Global Environmental Change 21 (2011) 66–76

Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Social identity, perception and motivation in adaptation to climate risk in the coffee sector of Chiapas, Mexico

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ARTICLE INFO

Article history:
Received 7 April 2010
Received in revised form 29 October 2010
Accepted 1 November 2010
Available online 3 December 2010

Keywords:
Social identity
Perception
Motivation
Adaptation
Coffee production
Mexico

ABSTRACT

Most investigation into climate adaptation to date has focused on specific technological interventions and socio-economic aspects of adaptive capacity. New perspectives posit that socio-cognitive factors may be as or more important in motivating individuals to take adaptive actions. Recent research indicates that incorporating insights from motivation theory can enhance theorization of adaptive capacity. Yet unexplored, and what we propose here, is the addition of social identity to models of adaptive capacity and adaptation. To apply this conceptual framework, the first author undertook in-depth interviews with a sample of farmers who had participated in broader surveys the previous year to explore their perceptions of their social identity, climate-related information and its sources, and climate risk. These interviews elicited compelling evidence that social identity mediates between risk perception and adaptation through its influence on motivation. Interviews revealed significant links between social identity and perception of information, risk perception and adaptation, of which the most salient were the relative credibility and legitimacy of information sources (related to *us vs. them* social group differentiation); the role of coffee organizations; and ethnicity and geographic marginalization. Strong in-group identity and perceptions of potentially influential out-groups such as the scientific community appear to particularly influence perception and use of information. These findings have rich policy implications for adaptation management and merit further investigation to identify how, where and why social identity plays a role in climate-risk perception, motivation and adaptation in other geographic areas of vulnerability worldwide.

1. Introduction

Adaptive capacity, or the factors that enable social systems to respond proactively to environmental change, has emerged as a core domain of global change research (Burton, 1996; Smit and Wandel, 2006; Nelson et al., 2007). Much recent conceptual and empirical research focuses on identifying the demographic, economic, geographic, and some socio-political factors that diminish or enhance adaptive capacity (e.g., Yohe and Tol, 2002; Adger and Vincent, 2005). While these factors remain significant, they do not represent the complete picture. Relatively little attention has been paid to the role of motivation in the process of adaptation. Whatever external pressures they experience, individuals must perceive a need, an ability and motivation to act. Thus full comprehension of the adaptation process may require further disaggregation of related socio-cognitive factors including the complex relationships among the characteristics of individuals, how they perceive and acquire information about risk, and the role of social identity in their motivation to act.

Perception of hazard risk has long been recognized as a critical determinant of human response to environmental shocks and change (e.g., Burton et al., 1978; Kasperson et al., 1988; Stehr and von Storch, 1995; Oliver-Smith, 1996; Weber, 1997). Nevertheless, recent research has expanded on this foundational literature to explore the socio-cognitive influences on adaptation more fully (Grothmann and Patt, 2005; Burch and Robinson, 2007). In Grothmann and Patt's (2005) socio-cognitive Model of Private Proactive Adaptation to Climate Change (MPPACC), perception is a key variable illustrated as influencing or being influenced by all the model's determinants of adaptive behavior. Segmenting the process of adaptation into "risk appraisal" and "adaptation appraisal," they argue that perception of hazard risk is an important determinant of adaptation, but so are perceptions of self-efficacy, adaptation efficacy, and adaptation costs.

A related body of literature has focused not on perception of risk *per se*, but rather on evaluation of information about risk and its relation to propensity to act. Recent work, such as that by Cash et al. (2002, 2003), Meinke et al. (2006), and Vogel et al. (2007), supports the assertion that in order to successfully build adaptive capacity,

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doi:10.1016/j.gloenvcha.2010.11.001

scientists, governments, NGOs, and other organizations must be able to communicate climate and adaptation information, and also establish and maintain their information's salience, credibility, and legitimacy. Assessment of the value of information, in turn, is influenced by the way that information is conveyed – not only by the media conveying it, but also by the social relationships of those involved in its transmittal (Stapel et al., 1994). In this paper, we argue that social identity plays an important role in shaping both perception of risk and evaluation of information, and thus is a core element in motivating adaptation. Understanding the influence of identity and interpersonal and intergroup relations on assessment of information and perceptions of risk and adaptive capacity could allow relevant institutions to make more sensitive choices about best ways to communicate climate and adaptation information and who should communicate it so it is more likely to be accepted as salient, credible, and legitimate by local actors. Knowledge about local social relations, values, and norms could even be used proactively as a behavioral guide in establishing more fruitful relationships between vulnerable populations and the organizations and institutions trying to help them build adaptive capacity and facilitate adaptations.

In the next section, we provide a review of the literature on motivation, perceptions of risk and adaptive capacity, and social identity. We build on Grothmann and Patt's MPPACC by incorporating social identity as an important variable contributing to adaptive motivation. We then explore the utility of this conceptual model in a case study of coffee farmers in Chiapas, Mexico. We conclude by discussing the implications and limitations of the case-study findings, the relevance of the theoretical framework, and avenues of future research.

2. Theoretical framework and conceptual model

Any conscious decision to adapt requires motivation. Mitchell defines motivation as "the degree to which an individual wants and chooses to engage in certain specified behaviors" (1982, p. 82). Motivation theory aims to explain the underlying cognitive and psychological processes that drive actions in order to predict behavior (Mitchell, 1982). Motivation cannot be observed or measured directly, but can manifest itself through attitudinal and behavioral measures (Ambrose and Kulik, 1999). In assessing adaptive motivation, attitudinal manifestations may include satisfaction or dissatisfaction with certain information and its sources and with certain adaptation options. Behavioral manifestations may include active pursuit and/or use of information and implementation of adaptations.

Nevertheless, the availability of information alone remains unlikely to motivate adaptation (Cash et al., 2002; Patt and Shröter, 2008). Individuals seek or receive, manage, and interpret information in different ways and then use or reject it. Farmer knowledge is largely a synthesis derived from personal experience, local sources of knowledge, and external sources of technoscientific information. Much of the literature on local traditional and indigenous agricultural knowledge has focused on how the scientific community perceives and might incorporate such knowledge (see Cleveland and Soleri, 2007). Conversely, how farmers perceive scientists and their knowledge is likely to affect farmers' use of scientific information in making decisions. Cash et al. (2002) argue that at the core of any decision process involving the creation of knowledge, individuals assess the salience, credibility, and legitimacy of available information. Cash et al. (2003) propose that effective management of these three components of information is central to successful knowledge production and the ability to mobilize knowledge for desired actions. Generally speaking, individuals tap into a mix of their personal experience, local knowledge, and technoscientific information when assessing their climate risk.

