

Cultural Models of Nature Across Cultures: Space, Causality, and Primary Food Producers

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Introduction.

This proposal requests support for a cross-cultural research project to investigate cultural models of nature held by populations across several cultures and five continents ranging from long-time primary food producers, e.g., farmers, fishermen, herders (and also hunters and gatherers) to those who recently shifted to become primary food consumers (e.g., Qatari) due to globalization forces. Evidence suggests that cultural models of nature affect environmental actions in ways not necessarily predicted by more traditional ecological models (see Kempton, Boster, and Hartley, 1995; Kempton and Clark, 2000; Paolisso, 2002; Feurt, 2006; Atran and Medin, 2008; Berninger, Kneeshaw, and Messier, 2008; Guneratne, 2010). While traditional ecological knowledge tends to freeze knowledge in the past, cultural models affect attention, observation, reasoning, and understanding and therefore are engaged with the current situation.

The findings of the research—a number of cultural models of nature—should enrich the already conspicuous literature about cultural models (e.g., Holland and Quinn, 1987; Kempton, Boster, and Hartley, 1995; Shore, 1996; Strauss and Quinn, 1997; Quinn, 2005; Gatewood and Cameron, 2009; Bennardo, 2009; Bennardo and de Munck, in press; but see also the recent NSF Award #1027140, 2010). The focus on one type of community, primary food producers, in different cultural areas of the world, should also allow to obtain insights on how this kind of population typically construct a cultural model of nature. The case of Qatar, and other well known available cases, e.g., Kempton, Boster, and Hartley (1995) and Bennardo, 2012 for US, offer contrasting cases for primary food consumers.

In addition, the cultural models obtained provide the opportunity to contribute to two other areas of research. One is theoretical, exploring the possibility that conceptions of space are central to the construction of cultural models. Thus, to acquire further supporting evidence for an architecture of the mind that includes a major role for the spatial domain (and the related temporal domain) in the construction of other domains of knowledge (see Mandler 2008; Bennardo, 2009; Mix, Smith, and Gasser, 2010; Schubert and Maass, 2011). The other is applied, supplying policy makers, i.e., major actors in finding solutions to climate change induced problems by implementing global and local policies, with information on indigenous cultural models of nature that will assist them in their decision-making (see Kempton, 2001; Paolisso, 2002; Lauer and Aswani, 2009; Guneratne, 2010). We take as given that cultural models of nature contribute to generating social behaviors in response to environmental changes in food production communities worldwide (Ignatow, 2006; Feurt, 2006; Atran and Medin, 2008).

The project comprises fifteen scholars and six graduate students—four doctoral and two master—who have conducted field work and are experts in a particular cultural area. They will return to the cultural area of their expertise to conduct field work in order to collect the data necessary for constructing cultural models of nature held by those populations. The PI foresees three successive stages for the project, including three visits to the field. However, this proposal is requesting support for the first stage only. Linguistic and experimental data will be collected during this first stage and analyzed linguistically, i.e., discourse analysis, and quantitatively, respectively. A short list of the methodological tools to be variably employed over three years includes: participant observation, semi-structured interviews, free listing, sorting, questionnaires, and experimental tasks for the data collection stage, and, in the data analysis stage, key word, gist, and metaphor analyses as well as frequency, multi-dimensional scaling, correlations, and consensus analyses.

1. The NSF Sponsored Workshop (Results from Prior NSF Support).

In 2011, on September 1-4, a workshop was held at Northern Illinois University (NIU), organized by the PI, entitled “*Cultural Models of Nature and the Environment: Self, Space, and Causality*”. The workshop was sponsored nationally by the National Science Foundation (BCS-1067577, \$7,500, 3/1/11-2/29/12), and locally by the Institute for the Study of the Environment, Sustainability, and Energy (ESE) at NIU, the Department of Anthropology at NIU, and by the Department of Leadership, Educational Psychology, and Foundations also at NIU.

The populations keenly aware of and most at risk of the effects of climate change are obviously those whose livelihood depends on daily contact with the changing physical environment, that is, primary food producers; either farmers, fishermen, or herders (and hunters and gatherers). The workshop participants discussed and debated their understanding of cultural models and in particular, what a

cultural model of nature in their community of expertise might look like and how it affects the decision-making processes of primary food producers. We also discussed the appropriate methods for sampling and gathering systematic information on the features, causal impacts, and distribution of cultural models across sample populations as well as the possible independent variables and their effects on the features, directive force, and popularity of one cultural model vis-à-vis alternative feasible models.

The first goal of the workshop was to examine the existing literature, personal experiences, and already acquired knowledge about the conceptualization of nature and the environment among primary food producers in a number of communities in several cultural areas. The second goal was to obtain from these extensive data a number of hypotheses about the cultural models of nature in each of these communities/cultures. The environment of all the primary food producing communities chosen have been heavily affected by climate change in the last few decades. The third and final goal was to lay the groundwork for a cross-cultural research project by which we can compare cultural models of nature and explore the external (socio-cultural) factors that affect them as well as the internal (mental) factors that generate them. In fact, the intention of the organizer and of the participants is to investigate the hypothesized cultural models by the acquisition of cross-cultural ethnographic, linguistic, and experimental data.

Each workshop participants contributed their ethnographic, cultural, and linguistic expertise of a specific community/culture. The cultural areas (in large brushes) represented were: Amazonia (Peru), China, Germany, Japan, Kenya, Lithuania, Mexico (Chiapas, Tzotzil Maya), Namibia (Akhoe Hai//om), Native American (US, Wisconsin, Menonimee), Pakistan, Panama, Polynesia (Tonga), Philippines, Qatar, and US (Pennsylvania). The environment of all the primary food producing communities described have been heavily affected by climate change in the last few decades.

Intellectual Merit: The workshop included two full days of work. Day one began with an introduction of the theoretical and methodological challenges that the project presents. Thereafter, each participant gave a brief presentation on their cultural area of expertise (e.g., social structure, belief systems, primary mode of production) and their initial findings regarding environmental issues (i.e., impact of climate change) and data relevant to the construction of a cultural model of nature. Data was based on their own primary research as well as on a preliminary review of the relevant literature on this topic. Day two was devoted to methodological and theoretical issues that need to be addressed for such an ambitious project, which would apply cognitive methods, mostly used for studying cognitive processes and rarely content (see Boster, 2012), for systematic cross-cultural data collection and analysis.

At the end of the second day of the workshop, the participants agreed on adopting a common protocol with a number of methodologies to be used in the proposed research project. Some of these methodologies were deemed as 'core' ones, that is, all researchers regarded them as essential for eliciting adequate data for both the elicitation and the cross-cultural comparison of cultural models. Another number of methodological tools were considered optional as some researchers spelled out how the use of some tasks in their specific field site would be ecologically inappropriate (e.g., gender, illiteracy, lack of familiarity with such stimuli like photos and/or videos).

