities locate. One African American community member explained the context into which these new bioenergy facilities were placed: “There is still a black and white issue here. It’s almost servitude, two notches removed, depending on who they work for.” Several African American community members we interviewed commented on the lack of diversity in the hiring processes at bioenergy facilities, and one explained at length what happened in his town:

There’s a lot of false advertising for jobs. Good people don’t have a fair shot at the jobs. ... The county ran ads [for jobs]. It was false advertising. They put people in positions that don’t even qualify. I can’t even get a phone call from them. What’s going on in this job market, it’s not right. They did a lot of picking and choosing. ... One guy [African American] didn’t get hired because he was too highly qualified. ... So that discourages others [African Americans] from even applying. ... It’s all white and black. They won’t talk about it in

public.

One politically engaged African American, recognizing that non-locals were often brought in for jobs created by industrial development that was targeted for poor and minority communities, pleaded for the companies to: “tell us how many jobs and what are the job classifications and competencies needed so that we can prepare [county name] people for the jobs and contracting opportunities.”

#### 4.3. Government promotion and investment

Bioenergy promoters often argued that technologies like pellets and even cellulosic fuels are just the beginning in the development of a large, sophisticated bio-based industry in the Southern U.S. A state official described pellet plants as laying the groundwork for a future liquid fuels industry. Commonly cited future products include drop-in fuels, cellulosic ethanol, chemicals, and pharmaceuticals. Improvements in biomass-processing technologies such as torrefaction, fermentation, and gasification were described as leading to new products and more efficient production of marketable bio-based products. Noting that initial failures often lead to future successes, one local development official stated:

We were very excited in [county name] after the announcement of [bioenergy company]. Some hope slipped away. That happens. But you can’t stop. Many great companies failed before they were successful. When failure happens, someone has to pick it up. We just welcomed [bioenergy company] to [county name]. They will pick up in some areas where [bioenergy company] left off.

Local people reacted in different ways to the fact that bioenergy plants came to their towns through government promotional efforts that included subsidies. Some, given the plant development setbacks and after plant failures, clearly believed that their community had been taken in by a scam, and community members frequently referred to this idea. One said, “I have seen reports after the failure of [company name]; I heard that it was a scam.” Another stated, “They hoodwinked us all on that one.” In one community, people linked bioenergy plants to government promoted development in other sectors. A former mayor noted that the town had provided a lot of money for a beef processing plant that went bankrupt. He said that as a result, people here “have a healthy dose of skepticism” and tend to view government subsidized bioenergy as a scam, stating that: “They wonder if [bioenergy company] is another beef plant.”

Other people, particularly those involved in promoting development, countered these arguments by suggesting that other types of energy, and many other industries in general, receive subsidies. They suggested that bioenergy needs subsidies in order to compete with these other subsidized energy products, or that the subsidies bioenergy got are small in comparison to other industries. One person stated, for example, “It’s hard to compete with coal; it’s not a level field because coal is subsidized. ... Other things get subsidies... oil, natural gas. ... There’s nothing for biofuels.” Several other interviewees in local communities mentioned the narrow mindset regarding opposition to subsidies for bioenergy development. One person, noting that a lot of people are skeptical about government investment in renewable energy, made the point that they are directly benefitting from governmental investments in what are now everyday technologies; he asked: “What about government investment in cars, planes? They think that all happened without help from the government? Roads? Hello?” Others emphasized the hypocrisy of some people opposed to government subsidies and government intervention in markets in general. One person stated:

Sure, there’s subsidies. Farmer subsidies, commodity subsidies. There’s insurance – farmers get money for spoiled crops.... There’s this disconnect – people are anti-government but they want their subsidies. They go off on people on welfare and the welfare system, but by god, they want the subsidies coming to them.

The question of subsidizing new and emerging technologies, and the government's role in technological innovation in general, was a divisive one in all three of our primary field sites. We found that opinions ranged widely, but individuals more involved in promoting economic development or expecting to be employed or sell wood to the facility were generally more positive than people not directly involved, particularly minorities and poorer community members. Opinions on government investment in bioenergy development were influenced by political affiliation, with more conservative community members tending to be more skeptical about or resistant to subsidies for renewable energy developments such as wood-based bioenergy.

