ARTICLE

Quantifying cultural values associated with deforestation in the Brazilian Amazon

Jeffrey Hoelle

Department of Anthropology, University of California, Santa Barbara, CA, USA

ABSTRACT

This study analyzes the distribution of cultural values associated with forest and non-forest landscapes among stakeholder groups shaping land use and land cover change (LULCC) in an agricultural/forest frontier in the western Brazilian Amazon. The study addresses theoretical and methodological obstacles to the integration of cultural data and social science research into the study of LULCC, providing a simple, systematic, and more accurate way of understanding this missing feature of land change. The findings offer insights on elusive cultural features that influence how diverse actors make land use decisions and respond to drivers, and can thus contribute to enhancing the predictive capacity of land change research.

1. Introduction

Amazonian deforestation is a particularly impactful form of land use and land cover change (LULCC) resulting in biodiversity loss and changes in hydrology and temperature across scales (Lawrence & Vandecar, 2015; Malhi et al., 2008). Since the Brazilian Amazon was opened to colonization in the 1970s, the extent of deforestation has steadily increased, but from 2004 to 2014, the rate of deforestation declined by 83%. In 2014–2015, however, deforestation rates in the Brazilian Amazon increased by 24% and then by 29% in 2015–2016 (INPE, 2016). The slowing of deforestation during the 2000s was attributed to more effective supply-chain governance and command and control enforcement, as well as reduced demand for agricultural commodities (Arima, Barreto, Araújo, & Soares-Filho, 2014; Gibbs et al., 2015; Nepstad et al., 2014). The recent increase in deforestation is understood to be the result of rising commodity prices and the waning efficacy of socio-environmental policies that were previously seen as robust and central to declines in deforestation (de Toledo, Dalla-Nora, Vieira, Aguiar, & Araújo, 2017; Fearnside, 2016; Klingler, Richards, & Ossner, 2018). Recent, unexpected shifts in deforestation in the Brazilian Amazon illustrate longstanding challenges in LULCC research and explanatory frameworks, and provide an opportunity to consider an important but often overlooked factor – culture.

Research on Amazonian LULCC examines the interplay of economic, demographic, infrastructural, and institutional-policy factors that drive deforestation, principally for agriculture, with an overarching emphasis on economic incentives and governmental policies that encourage cattle and soybean production (Hecht 1992; Keller, Bustamante, Gash, & Dias, 2009; Walker, Moran, & Anselin, 2000). While research focusing on material factors certainly helps explain much of what...
drives Amazonian land change, analysis of explanations over time reveals a pattern of inconsistency, in which political and economic drivers are ‘lauded when rates drop and blamed when rates increase’ (Zycherman, 2016). The Amazonian case also reflects deeper issues that researchers of the region (Fearnside, 2008; Pfaff, 1999; Skole & Tucker, 1993), as well as broader reviews of the field (Geist & Lambin, 2002; Lambin et al., 2001) have noted for years: it is unclear how drivers interact to stimulate deforestation, making it difficult to predict LULCC consistently and in different settings.

Over the years, global research programs have strengthened the study of LULCC by integrating previously disconnected specializations and expanding the study of human dimensions (Liverman, Moran, Rindfuss, & Stern, 1998; Rindfuss, Walsh, Turner, Fox, & Mishra, 2004; Turner, Lambin, & Reenberg, 2007; Verburg et al., 2015; Young et al., 2006). However, one of the most important human dimensions – culture – remains difficult to incorporate into land system science (LSS), introducing uncertainty into explanations, predictions, and models (Friis et al., 2016; Proctor, 1998). Culture is the mysterious ‘black box’ through which drivers are filtered and land use decisions are made (Caldas et al., 2015), and includes informal institutions (Ostrom, 1990), ‘invisible’ taboos (Colding and Folke, 2001) and other ‘internal’ factors that structure land use (Manson & Evans, 2007; Parker, Hessl, & Davis, 2008). Incorporating cultural factors more systematically into the study of the decision-making process could increase the predictive capacity of LSS (Munroe, McSweeney, Olson, & Mansfield, 2014). However, for this to happen we must consider the methodological and conceptual obstacles that continue to impede integration of social scientific research on culture into LSS and other types of human-environment research and policy (Cheong, Brown, Kok, & Lopez-Carr, 2012; McCarthy, Chen, Lopez-Carr, & Walker, 2014; Hackmann, Moser, & St. Clair, 2014).

The aim of this study is to provide an incremental contribution to the longstanding goal of integrating culture into LSS. This paper offers empirical data on cultural factors that play a role in stakeholder land use decisions, a basic conceptual framework that inserts culture more systematically into socio-ecological analysis, and a simple and more accurate method for studying culture that fulfills the core requirements of LULCC research, and provides concepts and measures derived from inductive, long-term ethnographic fieldwork. Given the complexity of culture and the fact that fully integrating culture is a long-term process, I focus on a specific component of culture – cultural values – an attribute that is widely understood to influence behavior (Dietz, Fitzgerald, & Shwom, 2005) and is currently the focus of integration in other fields of environmental research (e.g. Diaz et al., 2014; Jacobs et al., 2016). Specifically, I analyze the distribution of opposed pro-forest and agriculturalist values across a range of stakeholders shaping the landscape in an agricultural frontier in the Brazilian Amazon. Acre, Brazil is considered one of the most environmentally progressive states in the Amazon region because of its history and current emphasis on sustainable livelihoods (Kainer, Schmink, Leite, & da Silva, 2003; Schmink et al., 2014), but it is similar to other Amazonian forest frontiers confronting pressures from a rapidly changing and diverse set of stakeholder groups (Perz et al., 2017; Toni, dos Santos, de Menezes, Wood, & Sant’Anna, 2007).

2. Conceptualizing culture for the study of LULCC

In this section, I draw on political ecology and social science theory and methods to build a conceptual framework that emphasizes the dialectical nature of behavior in relation to structures, and the material and cultural dimensions of decisions and behaviors. The aim is to establish a more systematic understanding of the relationship between culture and land use, and then outline a more accurate way of studying culture that is capable of handling heterogeneity and change among a diversity of actors, such as those shaping land use on a frontier.

