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Public perception, knowledge and policy support for mitigation and adaption to Climate Change in Costa Rica: Comparisons with North American and European studies

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Abstract Over the past 20 years considerable efforts have been invested in exploring how the public understands climate change. However, the bulk of this research has been conducted in Europe and North America and little is known about public perceptions of climate change in developing countries. This article presents the results of the first nationally representative study (n=1473) of public perceptions of climate change in Costa Rica. In Costa Rica, a large proportion of interviewees (i.e. over 85%) are highly concerned about climate change in general and feel, as noted in European and North American studies, that its impacts are more worrisome for people farthest away (e.g. in the developed countries or among future generations). At the local level, people feel that food (10.5%) and water (16.1%) shortages as well as poverty (11.3%) and heat waves (11.7%) are the most expected impacts of climate change. Analysis of adaptation behaviour responses suggest that individuals have a relatively lower grasp of emergency and prevention disaster plans but are relatively more proactive in preventing hydro-meteorological extremes related to water scarcity or excess. A majority of respondents engage in mitigation behaviours largely for financial or contextual reasons. Finally, support for adaptation and mitigation policy responses is generally high (i.e. above 70% of interviewee supports them) except for the case of internalizing the cost of watershed protection increasing the water tariffs (52.5%). As discussions about mitigation and adaptation become increasingly common within developing countries, questions about

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public perceptions in that context are more pressing than ever. Work on climate perceptions needs to be carried out in specific countries to better understand which policies are most likely to resonate with public support, and which might be most difficult to implement.

Keywords Climate change · Public perception · Costa Rica · Mitigation · Adaptation

1 Introduction

In 2008 Costa Rica made international headlines when it became the first country to declare its intention of being carbon neutral by 2021.[1] This was not the first time that Costa Rica had taken active global leadership on issues related to climate change. Costa Rica was also central in introducing "Reducing Emissions through Deforestation and Degradation" (REDD) crediting in international negotiations (UNFCCC 2005).

Like other developing countries Costa Rica has been adamant that adaptation should be a priority (MINAET 2009) and have stressed the importance of adaptation internationally,[2] although it is only recently that they have started to promote concrete initiatives domestically. Instead, a strong focus of the national strategy rests domestic reduction of greenhouse gas (GHG) emissions (i.e. through the energy sector);, carbon sequestration (through reforestation, forest protection and regeneration); and the promotion of international climate change policy (Dobles 2008; MINAET 2009). Two related lynchpins cut through all these components. First, Costa Rica is extremely interested in participating in and expanding an international carbon market into which it could sell its offset credits. Combined with a proposed increase in hydroelectric power (Fletcher 2010), offset credits are the key mechanism by which the country proposes to achieve carbon neutrality. Second, set against a context of increased international attention to mitigation undertaken by developing countries, Costa Rica is interested in "merit as a fund-attracting mechanism" (Dobles 2008, 22). Costa Rica has argued for recognition and compensation for taking domestic mitigation-relevant actions, in particular, for its past efforts to curb deforestation and promote reforestation (MINAET 2009). Costa Rica is only one among many developing countries involved in developing Nationally Appropriate Mitigation Actions[3] (NAMAs) that could be used to generate revenues (UNFCCC 2009).

In light of these international policy developments it is important to consider whether public opinion within Costa Rica supports the government's explorations of domestic climate change policy. How do the domestic publics of this important developing country understand climate change, and which kinds of responses to climate change are most likely to receive public support? How do public perceptions of climate change differ from developed country contexts? What may account for the differences in patterns? Learning from the Costa Rica example may also provide insight into the situation of other developing countries seeking to foster NAMAs and adaptation efforts.

[1] http://environment.harvard.edu/news/huce-headlines/costa-rica-takes-carbon-neutrality-challenge accessed on 17 January 2012.

[2] Costa Rica together with Spain and the USA have launched the Adaptation Partnership at the Petersberg Ministerial Climate Dialogue hosted by the governments of Germany and Mexico in May 2010 (http://www.lamoncloa.gob.es/IDIOMAS/9/Gobierno/News/2011/08122011_DurbanSummit.htm).

