Social Acceptability of Bioenergy in the U.S. South

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INTRODUCTION

Global interest in bioenergy development has increased dramatically in recent years, due to its promise to reduce dependence on fossil fuel energy supplies, its contribution to global and national energy security, its potential to produce a carbon negative or neutral fuel source and to mitigate climate change, and its potential as a vehicle for rural development. However, a number of societal concerns about bioenergy have been identified, including deforestation and landscape fragmentation, loss of biodiversity, depletion of soil and water resources, introduction of invasive and/or genetically modified species, competition with food crops, high levels of required subsidies, and potentially inequitable distribution of risks and benefits associated with biofuels. Bioenergy's promises of renewability, net energy gain, and reductions in emissions of greenhouse gases and other pollutants have also been questioned. Several studies reveal the complexity of public perceptions of biofuels and landowners' willingness to manage their forests and cropland specifically for biofuel markets (Delshad 2010; Plate et al. 2010; Selfa 2010; Susaeta 2010).

As the U.S. South has a warm, wet climate that is conducive to high vegetative productivity of many leading bioenergy crops, as well as well-developed extant forestry and agricultural industries, it is likely that there will be a rapid expansion of the biofuel industry in this region as the demand for biofuels increases both domestically and internationally. There is a wide and still-unfolding array of energy technologies and feedstocks in the U.S. South. These include pellets from woody biomass and energy grasses; biodiesel from oilseed crops such as soybean, oilseed rape, crambe, and camelina, and from algae and animal fats; ethanol from traditional food crops such as corn, sugarcane/bagasse, wheat, and rice; and cellulosic ethanol and gasoline from non-food sources such as woody biomass, energy grasses, and forestry industry byproducts.

There are significant developments in liquid fuels from biomass in the U.S. South; a number of facilities have been announced, several are under construction, and at least one opened briefly before suspending operations due to technical problems. The only bioenergy plants currently

purchasing biomass on a commercial scale are pellet plants that are shipping pellets to Europe to meet renewable energy requirements. However, purchasing of biomass for domestic markets and drop-in fuels is likely to begin over the next several years. In many rural communities in the U.S. South, there is a long tradition of forest management for timber and other wood-based products; the integration of bioenergy development into these existing management frameworks, rather than competition with them, is often seen as key to the regional success of bioenergy development.

Bioenergy development in the South will utilize forest lands in new ways, thereby bringing about changes in the landscape; it will also create different sets of opportunities for and impacts on forest landowners and rural communities. Aesthetics, enjoyment of beauty and scenery, privacy, wildlife, investment, and family heritage are all important to family forest landowners in the South. However, the South is currently the major timber producing region of the United States; Southern forest landowners are more timber-oriented than their counterparts in the North and West, and Wicker (2002) notes that significant percentages of Southern forest landowners sell trees at some point. In the South, 41% of family forest owners indicated that timber was an important reason for owning forest, compared to 22% in the North and 18% in the West (Butler and Leatherberry 2004). Newman and Wear (1993) developed production functions for private forest landowners in the U.S. South and found that they were profit maximizers but that nonmarket benefits influence their production behavior. These results suggest that under certain market conditions, even people with little interest in timber may sell it. Given the active industrial forest sector in the U.S. South and the developing markets for bioenergy products, forest landowners in the South appear to be likely to adjust their forest management practices to meet available markets for bioenergy—if and when a viable bioenergy infrastructure emerges.

In addition to the development of a bioenergy infrastructure, the social acceptability of bioenergy in the U.S. South is contingent on how people interpret and understand the sustainability of biomass production for energy. Sustainability seeks to maximize synergies and minimize trade-offs across environmental, economic, and social domains. McCormick (2010) notes that, pragmatically, social acceptability is important because: (1) local communities can organize and prevent implementation of bioenergy projects, and (2) public concern and the popular media can damage legitimacy of bioenergy and limit policy options. Mayfield et al. (2007) note the importance of developing collaborative processes that bring together industry,

academia, and communities for the development of successful and locally beneficial bioenergy projects. Because of the multiple values and perspectives at play across the Southern landscape, the social acceptability of bioenergy must be analyzed broadly in a way that takes into account diverse values, governance processes, and equity concerns. Such analysis should also recognize and elucidate the multiplicity of and dynamics between various stakeholders and pay particular attention to the multi-scalar dimensions of bioenergy development.