LULCC is a process that occurs in complex socio-ecological systems that operate across temporal and spatial scales (Boillat et al., 2017; Verburg et al., 2015). By and large, research on the causes of deforestation concentrates on linking an environmental outcome (LULCC) with material drivers, with increasing refinements made through attention to indirect drivers and teleconnections (Richards, Walker, & Arima, 2014; Seto et al., 2012). Modeling research seeks to account for the
decision-making process of actors responding to drivers and other constraints (Manson & Evans, 2007; Parker, Hessl, & Davis, 2008). This research is capable of accessing 'internal' factors, such as ability, or the material attributes of an actor (e.g. size of land, wealth) and willingness, which includes predispositions and cultural values (Valbuena, Verburg, Bregt, & Ligtenberg, 2010). Research on cultural dimensions adds nuance to models and helps to mitigate the limitations of previous decision models (Diniz, Kok, Hoogstra-Klein, & Arts, 2015; Kok, 2009; Meyfroidt, 2013). The benefit of an increasingly integrated LSS framework is that both ends of the dynamic – drivers and decisions – can be connected because of shared commitment to deductive approaches, a focus on measurable and quantifiable material structures and factors, and the assumption of economic rationality of actors. Yet, these approaches perpetuate a mechanistic understanding of human actors, decisions, and behaviors (Munroe et al., 2014), and make it difficult to conceptualize or access the cultural factors that inform how actors respond to constraints and produce environmental outcomes (Escobar, 1999; Moran, 1993; West, 2005).

A political ecology framework complements LSS by situating a diversity of actors in relation to relevant political/institutional and economic structures, and examining how diverse groups navigate and respond to drivers (Brannstrom & Vadjunec, 2014; Turner & Robbins, 2008). It is useful to think of actors as positioned within a 'matrix' of multi-scalar constraints that change and affect stakeholder groups in unique ways based on their structural position and interests (Perz, 2002; Schmink, 1994). The relative reach and weight of drivers depends on the interests and actions of a wide range of institutions (Fearnside, 2008). For stakeholders making decisions in this matrix, deforestation and other destructive practices that are forbidden on paper, may nonetheless be the 'logical' or 'rational' response to constraints and opportunities as they configured on the ground (Hecht, 1992; Schmink, 1987). While deforestation may seem irrational from a deterministic, top-down framing of actors, it is one of numerous possibilities from a dialectical perspective acknowledging the human capacity to learn, innovate, and adapt, resist, reshape, and respond to constraints in creative ways (Chowdhury & Turner, 2006; Giddens, 1979; Scott, 2008).

For example, during the period of declining deforestation rates (2004–2014) in the Brazilian Amazon, policies were effective in stemming deforestation, but also catalyzed diverse agricultural stakeholders into a powerful political block (Adams, 2015) that sought to roll back pro-environment legislation, including the revised forest code (Soares-Filho et al., 2014), protected areas (Ferreira et al., 2014), and environmental impact studies (Fearnside, 2016). On the ground, some stakeholders adapted to governmental monitoring and surveillance programs, and began clearing in ways that avoided detection (and casting doubt on the actual extent deforestation declines) (Richards, Arima, VanWey, Cohn, & Bhattarai, 2017). Some stakeholders, both large and small, co-opted socio-environmental discourse and policies to expand their properties and pursue traditional goals of territorial expansion (Baletti, 2012; Campbell, 2015; Schmink, Hoelle, Gomes, & Thaler, 2017).

To fully understand stakeholder behaviors, it is also necessary to consider the 'invisible' cultural factors play a role in all human decisions (Wilk & Cliggett, 2009). However, a comparison of research on indigenous and migrant land use illustrates the inconsistent way that culture enters into explanations. In Amazonia, the actions of non-indigenous migrants are often seen as driven by political and economic constraints and guided by cost-benefit analysis. However, the migrants who have arrived in Amazonia since the late 1970s are similar to colonists and settlers from other, previous American frontiers, in that they bring their agricultural knowledge, values, and practices and these guide how they engage with an unfamiliar landscape (Moran, 1981; Turner, 1956). From the migrant perspective, the transformation from forests to cultivated land is a positive transition associated with deeply-held ideals of progress and development as well as the policies that promote such ‘improvement’ of the land (Glacken, 1973; Hoelle, 2012). As some land change researchers have shown, normative and subjective evaluations related to cultural beliefs and values play a role in migrant land use decisions (Lopez-Carr, 2008; Moran & Brondizio, 1998; Walker, Perz, Caldas, & Silva, 2002). While culture is often lacking as an explanatory variable in migrant LULCC, it
may be overemphasized in some conservation research and policy focused on indigenous groups. Many groups with a longstanding history of habitation in an environment, including indigenous, traditional, forest-based populations, and groups in a commons often develop beliefs and knowledge that may result in environmental benefits and conservation (Berkes, Colding, & Folke, 2000; Colding & Folke, 2001). Norms of appropriate behavior may also be reinforced through social mechanisms and informal institutions (Ostrom, 1990) and spiritual beliefs and ritual practices (Rappaport, 1968). However, environmentally beneficial cultural features should not be assumed to be inherent or unchanging, as in the ‘myth of the ecologically noble savage’ (Chapin, 2004; Redford & Sanderson, 2000). Depending on the conditions, indigenous groups are also capable of producing widespread environmental destruction (Alvard, 1993; Hames, 2007; Krech, 2000).

In sum, all humans make decisions as informed by cultural as well as material considerations. However, it is necessary to acknowledge that groups are heterogeneous and constantly changing in response to new influences and constraints generated by markets, migration, environmental change, and other factors. When migrant and indigenous groups come into contact in frontier situations, these encounters are material struggles over land and resources, but also over what land means in terms of different ideologies and value systems that are often reinforced by governmental policy and enforcement (Brown, Brown, & Brown, 2016; Foweraker, 2002; Hecht and Cockburn 1989; Hoefle, 2006; Schmink & Wood, 1992; Simmons, Walker, Arima, Aldrich, & Caldas, 2007). Groups with a long-term history in a setting may reject exogenous drivers and migrant values that favor forest transformation and maintain traditional land uses, or distinctive land use systems may eventually converge as cultural groups interact and influence one another (Atran et al., 2002; Gomes, Vadujenc, & Perz, 2012; Rudel, Bates, & Machinguiashi, 2002). In general, people strive to bring their beliefs and values in line with behaviors. In situations of uncertainty and change, actors may be motivated to change their behaviors or beliefs, resulting in cognitive dissonance (Festinger, 1962). If a behavior, such as land use, changes then there should also be a change in cultural values or beliefs, such as those associated with land (Adams, 1973; Bradshaw & Borchers, 2000). Structures such as policies may alter behaviors temporarily, but for measures to be effective in the long run, environmental values must be internalized (Lemos & Agrawal, 2006). Measures that are perceived as repressive, however, may actually backfire and fuel antagonism that works against the greening of stakeholder attitudes and behaviors (Young, 2016). It is thus crucial to know where stakeholders stand in a constantly changing context characterized by multi-scalar drivers, interactions with other groups, and internal cultural changes.