[3] NAMAs were first introduced in the Bali Action Plan (UNFCCC 2007) as a method by which developing countries could access financial or technical assistance from developed countries to facilitate the implementation of domestic mitigation actions.

Research into public perception of climate change started in the early 1990s (Kempton 1991; Löfstedt 1991) and is now an established area of study encompassing survey research, focus groups and public opinion polls. This work has focused primarily on the United States (Bostrom et al. 1994; Bord et al. 2000; O'Connor et al. 1999; Leiserowitz, 2003, 2006, 2007; Dietz et al. 2007; Reynolds et al. 2010; Shwom et al. 2010) and Europe (Darier and Schüle 1999; Stoll-Kleeman et al. 2001; Norgaard 2006; Zwick and Renn 2002; Poortinga and Pidgeon 2003; Lorenzoni et al. 2007; Lorenzoni and Pidgeon 2006), with some exceptions (McDaniels et al. 1996; Bulkeley 2000; Ohe and Ikeda 2005; Bales 2007; Etkin and Ho 2007). These studies have been augmented by several polls conducted in multiple countries (Dunlap 1998; GlobeScan 2007; Brechin 2003; Leiserowitz 2006). Only recently have some survey data started emerging from developing countries. For example, Takahashi and Meisner (2011) examine the perceptions of Peruvian political elites, and several studies have focused on the Nigerian public (Adelekan & Gbadegesin 2005) and elites Asiyanbi (2011). All the major multi-country polls include some developing countries but they generate general data that cannot delve into the specifics of each country or underlying behavioural motivations. As Brechin (2003) points out, global polls "lack the contextual information on what is happening in each country that might shed light on [their] outcomes". On the opposite end of the spectrum, detailed case studies of local adaptation efforts and capacities in developing countries are becoming increasingly common and take local realities seriously (e.g. Maddison 2007; Patt and Schroter 2008; Tucker et al. 2010; Bunce et al. 2010). These studies provide rich data on specific contexts but are not designed to assess public opinion at the national scale or to look at mitigation efforts. Hence, they do not facilitate comparisons among countries, and are less able to provide an overview of public opinion about national mitigation and adaptation policies.

The goal of this research is to compare Costa Rican perceptions and behaviours related to climate change with those reported in developed countries in Europe and in the United States. Comparisons with other developing countries are made wherever possible, but the paucity of data on developing country public opinion about climate change limits the extent to which these comparisons can be addressed. This paper reports on the first national survey on climate change conducted in Costa Rica, which was designed to provide input to the Costa Rican government during their national policy making process. The research provides a snapshot of public understanding of climate change, public mitigation and adaptation behaviours and public support for a range of policies stemming from Costa Rica's carbon neutral commitments. This study makes two contributions. First, it provides insight into public attitudes, perceptions and behaviors in the specific case of Costa Rica, a country that has aggressively sought international climate change leadership. Second, it is one of the first such surveys in a developing country that is pursuing both adaptation and mitigation, and so provides comparative insights about potential public perception dynamics in similar contexts.

2 Concepts and themes for climate change risk perception research

This section outlines three themes emerging from the current body of research on climate risk perceptions, to place our study in the context of earlier works. These themes include: public knowledge of climate change, public concern about climate

change, and public engagement in climate change actions or policy support. For each theme we consider ways in which these findings might vary in developing country contexts.

2.1 Knowledge

Clarifying the level of public knowledge of climate change has been a major theme of research on public perceptions of climate change. Early on it became apparent that most people have a limited grasp of the physical processes contributing to climate change (Kempton 1991; Löfstedt 1991; Bostrom et al. 1994; Bell 1994). Despite broad public education campaigns, many people still do not understand the basic causal drivers of climate change (Reynolds et al. 2010), and remain unclear of how particular actions connect to the issue (McDaniels et al. 1996). For example, many people did, and still do, confuse climate change and the depletion of the ozone layer (Löfstedt 1991; Read et al. 1994; Bell 1994; Bord et al. 2000; Brechin 2003; Lorenzoni et al. 2006; Nisbet and Myers 2007).