#### 4.4. Climate change

The climate change justification is fundamental to the national bioenergy imaginary in that it provides an overarching public goal. But it was invoked infrequently in the Southern U.S. We noted that speakers at local workshops hedged their acknowledgement of climate change to account for the prevalence of climate skepticism in the rural South. Such adjustments of discourse, likely rooted in a speaker's knowledge that climate change skepticism is common in the rural South and the forestry profession, reflect an attempt to connect with this audience as bioenergy moves to the local level. This type of equivocation, which essentially renders climate change irrelevant to the need to pursue bioenergy development, was evident in the following quotes by speakers at workshops:

Now, global warming ... they say it's about carbon that was stored a long time ago, burned, and put back in the atmosphere. You ask 10 scientists about it, and you get 11 different opinions. But the fact is that trees grow – they store carbon and release oxygen. [*Company name*] takes that carbon, makes fuel, emits CO<sub>2</sub>, which trees absorb. It sustains the life cycle of carbon. (Bioenergy company representative)

CO<sub>2</sub> causes global warming... half room thinks it does, half thinks it doesn't. I'm not going to get into that conversation. Either way, reducing CO<sub>2</sub> is a good thing because it uses less energy. (Workshop speaker)

Climate change, generally referred to by interviewees as global warming, received little support at the local level. A number of people actively denied the existence of climate change, seeing it as an issue fabricated to advance other agendas or for financial gain. One community member stated, "There is no global warming... Those people want that carbon tax, so they say they believe in global warming." Another community member who was particularly outraged about the claim that global warming was an important environmental issue, said:

I almost get sick when I hear the word "green." The "greens" generate a lot of self-serving information such as global warming. The only reason global warming has been such a hot topic is because Al Gore has been making millions of dollars out of the word "green." And he's one of the biggest abusers of energy. ... Global warming has been found to be fraudulent, based on fraudulent information. ... Carbon emissions... that's a big farce. ...

Other people, even while skeptical of global warming in general, found it difficult to believe that bioenergy was really a legitimate way to address it, given environmental costs associated with transporting bioenergy products. This was especially evident in discussions about shipping wood pellets from the U.S. to Europe, as seen in these comments from diverse stakeholders:

Let me ask you a question. So they bring the trees in on a logging truck, they make these pellets here and they get their power from Georgia Power, which is run off coal, then they run it on a train and then ship it across the ocean, and it's still coming out carbon

negative? I mean, if you believe in global warming.... (community leader)

I don't know how they claim to be renewable, shipping pellets to Europe. But with that government [E.U.], they're forced to do it. (state natural resource professional)

I think about the sustainability of it – is it still renewable after all the transport? Maybe we'd be better off digging coal in Russia [laughs]. (community member)

In contesting bioenergy development to address climate change, these quotes reflect the underlying local notion that bioenergy and environmental regulations requiring it are part of a larger scam for people to enrich themselves with little public benefit.

#### 4.5. Forests

The forest products industry is economically important in the Southern U.S.,<sup>6</sup> and bioenergy is promoted in the region as a market for surplus wood. A state agency forester said, "There's more wood there than is used by pulp mills, small diameter stuff anyway." Wood product markets are seen as critical for retention and management of the forest plantation systems in the South. As one forester said at a workshop, "The biggest threat to forests is no markets. Wood for energy is a key for forestry in the Southern US. ... Healthy forests need markets for forest products, and healthy forests need markets for management by-products." People from communities with bioenergy plants were widely engaged with and accustomed to all aspects of forestry and the forest products industry. They generally believed there were plenty of trees in their region, noting the compatibility of a new market for wood products in rural areas with many pine forests. One person said, "This is a woodbasket, a heavily forested area. There's a surplus because of the loss of a lot of pulp mills." Many interviewees differentiated people in their communities from environmentalists due to long-term relationships of people with the forest products industries. One community member commented: "Here people are used to seeing logging trucks, trains. It doesn't freak people out to see trees cut." They believed that biomass harvests would be good for forest cover, noting that adding new markets provides incentives for landowners to plant more trees. Other community members warned of potential negative consequences for forest health if surplus wood is not used. A functioning planted pine ecosystem, they explained, was dependent on sustainable forest management practices that include both planting and cutting at scheduled intervals.