If we could access and measure stakeholders’ cultural values and preferences as they relate to different land uses, this could provide a way of evaluating the efficacy of environmental governance interventions or the mounting pressures of shifting drivers prior to dramatic transformations. While modeling research attempts to access these internal factors, inductive approaches employed by social scientists, and cultural anthropologists and geographers in particular, are able to access insider knowledge necessary for understanding behaviors and provide cultural data that is more attuned to change and variation (Crate, 2011; Adger et al., 2013; Barnes et al., 2013; Fiske et al., 2014). However, research that provides generalizability of data, transferability of methods, and standardization of concepts and measures can be more easily integrated into natural science frameworks (Charnley & Durham, 2010). If cultural data derived from inductive, long-term social science research could be translated to meet core requirements of LSS frameworks, this could facilitate integration across disciplinary boundaries and help increase the predictive capacity of LSS.

In the most general sense, culture is ‘the learned and shared knowledge that people use to interpret experience and generate behavior’ (Spradley & McCurdy, 2012). Here I privilege the internal cognitive dimensions that are essential to understanding how stakeholders perceive the land and make decisions. Cultural beliefs, knowledge, and values are organized into mental models, or ‘simplified representations of the world that allows one to interpret observations, generate novel inferences, and solve problems’ (Kempton, Boster, & Hartley, 1996). I focus specifically on cultural values as they relate to the environment – shared knowledge of what is moral, just, and
appropriate and how people should behave in relation to nature (Mulder & Coppolillo, 2005; Dietz, Fitzgerald, & Shwom, 2005). Values are ‘principles, preferences and subjective importance’ that are assigned to things on the basis of people’s experiences, beliefs, and understandings, which are in turn influenced by their socio-cultural context (Díaz et al., 2014, p. 19).

The IPBES report (Díaz et al., 2014) is to date one of the most comprehensive documents defining values and outlining how they might be integrated into environmental research and policy. According to the authors, cultural values are context dependent, plural, and incommensurable, so it is necessary to find site- and group-specific approaches to determining ecosystem services (Díaz et al., 2014), with researchers providing case studies (e.g. Gould et al., 2015). If the goal is to contribute to a more general framework that includes cultural values, however, alternative approaches might be considered. On the general end, core cultural values can be measured and compared across the globe by translating specific content into broader parent categories (World Values Survey Association, 2005). Such broad-level instruments are not without their drawbacks, and substantial effort is required to ensure that translated questions and concepts are meaningful to different groups and actually measure that which they purport to measure (Bernard, 2012). An inductive, anthropological approach based on sustained research with a group or in a setting can help to identify salient values with greater accuracy and mitigate the error that results from largely deductive approaches with predetermined choices. For example, group-specific cultural values can be used as the starting point for finding overarching categories that allow for comparison across distinct cultural, linguistic, and national boundaries (D’Andrade, 2008; Vogt & Albert, 1966).

Anthropologists have used an inductive to deductive approach to determine patterns of agreement on opposed environmental and anti-environmental values across groups in the United States (Kempton et al., 1996). Similarly opposed values also exist in Amazonia, but they tend to be applied to a specific type of environment – the rainforest. ‘Pro-forest’ values emphasize the forest as some combination of productive, useful, beautiful, and important for the environmental health of the region or planet. These values reflect a range of political, economic, and environmental goals, from complete forest preservation to forest-based livelihoods to less destructive agricultural and forest-based livelihoods on already cleared lands. On the other hand, ‘agriculturalist’ values correspond more with anthropocentric and instrumental views of nature in which human food, property, and profit are valued over environmental concerns. Agriculturalist values are aligned with traditional ideas and policies promoting development through transformation of the native environment into cultivated cattle pastures and agricultural fields. In this paper I analyze the distribution of opposed pro-forest and agriculturalists values across a range of stakeholders shaping the landscape in Acre, Brazil. The iterative inductive-deductive approach described in the next section provides an example of how a mixed method approach can mitigate the weakness of exclusively deductive or inductive, or qualitative or quantitative forms of analysis and facilitate integration with environmental change frameworks.

3. Methods and materials

Data were collected during multiple field visits to Acre totaling eighteen months from 2007–2010 as part of a research project on land use, cattle raising, and culture in southern Acre. During the first several months of fieldwork, my questions about deforestation were met with responses that were inconsistent with observed household LULCC or yielded a pro-environment/forest discourse that seemed designed to appease me as the latest foreign researcher (and assumed environmentalist) asking about the rainforest. With time, it became clear that deforestation framed the relatively neutral term ‘land use’ from a specific set of values in which peoples’ actions were criminal, morally objectionable, and destructive. This experience illustrated to me the limitations of research on land use that begins with pre-set questions and also value-laden concepts that researchers may not be aware of (see Hoelle, 2015, pp. 74–75, 155–156).
After it became clear that this line of questioning would not lead to meaningful data nor help in establishing the rapport needed to access insider perspectives, I returned to some of the core principals and methods of cultural anthropology. Cultural anthropology is grounded on the principal of cultural relativism – attempting to put aside the assumptions and judgments of a people based on one’s own our ethnocentric values to facilitate understanding of unfamiliar beliefs and actions. Using the method of participant observation, I immersed myself into the daily life of the people, living with rural families for extended periods of time and participating in daily household activities, such as planting, clearing, and caring for livestock. These experiences also provided an opportunity to observe key decisions, social interactions, and occasions when people spoke about land and land use. Gradually, I came to better understand the logic of deforestation in relation to political and economic drivers, but also through a value system in which forest clearance was seen as productive, rather than destructive. Sustained interaction and multiple visits with families and individuals over the course of several years also allowed me to establish a level of trust and rapport that facilitated more honest conversations and access to knowledge that I could not have acquired – or even known to ask about – using a survey with predefined questions.