Individuals are not only motivated by information about risk but also by their direct experience with loss and harm brought about by living with hazards. In hazards geography, risk is commonly characterized as the product of the probability of a risk event and the magnitude of its consequences (Kasperson et al., 1988). How an individual perceives risk is influenced in part by the type of hazard to which he or she is exposed and the perceived severity and frequency of that exposure (Kasperson et al., 1988).

The process of adaptation is affected by perception of risk and evaluation of information, and also by perception of one's own capacity to adapt, or self-efficacy. Motivation theory posits that much of human action can be explained through the concept of perceived self-efficacy, defined by Bandura as "concerned with judgments of how well one can execute courses of action required to deal with prospective situations" (1982, p. 122). Perceived self-efficacy is positively associated with any behavior from which a desired outcome is anticipated (Bandura, 1977).

Grothmann and Patt's (2005) Model of Private Proactive Adaptation to Climate Change (MPPACC) integrates many of the above socio-cognitive attributes of motivation into its framework for understanding the complex linkages between adaptive capacity and the actions – adaptations – that result from this capacity. The MPPACC categorizes perceived adaptive capacity into three subcomponents: perceived adaptive efficacy (the extent to which one believes an adaptive action will effectively provide protection from a hazard; what Bandura would term outcome expectancy), perceived self-efficacy (one's perception of his or her ability to perform the adaptive action), and perceived adaptation costs (anticipated costs of carrying out the adaptive action). Central to their model is the idea that social discourses about risk affect how individuals perceive both risk and the viability of adaptation in the face of climate change.

Nevertheless, the MPPACC stops short of identifying the specific cognitive factors that influence the subcomponents of perception. We posit that underlying multiple aspects of perception and subsequently influencing adaptive motivation is the concept of social identity. Social identity refers to an individual's knowledge or sense of belonging derived from the emotions and values associated with group membership (Tajfel, 1972 cited in Turner, 1975). People classify others either as members of their own group, termed the in-group, or as members of some other group, the out-group, a concept commonly referred to as us vs. them (Allport, 1954; Tajfel, 1969). Social identity is arguably informed by socio-demographic characteristics since aspects of individuals such as their age and status as parents inform how they perceive themselves in relation to others (e.g., Gecas, 1989; Huddy, 2001; Smith, 2007). Individuals' perceptions of risk (Wildavsky and Dake, 1990; Sjöberg, 1998), of information (Hu et al., 2006), and self-efficacy (Gecas, 1989) all reflect how they see themselves in terms of group membership. In the context of our conceptual model, social identity is considered both an aspect of self and social perception as well as an influence on risk perception, perception of information and perception of self-efficacy.

To date there have been few investigations into the role of social identity in risk perception and adaptation. Hu et al. (2006) explored the possibility that individuals attribute specific beliefs, values, perspectives and opinions to distinct social groups, and thus the individual's perception of and relation to these groups also affect the individual's acceptance of information from them. They found that Nebraskan corn farmers' use of climate forecasts is highly affected by social influences, perceived social norms, and notions about the forecast sources: "Farmers' confidence in and motivation for using a forecast could be elevated by enlisting the help of those whom farmers feel trust for, share farm ownership with, or view as expert" (Hu et al., 2006, p. 1198). They conclude that harnessing knowledge of local social relations and norms

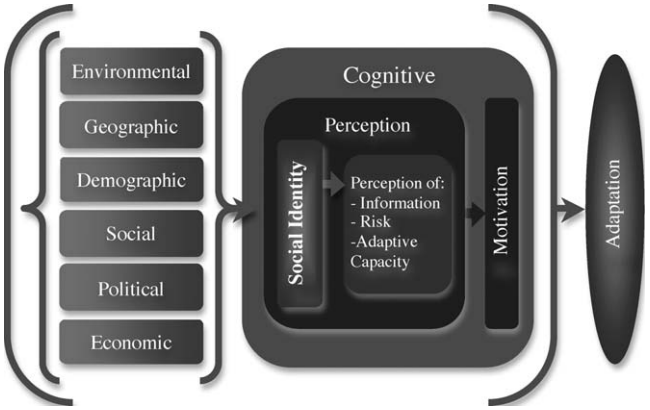

Fig. 1. Conceptual model of the major factors relating to adaptation with an emphasis on cognitive aspects. The primary focus of the case study is the relationship between social identity and the perception of information.

could lead to establishing credibility of information sources, enhancing the education and inclusion of influential groups in addition to individual farmers, and effectively employing the most influential sources in communication of information. If the influence of social identity and related social norms also apply to actors' perceptions of other types of climate information, including climate risk, as well as to their perceptions of self-efficacy, a similar influence may operate in climate change adaptation.

In the conceptual model above (Fig. 1), we elaborate on aspects of the MPPACC proposed by Grothmann and Patt by highlighting social identity as a shaper of individual perception, and hence motivation. Motivation is the final essential element leading to adaptation; therefore, gaining an understanding of the cognitive processes that affect motivation remains instrumental to developing climate change adaptation initiatives and policy. At the individual level, the socio-cognitive domain of the adaptation process, in which social identity interacts with perception and motivation, is affected by social, economic and demographic characteristics of individuals and their environments. Adaptations thus emerge in a decision process that takes into account not only who an individual is in terms of age, economic status, education, etc., but also how the individual perceives his or herself in relation to others and in relation to risk. While we propose that theoretically social identity influences perception of information, risk perception, and perceived adaptive capacity, in the case study that follows, we focus our analysis on the influence of social identity on perception of information and its sources in terms of salience, credibility and legitimacy.

Farmers arguably are highly perceptive of climate and its impact on their land and crops and, as also noted in our case study interviews, retain strong respect for their own and their social groups' experience and knowledge. When confronting environmental change, however, local knowledge is not always sufficient in building adaptive capacity. To adapt to change, new information is often needed – in this case, information about the changing climate and feasible adaptations of farming practices. Focusing on a need for new information does not delegitimize local knowledge, rather, through the social identity framework, one may be able to better explore how identity delegitimizes or enhances understanding, acceptance and use of new or exogenous knowledge.

3. Contextual background

3.1. Economic and cultural background and importance of Mexican coffee production

Small-scale coffee socio-agroecosystems present an excellent context for exploring the theoretical framework described above. Because such systems are highly codependent on social and biological processes and the majority of coffee farmers represent economically and geographically marginalized populations, their vulnerabilities, social relations, and information flows are perhaps more easily identified than in other human-environment systems.

The suitability of Mexico's climate and geography for coffee growing is reflected in the country's long history of coffee production and its prominence in the international market (Perfecto et al., 1996). Most Mexican coffee farmers are smallholders with less than 5 ha of land who rely on familial labor (Rice, 1997). More than a cash crop in Mexico, coffee represents a production system around which rural households have developed strong cultural, social and familial roles, identities and knowledge systems (Aguirre Saharrea, 1999).