RESEARCH METHODS AND CONCEPTUAL FRAMEWORK

Acknowledging the inherent social complexity of bioenergy development, our ongoing research broadly analyzes social acceptability as it plays out across regional, community, and landowner scales by examining biofuels narratives, stakeholder positions, policies and structures of governance, and mechanisms and criteria for landowner decision-making in a range of contexts of industrial biofuel sites that produce different bioenergy products.

The research presented here draws from an ongoing collaborative project, funded by the USDA NIFA/AFRI (National Institute for Food and Agriculture/Agriculture and Food Research Initiative) Sustainable Bioenergy Program and undertaken by social scientists from the USDA-Forest Service Southern Research Station and the Center for Integrative Conservation Research at the University of Georgia. This research is focused on understanding the social context of biofuels and the factors that influence the social acceptability of bioenergy. We are currently conducting in-depth ethnographic research in three sites where bioenergy facilities have been, will be, and are currently operating: 1) Soperton, Georgia (site of a proposed cellulosic ethanol/aviation fuel plant formerly operated by Range Fuels and currently owned by LanzaTech); 2) Waycross, Georgia (site of Georgia Biomass, an operating pellet mill; and 3) Columbus, Mississippi (site of the world's first commercial-scale cellulosic biocrude plant, operated by KiOR). We will also visit several additional sites with bioenergy facilities in Georgia, Florida, Louisiana, Alabama, and North Carolina. This paper will present preliminary research results from our first field site, Soperton, Georgia. We have completed the fieldwork component of our second field site, Waycross, Georgia, but have not yet analyzed the data from this site.

Conceptually, we will draw upon the Integrative Framework developed by the Advancing Conservation in a Social Context (ACSC) research initiative (Hirsch et al. 2011; McShane et al.

2011; Zia et al. 2011), to examine the socioeconomic impacts and social acceptability of wood-based biofuel development in rural communities in the U.S. South. ACSC was premised on the recognition that conservation problems are complex and that decisions about conservation and development inherently involve trade-offs. These trade-offs are experienced and understood from multiple perspectives, and each perspective highlights certain elements of complex problems while obscuring others (Hirsch et al. 2011, 2013).

The ACSC Integrative Framework is designed to facilitate recognition of the insights that emerge from a multiplicity of disparate perspectives. It serves a variety of purposes, and we have adapted it for use in our proposed research project as an analytic framework for examining specific case studies. We have drawn upon the Integrative Framework's three conceptual lenses—values and valuation, process and governance, and power and inequality—to design our research approach and methodology on the social acceptability of biofuels among small-scale forest owners in the U.S. South.

Values and Valuation

Bioenergy development will bring about changes in regional economies and landscapes, particularly in the areas immediately surrounding bioenergy facilities. Ecological, economic, social, and cultural values are all important. Social analysis, with attention to stakeholders and scale, enables us to understand how different people and groups perceive bioenergy development, how they frame the issues, where value conflicts and compatibilities lie, and how values influence behavior.