Broader Impact and Dissemination: The contributions to the Workshop, including the proposed cultural models and the methodology suggested to empirically investigate their validity, appear in the published proceedings (Bennardo, G. 2012. *Proceedings of Workshop: Cultural Models of Nature and the Environment*, Working Papers #1. Dekalb, IL: Institute for the Study of the Environment, Sustainability, and Energy (ESE) at Northern Illinois University. [PDF at <http://www.niu.edu/ese/>]). The Workshop participants agreed about the necessity and urgency for conducting further empirical studies motivated largely by the findings and discussions that occurred during the workshop. A methodological manual to further investigate the cultural models that had been suggested also appears in Bennardo (2012). This shared conviction motivated the writing of the present request for support of the cross-cultural research project hereby outlined.

2. Cultural Model of Nature and Primary Food Producers.

Climate change is one of the most challenging issues that we are collectively facing insofar as it threatens the survival of our species. It is without doubt that before long extensive action, beyond those initiated over the past two decades, will have to be implemented worldwide to try to minimize its potential and disastrous effects. The populations keenly aware of and most at risk from the effects of climate change

are obviously those whose livelihood depends on daily contact with the changing physical environment. Primary food producers best represent these kinds of populations: farmers, fishermen, or herders. Of course, the whole world population is at risk and we all will eventually be obliged to change our behavior to make our presence on the planet sustainable (see Moran, 2006, 2010). However, the daily and close contact with the environment by primary food producers makes them most directly affected by the effects of climate change. Besides, they are the primary actors who will likely implement whatever new and/or radical remedial policies are proposed. These policies may be locally generated as a community response to local environmental degradation or they may be suggested and imposed nationally or internationally by political and economic bodies whose knowledge of local realities is typically lacking, insufficient or worse, disregarded.

Ecological studies of nature and humans' adaptations to their environment focus on a cultural materialist and evolutionary bend. This view, while being fruitful, does not take into account other human interests or how humans devise mental models by which they plan their actions. In other words, such approaches lack a focus on human agency and cognition. It is individuals ultimately who act: their actions do not just occur independent of conscious thoughts, plans, feelings and motivations. This conscious ordering of the world is also collective, in that it is shared and distributed across members of a culture. Our goal is to study the "other half" of the ecological equation, by studying how mental models affect, shape and direct human behaviors. Our focus is on cultural models, a type of mental model that is shared across a population.

All primary food producers hold views about nature and the environment, particularly in terms of how they are affected by and must adapt to changes in the latter. Insightful publications (among many others) include *Redefining Nature: Ecology, Culture, and Domestication* by Roy Ellen and Katsuyoshi Fukui (1996), *Earth's Insights* by J. Baird Callicott (1997), *Nature Across Cultures* by Helaine Selin (Ed.) (2003) and *Environment Across Cultures* by E. Ehlers and C. F. Gethmann (Eds.) (2003)—but see also *Nature Knowledge: Ethnoscience, Cognition, and Utility* by Glauco Sanga and Gherardo Ortalli (2004); *Culture and the Changing Environment* by Michael J. Casimir (2008); and *Anthropology and Climate Change: From Encounters to Actions* by Susan A. Crate and Mark Nuttall (2009). These studies have opened the way to a better understanding of local/indigenous knowledge including beliefs about nature. With the proposed research, we plan to build on these studies and add deeper insight into how nature is conceptualized in ways that are out-of-awareness (Kempton, 2001), as most of our knowledge is (e.g., knowledge about language). Such out-of-awareness knowledge structures are typically called cultural models (Holland and Quinn, 1987).

One of the most widely accepted ways of understanding the organization of knowledge in the mind is that of mental models (Johnson-Laird, 1980, 1999). These mental structures are also called "schemas" (Bartlett, 1932; Minsky, 1975; Rumelhart, 1980; Brewer and Nakamura, 1984; Brewer, 1987), "frames" (Fillmore, 1982), "scripts" (Abelson and Schank, 1977) or "idealized cognitive model" (Lakoff, 1987). When a mental model comes to be shared within a community, then one calls it a "cultural model" (Holland and Quinn, 1987; D'Andrade, 1989; Shore, 1996; Strauss and Quinn, 1997; Quinn, 2005; Kronenfeld, 2008; Bennardo, 2009). These out-of-awareness mental structures are used to make deductions about the world, to explain relationships in a causal fashion, and to construct and interpret representations from simple perceptual inputs to highly complex information. Importantly, they can also motivate behavior (D'Andrade and Strauss, 1992; Kempton, Boster, and Hartley, 1995; Atran and Medin, 2008), or more precisely, contribute saliently to the generation of behavior. In other words, we use cultural models to make sense of the world around us and at the same time they provide the basis out of which we plan our behavior (see also Paolisso, 2002).

A cultural model of nature must minimally include a number of relationships (e.g., associative, co-occurring, and mostly causal) between fundamental and constitutive categories such as people, animals, plants, weather, physical environment, and the supernatural. Causal relationships may be intra-categorical (e.g., between people, between animals, etc.) or cross-categorical (e.g., between people and animals, between animals and plants, etc.; see Atran and Medin, 2008). These causal relationships contribute to a large part of what constitute reasoning about nature.

Even though they are shared, cultural models are not necessarily distributed uniformly within a population/community. Thus, after discovering a model, it becomes imperative to explore its level of sharedness within the communities, i.e., cultures, under investigation and the degree to which it differentially motivates people to act (Kempton and Clark, 2000; Gatewood and Lowe, 2008).

A three-tiered investigation is consequently made necessary exactly by these fundamental aspects of cultural models. However, we are not indicating the necessity of the ethnographic data collection stage that needs to precede any research about cultural models because it is included in the expertise of all the researchers. First, a variety of data, primarily linguistic need to be collected through interviews and then extensively analyzed (e.g., discourse analyses—key words, gist, metaphors, reasoning) to discover the cultural model. Second, constructed on the results of the first stage, cognitive data need to be collected (e.g., experimental tasks) and analyzed (e.g., statistical analyses: frequency, correlations, multidimensional scaling) to verify the content of the cultural model. Third, procedures need to be implemented (e.g., consensus analysis) to ascertain its distribution within the target population/culture (see Romney, Weller, and Batchelder, 1986; Kempton, Boster, and Hartley, 1995; D’Andrade, 2005; Weller, 2007). A differential distribution of the model provides insight into individuals’ and/or groups’ motivations and behavior regarding specific environmental issues (see Medin, Ross, and Cox, 2006; Atran and Medin, 2008; Gatewood and Cameron, 2009).