Effective exchange and coproduction of local and scientific knowledge sources is widely lacking (e.g., Nygren, 1999; Cash et al., 2002; Vogel et al., 2007), a situation that has spurred exploration into boundary organizations (Cash et al., 2002; Vogel et al., 2007). Boundary organizations can serve to mediate among different knowledge bases and facilitate decision-making in the face of significant uncertainty (Cash et al., 2002; Vogel et al., 2007). While exploring social identity and perception of information sources, this paper also briefly examines coffee cooperatives as boundary organizations that are important sources of information as well as generators of social identity (Milford, 2004). In the competitive global market, cooperatives enhance and formalize coffee producers' sense of identity and social cohesion, linking households to regional, national and global networks of information and technology flows. Coffee cooperatives can provide new arenas for social interaction by bridging boundaries between social groups. While a cooperative may be active in and represent many communities in one or many municipalities, not all members of those communities choose to join. Furthermore, because members also participate in other important social institutions and activities, a "member is not exclusively identified as a social actor by his or her participation in the [cooperative]" (Nigh, 1997, p. 431). With this caveat in mind, we use coffee cooperatives as a proxy to explore aspects of social identity that may influence farmers' decision-making and adaptations. We hypothesize that through their influence on social identity, evaluation of information, and perceived adaptive capacity, cooperatives are potentially instrumental in shaping farmers' motivation to adapt to climate risk.

3.2. Climate vulnerability of the coffee socio-agroecosystem

The vulnerability of coffee farmers to climate stress is associated with the economic and geographic marginality of the farm households, as well as the direct sensitivity of the crop to climate stress (Eakin et al., 2006). Coffee farmers have become increasingly dependent on a coffee economy following a trend of reduced crop diversity on their plantations since the 1990s. Dependency on the coffee market as the primary and sometimes only source of income creates an increased vulnerability to coffee-price fluctuations and to climate change (González Jácome, 2004; Eakin et al., 2006; Eakin and Wehbe, 2008). Climate changes such as shifts in the rainy season and variations in temperature and precipitation can negatively affect coffee plant physiology, flowering and fruiting resulting in reduced yields (Gay et al., 2006). Detrimental imbalances in the agroecosystem include increases in coffee pests and fungi, soil loss and degradation, and reduced biodiversity. Based on current trends and projections of climatic conditions in 2020, Gay et al. (2006) found that in a worst case scenario, coffee production in Mexico could decline by as much as 34%.

Coffee is sensitive to climatic extremes such as droughts, torrential rains, hurricanes, hailstorms, and frosts as well as associated soil loss, landslides, and damages to farmers' land and property. According to the Intergovernmental Panel on Climate Change (IPCC, 2007) an increase in frequency and, in some cases, intensity of extreme climate events is "likely to very likely" and historic trends in cyclone activity may be altered. Recent events illustrate the magnitude of potential damage should extremes become more frequent. In October of 2005, at the beginning of the coffee harvest, Hurricane Stan pummeled Mexico's southern states with intense rains causing floods, landslides, and significant physical damages (Hernández Unzón and Cirilo Bravo, 2005) that were particularly serious for Chiapan coffee farmers. The scale and severity of the impact of such extreme climate events in the agricultural sector and projections for their increased frequency and intensity highlight the need for adaptive capacity-building and adaptation strategies.

Ongoing research in Chiapas indicates that farmers are pursuing a number of strategies in the face of multiple stressors – climatic and non-climatic – including changing to coffee varieties more resistant to drought or excess moisture; crop diversification; economic diversification; soil conservation methods utilizing shade trees, live barriers, composting, and terracing; and joining social-economic organizations such as farmer cooperatives. Organic production, incorporating many of the aforementioned practices, is nearly exclusive to these organizations, suggesting that, controlling for other factors, cooperative members may be less vulnerable than non-members.

Farmers' implementation of climate adaptations may be conscious responses to climate risk, or they may be changes motivated by other stresses or influences having the unconscious or indirect effect of reducing their climate vulnerability. Appropriate to the focus of this paper, the definition of climate adaptation used herein refers to conscious actions taken to reduce vulnerability to climate risk and impacts. Although motivation is an essential variable in any adaptive action, the motivators influencing conscious climate adaptation vs. that which is indirect or unconscious are probably very different. If a farmer changes to a different coffee variety specifically because it sells better on the market, but it is also more resistant to drought, his motivation for changing is unlikely to be significantly influenced by his perception of climate information or the other factors explored in this paper. In the case study detailed in the following section, emphasis is placed not on the types of adaptations implemented by farmers, but rather on the fact that the action was consciously taken to address perceived climate risk with the aim of reducing vulnerability to climate impacts.

4. Case study

Our case study involves smallholder coffee farmers from two communities in the municipality of Cacahoatán in the state of Chiapas (Fig. 2). Cacahoatán neighbors the major city of Tapachula, which has nearby port access and is the terrestrial gateway to Guatemala. Cacahoatán communities have easy access to Tapachula by paved roads with van and taxi services.

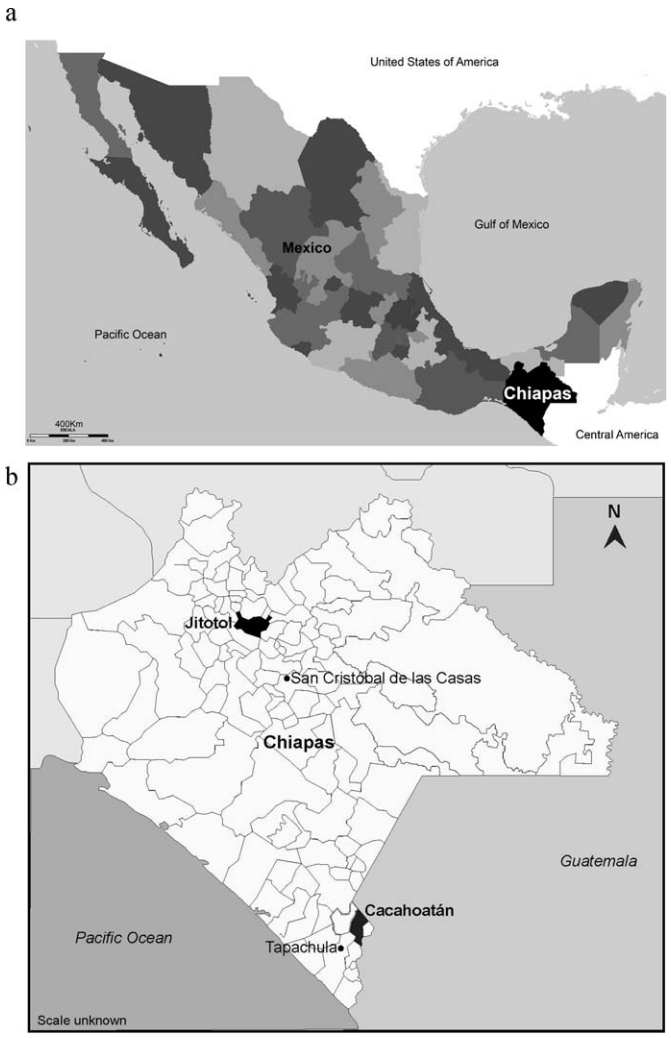

Fig. 2. (a) Map of Mexico identifying the state of Chiapas. (b) Map of Chiapas identifying the municipalities and cities in which interviews were conducted.