Most work documenting public knowledge of climate change has been North American or European, with only a few global polls including questions about knowledge. Multiple studies report generally weak knowledge across countries, despite broad awareness of the basic concept (Bord et al. 1998; Brechin 2003; Leiserowitz 2007). Costa Rica was not included in any of these studies. Another body of research on public knowledge of climate change has demonstrated that people are sensitive to the information they are given and from whom (Yearley 2000; Lowe et al. 2006). For example, it was found that using different messengers to present the same message changed people's reactions to the information. This pattern was clearly illustrated by one study which observed that respondents did not react to the same piece of climate information the same way when presented by different messengers, including a scientist, a religious leader or a politician (Bales 2007). Trust has emerged as a crucial issue mediating public responses to climate change in both the European and American contexts (Poortinga and Pidgeon 2003; Dietz et al. 2007), highlighting the importance of understanding where people obtain information, and the extent to which sources are trusted.

Unfortunately, none of the global polls to date have included questions about trust or information sources, making the issues of information sources and trust opaque in the few developing countries for which we have any data on public opinion. As more developing countries pursue NAMAs and domestic mitigation programs, greater attention to these dynamics may become important.

2.2 Concern

Public concern about climate change has been another important research theme. Recent North American and European studies suggest that a majority of people are concerned about climate change (Leiserowitz 2006; Lorenzoni et al. 2006; Pew Research 2009b; Reynolds et al. 2010; Carson et al. 2010). When people are asked to think about climate change, their most immediate thoughts are of negative climate impacts (Lorenzoni et al. 2006). For many, ideas of disaster and catastrophe are common (Darier and Schüle 1999; Kasemir et al. 2000; Bord et al. 2000; Lorenzoni and Pidgeon 2006; Etkin and Ho 2007).

Discerning levels of concern about climate change is complicated by two wrinkles in the data. First, when asked to list issues of concern without prompting, climate change typically ranks low against other concerns or more immediate threats (Bord et al. 2000; Leiserowitz 2006). For example, in a 2009 study, a majority of Americans were concerned or very concerned about climate change (Pew Research 2009a). Yet, when asked to rate climate change against a range of other issues including health care, education, taxes, terrorism, social security, it fell to the very bottom of the list (Pew Research 2009b).

Second, concern is expressed primarily for those temporally and spatially distant (Dunlap 1998; Lorenzoni and Pidgeon 2006; Nisbet and Myers 2007). When asked to rate levels of concern across a gradient of distances (i.e. myself and my family, my city, my country, the whole world etc.) the most common response is to rate potential impacts to those farthest away the highest (Leiserowitz 2005). Similarly, when asked to identify top-of-mind images associated with climate change, people most commonly identify relatively distant or abstract negative impacts (Leiserowitz 2005). The potential for health impacts is rarely recognized by study participants in the United States or the United Kingdom (Lorenzoni et al. 2006).

The lack of appreciation for personal exposure to climate impacts may be understood by the lack of survey research on climate-affected populations whose answers might reflect more local concern. For example, global polling results suggest that people in developing countries rate the seriousness of climate change higher than those in industrialized countries (Dunlap 1998; Brechin 2003; Sandvik 2008). Sandvik (2008) suggests that lower concern in wealthier countries may reflect a desire of people in these countries to protect themselves from cognitive dissonance, or "inconvenient truths" that may involve costs to reduce climate change. Similarly, Leiserowitz suggests that perceptions of personal risk may be higher in developing countries (2006) and notes that the types of impacts of concern in developing countries are more likely to involve health impacts and drought than perceptions in North America or Europe. However, without further study of public opinion within developing countries these hypotheses are difficult to assess.