3. Space and Cultural Models.

The definition of a good number of cultural models of nature in communities all over the world opens the possibility of investigating a significant aspect of human cognition, the role played by space. The role that space plays in cognitive architecture and development has been widely demonstrated (Gattis, 2001; Jackendoff and Landau, 1992; Jackendoff, 2002; Lakoff, 1987; Levinson, 2003; Mandler, 2004, 2008; Mix, Smith, and Gasser, 2010; Schubert and Maass, 2011; Slobin, *et al.*, 2010; Talmy, 2000a, b). For example, Clark (2011) argues that space and language perform similar cognitive functions, namely, they reduce the complexity of the environment. Space grounds language, and Spivey, Richardson, and Zednik (2010) convincingly show how abstract verbs are understood in terms of spatial relations (2010: 33). In addition to the contribution of space to the construction of language, the idea that “abstract concepts are connected to space at a deep, unconscious level—literally the product of neural juxtaposition” (Mix, Smith, and Gasser, 2010: 5) leads one to expect a very early reliance on spatial information in cognitive development. This is exactly what Mandler (2004, 2008) demonstrates in her research about cognitive development in pre-verbal children.

Recently, once established that space, i.e., spatial relationships, plays a fundamental role in the development of cognition, in the formation of concepts (see the relationship between space and time, e.g., Boroditsky, 2000; Bender, Beller, and Bennardo, 2010; Ramscar, Matlock, and Boroditsky, 2010), and in the construction of language, researchers have focused on the role it plays in social cognition. “The results converge in the insight that much of social thinking builds upon spatial cognition” (Schubert and Maas, 2011: 3). In other words, it is now being demonstrated that “space plays a role for thinking that goes far beyond a medium for communication. Indeed, it seems that it can become the medium of thinking itself, with spatial and social cognition being closely and intrinsically intertwined” (*ib.*: 3). Since space—and the relationships that constitute it—is a very early contributor to the development of cognition, concepts formation, and language, and since the same perception-action couplings are at work in both spatial and social cognition (see Tversky, 2011), then, it is plausible to expect that it may play a relevant role in the construction of knowledge representations as cultural models. Thus, we can find the preference for a specific set of spatial relationships (e.g., a frame of reference) replicated in the construction of other domains of knowledge, that is, a cross-domains homology.

Another relevant finding in support of the role of space in mind is the one presented by Shimizu’s (2000a, 2000b, 2011) work on the construction of self (i.e., proprioception). Shimizu shows how the cultural models of self in the US, Japan, and China reflect spatial features (e.g., focus on other-than-ego instead of on ego) in their structural compositions that correlate well with the respective preferences about the representations of spatial relationships (Shimizu, 2009; see also Nisbett, 2003; D’Andrade, 2008). In addition, in 2009, Bennardo showed how a Tongan preferential organization of the representation of spatial relationships is replicated in other domains of knowledge, e.g., time, possession, kinship, and social relationships (see the results of two NSF grants #0349011 and #0650458; PI Bennardo). He proposed that a preference for organizing knowledge about space (i.e., a foundational cultural model) contributes to the generation of cultural models in other domains (see also Shore, 1996).

We need to clarify the distinction between a foundational cultural model and a cultural model. The former refers to simpler and more abstract models that organize only few bits of knowledge during the

earliest stage of cognitive development, such as those within ontological domains, e.g., space, time, quantity. They are out of awareness and it is very difficult to bring them to consciousness. The latter refer to larger and less abstract models that encompass knowledge from a variety of source domains. They are also mostly out of awareness, but can be brought to consciousness either by others (e.g., researchers) or on occasion by one's self. Foundational cultural models participate in the construction of larger cultural models. For example, a preference for organizing spatial relationships in a radial manner—that is, organized around a point other-than-ego with consequent back-grounding of ego and foregrounding of other-than-ego—is replicated in other domains of knowledge, e.g., kinship relations constructed by starting from a sibling and not from ego. Bennardo and Read (2011) demonstrated empirically that this preference in the Tongan kinship domain resulted in performances on kinship tasks that were more correct and faster when a task required an individual to start reasoning from a sibling instead of from ego.

Thus, we are convinced that a preferential way in organizing the representation of spatial relationships (e.g., use of relative or absolute or radial frame of reference)—hence, a foundational cultural model (Bennardo, 2009)—can play a salient role in the organization of larger cultural models, and specifically, cultural models of nature. After all, the conceptualization of nature and the relationship of primary food producers to nature for production relies on a spatial dimension of knowledge and perception. The availability of the cultural models of nature eventually discovered in the many communities investigated makes it possible to find supporting evidence toward the hypothesis just advanced. The findings about space would then be available for a comparison with those about cultural model of nature. We expect the comparisons to provide evidence for a preference in space to match a specific way of conceptualizing nature, that is, a cultural model of nature. Hence, we anticipate to find support for an active participation of space in the construction of more complex cognitive realms.

4. Cultural Models and Policy Making.

In 2010, Guneratne states:

“Although recent scholarship has yielded a rich literature on the impact that human activity has had on the Himalayan environment and the uses which human beings have made of it, there has been relatively little attention paid to how human beings who live and work in that part of the world understand or conceptualize it, and the implications of their cognized models of the environment for policy-making in development work” (2010a: 1).

He goes on in his chapter, together with all the contributors to the edited volume to argue how the Theory of Himalayan Environmental Degradation (THED), held by many politicians, NGOs, and other environmental agencies has clashed with local uses and understanding of the environment (Guneratne, 2010b). “The assumption of THED that their actions only degrade the environment is wrong” (Metz, 2010: 38). The cultural, physical, and moral clash on a Greek island between environmentalists who want to ‘save’ the turtles’ pristine environment and the local population who want to use it for tourism related activities (among other things), witness to a conflicting way to conceive of nature as reported by Theodossopoulos (2003).

After having investigated cultural models of nature in three Mayan communities in Mexico, a Native American, Menominee, community in Wisconsin, and a majority-culture community sharing the same environment with the Menominee, Atran and Medin conclude:

Just as for the Itza’, Q’eqchi’, and Ladino differences, the Menominee and majority-culture differences reflect different framework theories that direct observations and dictate values and attitudes. It is these complexes or systems [i.e., cultural models] that must be understood in order to gain insight into cultural contributions to environmental decision making” (2008: 254).