One site, Agustín de Iturbide, is 37 km north of Tapachula and the other, El Águila, less than 5 km further northeast. Both study communities are characterized by modest wood or brick houses with multiple rooms and tin sheet roofs. Residents are non-indigenous and most speak only Spanish. Some families are originally from other areas, but most have lived in the same community for generations. To provide a broader view of the socioeconomic characteristics of this region, data from the Mexican population census for the municipalities and the communities are summarized in Table 1.

4.1. Methods

Our investigation into the role of social identity in adaptation is based on two sets of data: surveys of farm households conducted in

Table 1
Socio-demographic and economic indicators by community.

Municipality	Community	Total population	Average # of people per household	Average grade level of schooling completed	% of houses with television	% of houses with computer	% of houses with 2 rooms or fewer	% of employed 12 years and older in agriculture
Cacahoatán		40,975	4.86	6	79%	5%	49%	48%
	Agustín de Iturbide	1275	4.84	6	78%	4%	51%	
	El Águila	2147	4.62	6	75%	1%	32%	

Source: INEGI (2000/2005).

2007, and in-depth interviews with farm households and cooperative leaders conducted in 2008. The survey data represents a subset of households extracted from a larger survey of coffee farmers organized by the Colegio de la Frontera Sur (ECOSUR). This larger survey entailed 318 coffee farm households selected at random from the coffee farming populations of ten communities in the two municipalities of Cacahoatán and Jitotol in Mexico's southernmost state of Chiapas. The survey, conducted orally, was designed to collect data including household demographics and economics, agricultural practices, perceptions of risk, and economic and agricultural adaptations to various social, economic, and climatic stresses. The availability of the survey data permitted the creation of a risk perception index as a proxy for risk perception (see section 4.2 below), and permitted a general socioeconomic and geographic contextualization of the qualitative data that formed the focus of the analysis. In this paper, we use the survey data from two of the communities in the municipality of Cacahoatán, Agustín de Iturbide and El Águila, to complement and support the data collected from a small sample of households who participated in in-depth interviews. This survey subset is comprised of a total of 70 cases: 48 from Agustín de Iturbide and 22 from El Águila. Because these cases were selected from a broader sample designed to represent variation across a municipality, the 70 cases cannot be construed to be representative of the two specific communities. Nevertheless, the cases do represent a random selection of households in each of the two villages. As described further below, 16 of these cases participated in qualitative interviews in 2008.

Assessing and identifying aspects of social identity requires close interaction with subjects, and a nuanced reading of human expression and use of language. Qualitative methods used on a small sample for exploratory analysis are ideal for this form of assessment. In this analysis, we used data derived from in-depth interviews to evaluate the relationship of identity with perception of information and motivation to adapt. During of the summer of 2008, the first author visited three of the communities that had been surveyed in 2007 and conducted semi-structured interviews with 17 small-scale coffee producers, 16 of whom had been surveyed in 2007. She also interviewed 4 coffee organization leaders in two major cities (see Fig. 2b). The interview protocol was designed to collect more detailed qualitative information on some of the prominent themes present in the 2007 survey data with a focus on indicators of social identity and the relationship of identity to attitudes about information that would be potentially relevant for adaptation.

To directly analyze the role of social identity on farmers' perceptions of potentially influential sources of information as well as to assess farmers' hypothetical motivation for adaptive behavior, the semi-structured interview protocols employed scenario questions. In these questions, a technical field advisor (called a *técnico*), a European scientist, and a neighbor were used as hypothetical information sources. *Técnicos* are most often Mexicans from the same region as the farmers they advise. A hypothetical European scientist was chosen arbitrarily to differentiate the source ethnically and geographically. If the respondent was a member of a coffee cooperative (*organizado*), the hypothetical neighbor was identified as a non-member (*libre*) in scenario questions and if the respondent was a non-member, the neighbor was identified as a member to elicit intergroup attitudes and perceptions. Responses were nominal as yes, possibly, or no followed by elaboration on the reasons for the response given (although not all farmers provided further explanation).

Ten of the interviewed farmers were members of cooperatives; 7 were not. All 17 interviewed farmers were from the municipality of Cacahoatán. For those farmers that were members of organizations, the interviews collected information about the role of farmers' organizations and their membership activities; the salience of pertinent themes, primarily climate, within the organization; the farmers' perception of the organization and its staff; sources of production and climate information and means of communication; the farmers' experience of local climate changes and their impacts on coffee production; and finally farmers' perceptions of specific sources of information. Interview protocols for non-member farmers excluded the organization-specific questions, replacing them with questions on how they perceive organizations in general, but were otherwise the same as those for organized farmers. The interview texts were qualitatively categorized and coded to identify key themes relating to social identity and potential cognitive relationships between interview data variables.

To explore the theory of boundary organizations and to triangulate organization-related data reported by member farmers, the first author also interviewed leaders of four coffee organizations, two of which were active in Cacahoatán. Indígenas de la Sierra Madre de Motozintla (ISMAM), founded in 1986, is currently one of the Mexico's largest cooperatives with around 1000 members representing about 18 municipalities. Centro de Agroecología San Francisco de Asis (CASFA), also founded in 1986, is another of the largest cooperatives, with around 800 members. These two cooperatives were founded specifically to advance the cause of indigenous small-scale producers but have grown to include many non-indigenous members. Although it did not pertain to the specific region of study, Toyol Witz was included in the analysis to represent a small cooperative. Toyol Witz has an almost entirely indigenous membership of around 150 and is located in the municipality of Jitotol in the northern highlands of Chiapas. Unión Agrícola Regional de Productores de Café Tacaná (Unión Tacaná) in the city of Tapachula was included to explore an organization of mainly large-scale coffee producers (refer to Fig. 2b).

4.2. Risk perception indices

The subset of the survey data allowed for the documentation of farmers' experience with specific climate hazards. In addition, to facilitate the analysis, an index was created to serve as the dependent variable "perceived risk," using the following variables from the survey data: the perceived change in frequency (f) of each of eight possible climate event types (i) identified by farmers as having impacted them in the last 10 years, the perceived severity (s) of the impact of each event type, and the sources of risk farmers' reported as most preoccupying when considering the coming year. A raw climate risk perception index (CRPI) value was first determined using the equation $\mathrm{CRPI} = \mathrm{sum}(f_i \times s_i)$. The values of this index were then classified into quartiles, representing "none," "low," "moderate" and "high" risk perception.