2.3 Public engagement

The rationale for efforts to measure climate knowledge and concern has been their hypothesized role in facilitating, or hindering, public action on climate change. This rationale has been reflected in the literature in two ways. First, studies and polls have attempted to identify climate change-relevant behaviours and policies with which people either engage or support (Norton and Leaman 2004; Kirby 2004; Nisbet and Myers 2007; Leiserowitz 2006; Dietz et al. 2007). Second, research has focused on uncovering the underlying reasons why people engage in environmental behaviours generally (McKenzie-Mohr 2000; Stern 2000; see Wilson and Dowlatabadi 2007 for a review). This work shows that many factors, ranging from attitudes and values to infrastructure constraints, are involved in promoting or preventing environmental behaviour (Lorenzoni et al. 2007; Patchen 2010).

There is a need for research examining environmental behaviour and policy support in developing country contexts from both these angles. To some extent, studies have addressed aspects of climate-related behaviour in relation to adaptation (e.g. Brouwer et al. 2007; Valdivia et al. 2010; Tucker et al. 2010) and mitigation (Bord et al. 1998;

O'Connor et al. 1999; Dietz et al. 2007) in developed countries. Looking at public engagement with both mitigation and adaptation policies in developing countries is important due to their rapid growth of emissions, and increased interest in NAMAs and development of adaptation strategies.

3 Methods

This research was undertaken to contribute to Costa Rica's *National Communication Strategy for Climate Change,* which was promoted by the national *Initiative of Peace with Nature* and supported by the country office of the United Nations Development Program. In total 1473[4] structured interviews were conducted across Costa Rica by 15 interviewers and 3 supervisors. All the fieldwork occurred between September 29 and October 15, 2009. Each interview was conducted in person in the respondent's home. All respondents were permanent residents of the household and were between 18 and 70 years old. Respondents who had never heard of climate change were not questioned further.

The representative sample was generated with a stratified sampling strategy. Costa Rica has 17,221 census tracts; these were divided into rural and urban strata to reflect the population ratio located in each. Within each stratum a random sampling of census tracts was conducted to select a subgroup of 150 census tracts. Within each selected census tract, 10 interviews were conducted at respondents' homes. As an initiative of the Costa Rican *Communication Strategy on Climate Change* (NCSCC), the survey investigated how Costa Ricans understood climate change, their behavioural responses and their support for particular policy directions. Building on existing research on public perceptions of climate change the survey focused on four main themes: knowledge, concern, engagement in adaptation and mitigation behaviour, and socio-demographics. To the extent possible all questions were designed to build on or use those tested and employed in previous studies. A Costa Rican professional bilingual translator ensured appropriate wording, and piloting the questionnaires helped improve understanding of questions among the general public.

Knowledge The questions testing knowledge were built using interview questions (i.e. maintaining the same scales) used in previous public perception studies (Dunlap 1998; Leiserowitz 2003, 2006; Poortinga and Pidgeon 2003; Lorenzoni et al. 2007) to allow comparison of results. General understanding of climate change was assessed using 8 true-false questions,[5] and by asking participants to list associated images or concepts (Leiserowitz 2003). Participants were also asked to identify

[4] In total 1500 interviews were attempted, but some were incomplete or interrupted, resulting in 1473 complete interviews.

[5] Other authors have measured knowledge of climate change slightly differently due to specific research interests. For example, Sundblad and colleagues (2009) measured knowledge with true/false scales but also added items measuring confidence in one's own information on climate change given their interest in analyzing the influence of knowledge and confidence on general concern of climate change among different social groups. In their work, these authors measured knowledge using questions with a relatively greater technical content (e.g. including specific thresholds of climate change impacts) given their interest to discriminate among social groups with scientific technical expertise and others. Similarly, in their questionnaires Bostrom and colleagues (1994) focused mainly on knowledge of climate change and measured it using mental model interviews which are more easily applicable to a much smaller sample (n=100) than ours, allowing in-depth exploration of differences between lay people's and experts' understanding of climate change.

specific causes and impacts of climate change. The survey also asked respondents about their sources of information about climate change (10 sources identified by dichotomous yes/no responses) and their trust in these sources (9 items with a 5-point Likert scale).

Concern Likert scales (based on Dunlap 1998 and Leiserowitz 2003) were used to assess the levels of concern felt for different climate affected groups (i.e. from oneself to the entire world). Data from the lists of associated images was also used to assess concern, and participants were asked when they thought climate change might begin to affect the Costa Rican population.