These exemplary findings, among many other examples available, have convinced us that before implementing any strategy directly impacting the lives of any population/community, e.g., primary food producers, it would be extremely prudent and highly appropriate to understand their cultural models of nature. This would allow sound policies to be based not on de-contextualized scientific notions, but be grounded in the local knowledge (the one we intend to focus on is the out-of-awareness one) of the people directly responsible for experiencing and possibly embracing these changes (see Guneratne, 2010a: 16; Kempton, 2001; Lauer and Aswani, 2009; Medin, Ross, and Cox, 2006; Medin, Ross, Cox, and Atran, 2007). Taking into account these types of local knowledge may increase the success of any

policy implementation while at the same time offer the opportunity to discover ecologically-sound solutions still unknown and unexplored, at least locally (see Atran and Medin, 2008; Guneratne, 2010b)

A good number of examples already exist for projects in which indigenous knowledge (IK) and more specifically traditional ecological knowledge (TEK) have been incorporated in the implementation of policies about different ways of relating to the environment (see Dudgeon and Berkes, 2003, and Bicker, Sillitoe, and Pottier, 2004, for discussion of related issues; Maffi and Woodley, 2010, for a survey of projects; Appiah-Opoku, 2005, Wallace, 2006, Casimir, 2008, and Vayda, 2009, for specific project examples). One common feature, though, to be found in all of the projects referred to (and many others as well) is the lack of attention to these out-of-awareness knowledge structures or cultural models (as opposed to explicit knowledge and beliefs). These models can only be accessed (and discovered) via laborious and time-consuming methodological procedures (both data acquisition and analysis) that are part and parcel of the cognitive anthropology and cognitive science camp. This is one relevant novelty, we want to stress, that the planned research project introduces into the already vast work—theoretical and practical in the field—about the conceptualization of nature.

5. Multiple Cultural Areas.

The impact of climate change varies across the world and across different types of primary food producers. Consequently, when investigating cultural models of nature with the intention of contributing salient indigenous knowledge to policy makers engaged in finding possible solutions to climate change induced issues, it is necessary to investigate a range of communities from around the world which represent a sufficiently diverse sample of situations (see Ember and Ember, 2007, 2009). In addition, not only common features among these various populations of primary food producers may emerge, but possibly contrastive feature with the models held by non-food producers (where available) may also be highlighted. It is relevant to be reminded here that the goal of the research proposed herein is to collect information about knowledge representations of nature that underlies behavior in specific communities/environments affected by climate change. Although this knowledge should contribute to policy development and implementation, the researchers do not intend to find out or suggest what type of policies should be implemented in those same locales to tackle those issues.

While it is not difficult to find anthropological expertise in almost any area of the world, this research project requires specific expertise, i.e., in cognitive anthropology theory and methodology. The PI, then, considers extremely fortunate the circumstances that have brought together such a varied group of experts all willing to cooperate to reach the goals of the present research project. The researchers involved in the project are participating because of their expertise in their cultural areas. They are all fluent in the local languages of interest and have in different ways conducted and published extensive research on various aspects of local knowledge. It must be pointed out again that all the field sites within the targeted cultural areas are very closely affected by climate change, e.g., changing weather patterns, desertification, rising water level, etc.

The workshop mentioned in Section 1 contributed to focus all the participants on the ethnographic and theoretical knowledge required by the project while at the same time generating a willingness to implement a common methodological protocol. A field manual illustrating this protocol has been prepared and is part of Bennardo (2012), a proceedings of the workshop published as a working paper of the Institute for the Study of the Environment, Sustainability, and Energy at NIU (find a PDF of the working paper at <http://www.niu.edu/ese/>).

6. Field Sites and Researchers Involved.

The field sites to be visited will be small communities of food producers whose members have daily contact with nature, e.g., farming, fishing, herding (and hunting and gathering). The size of these communities, e.g., small villages/towns, allows one to conduct intensive ethnographic studies. The cultures chosen are representative of areas very sensitive to climate change/global warming, e.g., small island/s with rising water level, drought prone area/s, and areas where precipitation patterns have dramatically changed in recent times.

Table 1. Field Sites and Broad Sources for Variation in Cultural Models.

Site	Settlement Pattern	Major Productive Activities	Notable Environmental Changes
Tonga	Small coastal village	Horticulture, fishing, gathering	Rising sea water; decreased fish availability
Germany	Two river valley villages	Perennial fruits	Temperature increases; flooding; plant diseases
Peru	Small riverine foothills settlements	Horticulture	Land desiccation; decreased game availability; decreased crop varieties
Lithuania	Small city in hills	Small-scale agriculture and dairy; gardens;	More extreme seasons; flooding; increased temperatures
United States	Rural river valley	Industrial and small-scale agriculture and dairy	Flooding; increased temperatures; erratic weather
Ecuador	Rural mountainside	Small-scale agriculture	Reduced glaciation; greater aridity; change in crops produced (less native)
Pakistan	Small village in hills	Irrigated and non-irrigated agriculture	Reduced groundwater; erosion
Kenya	Fertile highlands village	Small-scale agriculture	Desertification; changing weather patterns
Italy	Small mountain village	Gardens; pastures	Increased temperature; reforestation
Japan	Village on hillside	Yams; plums	Weather extremes
Namibia	Rural desert	Hunting; gathering; cattle; farm labor	Reduced forage; aridity/drought
Philippines	Two coastal villages	Fishing	Decreased fish availability; reef damage; reduced fish nursery habitat
Qatar	Desert cities	Wage labor	Rapid urbanization, but continued kin focus
China	Five mountain villages	Hunting; gathering; forestry; livestock; horticulture; small-scale agriculture	Drought; more commercial crops

The list below includes the proposed collaborating scholars (PI, CoPIs, doctoral and master students), their affiliation, their respective cultural areas of interest and expertise (in brackets), followed by a brief description of their field site:

PI Giovanni Bennardo (and master student): Northern Illinois University, Anthropology (Tonga).

The Tongan community that will be investigated by the PI is a small village in the northern archipelago of Vava'u. The population practices a number of subsistence activities such as farming, especially root crops, and fishing, including gathering. The rising water level is causing problems with drinking water supply and the rising ocean temperature and other issues, e.g., overfishing and changing current patterns, are drastically changing the availability of fish. The environmental changes are just one aspect of the other various social, economical, and cultural changes that are occurring. Thus, appropriate sampling of the population would have to be implemented (social group membership, age, gender, education, etc.). The PI has conducted several research projects in this community and is very well acquainted with its socio-cultural structure. The PI will supervise the work of a Tongan master student.

CoPI Andrea Bender (and doctoral student): University of Freiburg, Germany, Psychology (Germany).