These classifications were further adjusted to reflect the perceived risk associated with climate relative to a broad spectrum of other life stresses, as reflected in the survey question "What worries your household most as you think about possible effects on your households' wellbeing in the coming year?." The sum of responses of each farmer to this question resulted in a count of perceived sources of highest preoccupation, and this count was converted into an index of general risk aversion (GRAI). If in answering this question a farmer identified climate as a source of highest preoccupation, then this raised his or her Climate Risk Perception Index value up one level from that initially determined. In both communities, climate was among the top three most frequently identified sources of greatest preoccupation indicating it is perceived as a significant source of risk even in relation to all other potential sources (Fig. 3). Climate ranked second to coffee prices for farmers from Agustín de Iturbide and third after coffee

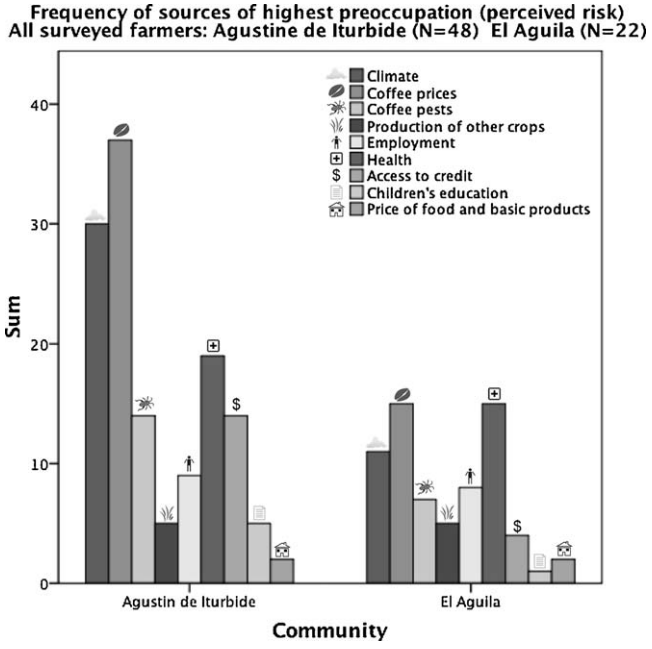

Fig. 3. Distribution of frequency of sources of highest preoccupation (perceived risk) reported by farmers.

prices and family health for farmers from El Águila. The final adjusted variable is the Climate Risk Perception Level (CRPL). In cases in which climate was the only source of highest preoccupation identified by the farmer, his CRPL was directly classified as high.

5. Results

5.1. Demographic and economic profiles

Table 2 summarizes the demographic and economic profiles of all the surveyed households in the two communities in Cacahoatán ($n = 70$) as well as of the subsample of 16 interviewed farmers (the 17th interviewed household was not represented in the survey database). In 15 of the 16 households, coffee is the primary source of earned income, where other primary sources are remittances and subsidies. In most cases, one or two members work producing coffee, usually the male head of household except where the head is a single widow. The majority of these individuals (12 of the 16) have been coffee producers for over 30 years. While there is no significant difference between the surveyed households in Agustín de Iturbide and those in El Águila in terms of the demographic composition of the household, in the interviewed sub-sample, farmers in El Águila are younger (a mean of 51 compared to a mean of 59 in Agustín de Iturbide) and have slightly lower levels of education than those in Agustín de Iturbide.

5.2. The 'coffee farmer' identity

Perdue et al. (1990) identify language as a powerful indicator and determinant of social perceptions. The language and many of the comments of farmers during interviews illustrate the strength of social identity among coffee farmers, independent of the relation of this identity to climate-risk perception, climate information, and adaptation. For example, the majority of interviewees, when asked how many years they have been coffee producers answered "all my life" and had to be prompted for a numeric answer. For these farmers, coffee production is an activity and identity passed down through generations rather than acquired by individuals through independent experience or education. One farmer stated, "more than anything, among comrades we help each other, we all have the same thing [coffee]. Now, for being organic we are selling better." Because the nuances of certain Spanish words are lost in translation, the original statement merits inclusion: "*Más que nada, entre los compañeros nosotros nos ayudamos, todos tenemos lo mismo. Ahorita por ser orgánicos estamos vendiendo mejor.*" The word *compañeros*, translated comrades or companions, in Spanish is embedded with a strong sense of solidarity that is absent in the English usage. Furthermore, the interviewees commonly said *we* and *us* instead of *I*, even when talking about their own preferences and activities, pronouns indicative of their strong perceptions of social group membership and solidarity (Ashforth and Mael, 1989). As evident in the results below, the social group "coffee farmer" is both divisible and expandable depending on the issue at hand. In relation to specific 'out-groups' a farmer's in-group can at times include all small-scale coffee farmers; in other circumstances farmers perceive differences among themselves associated with cooperative membership.

5.3. Climate impacts

The survey data revealed that farmers are experiencing climate changes and impacts on their production. The majority of farmers in El Águila reported impacts primarily from torrential rain in the past 10 years, while those in Agustín de Iturbide reported impacts from a greater variety of climate events, particularly drought and hailstorms, in addition to torrential rains. In both communities farmers perceived an increased frequency of most of the events they reported. The reported climate impacts and frequencies permitted the assessment of farmers' risk-perception levels as described in section 4.2 above. Table 3 illustrates the percent of farmers classified in each level of the climate risk perception index.

The in-depth interviews with farmers in the sub-sample confirmed a general perception of an increase in the frequency and severity of diverse climate events, and a preoccupation with the implications of these climatic changes for production. The farmers reported direct loss of coffee fruit and to a lesser extent loss of coffee plant foliage, both caused by strong rains and excessive moisture. Other impacts mentioned include increased

Table 2
Demographic and economic profile of the surveyed sample and the interviewed sample.

Community	Survey sample means ($n = 70$)		Interview sample means ($n = 16$)	
	Agustín de Iturbide	El Águila	Agustín de Iturbide	El Águila
Total number of people in household	4	6	5	6
Males	2	2	2	2
Females	2	3	3	4
Total younger than 15 years	1	2	2	2
Age of producer	55	54	59	51
Land owned (ha)	3.4	2.02	4.86	1.65
Coffee production (kg)	2644.24	994.19	5289	1111
Production per hectare (kg/ha)	1032.11	493.28	1126	518
Production per capita (kg/person)	887.21	221.35	1729	199

Table 3
Frequency and percent of households at each climate risk perception level.

	Frequency	Percent	Valid percent	Cumulative percent
Climate risk perception level				
Low	19	27.1	28.4	28.4
Moderate	20	28.6	29.9	58.2
High	28	40.0	41.8	100
Missing value	3	4.3		
Total	70	100		

coffee pests and diseases from excess moisture, delay or prevention of coffee plant flowering and fruiting due to temperature extremes or too much rain, and drying of the coffee fruit on the plant resulting from excess heat.