During this first phase of participant observation, I noticed that people often commented on the character of other landowners based on the state of his/her land. This often happened when I was walking from one home to another with stakeholders or guides who lived in rural communities. Cultivated landscapes, such as pastures, were often praised with words such as ‘development,’ and ‘progress’ and the people who produced them were considered positively, as ‘hard working.’ In conversations and unstructured interviews occurring while working and living with rural groups, I was able to develop a deeper understanding of the context that surrounded these values, and how cultural features were connected with economic and policy factors. Some rural landowners spoke of the forest as an unprofitable waste of space and an obstacle to development. They resented the federal laws that forced them to preserve it. Whereas some took pride in pastures and saw profit in the transformation of the rainforest, others spoke of the beauty of the forest and its virtues, and the importance of preservation. With time and interactions with many different types of stakeholders, I saw that positive or negative values could be applied to forests or pastures, depending on the person. While I could describe these narratives qualitatively, I also wanted a more systematic way to analyze and compare the values across groups.

I compiled a list of the most common concepts used to describe land uses/land covers (LULC) categories in southern Acre. I consulted with key informants in each group to narrow this list to ten cultural values that were meaningful and relevant across groups. The final list included ten concepts: conservation, poverty, decline, beauty, work, development, progress, wealth, productivity, and status. The three main land uses in Acre were well known across rural and urban groups, and recognized by the resultant land cover: forest extractivism, agricultural clearings, and cattle raising pastures. There was limited large-scale agriculture in Acre at the time of this study, so agriculture refers to small-scale, shifting agriculture reliant on burning and clearing of the forest. Agricultural clearings were often converted to pasture after a few years by most respondents. Agriculture and cattle ranching are grouped together under the term agropecuária in Brazil and both require alteration of the landscape and the removal of forest. While local categories of land were complex and could have a dizzying number of classifications based on stage of regeneration, composition, land use history, and other factors, respondents were all familiar with the core dichotomy between forest and non-forest spaces. This was due to their own classification schemas, but was also reinforced by the necessity to understand how their land was classified by environmental monitoring programs to avoid punishment and fines. Thus, the forest and non-forest categories that are shared across groups also match up with ways that LULC is classified externally, by both researchers and governmental monitors of deforestation.
Over the course of six months in 2010, I administered a survey examining land use, perceptions, and demographic information (see Hoelle, 2015, pp. 169–179). Included in the survey were the cognitive associations between land uses and values that are the focus of this study. Each of the three primary land use categories was drawn on the survey in the presence of the respondent and with their input to ensure shared understanding of what the land was used for and its composition and cover. The respondent was then asked to indicate which of the three LULC categories was most associated with one of ten concepts (e.g., progress). After a response was provided, the same prompt was given for the next concept on the list. To facilitate comparison in this analysis, I collapse the three categories into the dichotomous LULC classifications of forest and non-forest (agriculture and pasture), based on the rationale provided in the previous paragraph. The sample consists of twenty respondents in six groups (n = 120). Respondents were chosen using a purposive sampling technique (Bernard, 2012).

The survey was administered by the author to the respondents in each of the six groups involved directly and indirectly in land use dynamics in southern Acre, the most densely populated and historically contested part of the state (see Figure 1). Rubber tappers, colonists, and ranchers all directly shaped LULCC in the region as owners or claimants of rural properties. Migrant large-scale cattle ranchers and smallholder agricultural colonists arrived in Acre in the 1970s and 1980s and came into contact and conflict with forest-extractivist rubber tappers, who had been in the region since the rubber booms in the mid-nineteenth century. In the 2000s, cattle raising and deforestation increased in Acre, as smallholder colonists and rubber tappers expanded the role of cattle in their livelihood systems (Salisbury & Schmink, 2007; Toni et al., 2007). These three groups, including large and small-scale private landowners and residents of a protected area, are in institutional situations similar to those of other groups making land use decisions along other forest frontiers of Amazonia (Soares-Filho et al., 2014). Research with these three groups was conducted in southern Acre, with the majority of interviews in the municipality of Brasiléia, which was 31.3% deforested in 2010 (INPE, 2016).

![Figure 1. Southern Acre, Brazil.](image-url)
Figure 2 illustrates the study area and provides general characteristics of the three stakeholder groups. The satellite image illustrates LULC in three tenure areas/types of property where the different stakeholder groups reside. 1. Chico Mendes Extractive Reserve, home of the rubber tappers; 2. Privately owned land used for large-scale cattle ranching; 3. Quixadá Directed Settlement Project, where smallholder colonists live. The three photographs above the satellite image show what a typical stakeholder’s landholding looks like on the ground in each of the areas, the approximate property size, and reported percentage of deforestation for rubber tappers (INPE, 2016) and colonists and ranchers (Toni et al., 2007). The boundaries of two ranches illustrate only the amount of non-forested areas and do not include forest reserve or overall property boundaries.

Respondents from three groups with an indirect role in land use were also included to capture the broader social and political context: cowboys, NGO employees, and policymakers. Cowboys served as wage laborers on the ranches. Although many cowboys did not own land, they actively created and maintained pastures on ranches. Socio-environmental NGO decision makers and governmental policymakers influenced land use through rural policy, technical extension, and rural development and environmental preservation projects. Members of these two groups lived in the city and had higher levels of education compared to other groups. 1

The sampling strategy was designed to have a balance of groups who were considered to be on opposed sides of debates over rural development. The placement of groups into these separate blocks is based on the ways that groups defined themselves, their allies or like-minded groups, and groups that they identified as opposed to their interests. The six groups can thus be separated into two aggregate blocks based on dedication to or support for opposed agricultural or forest-based livelihoods. The ‘agriculturalist’ block includes ranchers, colonists, and cowboys who favor development through forest conversion to agriculture and cattle raising. The ‘pro-forest’ block includes rubber tappers with varying degrees of reliance on forest-based livelihoods and urban policy-
makers and socio-environmental NGO employees working to reorient rural groups to sustainable, forest-based alternatives to livelihoods requiring deforestation.  