The Kaiserstuhl area in the Upper Rhine valley in Southwestern Germany is among the country's most productive regions in terms of agriculture, and specializes in wine and fruit growing. It is also among those areas that are affected most intensely by climate change. Being already one of the warmest areas in Germany, it will literally become a "hot spot" in the near future. Anticipated changes include an increase in temperature, in heavy rainfalls during winter, and in extreme events (such as severe storms, flooding, droughts, and frost). As vine plants are rather sensitive to changes, they will become more susceptible to yet unknown diseases or need to be replaced entirely, which takes years to pay off. How these predicted changes are perceived by the local food producers, and how this in turn will affect their behavioral responses are two of the questions to be investigated. The target communities are the inhabitants of two villages in the Kaiserstuhl (one predominantly Lutheran, the other Catholic) and, specifically, the families that live on wine and fruit growing. The CoPI will supervise the work of a doctoral student.

CoPI James Boster: University of Connecticut, Anthropology (Amazonia, Peru).

The Awajún (Aguaruna Jívaro) of North-eastern Peru inhabit moist tropical forest in the rugged foot-hills of the Andes and head-waters of the Amazon, locally called the Alto Rio Marañón. The most important environmental problems faced by the Awajún are: desiccation, due to the conversion of tropical forest to cattle pasture land; decreased game populations due to over-hunting; and loss of varietal diversity of crop plants. The area to be studied is where the investigator spent a year and a half doing field work thirty five years ago. Data collected then can serve as a baseline for comparison with present conditions (Boster 1983, 1984a, 1984b, 1985a, 1985b, 1986).

CoPI Victor deMunck: State University of New York-New Paltz, Anthropology (Lithuania).

The CoPI will conduct research in Telsiai a rural town in Lithuania. Telsiai is an area where there are many small family-owned farms as well as Russian style Dacha's (*Sodybe*, in Lithuanian) that have evolved into permanently inhabited communities where the residents rely on large garden plots as a primary means of subsistence. The researcher has already conducted limited fieldwork in the area and has access to many farmers in the area.

CoPI John Gatewood: Lehigh University, Anthropology (Pennsylvania, USA).

Within the Lehigh Valley of eastern Pennsylvania, there are several kinds of farms and farmers. Most sell their livestock and/or crops to processors who market the foods nationally. Others subscribe to the "eat locally" ideology and sell their products only to local market. Some are organic farmers. And, about 60 miles to the west are the Amish of Lancaster County, who practice their distinctive brand of non-industrialized agriculture. Thus, this portion of eastern Pennsylvania offers an appropriate locale to compare and contrast understandings of nature among different kinds of farmers. In this initial study, the focus is on two broad categories: (a) industrialized farming operations that sell their products to national processors/distributors, and (b) the farming operations that sell products "locally." The initial hypothesis behind this comparison is that category (a) will tend to view humans as being separate from nature (nature provides resources for humans to use), whereas category (b) will tend to view humans as simply part of the natural system (a more ecologically understanding). The research includes conducting interviews with at least 12-15 farmers in each category and then constructing each group's (different?) cultural model of nature from these qualitative data. Potential informants will be identified through referrals, and then snowball sampling.

CoPI Eric Jones: University of North Carolina, Anthropology (Ecuador).

The project will be conducted with Quichua-speaking farmers near the city of Cotacachi in north central Andean Ecuador. They intercrop corn and pulses and are losing some traditional crops while adding some fruits and vegetables (Skarbo 2006). The area's farmers list climate change as the most prominent factor affecting changes in agriculture in the early 21st century (Campbell 2006). Indeed, glaciers on Mt. Cotacachi stopped being permanent sometime between 1997 and 2004 (Rhoades, Zapata Rios and Aragundy 2006). As part of the multi-year interdisciplinary Sustainable Agriculture and Natural Resource Management-Andes project from mid-1990s to mid-2000s, Jones and colleagues compared Cotacachi with other ecological zones in terms of perceptions of the landscape and the role of migration in developing rootedness and agricultural continuity (Rhoades, Martinez and Jones 2001; Flora 2006; Jones 2002).

CoPI Stephen Lyon (and doctoral student Aurang Zeb Mughal): University of Durham, UK, Anthropology (Pakistan).

The project research will take place in northern Punjab, in Attock District, in a village previously studied by Lyon. The area was historically a rain fed agricultural area, though the spread of tube wells in recent decades has led to the expansion of previously uncultivated crops in some areas. Land erosion is an increasing problem and this has been exacerbated by a diminishing supply of groundwater. The coPI has worked in the area since 1998. The doctoral student assistant has worked in similar areas of Punjab since 2006, so both are very familiar with the local setting. The doctoral student is a Pakistani national and is not only fluent in the local language, but also less vulnerable in the current political instability.

CoPI Justus Ogembo: University of New Hampshire, Anthropology (Kenya).

The Gusii, a farming community living on the fertile highlands of southwestern Kenya and amongst whom the PI has done fieldwork, have, in the recent two or so decades, been feeling unusually vulnerable to food insecurity, and to resistant malaria due to the vagaries of weather patterns and to human encroachment on the natural vegetation that coincides with the disappearance of certain animal and plant species. The PI is familiar with the region and proficient in the languages and cultures of the local setting.

CoPI Anna Maria Paini (with Giovanni Bennardo and Elisa Bellato, Research Assistant): University of Verona, Italy, Anthropology (Italy).

Phenomena related to climate changes affect the Dolomites in general. The perception of global warming is an experience shared by the inhabitants of these areas. The research project will be conducted in Vinigo (population 100) in the province of Belluno, one of the oldest settlements in the Ladin area (*Vinego Paes Laden*) of the Dolomites (Veneto region). The areas outside the village, which until the mid-twentieth century were cultivated with barley, wheat, rye and corn, have been restored into meadows and the forest, no longer maintained and used for woodcutting, has returned. The cultivation of a variety of cabbage, for which Vinigo is well known, is unusual in that the gardens, located at the center of the village, form a single large field divided into many small sections each one owned by different families (this feature is expected to be related to a specific way of conceptualizing space). Paradoxically, at this altitude (over 3,000 feet), the increased temperature has also had positive effects on agriculture: new cultivations (definitely not alpine) like tomatoes are now possible in the sunniest areas. On the other hand, the increase in uncultivated forest is changing the micro-climate and raising the level of humidity with negative effects. The researcher is well acquainted with the area and in previous projects has already established working relationship with the Ethnographic Museum of the province of Belluno and the Belluno Dolomites National Park.

CoPI Hidetada Shimizu: Northern Illinois University, Educational Psychology (Japan).

The general research site is Gunma Prefecture, Japan, about 60 miles north of the Tokyo Metropolis. Gunma is the largest producer of konjac yams and second largest of plums in the nation. The communities intensely engaged in the productions of these two plants will be investigated. Gunma is surrounded by mountain range on the north and the Kanto Plain, the largest flatland in the nation, toward the south. The mountains gradually taper themselves to the Plain. Because of this naturally sloped landscape, farmers can alter the growing temperatures by changing the altitudes on which to plant. Recently, however, extreme temperature changes, possibly linked to climate change, made it difficult for the farmers to choose the correct and steady temperature range to protect their crops from frosts, droughts, and heat. The researcher is a native of Gunma, and had conducted research there during the last 20 years.