At the same time, landowners had little interest in changing the ways they grow trees. The existing system of plantations of native pine, in which trees are thinned for pulp in the first two decades and then grown into saw timber or poles, was seen as flexible and durable. People believed there have always been markets for pine trees over the past century and were resistant to large changes in the system. They saw harvests for biomass fitting into this system, but not wholly replacing it with trees grown only for biomass, because the final products, sawtimber and poles, were the most valuable part of the system and made the system work economically. They did not see production of bioenergy feedstocks as the sole goal of forest management. One person stated, "forest landowners may switch to a shorter rotation, but sawtimber is still the goal." A forest landowner said:

I'm all for it [bioenergy]. But I wouldn't grow just for that. I don't think it will ever be an industry in itself. People need to have multiple products – both landowners and companies – you can't put all your eggs in one basket.

<sup>6</sup> The U.S. South contains 40% of the nation's timberland [67], and accounts for 63% of the timber harvested in the U.S. [68]. Ninety percent of the timberland in the U.S. South is privately owned, with family forest owners controlling about 63% of that acreage [69].

One forester noted that: “Bioenergy works best when integrated with other forest products.”

The biggest point of contention from communities and forest owners was that every bioenergy plant came into town saying that they were going to buy residues and waste wood for which there was not currently a market. This would include logging residues and trees smaller than those used for pulpwood, a resource that exists but may not be economically harvestable [26,70]. In the development stage, using a non-utilized waste product both fit the larger imaginary and the promised greater economic return to forest owners. This practice would provide both direct revenue for products that previously had no economic value and also reduced costs for site preparation for new plantings, which involves removing waste products. One person explained that landowners were “excited about the possibility of having a market for trash left over from harvests...limbs, tops, stumps, to clean up the land.” However, when markets for early thinnings and residues did not materialize after the bioenergy plants began production, there was widespread disillusionment about the preliminary statements by bioenergy companies that they would buy these materials, as the following quotes from forest landowners demonstrate:

A lot of us thought [company name] would buy our leftover products from cutting timber. That was wishful thinking maybe on our part.

They were blowing smoke... everyone was excited about them taking thinnings.

They said they'd take everything. [Forester's name] told us all that bullshit. In the end, they're only taking clean chips. At their first presentation, they said they'd take leaves and scraps. That gets people excited. The average person, they see all that wood [slash piles after a cut] wasted.

Despite promises to the contrary, all the plants ended up buying the equivalent of pulpwood. A wood buyer at a pellet company said, “We buy the same thing as the pulp mills. We buy pine pulpwood. Two-inch tops, limbed. ... We call it pine fiber. ... It's cheaper to buy roundwood and pulpwood than waste.” Similarly, while forest owners hoped that bioenergy development would lead to higher wood prices, many forest owners felt that there has been little effect on wood markets. However, professional foresters took a more optimistic view, saying that it has stabilized pulp prices or kept them from dropping lower.

Forests were valued for more than timber, including wildlife, hunting, and aesthetics. One forest owner who was actively engaged in growing timber expressed this notion particularly clearly:

I love the forest for several reasons. Tree farming doesn't require the constant input necessary for row crops. I'm too old and don't have the technology and skills to do that. Forestry, I can do and be successful with it. ... The other thing, I love having forest around me. It's sort of like a blanket. I can be next to God, go outside and walk the trails through the forest. Feel Mother Nature, see wildlife in the forest, the whole gamut. The forest is my blanket.

This broad moral dimension in the ways that landowners talk about and relate to forests differs from the ways we observed people engaged in forest product and bioenergy industries talk about them. Specifically, industry participants tended to refer to wood obtained from forests as “feedstock” of “product,” removing any association to land or forests.

#### 4.6. Renewability and sustainability

If bioenergy development is to meet the expectation of the national imaginary, it must be seen as renewable and sustainable. This includes reduction of greenhouse gas emissions to address climate change and sustainable production of biomass feedstocks. International and national discussions of bioenergy and government policies that promote it emphasize the need for these to be measured and certified. Many actors involved in promoting bioenergy in the Southern U.S. recognized that

the concerns raised by the counter-narratives about renewability and threats to forest ecosystems are real, or at least have powerful constituencies.