I analyze the distribution of values according to three groupings of the sample to evaluate three corresponding hypotheses based on twelve months of ethnographic research: 1) Overall (all 120 respondents from six groups), I expected that the forest LULC category would be associated with positive attributes by the majority of respondents, given the historical, social, and political commitment to forest-based livelihoods in Acre. 2) On the group level, it was hypothesized that there would be significant differences between groups. Rubber tappers, policymakers in the forest government and employees at socio-environmental NGOs would agree more with pro-forest values, compared to ranchers, colonists, and cowboys. 3) Aggregating these distinct groups into agriculturalist and pro-forest livelihood blocks, I assumed that each block would exhibit values that reinforced or corresponded with their livelihoods, and the two blocks would be markedly different from each other.

4. Results

Figure 3 shows the percentage of respondents in the overall sample (n = 120) selecting either forest or non-forest LULC for the entire list of ten cultural values. Overall, non-forest landscapes are linked with positive values more than forest landscapes by the majority of respondents. Cultural values of progress, development, wealth, productivity, status, and work are associated with non-forest clearings by more than 75% of the overall sample. On the other extreme, conservation, poverty, decline, and beauty are associated with forest LULCC by the majority of respondents, although the strength of these associations is weaker than for non-forest values.

Analyzing results on the group level allows us to see how these associations are distributed across the six groups and how values are connected. In the heat map (Figure 4) each cell shows the percentage of respondents in each group who selected ‘non-forest’ LULC for each cultural value. Cells are shaded on a gradient from light yellow (100% forest; e.g. conservation-NGO) to dark blue (100% non-forest; e.g. NGO-status). The percentages were converted from the proportion of responses for each group to facilitate comparison. P-values were obtained using Fisher’s exact test and the seventeen items that are statistically significant are indicated (*p < 0.05; ** p < 0.01, ***p < 0.001; t < 0.1 is not significant, but is often included). The dendrograms (lines outside the main figure) represent the

Figure 3. Cultural values associated with forest and non-forest LULC.
distance between concepts and groups (how similar they are), as calculated by a hierarchical clustering procedure.

Group-level associations were similar to the overall sample, as illustrated by the clear separation of dark (non-forest) and light (forest) cells. The NGO group was significantly different from the other groups on seven of the ten values. There was less variation across the three landowning groups, who were only different from the overall sample on a total of five values. There was also little overall difference in values between those traditionally oriented to agriculture and/or cattle raising livelihoods (ranchers, colonists) and those who made the transition more recently (rubber tappers).

It was expected that policymakers and rubber tappers would be more similar to the NGOs as pro-forest groups, but results showed that their values were much closer to the agrarianist groups (ranchers, colonists, and cowboys). How different were the associations between these pro-forest and agrarianist blocks? Table 1 shows the results of two sample t-tests conducted per variable, testing whether means differed significantly for agrarianist (N = 60) and pro-forest (N = 60) groups. The mean for non-forest LULC is presented; the mean for forest LULC is the difference from 1.00. Positive values is the mean score on five values (progress, development, wealth, productivity, status); negative values is the mean score of two values (poverty, decline). Three individual values were excluded from this final analysis because they were contested (e.g. beauty) or not clearly positive or negative (work, conservation).

Results show that agricultural and pro-forest blocks are different in the extent to which they link forest and non-forested land with positive and negative cultural values. However, these differences are a matter of degree within an overall consensus of positive- non-forest/negative-forest
associations. The agricultural block associated non-forest landscapes with positive values 98% of the time, compared to 84% across forest-oriented groups.

5. Discussion & conclusion

In Acre, Brazil it was hoped that the divide between forest conservation and economic development had been bridged, but most stakeholder groups, and particularly those making land use decisions, view the forest negatively and associate non-forest pastures and agricultural fields with positive values. The widespread agreement with agriculturalist values is surprising in a setting widely considered to be on the cutting edge of sustainable development in Amazonia. Agriculturalist values may be even more pronounced in other Amazonian contexts, where opposition to forest conversion has been less successful and there is less governmental support for forest-based populations, livelihoods, and sustainable development strategies.

Policy interventions are widely credited with declining deforestation between 2004 and 2014 in the Brazilian Amazon, but the findings, based on data collected in 2010, suggest that stakeholders in Acre were not developing the pro-forest values necessary for long-term sustainability. Given that long-term sustainable land use occurs when economic, institutional, and cultural factors are aligned, the economic and institutional approaches currently favored in land change research could benefit from attention to the cultural values that influence destructive practices and undermine environmental governance. For groups with non-forest values linked with agricultural livelihoods, the analysis of culture can help to understand to what extent policies are producing shifts in values necessary for sustainability. For groups historically oriented to forest-based livelihoods, such as the rubber tappers, the analysis of cultural values can be particularly revealing into cultural changes that may presage a shift in land use.

Yet, in most of Amazonia, it is unclear what stakeholder values are or how they are changing. Until we can compare values across contexts and time, our understanding of a key component of land change will remain limited. The research reported here can provide a starting point for future attempts because it uses concepts and categories that are meaningful to researchers, but also to a range of the primary stakeholder groups making land use decisions in Acre and throughout Amazonia. This method could be revised and transferred to other contexts to build a comparative framework across space. For research seeking to understand change across time (e.g. if the green values necessary for enduring environmental governance are being internalized), it could be particularly useful to employ such a method longitudinally.

The overwhelmingly positive values surrounding non-forest LULCC categories helps to conceptualize a more holistic view of land change as related to interlinked economic, institutional, and cultural factors. Positive cultural values associated with non-forest spaces are inseparable from the material context in which pastures and fields offer greater profit and tenure security compared to forest-based livelihoods and landscapes. The similarity of cultural values across a range of rural stakeholder groups suggests that values function as more than place- or group-specific proximate variables that mediate exogenous drivers. Values can also be shared across groups as part of the broader economic and institutional matrix that supports not only forest transformation, but also motivates actors to subvert,
resist, and reconfigure measures aimed at forest preservation and use. Even after a decade of decline due in part to impressive shifts in policy by the Brazilian government, these values remain strong because of the continued incentives to transform forest for agriculture. Agricultural livelihoods and values can shift to more sustainable, pro-forest use and values, but this requires time and a sustained commitment to creating a context in which the forest has both economic and cultural value.