CoPI Thomas Widlok (and doctoral student): University of Cologne, Germany, Anthropology (Namibia).

The San (=Akhoe Hai//om) community in northern Namibia investigated by the coPI lives in northern Namibia at the edge of the Kalahari desert at places that are well-known for their large Mangetti (Mongongo) groves. Despite their traditional importance as local areas of high food security and as regional areas for emergency food provision none of these groves has, as yet, been declared a conservancy (a community-based resource management area). Thus, the productive forest as well as the subsistence base of the local San population is increasingly at risk due to overgrazing, over-utilization, bush encroachment, and drought. The PI has worked in this community since 1990, and is very familiar with the local setting. The CoPI will supervise the work of a doctoral student.

CoPI Katharine L. Wiegale (and master student): Northern Illinois University, Anthropology (Philippines).

In the past 20 years, the number of Marine Protected Areas (MPAs) in tropical areas has surged worldwide, with over 600 now in the Republic of the Philippines, a country recognized as a global priority for marine conservation. Yet small-scale coastal fishers, estimated to number more than 700,000, who are directly engaged in fishing for food and livelihood have for several decades seen their harvests decline and their poverty rates rise well above the national average as a result of illegal and destructive fishing, loss of fish nursery habitat, and overexploitation. However, restricting use of what was previously a common property resource through MPAs has been problematic in fishing communities on a variety of levels. The research sites are two fishing communities in Batangas Province, Philippines. The study will compare fisherfolk's conception of nature and their role in the marine ecosystem with models of nature implied by Pamana, a major national grassroots fisherfolk alliance that is linked with the establishment of MPAs. The first field site, a coastal community in Bauan near the rapidly industrializing Batangas City, is not in the Pamana alliance and no MPAs exist there yet. The researcher has prior fieldwork experience in this area. In contrast, the second site, Mabini, is a Pamana member community, and is therefore part of a network of MPAs. Reefs in this tourist destination have been damaged by overfishing, coastal development, sedimentation, sewage, anchors and divers. An NIU anthropology master student will assist the CoPI.

Non-CoPI Senior Personnel Fadwa ElGuindi (and doctoral student Shalkha Al-Kuwari): Qatar National Research Fund, Qatar Foundation (Qatar).

Qatar is an Arab country, with Arabic as its language and Islam as its religion. The majority of Qatari nationals adhere to a conservative school of Sunni Islam. A small Peninsula of the Arabian Gulf, Qatar is situated on the northeast coast of the Arabian Peninsula, sharing its only land border with Saudi Arabia. It is a hot subtropical desert region, with low rainfall (≈ 80 mm per annum) and high temperature (reaching $50^{\circ}\text{C}+$ in late spring and summer), with sand dunes and few beaches along its coasts). Qatar as field site is most suitable for experimental comparison of cultural models as it is undergoing rapid urbanization and industrialization, a state of flux that surpasses any awareness by the people of climate change. It moved from a previous nomadic Bedouin subsistence with some farming around oases of dates, and a semi-settled lifestyle of fishing, hunting, and pearling to living in urban centers served by malls and SUV private transportation. The population is rapidly approaching 2 million with a male-majority population of foreign laborers, making Qatari nationals a small minority in their country. Traditional structures of kinship and Bedouin values persist amid rapid development, which suggests relatively slow-changing cultural models of nature (desert and sea, moon and sun), and of relations with animals and natural environment. The CoPI will supervise the work of a doctoral student.

Research Associate Wenyi Zhang: Northern Illinois University, Anthropology (China).

Wenyi Zhang will conduct fieldwork in Sama and its four neighboring villages (they have been interconnected by marriage for hundreds of years) in Yingjiang County, Yunnan Province. Sama is an ethnic Kachin cultural center in China. Traditionally villagers practice swidden agriculture, hunting, and collection. Since the 2000s, development projects sponsored by the Chinese government have supported villagers to cultivate cash crops (such as walnut and coffee) and commercial woods (like the Chinese fir) in mountains. These projects have considerably changed the local cycle of work and relaxation in the dry and rainy seasons, and caused problems between cultivation and animal husbandry in mountains. Recent climate change, such as the severe drought during 2009-10, has destroyed a great quantity of cultivated seedlings and stimulated villagers to rely more on chemical fertilizers and to adopt cross-bred plants that endure climate change more effectively. Starting from 2003, the Co-PI has conducted 29 months fieldwork in these villages (including his NSF-funded dissertation research).

7. Research Design and Methodologies.

Time-Line.

There will be three phases in this research project. The first phase requires a visit to the field (in summer 2013, between four and eight weeks), a period of data analyses (also in summer 2013, between four and eight weeks), and a workshop (late fall 2013, three-days) in which the first findings will be presented, compared, and discussed. The second and third phases also require a visit to the field (between four and six weeks each, in summer 2014 and 2015), and a period of data analyses (between four and six weeks each, in summer 2014 and 2015). This application requests support for the first phase of the project.

First Phase:

Field Work and Data Collection.

All CoPIs, as experts of a specific culture, have extensive experience in the field. However, due to the new focus of the research it is necessary for them to re-visit the community and spend some participant-observation time within it. This first period may include 'nature walks' (see Stross, 1973; Boster, 1985a) such that new insightful understanding of local conceptualization of nature could be obtained.

Then, a number (typically a minimum of 18 and above, depending on the size of the community) of semi-structured interviews will be conducted with a sample of the community; gender, age, education (literate vs. illiterate), and status are some of the relevant criteria to be used in constructing the sample. We want to highlight the fact that differences in age and literacy will potentially obtain differences in conceptualization of nature due to the extremely dissimilar experiences within the last generation and the previous one. Similarly, difference in literacy and schooling may have a relevant effect on the content of the cultural model one holds.

Following D'Andrade's (2005) suggestions, these interviews will be about a topic different from the domain of knowledge (nature) to be focused on. They will be about 'daily activities' related to food production. This topic was selected because it is highly regarded as one that can activate the model of

nature that each interviewee unconsciously holds. These are the topics and questions (to be translated and pre-tested) for the semi-structured interviews:

Questions about Daily Activities: What is your typical work/work-day? Describe your work/job (related to primary food production). What is the rhythm of work in this area?_What are some of the essential knowledge, skills, experience you need to be a successful food producer?_What are the key decisions one must make to be successful? What information do you need to make decisions? How do you choose what crops to grow, what to hunt, what to go after? What are considered 'productive activities'? Which fields/sea areas/etc. are productive? What effects productivity? What forces have an influence on production success? What is meant by growth, why do plants grow? What are some of the constraints/problems you face as a food producer? Who effects your environment (fields, forest, sea, etc) the most? Agency (human, animal, plants, ancestors, spirits)—what/who makes things happen? Government/NGO agency? What is the worst/best thing humans can do in fishing/farming/etc.? What do you like/not like about what you're doing (satisfaction)? Are there things you have to do that are destructive but you'd prefer not to do? Effect of weather, government, wars, people, terrorists? What are the livelihood alternatives?