Renewability and sustainability have long been claimed by forestry and forest owners, although their interpretation of these terms tends to have a narrow focus. These terms may refer only to the continued production of wood products, be expanded to include wildlife (both game and non-game species), or more broadly approach national definitions. We found that people in the Southern U.S. assume that forestry is a sustainable way to grow a renewable resource. As one forester noted, “Trees are truly renewable. The forest products industry has been doing sustainable forest management for a long time.” Similarly, a forest owner noted that trees are a renewable resource, and that he would like to see a bioenergy market develop so that more of each tree utilized; he said, “We hope that we can use the whole tree. There is so much waste when all we can do is burn it or let it rot.” One forester emphasized his attention to the larger forest, rather than just products:

I'm a forest manager, not a tree manager. We don't do 100% weed control. I don't like to just see 100% pine trees. I like healthy forests. It's not healthy if it's only trees. I'm a forester, but I like to see quail. In a forest, it all has its place.

Showing the extent to which an assumption of renewability and sustainability has been internalized at the local level, one person associated with community development tried to extend sustainability to include the social dimension: “We're making a sustainable, renewable product, and we want all the processes, including the workforce, to be sustainable and renewable.” These quotes demonstrate the almost ubiquitous belief that sustainable forest management is important and that people in this region are knowledgeable about how to do it.

Along with the tendency to view forest management as inherently sustainable and trees as a renewable resource, there was resistance to forest certification. The tendency was for people to see it as outside interference in their forest management, which they believed was already sustainable. As an industry forester said, “[Certification] is for what producers already do.” Another forester said:

They [landowners] don't like being told what to do. They don't like that with certification, third parties have the right to audit. ... It costs us \$2500 a year to have someone tell us we're doing it right.... It's going to be a hard sell. People don't want any new regulations shoved down their throat.

One forester was openly hostile to forest certification, linking it to environmental and social agendas: “Certification is a tool for people with an agenda ... a political agenda.” Another suggested that even when required, it wasn't taken seriously: “[Company name] requires SFI, to cover their ass. They don't really check it. But it's okay, it's good.” Similarly, another forester said, “Certification is only a marketing tool. It's hogwash. ...” But then he went on to admit that it may be needed: “The public perception of certification is that it's more sustainable. You have to acknowledge that.” Ultimately, those involved in the forest products industry tended to see certification as inevitable: “Landowners also will need to demonstrate sustainability. But they don't want to do this. ... Landowners need to unite and encourage the markets to come to them. If they don't, the industry will pass them by.”

## 5. Discussion

Our research focused on identifying the cultural models used in our discussions with local community members and landowners about bioenergy in relation to their forests and communities. The bioenergy plants in our study sites were designed to use woody-biomass harvested from nearby forests and to produce products for national and international markets. Notably, all three plants were stand-alone plants that did little to take advantage of efficiencies and synergies with other wood-product industries [see 71]. Development of each of these plants

was high profile and had stated goals of energy security, renewable energy, and rural development. We argue that these efforts to envision and implement wood-based bioenergy in the Southern U.S. fit within the concept of sociotechnical imaginaries [17–19]. They represented a powerful vision of a new energy future strongly supported by the state that advocated for and supported new technological development that would entail significant changes in social and economic systems. The vision claimed to be able to address multiple issues, including energy security, rural development, and climate change through the use of the South's forests in ways that are sustainable and renewable. It minimized risks and uncertainties while emphasizing the unbounded potential to develop a new, bio-based industry. It involved strong state support through discourse, policies, and financing, but a wide array of non-state actors are also involved in developing, promoting, and supporting the vision. Driven by this imaginary, bioenergy facilities were proposed and developed in multiple communities in the Southern U.S. At the same time, the imaginary relied on a vision of the public good that was defined by narrow interest groups without widespread public engagement, leading to questions about its durability and motivating force [46,48].