Only one group – the NGO group – was discernibly pro-forest in their values. Contextualizing the NGO responses with ethnographic data and information that does not fit into the boxes of a standardized survey provides an opportunity to reflect on the broader meaning of pro-forest values and implications for research and policy. The NGO respondents labored over responses to questions that rural respondents found to be relatively straightforward. NGO members were less comfortable agreeing with the way things were (according to the majority of respondents), with many qualifying their responses with the way things should or could be. Unlike rural groups, the NGO respondents cited environmental and economic figures and academic studies to back up their responses, and described win-win scenarios in which the forest is maintained and rural groups make a living. This reasoning often rang hollow to those rural groups invested in agricultural livelihoods and values. For many rural groups, the NGOs, along with researchers and policymakers, were disconnected from reality and driven more by an environmentalist ideology that made little sense within the socio-political context in which rural stakeholders operated. Some of the more outspoken local critics of the green agenda noted that those who protest and/or study Amazonian ‘deforestation’ come largely from developed nations and parts of Brazil where forests and other ecosystems were and continue to be euphemistically ‘improved’ ‘developed,’ or ‘managed,’ with environmental concerns taking a backseat to economic development. Such qualitative data show what is below the patterns and trends of the survey data. Pro-forest values are perceived to mask inequality and bias that are often glossed over in both scientific and more politicized pursuits to study or ‘save’ the forest.

This paper aims to connect with and complement the innovative interdisciplinary research contributing to general frameworks that increase our understanding of the many factors involved in LULCC and environmental change in general. As researchers from across the world work toward integration, it is important to remember that the shared environmental values that facilitate overcoming longstanding disciplinary obstacles are not universal. The increasingly urgent nature of environmental research and policy, coupled with the expanding reliance on remote sensing and monitoring technologies, command and control enforcement, and techno-managerial policies, makes it easier than ever to lose sight of the fact that there are real people down there, on the ground, facing difficult decisions. In the end, grounded social science research can generate data and insights that are impossible to acquire by other means, and also provide a window into alternative value systems that allow for reflection of our own deeply-held values.

Notes

1. Respondents for the policy group were drawn from the following government agencies: INCRA (Brazilian Institute for Colonization and Agrarian Reform), EMBRAPA (Brazilian Agricultural Research Corporation), SEAPROF (Secretariat for Agriculture and Family Production), IDAF (Institute for the Defense of Agro-Cattle Raising and the Environment), SEAP (Secretariat for Agro-Cattle Raising), IBAMA (Institute of Biodiversity and the Environment), and IMAC (Institute of the Environment-Acre). The NGO sample included respondents from S.O.S. Amazonia, World Wildlife Fund (WWF), Center for Amazonia Workers (CTA), Group for Agro-Forestry Research of Acre (PESACRE), and the Pro-Indian Commission (CPI).

2. The policy respondents represented a range of institutions, some of which could be considered of an ‘agriculturalist’ perspective. My grouping of policymakers in the ‘pro-forest’ category was based on the fact that most respondents were appointed by the state ‘forest’ government administration and expressed personal ideologies that were more oriented to environmentally sustainable livelihoods than to traditional development compared to ranchers, colonists, and cowboys and compared to previous government administrations.
Acknowledgement

Writing this paper as an anthropologist attempting to connect with the field of land system science was only possible thanks to the encouragement and insights of several scholars committed to interdisciplinary study of human-environment interactions. My thanks to go to all of those who helped in the creation of this paper: Stephen Perz, David Lopez-Carr, Marianne Schmink, Peter Richards, Eduardo Brondizio, Jaqueline Vadjunec, Nick Kawa, H. Russell Bernard, Tracy van Holt, Robert Walker, Marcellus Caldas, Frank Davis, John Melack, Mike Gurven, Aaron Blackwell, Barbara Herr-Harthorn, Jono Wilson, Emilio Moran, Andreas Heinemann, Casey Walsh, Oran Young, Valerio Gomes, Tatiana Kuplich, Jason Bergtold, Francesco Orsi, and Rachelle Gould, as well as the anonymous reviewers of the manuscript. Aaron Blackwell and volunteers at the UCSB Broom Center for Demography assisted with statistical analysis and Eddy Peralta and Chris Chien helped with the maps.

Disclosure statement

No potential conflict of interest was reported by the author.

Funding

This work was supported by the NSF [0527511];University of Florida;Fulbright Brazil;University of California, Santa Barbara.

References

Adams, R.L. (1973). Uncertainty in nature, cognitive dissonance, and the perceptual distortion of environmental information: Weather forecasts and New England beach trip decisions. Economic Geography, 49, 287–297.
Adams, R.T. (2015). An emerging alliance of ranchers and farmers in the Brazilian Amazon. Tipiti, 13, 63–79.
Adger, N, Barnett, J, Brown, K, Marshall, N, & O'brien, K. (2013). Cultural dimensions of climate change impacts and adaptation. Nature Climate Change, 3(2), 112-117.
Alvard, M.S. (1993). Testing the “ecologically noble savage” hypothesis: Interspecific prey choice by Piro hunters of Amazonian Peru. Human Ecology, 21(4), 355–387.
Arima, E.Y., Barreto, P., Araújo, E., & Soares-Filho, B. (2014). Public policies can reduce tropical deforestation: Lessons and challenges from Brazil. Land Use Policy, 41, 465–473.
Atran, S., Medin, D., Ross, N., Lynch, E., Vapnarsky, V., Ek, E., … Haenn, N. (2002). Folkecology, cultural epidemiology, and the spirit of the commons: A garden experiment in the Maya Lowlands. Current Anthropology, 43, 421–450.
Baletti, B. (2012). Ordemamento territorial: Neo-developmentalism and the struggle for territory in the lower Brazilian Amazon. Journal of Peasant Studies, 39(2), 573–598.
Barnes, J., Dove, M., Lahren, M., Mathews, A., McElwee, P., McIntosh, R., … Yager, K. (2013). Contribution of anthropology to the study of climate change. Nature Climate Change, 3, 541–544.
Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. Ecological Applications, 10(5), 1251–1262.
Bernard, H.R. (2012). Social research methods: Qualitative and quantitative approaches. Boston: Pearson.
Boillat, S., Scarpa, F.M., Robson, J.P., Gasparri, L., Aide, T.M., Aguiar, A.P.D., … Brondizio, E.S. (2017). Land system science in Latin America: Challenges and perspectives. Current Opinion in Environmental Sustainability, 26, 37–46.
Bradshaw, G.A., & Borchers, J. (2000). Uncertainty as information: Narrowing the science-policy gap. Conservation Ecology, 4(7). doi:10.5751/ES-00174-040107
Brannstrom, C., & Vadjunec, J. (Eds.). (2014). Land change science, political ecology and sustainability: Synergies and divergences. London: Routledge.
Brown, D.S., Brown, J.C., & Brown, C. (2016). Land occupations and deforestation in the Brazilian Amazon. Land Use Policy, 54, 331–338.
Caldas, M., Sanderson, M.R., Mather, M., Daniels, M.D., Bergtold, J.S., Aistrup, J., … Lopez-Carr, D. (2015). Endogenizing culture in sustainability science research and policy. Proceedings of the National Academy of Sciences, 112, 8157–8159.
Campbell, J.M. (2015). Conjuring property: Speculation and environmental futures in the Brazilian Amazon. Seattle: University of Washington Press.
Carr, D. (2008). Migration to the Maya biosphere reserve, Guatemala: Why place matters. Human Organization, 67, 37–48.
Chapin, M. (2004). A challenge to conservationists. Washington D.C:WorldWatch Institute.
Chamley, S., & Durham, W. (2010). Anthropology and environmental policy: What counts? American Anthropologist, 112, 397–415.
Cheong, S.M., Brown, D.G., Kok, K., & Lopez-Carr, D. (2012). Mixed methods in land change research: Towards integration. Transactions of the Institute of British Geographers, 37(1), 8–12.