5.4. Attitudes about climate information sources: social identity and credibility

The relationship of social identity, perception of the validity of information sources, and adaptive motivation was explored in detail through scenario questions with the 17 farmers who participated in the in-depth interviews. Members of cooperatives, who had experience with *técnicos* hired to support cooperative goals and activities, were asked, (1) whether they would believe a hurricane warning given by a *técnico*, and (2) whether they would believe a hurricane warning given by a European scientist. As Table 4 shows, there were negligible differences in farmers' trust in information from a *técnico* employed by the cooperative compared with the scientist. However, respondents reported different reasons for believing each source of information. Farmers primarily identified having personal experience of recent local climate trends that agreed with the *técnico*'s information as the reason for believing him, while they identified expertise or high level of education as the reason for believing the scientist. When asked whether she would believe a scientist's hurricane warning, a widow responded, "If they study, it's possible they have more knowledge. If it's a scientist, possibly, because they study the planet and everything." Farmers perceived scientists as a highly educated social group, with unfamiliar but broad knowledge, contrasting sharply with their own educational background (most farmers in this region have, at most, an elementary school level education).

Farmers saw fewer differences between themselves as coffee producers and the *técnicos* as agricultural advisors than they did between themselves and the "scientist" group. Two respondents explained that they trust the *técnico*'s explanations because, "we know if the explanations make sense," and "what they explain, we already know also." The legitimacy of the *técnicos* as a source of information was reflected in the expectation that the knowledge they offered could be corroborated through the farmers' own experience or in the popular media. Regarding the hypothetical hurricane warning, one farmer stated, "If they told me something, it's because they have heard something; even if they haven't heard, it could happen. Through the medium of the radio information reaches us. According to the information, the rain came from the Pacific coast today."

In general, the *técnico*'s climate information was perceived as less credible than that of the scientist, perhaps because farmers view *técnicos*' social identity as similar to their own and as having the same experiences and limitations of knowledge. One farmer suggested that the *técnico*'s advice would likely be irrelevant, given the farmer's own knowledge of the region's topography: "It's not so easy, because hurricanes don't come here, the area protects us because we are in a low part where hurricanes don't reach, but the rain does." Other farmers indicated that only God knew when a hurricane would arrive, and two others indicated that the television/radio would be considered a more credible source. One explained, "Sometimes, yes [I would believe the *técnico*], but one also has to watch the news; sometimes they don't take him [the *técnico*] seriously," and the other stated, "Listening to the news, one is more informed." In contrast, responses indicate that under the same circumstances a scientist's forecast would be more credible. One farmer reported that he would not believe the *técnico*'s hurricane warning because, "God knows, that's it. People came once to tell us to prepare for a hurricane; we bought food and everything and people got scared, but instead of bad weather, it became hot. God is the only one that can decide the things that are going to happen, only he knows;" however, he later responded that he would believe the scientist's hurricane warning because, "they study for that."

In five cases in which farmers said they would not believe the European scientist's hurricane warning, social identity was the prominent theme among farmers' reasons. One farmer asserted, "We have here those who inform us" indicating an us vs. them type of social-group differentiation linked to place in which the in-group of local or regional sources is preferred or trusted over foreign sources of information. Similarly, another farmer explained he would not believe a European scientist "because he belongs to another continent." Here this farmer is either signaling an inherent distrust of knowledge from a foreign source, or a belief that climate knowledge in particular should come from local knowledge and experience.

Table 4
Comparison of farmers' trust in a hypothetical hurricane warning from a *técnico* and from a European scientist.

Response	*Técnico*	European Scientist
Yes	10	8
Somewhat	2	3
No	5	5
Total N	17	16

5.5. Perception of mass media sources of information

The 2007 survey data identified radio and television as the most frequently available sources of information for farmers in this region. According to the survey, 56 of the 70 farmers in the two communities reported owning a radio, and 65 of the 70 reported owning a television. All 17 interviewed farmers said they hear about climate on both the radio and the television. Only one farmer out of the 17 interviewed said he had access to a computer with Internet connection, not necessarily in his home, and others explained that Internet services had not yet reached their communities. Population census data records only about 5% of the population of Cacahoatán with computer access and, given limited services in the area, it is likely that many of these are not connected to the Internet.

The local and regional newspapers offer local, national and sometimes international news as well as climate-event warnings and weather reports. Of the 17 respondents interviewed, 7 said they read newspapers regularly, with one farmer commenting, "Not knowing how to read is like having one's eyes closed." His quote is a powerful simile indicating the importance of information generally for one's awareness of the external world, particularly for farmers who live in rural highland communities. Similarly, reinforcing both farmers' perception of the importance of information and their respect for education, another farmer exclaimed, "I give thanks to God for the radio, for the TV, for school."

The farmers expressed confidence in these media as credible sources of information, associating mass-media sources with access to knowledge and higher education that the farmers themselves were lacking. When a *libre* farmer was asked if he would believe a hurricane advisory conveyed by an *organizado* neighbor, the farmer stated that he would not because, "No one knows. We believe if they say it on TV because they are educated." Here the farmer associates the organized neighbor with his own social group (e.g., "no one" in his in-group knows), which he perceives lacks education and certain knowledge of climate matters. The TV anchors, in comparison, are assumed to be educated and to possess much greater knowledge.

As with the perception of climate information from the *técnicos*, an informant close to the farmers' own social group who had higher education could acquire credibility if his or her knowledge could be corroborated through the mass media. For example, a farmer reported that he would believe climate information provided by an *organizado* neighbor, not because the neighbor had superior knowledge derived from his cooperative membership, but because "maybe he saw it on TV or the radio," and added jokingly, "or he saw it on the Internet." Underlying these comments is an apparent assumption that farmers who participate in cooperatives might have greater access to the media, perhaps through a higher level of education. Indeed, survey data indicate a significant relationship between organization membership and higher levels of education ($p = 0.01$). It also may be that being able to corroborate a warning through the media transfers credibility to a neighbor's information.

5.6. The role of coffee organizations

Cooperatives offer an important forum and source of information for their members to which non-members do not have access, and, more importantly, serve as boundary organizations (see Nigh, 1997). These facilitate increased access to government funding as well as information and consultation while bridging the otherwise firm boundary between small-scale farmers and the international organic coffee market.

As indicated in interviews with cooperative leaders and cooperative member farmers, cooperatives and their *técnicos* primarily provide market information and access and technical assistance in matters such as transitioning to organic production, pest control, and soil conservation methods. While many of the strategies cooperatives assist with can be considered adaptations to climate impacts, they were not labeled or offered as such by the cooperatives or the farmers. Interaction between farmers and cooperatives seemed to be for the purpose of maintaining or improving production and marketing of the product and not consciously for providing adaptive strategies to climate change.