Engagement in mitigation and adaptation behaviours We used a binary yes/no measure to assess involvement with 11 Costa Rican-specific mitigation behaviours and asked respondents to explain the reasons behind these choices, as has been done in other studies (Shwom et al. 2010). Similarly, respondents were asked to identify adaptation measures they had undertaken from a list of 6 options. In order to ensure that respondents were asked about the most contextually relevant options, the range of mitigation behaviours explored in this study were chosen to reflect efforts that individuals could feasibly undertake and that were directly related to the national policy guidelines outlined in the *National Strategy on Climate Change* (MINAET 2009). The adaptation behaviours focused on reactive and anticipatory measures (Fankhauser et al. 1999) that were sufficiently generic that respondents from anywhere in Costa Rica could have engaged with them, despite the variation of local adaptation needs.

Respondents were also asked about their awareness of existing Costa Rican climate change policy initiatives (10 items), and were requested to indicate their level of policy support (5-point Likert scale) for a broad range of potential mitigation and adaptation policies. These questions were specific to Costa Rica and thus not taken from existing studies.

Socio-demographics All respondents were asked to respond to a set of standard socio-demographic questions concerning their age, gender, education, children, income, basic value orientations, and occupation. Respondents were also asked about home ownership and possessions (such as cell phones, computers, refrigerators, or automobiles). Statistical analysis in SPSS (2010) included descriptive statistics showing frequencies of responses to questionnaire items to allow comparison with similar data from studies in US and Europe.

This study has several specific methodological limitations. Although some qualitative data about the reasons for policy support was gathered, the majority of questions used a limited set of answer options. This approach reduced the complexity of the answering tasks demanded to a highly varied population sample (i.e. with a broad range of educational levels) but may have resulted in the loss of some potential additional responses. In addition, policy support was assessed for each policy individually, instead of in a comparative context; this approach may mask underlying tensions in competing choices, and does not provide insight into how people may address policy trade-offs. Finally, respondents who had not heard of climate change were not asked to continue the interview. This approach excludes the possibility of some kinds of comparative analysis, which would have provided additional information about the likelihood of engagement in mitigation and adaptation activities for reasons other than concern about climate change.

4 Results and discussion

The sampling strategy described above resulted in a broad cross section of Costa Rican society as outlined in Table 1.

Our cross section of the Costa Rican population had a slight gender bias (possibly due to surveying methods visiting houses during daytime when the only available head of households were women[6]) as seen in Table 1.

4.1 Knowledge

Several key insights emerged when respondents were asked about their understandings of climate change. As seen in Table 2, respondents broadly perceived humans as strongly involved in causing climate change (91.6%) but human responsibility may be nested within larger constructs. For example, a large majority (75.6%) felt that climate change is influenced by the will of God. The sense that 'climate' is a long-term phenomenon was also strong, as well as mixed support for ideas that short-term and climate-unrelated events, such as phases of the moon or earthquakes, could influence it.

When respondents were asked to indicate the factors they felt caused climate change, the most common response by far was deforestation (57.1%), followed by the hole in the ozone layer (11.5%) and fossil fuels (10.5%) while a very low segment of interviewees (2.7%) reported livestock as a cause of climate change. The low awareness of livestock's contribution to climate change is in contrast with its position as the largest contributor in the agricultural sector (following only the energy sector) in terms of national GHG emissions (NMI 2010). It is unsurprising that deforestation plays such a strong role in national perceptions of climate change because debates about forest reserves are long standing in Costa Rica (Blum 2007). These debates have been important within national discourse, and also play a prominent role in Costa Rica's international discourse about climate change and deforestation (MINAET 2009:20). Reforestation is a key component of the *National Climate Change Strategy* in Costa Rica, which may also contribute to the perception of the importance of forests for climate change. In a cross-national study, Dunlap (1998) found particularly high proportions of people who perceived deforestation as a key issue in Brazil a country which shares with Costa Rica an ongoing internal and international debate about forest protection.