Process and Governance

In conjunction with studies of stakeholders' values, it is necessary to examine the various institutional frameworks, legislative structures, and regulatory mechanisms involved with decision-making about biofuels at different spatial and temporal scales (Hitchner 2010). On a national level, the U.S. Energy Policy Act [EPACT] of 2005 and the Energy Independence and Security Act [EISA] of 2007 mandate the use of renewable energy sources. EISA mandates a six-fold increase of ethanol usage in the US by 2022 (to 36 billion gallons a year, of which only 15 billion gallons can be corn ethanol; advanced biofuels, including cellulosic ethanol, account for the other 21 billion gallons) and established a mandatory Renewable Fuel Standard (RFS). The European Union also plays an important governance role in the U.S. South, as their

mandates for renewable energy directly affect production of bioenergy products (especially wood pellets) in this region. Incentives to participate in various forest certification programs such as SFI (Sustainable Forestry Initiative), FSC (Forest Stewardship Council), and American Tree Farm, can also influence forest landowners' management decisions.

POWER AND INEQUALITY

In the development of a bioenergy plant, like the implementation of any conservation or development project, certain groups often have more power to shape activities. Racial and ethnic minorities and limited resource landowners have often been underrepresented and underserved in forestry-related developments in the South (Schelhas 2002). In particular, this is true both for African American forest landowners (Schelhas et al. 2003) and African American employees in forest product industries (Bailey et al. 1996). It is not uncommon for the individual interests of minority stakeholders to be neglected when pursuing broad goals such as forest conservation or energy independence that are defined as being in the public interest (Schelhas and Pfeffer 2005).

Our ethnographic research, guided by our project objectives and research questions, enables us to examine the trade-offs and synergies that occur in bioenergy development and how they are dependent on social context and the specifics of certain bioenergy projects. We are engaging in a specific set of research activities, guided by this larger analytical framework and rooted in comparative ethnography, in a set of field sites selected to represent a variety of types and stages of bioenergy development in different socio-economic contexts. The combination of complementary research methods, including interviews, content analysis, and participant observation, allow us to gain nuanced understandings not only of the range of ways that people think about biofuel development in our primary and secondary field sites, but also how the multiplicity of values and valuation systems, structures of institutional and informal governance, and dynamics of power and inequality affect perceptions and acceptability of bioenergy development in the U.S. South.

We will produce a systematic analysis of the multiple perspectives and ways that people view other perspectives for use by managers, policy-makers, non-profit organizations, and community-based groups to guide sustainable bioenergy development. We are paying particular attention to identifying ways that bioenergy development can fit into current community development and forest management goals, as well as avoid the potential pitfalls that may result

when particular stakeholder groups are negatively affected or when certain values are underrepresented in decisions. This approach enables a comprehensive and dynamic understanding of social acceptability that can guide efforts to maximize the sustainability of bioenergy development, focus attention on areas where negative impacts of bioenergy development need to be addressed, improve our ability to communicate with stakeholders, and ultimately lay critical groundwork for bioenergy development by increasing its social acceptability.

PRELIMINARY RESEARCH FINDINGS AND DISCUSSION

In this paper, we will primarily discuss preliminary findings from our work in Soperton, Georgia, the site in which we have conducted the most research and analysis to date. In this site, we have met with extension personnel, county and state foresters, industry representatives, and members of community organizations, including the development councils involved with promoting bioenergy industry in Treutlen County. We have also met with a number of forest owners, whose landholdings vary greatly in size.

Construction began on Range Fuels, a wood-based cellulosic ethanol plant using gasification technology, in Soperton, Georgia in November 2007, after the company received a $76 million grant from the DOE (followed by an $80 loan guarantee from the USDA in 2009). The company was also backed financially by over $160 million of investor funds and a $6.25 million grant from the state of Georgia (Lane 2011), as well as a $80 million construction loan from AgSouth Farm Credit bank (on which it defaulted) (Lane 2011). Range Fuels was expected to produce 40 MGY of cellulosic ethanol with technology based on its demonstration scale plant in Colorado. However, due to technical problems in scaling up the technology, Range Fuels was only able to produce one batch of methanol from synthesis gas. The failure of Range Fuels has been compared to the dramatic failure of solar energy company Solyndra.