Questions about Climate Change: What changes have occurred in your work/environment? Why are there these changes/variations? Weather change? How? What can humans do about it? Can humans/human activity effect nature/weather/wind/currents? Species X changes in presence of Y?

During the interviews, close attention will be devoted to causal reasoning as a fundamental characteristic of the internal structure of the cultural model of nature. The interviews will be recorded (if culturally possible, video-recorded) and later transcribed. If the native language of the researcher is different from the native language of the interviewees, the interviews will be transcribed in the field with the help of native speakers. Relationships between humans, animals, plants, physical environment, weather/climate, and the supernatural will be on focus as well as relationships within each category, such as between different types of trees, animals, etc. In addition, in order to define the locally articulated content of these constitutive categories of nature, free listing tasks will be administered to a different set (it may include subjects already interviewed) of subjects (around 30) about each of the mentioned categories.

Then, data will be collected about a possible preference in representing mentally spatial relationships. The task used is called 'animals in a row' and was developed by the Cognitive Anthropology Group at the Max-Planck Institute, Nijmegen, The Netherlands, and used by many scholars including Levinson (2003), Bennardo (2009), and Dasen and Mishra (2010). Subjects participating in the 'animals in a row' task are required to stand in front of a table (or available surface). On the table they are shown a set of three small plastic farm animals—a cow, a pig, and a horse (the animals may differ in each field site to match familiar ones)—standing in a row, all facing the same direction, either to the right or the left on the transverse axis in front of the informants. Subjects are asked to memorize the position of the animals. When they are ready to go to the next step (typically, after a few seconds), the animals are taken away and a minimum of 60 seconds need to elapse in which some conversation takes place between the informant and the researcher (this is done to engage long term memory).

Thereafter, the subject is directed to another table opposite the first one requiring a 180 degree rotation from the previous position (see Figure 1). The researcher then hands the three animals to the subject and asks to place them on the new table in the sequence and direction memorized. The trial is repeated five times for each informant and each time the sequence and direction of the three animals changes randomly (a variation of this task was introduced in Levinson, 2003, and used by Dasen and Mishra, 2010).

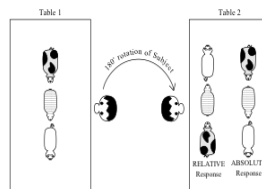


Figure 1: Responses for 'Animals in a Row' Task (from Levinson, 2003: 156)

The way in which the subjects put down the animals provides a cue towards which Frame of Reference (FoR) has been used to remember the spatial arrangement observed. If participants use a relative FoR,

the direction of the animals would stay the same as in the way they were seen, that is, either to the subject's own left or right. If participants used an absolute FoR, the direction of the animals would stay the same relative to some landmark or cardinal point, but not to the subject's left or right (see Figure 1). The stimulus involves only visual perception and the response only motor activity. Between the exposure to the stimulus situation and the response some coding of spatial relationships by means of a FoR in non-perceptual memory is involved. The nature of this coding is exactly the target of the task.

The activities just described, including participant observation, semi-structured interviews, free listing, and the 'animals in a row' task make up a protocol that will be replicated as far as possible in all the various sites so that most of the data obtained can be comparable. Local situations may generate attention to specific factors, e.g., urbanization, thus calling for a researcher to implement different methodologies in some areas only. In addition, an experienced researcher can and will decide while in the field to use the methodology, i.e., specific tasks, that s/he conceives as the most effective within a particular field situation—the Field Manual Section of the Proceedings of the Workshop in Bennardo (2012) also provide a description of a number of alternative activities and tasks. Thus, ample opportunities are provided for choosing the common protocol and/or for making localized methodological decisions. In this way specific methodological successes can be used to strengthen the continuation of the research while at the same time any failure would remain possibly localized.

While the underlying theoretical approach is shared by all the researchers working on the project, the methodological flexibility discussed above will highly increase the chances of obtaining results that are locally appropriate. When one conceives a research project to discover local knowledge as a required step toward a respectful and strategic use of its content, it is mandatory to allow flexible means of investigating such knowledge. We feel that in the end a common core set of methods will be used in all the field sites, but we also need to include in our planning the possibility that local methodological strategies may be required.

Data Analysis.

The linguistic data collected in the first stage will be analyzed in detail, and a first sketch of the cultural model and its fundamental causal structure should emerge. Analyses include discovery of key words, gist analysis, metaphors used, finding reasoning fragments, and highlighting discourse structures including explicit or implied causal relationships (see Quinn, 2005). The experimental tasks, e.g., free listing and animals in a row, will be analyzed statistically. Analyses include frequency, multi-dimensional scaling, and non-parametric tests of association (see Ross, 2004).

The analyses of the ethnographic, linguistic, and experimental data, in addition to allowing the discovery of a number of cultural models of nature, should make it possible to find positive support or negative evidence (null hypothesis) toward the hypothesized role of space in human cognitive architecture. For example, after having determined a specific preference for mentally representing space in a number of communities, e.g., preferred use of the absolute frame of reference, it is expected that the cultural model of nature in these same communities would privilege a focus on other-than-ego. In other words, while ego might be consciously kept distinct from nature, it would be considered only part of nature. That is, it is hypothesized that a holistic approach to the conceptualization of nature would result from a specific way of preferentially organizing spatial relationships. A positive pattern can emerge between the cultural models of nature discovered and the preferential ways of representing spatial relationships elicited that could clearly support this hypothesis.

Workshop and Dissemination.

After conducting the first phase of the research, the PI, the CoPIs, and the graduate students will meet in late fall of 2013 for three days to present, compare, and discuss their findings. The workshop will be organized by the PI at NIU. Coming together for this workshop is of paramount importance for the success of the research project and for making sure that the experiences on the field have provided a sufficient positive common ground. In addition, problems, setbacks, and overall not positive experiences can be shared so that unanticipated corrections and/or adjustments could be made.

Also at the workshop, the second and third phase of the project will be defined. Results of the free listing activities will be used to construct sorting tasks (followed by explanations about the criteria used for the second phase (second field work season) To test saliency of cross-categorical relationships between agents and environmental conditions (e.g., between animals and trees or between different types of

trees) researchers would administer another task (or more than one). Within it, one would ask about the kind of relationship (either positive or negative or locally conceptualized) that exists between, for example, humans and the forest, a tree and an animal. The items asked about will be the most frequent ones elicited from the free listing tasks (see Atran and Medin, 2008).