Furthermore, the interviews did not indicate that the cooperatives were significant as sources of climate information to farmers. None of the interviewees reported seeking or receiving climate news or weather forecasts from their cooperatives. Leaders of three cooperatives (CASFA, ISMAM, and Toyol Witz) confirmed that they do not provide climate information to their members. Unión Tacaná, comprised mainly of large-scale producers, does provide climate information to members. The president said the organization employs an online service that sends email newsletters, including climate reports, to members, illustrating that climate information salient to coffee farmers is available. Obviously members who lack Internet access would not receive such bulletins.

Although the provision of climate information does not appear to be an important function of the cooperatives, nearly all *organizado* farmers reported that they discussed climate matters in cooperative meetings. Discussion centered on climate impacts rather than climate forecasts, scenarios or future conditions. Most farmers expressed little demand for more climate information because they felt that they already knew what the local climate was like. A farmer explained: "One takes it naturally, we are already accustomed to the climate here," and "We already know what the weather is like, we can't do anything." Another farmer said talking more about climate during cooperative meetings "would not be appropriate for our meetings. Meetings deal with prosperity. The cyclones are hitting us. We don't even know when they are going to arrive. They make us lose some of our production." Farmers invariably expressed awareness of climate events and impacts yet remained comparatively uninterested in climate information such as forecasts.

In the absence of any more credible authority (e.g., a "scientist"), farmers perceived general local climate knowledge as part of their own identity, within the domain of knowledge and experience of their social group. For them, the cooperative was not an external organization, but part of their own social group and thus an extension of their identity as *organizado* farmers. It thus provided a forum for discussion of climate and its impacts on coffee production, but was not in and of itself a source of external climate information such as formal forecasts and advisories.

5.7. Social identity and adaptation

Somewhat surprisingly, an analysis of the survey data found that for the farmers in the two case study communities of Cacahoatán, age, level of education, number of children younger than 15, organization membership, community, and the General Risk Aversion Index were not significantly associated with adaptation, although these factors may affect perceptions of climate risk. In addition, only two of the six farmers classified as having a high level of climate-risk perception reported taking specific actions to mitigate this risk, although three of the four farmers classified as having moderate risk perception reported making adaptations. None of the farmers classified as perceiving low climate risk adapted. While socio-demographic factors and relative risk perception in isolation do not explain choices to adapt or not adapt, they probably factor into cognitive processes and socio-psychological variables, such as social identity, that influence adaptive motivation and action.

To explore farmers' intergroup perceptions as indicators of their motivation to change production methods and implement adaptations, scenario questions were again employed. To elicit farmers' perceptions of their own group in relation to others, the interviewer asked for their hypothetical responses to advice on coffee tree pruning from several possible sources – a *técnico*, an *organizado* or a *libre* neighbor, or a scientist – if each suggested a new method of pruning the plants so they would produce more. The example of a new pruning method was chosen under the assumption that pruning, necessary for sustained coffee production, is done by most if not all coffee farmers (Nolasco, 1985).

Once again, the relative proximity of the *técnico* to the farmers' social group was apparent in farmers' comments, but in this case the *técnico*'s presumed expertise in agronomic matters (in comparison to climatic) conveyed greater credibility. Nearly all those interviewed said they would change their pruning method at the suggestion of a *técnico* (15 of 16, with one farmer not responding). A farmer explained, "We are like the *técnicos*, we manage everything." As this farmer was not an *organizado*, the plural pronoun here can be interpreted as referring to his identity as part of a general coffee farmer social group. In contrast, when asked if they would change their pruning method at the suggestion of a European scientist, 10 said yes, 5 said possibly, and 2 said no. Both negative and affirmative responses included references to social identity. One *organizado* indicated concern about the

Table 5
The most significant outcomes of links between social identity and perception of climate and production information sources for the *Organizado* Coffee Farmer group. Results were equivalent for the *Libre* Coffee Farmer group except that it perceives both its own *Libre* In-group and the *Organizado* Out-group as highly credible within their area of expertise.

Interviewed Social Group	Information Source	Perceived Social Group Membership of Source	Perceived Credibility Outcome	Perceived Legitimacy Outcome
Organizado Coffee Farmer	*Organizado* Coffee Farmer	Coffee Farmer In-group	High within area of expertise	High
		Organizado In-group	High within area of expertise	High
	Libre Coffee Farmer	Coffee Farmer In-group	–	High
		Libre Out-group	Low	–
	Técnico	Coffee Production Expert In-group	High within area of expertise	–
		Municipio or Community In-group	–	High
	Mass Media	Educated Expert Out-group	High	–
		Chiapan or Mexican In-group	–	High
	European Scientist	Educated Expert Out-group	High	–
		Elitist or Geographic Out-group	–	Low

legitimacy of scientists stating, "They have tricked us a lot. The way we know how to do it, that is how we will do it." Again, although asked about a personal decision that would directly impact only his plantation, he did not respond in the first person. The issue of legitimacy arose in another farmer's response explaining she would adopt the new pruning method, "Only if it is not going to cost us a lot and if they are not going to leave without returning to check back with us."

While the farmers apparently perceived themselves to be in a single social group when considering other actors such as *técnicos* or scientists, intragroup divisions were clear when exploring perceptions of *organizado* and *libre* subgroups. Asked whether they would change their pruning methods at the suggestion of an *organizado* neighbor, 6 of 7 *libre* respondents said they would. The one *libre* who did not provide a yes or no answer simply stated, "They are advised [by their organization's *técnicos*] and don't come to teach others."

In contrast, when the 10 *organizado* farmers were asked if they would change to new pruning methods at the suggestion of a *libre* neighbor, only four said *yes* without reservation; 2 additional respondents said *possibly*. One *organizado* exclaimed, "If they don't organize, they don't work. What am I going to learn from them? [...] They are people who don't organize because they don't want to improve their product." In keeping with theories of social categorization, the farmer perceived differences between the *libre* social group and his *organizado* group in terms of specific agronomic practices and behavior, despite the fact that they are both members of the coffee-farmer social group. An *organizado* who said he would make the change explained, "I knew a man who was a very hard worker with experience and I used to talk with him about good ways to do things." Similar to some farmers' views of climate information offered by *técnicos*, credibility among very similar social groups (or in this case, subgroups) appeared enhanced to the extent similarities were identified in experience and knowledge (Table 5).