The implications of Range Fuels' failure have been profound, both within the national biofuel industry and within the communities in and around Soperton, Georgia . There is fear that the U.S. government will end loan guarantees and grants to commercial-scale biofuel industries, as well as public anger over what is seen as a waste of taxpayer money. In Soperton, the initial announcement of the plant was met with great enthusiasm, as it would bring many jobs to relatively poor and underdeveloped Treutlen County, as well as a new market for wood products,

including forest residue that previously had little or no monetary value. However, after the closure (or "temporary suspension of operations") of Range Fuels, jobs were lost, potential markets for wood waste dried up, and as one resident told us, "Even our Dairy Queen shut down." According to the extension agent and landowners in Soperton with whom we have conducted preliminary interviews, people in Treutlen County are now wary, but also cautiously optimistic that the facility will re-open (after being purchased at auction for $5.1 million on January 3, 2012 by New Zealand-based company LanzaTech and being renamed the Freedom Pines Biorefinery) and eventually bring the promised development and markets.

Our preliminary ethnographic research has helped us identify key informants and plan interview strategies; it has also provided several insights into local issues surrounding biofuels. We have noted that there are broad societal concerns about deforestation and intensification of forest management from bioenergy development, although others feel that thinning and harvesting of small diameter trees for bioenergy will look a lot like conventional (and socially acceptable) forest management. Local forest owners and communities with bioenergy plants have different interests than those expressed in broader public debate and discourse. Our initial interviews with landowners, foresters, and community members help outline some of the key attitudes, issues, opportunities, and constraints related to bioenergy development.

Bioenergy Plant Location and Community Development START HERE

We have found that landowner and community expectations prior to the opening of a bioenergy facility are often not realistic, and so we have selected sites at different stages of development of bioenergy facilities and markets. There has been considerable activity in bioenergy development in the South, with states and communities creating incentives and promoting bioenergy plant location. The forest-dependent rural communities we have visited are desperate for local jobs and say they would take almost anything short of toxic waste dumps. Some community members in Soperton, GA did express safety concerns regarding the siting of a new school in close proximity to the Range Fuels/Freedom Pines facility.

Press releases, negotiations with communities for plant location, and announcements of plants all are just the beginning of the bioenergy development process. Companies locating plants are often still developing commercial-scale technologies, and plant location plans and announcements are a precursor for obtaining government assistance and loan guarantees and

raising private capital. It appears that plant announcements are also used to stake out a place within regional woodsheds and discourage other companies from locating in the same region. The result, particularly for liquid biofuel plants, is that even after announcements there is still a high level of uncertainty. Even for pellets plants, which have generally been the first plants to become operational, markets have some uncertainty due to being highly dependent on European Union commitments to renewable energy goals.

The uncertainties and the financial arrangements for bioenergy industry start-ups have implications for social acceptability. Press releases and negotiations with communities create high expectations, which can crash if plants are put on hold or cancelled (as was the case for the Range Fuels facility in Soperton, GA and the Coskata facility in Boligee, AL). For example, comments after the closing of the Range Fuels facility, strongly influenced by the fact that local tax abatements were awarded, included: "we got hoodwinked," "it was a scam," and "we got taken to the cleaners." In a very politically conservative part of the country, people are also very sensitive to government involvement and government loans, and publicity around the failure of the Solyndra solar plant in California has tainted government loans for renewable energy in general.

Attitudes toward Biofuels

Attitudes toward biofuels in communities and among landowners are mixed. There is a general dislike of ethanol. We frequently encounter gas stations in our study sites with signs proudly advertising ethanol-free gas. Many people believe that ethanol is bad for engines, particularly small engines, and that it decreases gas mileage. There is a dislike for using food crops, corn in particular, for fuel. People believe it drives up corn prices (including animal feed) and don't like the fact that it is being mandated by the government. Concerns related to the food-versus-fuel debate tend to support, rather than discourage, interest in forest biomass. However, in the case of cellulosic ethanol, there are also local concerns about the size of the market for ethanol and whether it is already saturated.