By the third phase, from the ethnographic, linguistic, and experimental data collected and analyzed, cultural models of nature would have been delineated. Then, using the content of these models, structured questionnaires will be constructed to be employed during the consensus analysis stage (see below Second and Third Phase Field Work). Again, the intent is to find a common protocol to be used in the field. However, the final questionnaires for each site will vary because of the different content of the cultural models.

The proceedings of this workshop will be published and they will represent a foundational text that can function as a reference point for the next stage of the research as well as promote a number of further publications. Publications for Phase 1 will focus on *American Anthropology*, *Ethnology*, *Ethos*, *Current Anthropology*, *Journal of Anthropological Research*, and *Journal of Cognition and Culture*. Conferences will include the *American Anthropological Association*, the *Society for Applied Anthropology*, *American Association for the Advancement of Science*, and *Society for Anthropological Sciences*.

Second and Third Phase:

Second and Third Phase Field Work and Data Analysis.

During the second field work (4-6 weeks in Summer 2014—funding to be sought with a subsequent proposal), the cultural model of nature evinced from the analyses of the linguistic data will be thoroughly verified. Intra-categorical relationships will be tested by constructing sorting tasks (followed by explanations about the criteria used) from the results of the free listing activities. In addition, to test and possibly discover salient cross-categorical relationships, e.g., between animals and trees or between a supernatural entity and weather, researchers would administer a rating task. Within it, one would ask a sample of the community about the kind of relationship that exists between, for example, a tree and an animal. The elements asked about would be the most frequent ones elicited from the free listing tasks (see Atran and Medin, 2008).

For the third season of field work (4-6 weeks in summer 2015—funding to be sought with a subsequent proposal), the discovered cultural models and their causal structure will be used to construct follow-up questionnaires. These questionnaires would contain statements derived from the discovered cultural models of nature and require interviewees to state their agreement about the statements on a 1-5 scale. They will be administered to a sample of the population in the communities investigated. By using consensus analysis procedures, distributional features of the cultural model within the community should then become apparent. The data obtained at this stage combined with the fine ethnographic knowledge of each community that the PI and all the CoPIs possess should highlight salient variations within those communities. In fact, variations about the model could correlate with ethnic and religious affiliations, gender, age, and/or a number of other characteristics of specific populations within the communities.

The PI will apply for funding for these second and third stage of the research project after the activities of the first stage have been completed. That is, after the workshop in late fall 2013.

8. Expected Findings.

We expect to discover a variety of cultural models of nature that characterize each community investigated. These models will represent specific organizations of the constitutive categories underlying the concept of nature, that is, humans, animals, plants, weather, physical environment, and the supernatural. We also expect to obtain insights on how primary food producers in general may be typically constructing a cultural model of nature. The case of Qatar, and other well-known available cases, for the US see Kempton, Boster, and Hartley (1995), provide contrasting cases for primary food consumers. In addition, we expect causal relationships to be one of the major forces weaving together the constitutive categories of the models. Similarly, while attributed to different elements and in a different potency, intentionality will be universally present.

We assign to space a fundamental role in the construction of cognition, both content/knowledge and processes. We expect then that preferential ways of mentally representing spatial relationships will be

reflected in larger mental constructions such as cultural models of nature. In other words, cultures where the absolute FoR is preferred will hold models of nature that reflect that preference. That is, a holistic conceptualization of nature where ego and other-than-ego are not separated should correlate well with a preference for the absolute FoR. In fact, in the absolute FoR ego and other-than-ego are integrated with one another (see Bennardo, 2009: Chapter 6, for a discussion of this latter point). This does not mean that local practices are ecologically sound. It only means that the mental models of nature held by some communities reflects their preferences for space and since space is foundational to cognition it may very well be that specific spatial preference generates a specific cultural model of nature.

Finally, we expect our findings to highlight a substantial predictive power. That is, from what we know about mental preferences about space within a community we may predict what type of model about nature people hold and vice versa. This correlation, once robustly supported by our findings, could compensate for situations where access to only one type of data (either) is possible.

9. Relevance of Findings (including Intellectual Merit and Broader Impact).

The expected findings are of relevance in three ways:

Cultural Models: A good number of cultural models of nature by primary food producers and the similarity they may share should enrich the already conspicuous literature about cultural models. At the same time, they would foster an appropriate attention to these community wide knowledge representations, i.e., cultural models, that can be investigated only via interdisciplinary theoretical approaches and methodologies, that are part of anthropology, psychology (cognitive), and cognitive science. The attempt at a common protocol should validate the suggested methodology. This latter represents a major innovation insofar as it blends participant-observation (anthropological), discourse analysis (linguistic), and consensus analysis (statistical) approaches. Methodology and ethnography play paramount roles in the project.

Role of Space in Cognition: The fundamental role of space within the architecture of the mind as well as in its development should find further and solid support. Thus, new research should be fostered that can adopt these findings as a main point of reference.

Climate Change Policies: Policy makers engaged in solving problems caused by climate change would find this novel aspect of local knowledge very useful both in the content highlighted, i.e., cultural models of nature, and in the methodology that leads to the discovery of this content. Typically held out of one's or a community's awareness, a cultural model of nature is fundamental to the generation of behaviors that respond to or result in a rapidly changing physical environment. Thus, the largest relevance of the proposed cross-cultural investigation is to obtain insights into such knowledge organizations. These insights will ultimately allow researchers to better understand human behavior in this domain and at the same time make it possible to devise and implement reasonable corrective policies that would be understandable and shared by local populations affected by climate change.

Finally, the PI wants to underline that a number of young scholars and doctoral students are involved in this project. Some are representative of minority groups (e.g., Zhang, Aurang) and some are first generation college (e.g., al-Kuwari). Providing the appropriate scientific training and experience for this group of young scholars is another important aspect of the research project here described. In addition, a number of members of the communities investigated will also be involved in the project either by assisting senior scholars in the field or by becoming graduate assistants in the home institutions of these same scholars (e.g., a Tongan graduate assistant at NIU; a German graduate assistant at Freiburg University, Germany; a Pakistani graduate assistant at Durham University, UK).

This is not the first time that the PI and some CoPIs have provided opportunities for members of the communities they study to pursue higher education goals. The researchers for this project intend to continue along this line. They will make sure that a great benefit would be gained by the communities investigated. In fact, when well trained and experienced professionals come back to their communities of origin, they enhance the chances for those same communities to move in the direction of modernity they choose to take.

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