In other ways, these results are broadly similar to those observed in other studies. For example, the percentage of people identifying the use of fossil fuels as the key contributor to climate change is below 20% in a very wide range of countries (Dunlap 1998; Brechin 2003; Adelekan and Gbadegesin 2005; Lorenzoni and Pidgeon 2006). In addition, the confusion between ozone depletion and climate change has been observed in multiple nations (Bostrom et al. 1994; Brechin 2003), although recent studies suggest this may be shifting in the United States (Reynolds et al. 2010).

The vast majority of respondents received their information about climate change from television (95.6%), followed by radio (49.3%) and the newspaper (43%). Informal networks, such as friends (13.8%) and family (14%), were relatively unimportant in this regard. This pattern suggests that climate change is not a topic of conversation among peers, but is more frequently encountered as part of an information campaign, news event or other mass media interventions.

[6] According to NISC (2002) 62% of women economically active and inactive above 12 years old in the country are dedicated to household care.

Table 1 Summary demographics of sample (n=1473)

Item	Measurement	Percentage of the sample
Region	Rural	38
	Urban	62
Gender	Male	35.5
	Female	64.5
Income ranks (Colones[a])	0–100000	16
	101000–200000	37
	201000–500000	41
	500000–1000000	5
	Over 1000000	1
Age (years)[b]	Average	41
Education	No formal schooling	1[c]
	Primary school	31
	High school	37
	Technical training	5
	College/Technical	2
	University	25
Occupation	Private sector	20
	Public sector	8
	Self-employed	17
	Student	11
	Housewife	34
	Retiree	8

[a]1 US$=502 Colones; [b]Min 16, Max 81 years; [c]The sum is different from 100% given to rounding

The relatively low extent of reliance the internet as an information source (3.3%) is an intriguing result since Costa Rica has the second highest number of internet connections in Central America and the highest number of fixed telephone lines and computers per capita in Latin America (IADB 2010). This result contrasts with the findings of Takahashi and Meisner (2011) who found that the internet was the most common source of information among Peruvian political elites. While media analyses of climate change have become common in American and European contexts (Bell 1994; Trumbo 1996; Boykoff and Boykoff 2004; Brossard et al. 2004; Antilla 2005; Carvalho and Burgess 2005), they have

Table 2 Respondent's frameworks for understanding climate change

Climate change knowledge statements	Yes (%)	No (%)	Don't know (%)
Talking about weather is the same as talking about temperature	69.8	28.1	2.1
Climate can change within a year	13.6	85.7	0.7
The Earth's climate has been the same for millions of years	91.9	6.7	1.5
Climate change occurs through natural causes	34.7	63.4	1.9
Climate change happens through the will of God	75.6	22.3	2.1
Humans are responsible for climate change	91.6	7.8	0.5
The phases of the moon affect the Earth's climate	41.7	47.9	10.4
Earthquakes affect the Earth's temperature	45.8	46.4	7.8

only started to be conducted in developing countries (Billett 2009; Boykoff and Boykoff 2004; Takahashi 2010). A fruitful extension of this study would be to investigate whether different sources convey different kinds of climate change information, and how.

Research on environmental information has stressed that interpretation of information is a crucial mediator between receiving information and engagement in climate change actions (Shwom et al. 2010). Part of this interpretation is dependent on trust in the messengers. Information provided by less trusted messengers is less likely to be accepted or acted upon (Poortinga and Pidgeon 2003; Bales 2007). In this study most respondents expressed strong trust in the information provided by scientists, the media, environmental organizations, and the national meteorological institute (Fig. 1). This pattern is striking when compared with the low levels of trust accorded information from governments, companies, religious leaders, and friends or family.

These results are not dissimilar from those reported elsewhere with a few exceptions. First, scientists are considered extremely trustworthy in this study, while in the US at least, studies suggest a cooler response. In the US polls presented by Nisbet and Myers (2007) only 5% of respondents reported "complete" trust in scientists, while another 27% reported "a lot" of trust. It is possible that Costa Rica has seen a less contentious discourse about climate science than has been observed in the United States. The second exception is the low level of trust given friends and family in Costa Rica. In their study of the British public, Poortinga and Pidgeon (2003) note that the most trusted source for climate change information flowed from family and friends followed by environmental groups, and scientists working for environmental groups and universities.