In accordance with recent literature on energy imaginaries, we recognized that this imaginary is not homogenous or universally endorsed [14,17,50,51]. Counter-narratives to contest it, which emphasized negative environmental impacts and wasteful government expenditures, have emerged at the national and regional levels. Following Strauss [34,35,39], we endeavored to trace elements of the national bioenergy imaginary and related counter-narratives in talk about bioenergy in communities in the Southern U.S. where bioenergy production facilities have been implemented in response to the national bioenergy imaginary and related policies. Our findings focus on liquid fuel and wood pellet bioenergy plants developed at a time of high enthusiasm for bioenergy. By examining the ways that cultural models related to bioenergy imaginaries are repeated, contextualized, contested, and reshaped in the talk of community members with varying levels of engagement in bioenergy development, we have endeavored to understand how the national bioenergy imaginary operates in local social and cultural systems.

As we expected for dominant discourses and related development (see, for example, [60]), we found that the dominant national bioenergy imaginary played an important role in structuring the way local people talked about bioenergy. In particular, the themes of energy independence and security and rural development resonated at the local level. Rural Southern U.S. communities tend to be politically conservative, and arguments about independence from Middle Eastern oil sources, prioritizing domestic resources and production, and supporting and protecting soldiers are very much in line with the way people already think. Support for domestic industry and shrinking employment in traditional wood product industries lead to support for bringing new industries to these communities. These elements of the bioenergy imaginary appear most strongly in the talk of local promoters of bioenergy, including people associated with related industries and local elites involved in economic development.

When subjected to powerful discourses, people (re)interpret them by drawing on their own personal experiences, identities, and a broad range of discourses form their personal opinion communities [21,24,35]. Within the broader population in our research communities, we found people looking more closely at the contribution of bioenergy plants to energy production, actual job creation, and improvement of wood markets. Many of these material benefits failed to materialize, seemed precarious, or went unnoticed in local people's experiences. This led to some skepticism about bioenergy development. This skepticism conformed in many ways with the larger conservative political discourse, prominent in the Southern U.S., that is suspicious of government spending and subsidies. Many people drew on this discourse in their belief that bioenergy development was a scam to benefit elites, a belief that was also fed by widespread disbelief in climate

change. Others in the communities countered this perspective by pointing out the many ways that other energy industries and infrastructure were subsidized in the U.S., and arguing that this was more a leveling of the playing field. This contrast in views, between seeing the bioenergy development in their communities as wasteful government spending to benefit elites and promoting development within existing structures and patterns, represented an important cleavage and tension with communities. The former group rejected many of the key components in the national bioenergy imaginary.

The communities we worked with can be characterized as forestry or wood products communities. All were or had been home to mills of one type or another, and were home to many family forest owners. We know from other research that Southern family forest owners value forests broadly [72]. Even when they manage tree plantations, forests are at least as important to them for wildlife and hunting, aesthetics, and family heritage as they are for economic return from timber. People tended to view wood-based bioenergy development from a perspective rooted in their community's recent experience with forestry and forests. They were accustomed to timber harvesting, transport, and processing, and there was little evidence that they were influenced by environmentalists' messages about bioenergy being a threat to forests. At the same time, they had a relationship to forests that was much broader than as a source of timber. There was a moral dimension to the ways they described the forests owned by their families and surrounding their communities. The presence of forests contrasted their communities with urban areas and was linked to religion and healthy lifestyles. While promoters of bioenergy saw forests as raw materials and talked of planting new biomass feedstock and intensifying production, forest owners, family owners in particular but industrial and corporate owners as well, were generally satisfied with the existing native pine plantations. Through this lens, they saw their forest management as renewable and sustainable, and showed very little interest in meeting other definitions of these terms related to national and international markets as would be required by bioenergy development.

What emerged from our research is a largely coherent and shared story about recent bioenergy development. Our respondents generally valued the communities they lived in, although there was some disenfranchisement along racial and class lines. They recognized that they are forest product communities surrounded by forests and tree plantations, and that their most likely paths for economic development would involve better wood markets and jobs in wood processing facilities. Bioenergy development was generally seen as a good fit for their communities, and they were receptive to arguments for energy independence and security. At the same time, they drew on other discourses in their suspicion of climate change, government subsidies, and policy interventions in a market economy. These other discourses combined with uncertainty around pellet markets and the failure to develop economically viable liquid fuels to feed skepticism about local bioenergy development. At the same time, environmentalist counter-narratives stating that bioenergy would lead to forest loss and degradation had little influence. Community members engaged in timber harvesting and the forestry industry in ways that suited their aesthetics, lifestyle, and household economies shared broad support for forestry but had little interest new silvicultural systems or meeting outside standards of forest management. Primarily, local communities wanted jobs and improved markets for wood from their conventionally managed pine plantations.