Chowdhury, R., & Turner, B.L. (2006). Reconciling agency and structure in empirical analysis: Smallholder land use in the southern Yucatán, Mexico. Annals of the Association of American Geographers, 96(2), 302–322.

Colding, J., & Folke, C. (2001). Social taboos: “invisible” systems of local resource management and biological conservation. Ecological Applications, 11, 584–600.

Crane, S. (2011). Climate and culture: Anthropology in the era of contemporary climate change. Annual Review of Anthropology, 40, 175–194.

D’Andrade, R. (2008). A study of personal and cultural values: American, Japanese, and Vietnamese. New York: Palgrave Macmillan.

de Toledo, P.M., Dalla-Nora, E., Vieira, L.C.G., Aguiar, A.P.D., & Araújo, R. (2017). Development paradigms contributing to the transformation of the Brazilian Amazon: Do people matter? Current Opinion in Environmental Sustainability, 26, 77–83.

Díaz, S.M., Pataki, G., Roth, E., Watson, R.T., Al-Hafedh, Y.S., Ahn, S., … Bullock, C.H. (2014). Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services. Kuala Lumpur: IPBES Assessment Reports; IPBES/3/INF/7.

Dietz, T., Fitzgerald, A., & Shwom, R. (2005). Environmental values. Annual Review of Environmental Resources, 30, 335–372.

Diniz, F., Kok, K., Hoogstra-Klein, M., & Arts, B. (2015). Mapping future changes in livelihood security and environmental sustainability based on perceptions of small farmers in the Brazilian Amazon. Ecology and Society, 20(2), 26.

Escobar, A. (1999). After nature: Steps to an antiessentialist political ecology. Current Anthropology, 40(1), 1–30.

Fearnside, P.M. (2008). The roles and movements of actors in the deforestation of Brazilian Amazonia. Ecology and Society, 13(1), 23.

Fearnside, P.M. (2016). Environmental policy in Brazilian Amazonia: Lessons from recent history. Novos Cadernos NAEA, 19(1). doi:10.5801/ncn.v19n1.1379

Ferreira, J., Aragão, L.E.O.C., Barlow, J., Barreto, P., Berenguer, E., Bustamante, M., … Zuanon, J. (2014). Brazil’s environmental leadership at risk. Science, 346(6210), 706–707.

Festinger, L. (1962). A theory of cognitive dissonance (Vol. 2). Palo Alto: Stanford University Press.

Fiske, S., Crane, S., Crumley, C., Lazrus, H., Lucero, H., Oliver-Smith, A., … Wilk, R. (2014) Changing the atmosphere: Anthropology and climate change. Final report to the AAA global climate task force. Arlington, VA: American Anthropological Association.

Foweraker, J. (2002). The struggle for land: A political economy of the pioneer frontier in Brazil from 1930 to the present day. Cambridge: Cambridge University Press.

Friis, C., Østergaard Nielsen, J., Otero, I., Haberl, H., Niewöhner, J., & Hostert, P. (2016). From teleconnection to telecoupling: Taking stock of an emerging framework in land system science. Journal of Land Use Science, 11(2), 131–153.

Geist, H., & Lambin, E. (2002). Proximate causes and underlying driving forces of tropical deforestation. BioScience, 52, 143.

Gibbs, H.K., Munger, J., L’Roe, J., Barreto, P., Pereira, R., Christie, M., … Walker, N.F. (2015). Did ranchers and slaughterhouses respond to zero-deforestation agreements in the Brazilian Amazon? Conservation Letters, 9(1), 32–42.

Giddens, A. (1979). Central problems in social theory: Action, structure, and contradiction in social analysis. Berkeley: University of California Press.

Glacken, C.J. (1973). Traces on the Rhodian shore: Nature and culture in western thought from ancient times to the end of the eighteenth century. Berkeley: University of California Press.

Gomes, C., Vadjunec, J., & Perz, S. (2012). Rubber tapper identities: Political-economic dynamics, livelihood shifts, and environmental implications in a changing Amazon. Geoforum, 43, 260–271.

Gould, R.K., Klein, S.C., Ardoin, N.M., Satterfield, T., Woodside, U., Hannahs, N., … Chan, K.M. (2015). A protocol for elicitng nonmaterial values through a cultural ecosystem services frame. Conservation Biology, 29(2), 575–586.

Hackmann, H, Moser, S, & St. Clair, A. (2014). The social heart of global environmental change. Nature Climate Change, 4, 653-655.

Hames, R.H. (2007). The ecologically noble savage debate. Annual Review of Anthropology, 36, 177–190.

Hecht, S., & Cockburn, A. (1989). The fate of the forest: Developers, destroyers and defenders of the Amazon. London: Verso.

Hecht, S. (1992). Logics of livestock and deforestation- the case of Amazonia. In T. Downing, S. Hecht, & C. Garcia-Doming (Eds.), Development or destruction: The conversion of tropical forest to pasture in Latin America (pp. 7–26). Boulder: Westview.