Biofuels and Forests

While some industrial developments, notably Range Fuels in Soperton, GA, have planned to use waste wood that is currently left on-site (tops and branches), making this economically feasible is a challenge. Landowner enthusiasm for this is high, because they would like to have a

market for a product that is not currently used and a way to leave logging sites "cleaner." One forester's in-woods chipping experiment near Soperton was discouraging; he said if the chips had been sold the price would have been $90 a ton. This forester is more enthused about whole tree harvesting and transport. However, a forest product company in Alabama sees in-woods chipping as viable in the near future. The material used for bioenergy will depend on the type of facility, and is often categorized as clean versus dirty chips. Tops and branches do not provide the clean chips needed for pellets, which require chips made from debarked trees in order to hold together during shipment. Liquid fuel plants are beginning with clean chips, basically pulpwood, but expect to be able to take more diverse materials in the future. Combined heat and power plants, often associated with sawmills and their by-products, may be the best market for dirty chips.

The economics of wood transport mean that harvesting will be concentrated near biofuel plants (probably within a 50–70 miles radius). Sites where plants are locating, such as Soperton, generally have a lot of wood available due to CRP [Conservation Reserve Program] plantings within the past 20–30 years. Landowners would like to see a biomass market develop to create more competition for pulp wood, thereby increasing prices. While in most cases forest growth data suggests that the growth increment exceeds the harvesting increment, there are important questions related to price. Some foresters suggest that the pulp and paper industry can afford to pay much higher than current prices; bioenergy feasibility, on the other hand, may be dependent on low prices. However, bioenergy markets may be more predictable and fluctuate less, which could make biomass attractive to landowners and even change the way wood is bought and sold by leading to changes such as long-term contracts or forest owner marketing cooperatives.

If it is economically feasible to have biomass production as a land management goal, some landowners say they may be willing to shorten rotations on some of their forest tracts. The constraint to this is that sawtimber has historically provided greatest returns and is critical to the economics of forest management. Most forest owners want to continue to manage for sawtimber, as well as for hunting and recreation. But there may be ways to increase biomass yields early in the management cycle, for example, with high density pine planting and early thinning for biomass and then allowing the stand to move into chip and saw and sawtimber. One tree seedling company has a planting system that combines high value saw timber seedlings with lower cost biomass seedlings to reduce planting costs. In middle and south Georgia, increasing early

biomass thinnings may not be compatible with pine straw production, which often provides very good returns in the middle years of slash and longleaf pine management (although it is dependent on immigrant labor, which is currently a contentious issue, both nationally and regionally).

While there are experiments with fast-growing tree species targeted for bioenergy (e.g., frost resistant eucalyptus, paulownia), most landowners prefer traditional forestry species (loblolly, longleaf, and slash pine) that they perceive to be less risky because of existing markets and multiple uses. In some study sites (e.g., near Soperton), there are experiments with energy grasses (Giant Miscanthus, switchgrass), and there are indications that, with appropriate markets, some landowners may convert poorer forestry sites to grasses. But due to planting requirements, land for energy grasses appears more likely to come from what is now pasture. Over the past few decades there have been several highly promoted new biomass crops in the Soperton area, such as kenaf and paulownia, that never became profitable or marketable. These have left landowners very skeptical of new species that do not have existing markets and financial support for planting. Many of these new species also raise social sensitivities related to genetic modification and invasive species among landowners and the public.

Renewability and Sustainability

Biomass is ultimately likely to be most successful as a renewable and sustainable energy resource, suggesting that certification issues may be important. Some certification programs, such as FSC, have lagged in the South, and in general the certification programs more popular with consumers and environmental groups have been less popular with forest landowners (Cashore et al. 2004). Newsom et al. (2003) found that forest landowners in Alabama tended to view certification as another form of government regulation. In the end, the way that landowners think about the broader policy motivations behind biofuels, combined with their acceptance of certification, may be as important as markets in willingness to produce biofuels. Interviews with forest owners and community members indicate an interest in biofuels primarily as a mechanism to reduce dependence on foreign oil, create markets for local biomass, and improve community and landowner well-being. Climate change is rarely mentioned in the rural South, and when it is, generally only in the context of disbelief. Most landowners and foresters feel that certification is not necessary because they are already managing sustainably, and are not interested in separate BMPs or certification requirements for biomass. A number of pulp and paper mills and pellet

plants that are shipping to Europe, however, are planning for acquisition of certified wood (both FSC and SFI), and certification for biomass may be inevitable.