6. Discussion

In this case study, it was apparent that climate impacts were salient to farmers and that their adaptive capacity to climatic variability and change is likely to become more important in the future. The survey data and qualitative interviews revealed that farmers' identities are constructed through diverse and overlapping associations, including geographic proximity (areas similarly affected by climate) and place-based ties, occupation (coffee farmer), access to mass media, and participation in cooperatives. Experience and identity appear to go hand-in-hand. Climate is paradoxically both a familiar and foreign topic to farmers: as an integral part of their experience as producers and rural residents, it is thus within the domain of their 'in-group' knowledge, but it is also an enigmatic and esoteric subject accessible differentially to those with higher education. *Técnicos* were essentially perceived as "one of us," and were not expected to have knowledge greater than the farmers' own. Knowledge and communication of climate information is not part of the regular activities of *técnicos* in coffee cooperatives, and farmers might indeed consider it unusual to hear such information from them. It may be that in stepping beyond his or her established or perceived role, a member of any particular social category might, at least initially, have a reduced credibility in his or her new function. If this is indeed the case, *técnicos* and perhaps other potentially instrumental actors perceived as legitimate may become credible sources of climate information after re-defining and establishing their role over time to include this new service. For *técnicos*, doing so may mean distancing themselves from their identities as "farmers" and emphasizing the uniqueness of their own education and experience; on the other hand, for "expert" groups and institutions, it may mean emphasizing similarities with which farmers identify.

Despite the growing role of cooperatives as boundary organizations for agronomic and market information and knowledge, there was no evidence that they were perceived as a source for climatic information. Instead, cooperatives act as forums to enhance and define in-group identity, reinforcing existing in-group climate knowledge through discussion and exchange rather than serving as a conduit for external climate information. Should cooperatives become disseminators of forecasts and warnings, their role as forums for discussion may lead to sufficient ownership of such information that members can then corroborate it with information they acquire independently from external agents – be it media, *técnicos*, or scientists. In other words, ownership of knowledge enhances its legitimacy and credibility.

Although the farming populations in Cacahoatán who were included in the survey did not identify themselves as belonging to an indigenous group, many agricultural cooperatives in Chiapas are built around ethnic identity (Martínez-Torres, 2006, p. 76). It is likely that the strength of this sense of identity, although not necessarily homogenous as evidenced by Hernández Castillo and Nigh (1998), intensifies the us vs. them type of social group differentiation that was observed among the study sample in Cacahoatán. Ethnic identity is compounded by identity politics associated with the long history of the indigenous struggle with the government for land, cultural recognition, and other rights (Hernández Castillo and Nigh, 1998; O'Brien, 1998). Not surprisingly, many cooperatives have agendas both political and productive, serving both to attract and repel farmers based on each individual's perceived social group memberships. Nevertheless, there is no evidence from this study that would suggest that the strong cohesive identity of indigenous groups would cause these groups to view information from external but similar social

groups (e.g., other farmers, *técnicos*) with greater credibility or legitimacy. To the contrary, it is likely that the same apparent criteria – measurement against the farmers' own knowledge and experience – would apply. It is possible, however, that the politicization of many of the indigenous groups in the region might cause members of such groups to view information from foreigners, scientists, the media, and other out-groups with suspicion and mistrust. These issues were all clearly evident in the interview with a leader of the indigenous coffee cooperative Toyol Witz.

Finally, this study adds to a growing body of literature that suggests that risk perception and experience with particular hazards alone remain insufficient to motivate adaptation. In this case study, the majority of households were classified as having a 'high' or 'moderate' level of risk perception. Because most farmers received climate information primarily from the mass media, sensationalist media tendencies may create exaggerated perceptions of the potential impacts of climate events and convey to farmers that preparation for them is futile. If these farmers' perceptions of self-efficacy can be enhanced, they may be more motivated to seek new climate and adaptation information and to take action in response. Again, coffee cooperatives and the *técnicos* associated with them may well prove to be a means of mediation and facilitation. The interviews revealed considerable confidence among farmers concerning agricultural practices and experience, and an associated confidence in agronomic information from *técnicos* and out-groups whom farmers perceive as credible and legitimate. Enhancing the credibility of *técnicos*' information on climate and adaptive options may transfer confidence to the farmers themselves, and, as farmers adopt the knowledge of the *técnicos* as their own, increase their adaptive capacity and their motivation to adapt.

Consistent with the MPPACC framework, another reason for farmers' low perceived adaptive capacity may be a real inability to adapt or to take further adaptive action to climate impacts as a result of socio-economic constraints or other non-cognitive limitations. Some farmers at the time of interviews may have already acted to their full capacity and what seems to be a lack of adaptive motivation may in fact be a realistic assessment of the limitations of their current circumstances. Lack of resources could lead to a correct assessment of low self-efficacy and thus translate into low adaptive motivation. Nevertheless, strong social identity may also strengthen social capital, enabling resource-constrained households to collaborate in accessing new resources for adaptation, including knowledge, technological and financial capital. The exploratory findings of this study suggest that further research is needed on the role social identity plays in mediating the resource constraints and enhancing self-efficacy of vulnerable households.

7. Conclusion

This exploratory case study suggests that social identity may play an important role in the process of adaptation. Identity is one lens through which individuals perceive risk, such that farmers' perception of themselves in relation to others shapes how they interpret threats to their wellbeing and livelihoods. Identity also shapes how information is assessed. While a perceived closeness between social groups' identities can convey legitimacy, it does not necessarily convey credibility, particularly if the content of the knowledge is viewed as foreign or external to the social groups' domain of knowledge. Cooperatives, *técnicos*, scientists and the media all have roles to play in conveying knowledge and information to farmers; nevertheless, their contributions are circumscribed by their positioning as "one of us" or "one of them" in relation to how farmers perceive their own identities. The weight of social identity in the case study indicates that the addition of inputs concerning social identity would enhance Grothmann and Patt's (2005) Model of Private Proactive Adaptation to Climate Change (MPPACC). Increasing adaptive capacity may require careful consideration in cases such as the one explored here, where strong in-group identity and worldviews differing from those in the scientific community appear to have significant influence on adaptive motivation. Future research on the role of social identity in adaptive motivation would likely also benefit from investigations into relationships between social identity and perceived adaptive capacity.

Acknowledgements

This project was funded through a UC MEXUS-CONACYT collaborative grant to Dr. Eakin, Dr. Morales and Dr. Cruz-Bello (2006) and conducted with the aid of a grant from the Inter-American Institute for Global Change Research (IAI) CRN-2060: "Effective adaptation strategies and risk reduction towards economic and climatic shocks: lessons from the coffee crisis in Mesoamerica," PI Dr. Edwin Castellanos, Universidad del Valle de Guatemala. IAI is supported by the US National Science Foundation (Grant GEO-0452325). All findings and possible errors expressed in this article pertain to the authors and cannot be attributed to the financing agencies. The first author would like to thank Dr. Helda Morales and Dr. Juan F. Barrera for providing access to the survey data; Joel Herrera, Pedro Ramírez López and Conrado Martínez from ECOSUR for their assistance in the field; the farmers and organization leaders in Chiapas for their hospitality and participation in the interviews; the editorial staff of the ASU School of Sustainability; the UCSB Department of Geography; and two anonymous reviewers.

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