Hoeﬄe, S.W. (2006). Twisting the knife: Frontier violence in the central Amazon of Brazil. The Journal of Peasant Studies, 33(3), 445–478.

Hoeﬄe, J. (2012). Black hats and smooth hands: Elite status, environmentalism, and work among the ranchers of Acre, Brazil. Anthropology of Work Review, 33(2), 60–72.

Hoeﬄe, J. (2015). Rainforest cowboys: The rise of ranching and cattle culture in western Amazonia. Austin, TX:University of Texas Press.

INPE. (2016, March 17). Brazilian national institute for space research PRODES Retrived from http://www.obt.inpe.br/prodes/index.php
Rudel, T.K., Bates, D., & Machanguishi, R. (2002). Ecologically noble Amerindians? Cattle ranching and cash cropping among Shuar and colonists in Ecuador. Latin American Research Review, 37(1), 144–159.

Salisbury, D., & Schmink, M. (2007). Cows versus rubber: Changing livelihoods among Amazonian extractivists. Geoforum, 38, 1233–1249.

Schmink, M. (1987). The rationality of tropical forest destruction. In J. Colón, F. Wadsworth & S. Branham (Eds.), Management of the forests of tropical America: Prospects and Technologies (pp. 11–30). San Juan, Puerto Rico: Institute of Tropical Forestry, USDA Forest Service in Cooperation with the University of Puerto Rico.

Schmink, M., Duchelle, A., Hoelle, J., Leite, F., d’Oliveira, M., Vadjunej, J., … Wallace, R. (2014). Forest citizenship in Acre, Brazil. In P. Katila, G. Galloway, W. Jung, P. Pacheco, & G. Mery (Eds.), Forest under pressure: Local responses to global issues. Finland: IUFRO.

Schmink, M., Hoelle, J., Gomes, C.V.A., & Thaler, G.M. (2017). From contested to ‘green’ frontiers in the Amazon? A long-term analysis of São Félix do Xingu, Brazil. The Journal of Peasant Studies, 1–23. doi:10.1080/03066150.2017.1381841

Schmink, M. (1994). The socioeconomic matrix of deforestation. In L. Arizpre, P. Stone, & D. Major (Eds.), Population and environment: Rethinking the debate (pp. 253–275). Boulder: Westview.

Schmink, M., & Wood, C.H. (1992). Contested frontiers in Amazonia. New York: Columbia University Press.

Scott, J.C. (2008). Weapons of the weak: Everyday forms of peasant resistance. New Haven, CT: Yale University Press.

Seto, K.C., Reenberg, A., Boone, C.G., Fragkias, M., Haase, D., Langanke, T., … Simon, D. (2012). Urban land teleconnections and sustainability. Proceedings of the National Academy of Sciences, 109(20), 7687–7692.

Simmons, C.S., Walker, R.T., Arina, E.Y., Aldrich, S.P., & Caldas, M.M. (2007). The Amazon land war in the south of Pará. Annals of the Association of American Geographers, 97(3), 567–592.

Skole, D., & Tucker, C. (1993). Tropical deforestation and habitat fragmentation in the Amazon: Satellite data from 1978 to 1988. Science, 260, 1905–1910.

Soares-Filho, B., Rajão, R., Macedo, M., Carneiro, A., Costa, W., Coe, M., & Alencar, A. (2014). Cracking Brazil’s forest code. Science, 344, 363–364.

Spradley, J., & McCurdy, D. (2012). Conformity and conflict: Readings in cultural anthropology. Boston: Pearson.

Toni, F., dos Santos, J., de Menezes, R., Wood, C., & Sant’Anna, H. (2007). Expansão e Trajetórias da Pecuária na Amazônia: Acre, Brasil (Expansion and trajectories of cattle raising in Amazonia: Acre, Brazil). Brasília: Editora Universidade de Brasília.

Turner, B., Lambin, E., & Reenberg, A. (2007). The emergence of land change science for global environmental change and sustainability. Proceedings of the National Academy of Sciences of the United States of America, 104, 20666–20671.

Turner, B., & Robbins, P. (2008). Land-change science and political ecology: Similarities, differences, and implications for sustainability science. Annual Review of Environment and Resources, 33, 295–316.

Turner, F.J. (1956). The significance of the frontier in American history. Ithaca: Cornell University Press.

Valbuena, D., Verburg, P.H., Bregt, A.K., & Litgenberg, A. (2010). An agent-based approach to model land-use change at a regional scale. Landscape Ecology, 25(2), 185–199.

Verburg, P.H., Crossman, N., Ellis, E.C., Heinimann, A., Hostert, P., Mertz, O., … Zhen, L. (2015). Land system science and sustainable development of the earth system: A global land project perspective. Anthropocene, 12, 29–41.

Vogt, E.Z., & Albert, E.M. (Eds.). (1966). People of Rimrock: A study of values in five cultures. Cambridge, MA: Harvard University Press.

Walker, R., Moran, E., & Anselin, L. (2000). Deforestation and cattle ranching in the Brazilian Amazon: External capital and household processes. World Development, 28(4), 683–699.

Walker, R., Perz, S., Caldas, M., & Silva, L.G.T. (2002). Land use and land cover change in forest frontiers: The role of household life cycles. International Regional Science Review, 25(2), 169–199.

West, P. (2005). Translation, value, and space: Theorizing an ethnographic and engaged environmental anthropology. American Anthropologist, 107(4), 632–642.

Wilk, R.R., & Cliggett, L.C. (2009). Economies and cultures: Foundations of economic anthropology. Boulder, CO:Westview Press.

World Values Survey Association. (2005). World values survey. Wave, 5, 2005–2008.

Young, O.R. (2016). On environmental governance: Sustainability, efficiency, and equity. London & New York: Routledge.

Young, O.R., Berkhout, F., Gallopín, G.C., Janssen, M.A., Ostrom, E., & Van der Leeuw, S. (2006). The globalization of socio-ecological systems: An agenda for scientific research. Global Environmental Change, 16(3), 304–316.

Zycherman, A. (2016). Cultures of soy and cattle in the context of reduced deforestation and agricultural intensification in the Brazilian Amazon. Environment and Society, 7(1), 71–88.