CONCLUSION

The development of the liquid biofuels industry in the U.S. South is in the early stages and has seen some fluctuation, and most landowners and community members are now cautiously optimistic about a bioenergy industry and related markets. There is limited investment due to uncertainty, careful attention to long-term job creation and development potential, and interest in environmental sustainability. In some sites, there has been opposition to bioenergy development. Interest in biofuels is usually justified on the basis of energy independence and rural development. Our interviews with diverse stakeholders suggest that no one has a complete understanding of what is happening at any particular site, and that our research can play a key role in bringing clarity to the diverse perspectives and interests.

While our results are preliminary, they show the potential for the Integrative Framework to improve our understanding of the social acceptability of biofuels in the South. Values and valuation dimensions are highlighted in different stakeholder interests, including economic returns to land, community development, and the many non-commercial forest values and uses. Acceptability of bioenergy development in general is also affected by broader social values related to the environment, government, and markets. Process and governance dimensions are highlighted by multiple levels of government support for bioenergy development, as well as by emphasis on who does, and who does not, have a place at the table when these decisions are made. Bioenergy development is dependent on government policies such as renewable fuel standards, ethanol mandates, and loan guarantees. Certification programs and their legitimacy will play a role in ensuring that biofuels meet public standards for renewability and sustainability. Power and inequality issues come to play in differential access of landowners and community members to decision-making processes about biofuel plant location and differential access to biomass opportunities. Many of the communities where biofuel development is taking place have sharp racial and economic divisions, a backdrop that will influence how biofuel facility locations are viewed and will determine which landowners have access to biofuel opportunities and which receive few benefits or are negatively impacted.

We anticipate that the results of our research will highlight many interrelated factors that make bioenergy development for liquid fuels in the U.S. South a socially complex phenomenon. The results will clarify elements of social complexity that are often left out of models based on other research approaches. By analyzing this complexity with an integrative analytical framework that uses different theoretical lenses, our research will: (1) show the different value dimensions that underlie bioenergy discussion and actions, provide insights into how these are formed and change, and examine ways that discourses can drive collaboration and polarization; (2) show how the current policies shape biofuel development and determine the potential for developing governance mechanisms to assure renewability and sustainability that effectively work across stakeholder groups; and (3) highlight groups that are underrepresented in the process and identify ways to incorporate them. Our results will also be important for designing effective policies, incentives and programs, and new land use technologies. Finally, our research will provide a foundation for collaborative planning in bioenergy sites.

ACKNOWLEDGEMENTS

Financial support for this research was provided by the Southern Research Station, USDA Forest Service through the project "Social and Cultural Dimensions of Climate Change Adaptation: Anthropological and Sociological Approaches to Social Vulnerability and Biofuels in the U.S. South" (11-JV11330144-147) and the USDA NIFA (National Institute of Food and Agriculture) AFRI (Agriculture and Food Research Initiative) Sustainable Bioenergy Program through the project "Social Acceptability of Bioenergy in the U.S. South."

REFERENCES

Bailey, C., P. Sinclair, J. Bliss, and K. Perez. 1996. Segmented labor markets in Alabama's pulp and paper industry. Rural Sociol. 61:475–496.

Butler, B. J., and E.C. Leatherberry. 2004. America's family forest owners. J. Forestry 102:4–14.

Cashore, B., G. Auld, and D. Newsom. 2004. Governing through markets: forest certification and the emergence of non-state authority. Yale Univ. Press, New Haven, CN.