## 6. Conclusions

The central focus of this paper has been the salience and nature of the national bioenergy imaginary in local communities. We found acceptance of the call for energy security and independence, rejection of the climate change justification, and ambivalence about government promotion and subsidies. The imaginary became diluted at the local level in that it addressed fewer broad goals, and it was in some sense co-

opted as it was exploited primarily for local development and wood markets. Our findings have some similarities to and some differences from what other researchers have found. We did not find differing niche bioenergy imaginaries emerging [50], nor did we find the different keying or interpretations of “wood for energy.” The bioenergy developments in the communities we studied came from the outside and were seen as vehicles for economic development compatible with existing forestry communities and forest management. This likely reflects differences in the nature of bioenergy facilities and the role of timber harvesting between regions in the U.S. Similar to Kulscar et al. [53], powerful interests in communities were associated with bioenergy development and emphasized job creation and minimized risks; however, we found more people willing to speak out against this. This was probably due to the nature and uncertainty of the facilities in our communities, as well as perhaps a greater willingness for anti-government activists to speak out in a time of anti-government sentiment. Our ethnographic methods may have also enabled us to reach more people who were out of their community’s mainstream. Finally, we did not find links to environmentalist counter-narratives and imaginaries or other social movements [46], instead finding limited local interest in changing forest management to meet the demands of bioenergy.

Our analysis also provides some new insights. Many different actors, some local, drew on the national bioenergy imaginary, both because they saw in it a solution to multiple problems and because their own interests fit within it. Bioenergy development was aggressively promoted by a variety of interests, and communities desperate for development were asked to commit to bioenergy plants based on uncertain technology and policies that could change. Very optimistic scenarios and inaccurate descriptions of raw materials were provided to local communities. Local people brought their own interpretations to bear on the projects, which diminished the resonance of the national bioenergy imaginary. Non-elite locals had few opportunities to be heard during bioenergy development, and their views were not incorporated into visions or development. These issues were exacerbated by the particular nature of bioenergy development in the communities in which we worked, which was implemented through outside government and business initiatives. The limited success of the liquid fuels plants was also in part due to generally unfavorable policy and market environments for renewable energy. The expectation of a mechanism to regulate carbon emissions and address climate change, combined with relatively low natural gas and gasoline prices, clearly shifted during our research. Nevertheless, climate change and geopolitical turmoil will not go away, and a resurgence of interest in renewable energy and bioenergy, including cellulosic biofuels, seems likely at some time in the future.<sup>7</sup> Bioenergy imaginaries can be powerful cultural resources to motivate action, but our research shows that top-down imaginaries can become diluted and lack motivating power among key participants in bioenergy development at the local level. Failure to account for local interests and values may limit the effectiveness of imaginaries in promoting bioenergy development.

Here we have examined a recent history of envisioning and implementing a new bioenergy system in the Southern U.S. to draw lessons for energy futures and transitions. We used a fine-grained analysis of everyday talk to show how an energy imaginary that emanated from a coalition of powerful national interests and was implemented through local elites became diluted and diminished in communities where bioenergy development was pursued. Our analysis intersects with a number of critical themes found throughout this collection of papers. Imagined energy futures have technical, social, and moral elements and are rarely universally shared, and their implementation plays out in the context of a variety of other factors including national energy security, political economy, and environmental justice [20,24,73]. Within

individuals, communities, and societies, energy visions and their implementation can fragment across value spheres and require trade-offs [14,21,24,74], meaning that energy transitions are complex processes (sometimes called wicked problems) that require continual attention to address interpretations and tensions [21,75,76]. Our analysis of bioenergy highlights some of the issues that can develop when diversity and social complexity are not taken into account when envisioning and implementing an energy imaginary, highlighting the importance of both social research and inclusive approaches [14,77,78].

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