Delshad, A. B., L. Raymond, V. Sawicki, and D.T. Wegener. 2010. Public attitudes toward political and technological options for biofuels. Energy Policy 38:3414–3425.

Hirsch, P.D., J.P. Brosius, S. O'Connor, A. Zia, M. Welch-Devine, J.L. Dammert, A. Songorwa, T.C. Trung, J.L. Rice, Z.R. Anderson, S. Hitchner, J. Schelhas, and T.O. McShane. 2013. Navigating complex trade-offs in conservation and development : an integrative framework. Issues Interdiscipl. Studies 31:99–122.

Hirsch, P.D., W.M. Adams, J.P. Brosius, A. Zia, N. Bariola, and J.L. Dammert. 2011. Acknowledging conservation trade-offs and embracing complexity. Conservation Biol. 25(2):259–264.

Hitchner, S.L. 2010. Heart of Borneo as a *jalan tikus*: exploring the links between indigenous rights, extractive and exploitative industries, and conservation at the World Conservation Congress, 2008. Conserv. Soc. 8(4):320–330.

Lane, J. 2011. The Range fuels failure. Biofuels Digest. 12 June 2013. http://biofuelsdigest.com/bdigest/2011/12/05/the-range-fuels-failure/

Mayfield, C.A., C.D. Foster, C.T. Smith, J. Gan, and S. Fox. 2007. Opportunities, barriers, and strategies for forest bioenergy and bio-based product development in the southern United States. Biomass Bioenergy 31:631–637

McCormick, K. 2010. Communicating bioenergy: a growing challenge. Biofuels Bioproducts Biorefining 4:494–502.

McShane, T.O., P.D. Hirsch, T.C. Trung, A.N. Songorwa, A. Kinzig, B. Monteferri, D. Mutekanga, H.D. Thang, J.L. Dammert, M. Pulgar-Vidal, M. Welch-Devine, J.P. Brosius, P. Coppolillo, and S. O'Connor. 2011. Hard choices: making trade-offs between biodiversity conservation and human well-being. Biol. Conserv. 144(3):966–972.

Newman, D.H., and D.N. Wear. 1993. Production economics of private forestry: a comparison of industrial and nonindustrial forest owners. Amer. J. Agr. Econ. 75:674–684.

Plate, R.R., M.C. Monroe, and A. Oxarart. 2010. Public perceptions of using woody biomass as a renewable energy source. J. Ext. 48(3):1–15. Article 3FEA7.

Schelhas, J. 2002. Race, ethnicity, and natural resources in the United States: A review. Nat. Resourc. J. 42:723–763.

Schelhas, J. and M.J. Pfeffer. 2005. Forest values of national park neighbors in Costa Rica. Human Organization 64:385–397.

Schelhas, J., R. Zabawa, and J.J. Molnar. 2003. New opportunities for social research in forest landowners in the South. Southern Rural Sociol. 19(2):60–69.

Selfa, T., L. Kulcsar, C. Bain, R. Goe, and G. Middendorf. 2010. Biofuels bonanza? Exploring community perceptions of the promises and perils of biofuels production. Biomass Bioenergy 34:1–11.

Susaeta, A., J. Alavalapati, P. Lal, J.R. Matta, and E. Mercer. 2010. Assessing public preferences for forest biomass based energy in the southern United States. Environ. Mgt. 45:697–710.

Wicker, G. 2002. Motivation for private forest landowners. In: D.N. Wear and J.G. Greis (eds.), Southern forest resource assessment. Gen. Tech. Rep. SRS-253. USDA Forest Service, Asheville, North Carolina.

Zia, A., P. Hirsch, A. Songorwa, D.R. Mutekanga, S. O'Connor, T. McShane, J.P. Brosius, and B. Norton. 2011. Cross-scale value trade-offs in managing social-ecological systems: The politics of scale in Ruaha National Park, Tanzania. Ecol. Soc. 16(4):7.

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