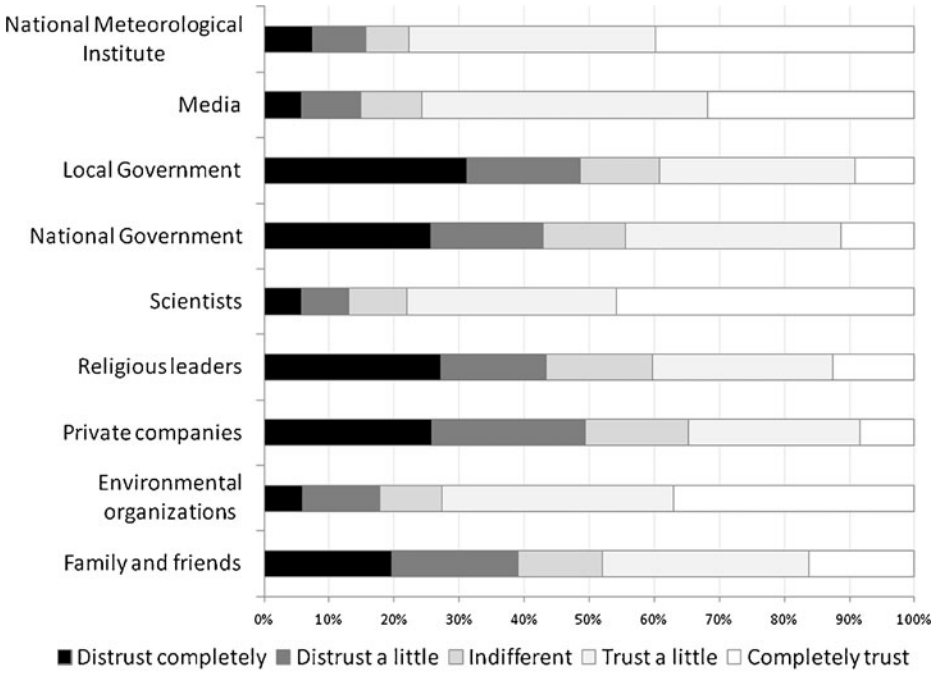

Fig. 1 Respondents ratings of the perceived trustworthiness of each information source

4.2 Concern

Concern about climate change was assessed in a variety of ways. Over 85% of respondents indicated they were concerned or very concerned (Fig. 2) about climate change. Relative to polling data from others studies, the Costa Rican results are on the higher end of the range. In Nisbet and Myers' (2007) summary of American polling data from 1989 to 2007, the highest level of concern is observed in 2007 when 41% of respondents said they were very concerned about climate change, while another 24% said they had a fair amount of concern. The European polling data is more similar to the Costa Rican results where large majorities in Southern Europe reported being concerned or very concerned (Lorenzoni and Pidgeon 2006). Levels of concern in Peru (Takahashi and Meisner 2011) and Nigeria (Asiyanbi 2011) were also relatively high, lending credence to arguments that those in less affluent countries may be more sensitive to the possibility of climate vulnerabilities (Bord et al. 1998)

Similarly, when asked to free associate with the concept of climate change, Costa Rican respondents focused on negative, rather than positive, climate impacts, a result in keeping with other studies (Leiserowitz 2003; Lorenzoni et al. 2006). However, the predominant ideas associated with climate change involve drought (19%), water shortages (18%), deforestation (17%), changes in seasons (17%), pollution (15%) and floods (12%). These are different than those identified in the US, and are likely more directly perceived by respondents. Strikingly, a vast majority (94.4%) of respondents felt that climate change was already happening. This result is higher than has been observed in American polls where only 23% of people reported being completely convinced climate change was happening, while another 33% were mostly convinced it was occurring (Nisbet and Myers 2007).

While respondents felt that climate change was already happening, this view was not tied to perceptions of direct or personal impacts. When asked to rate their level of concern across

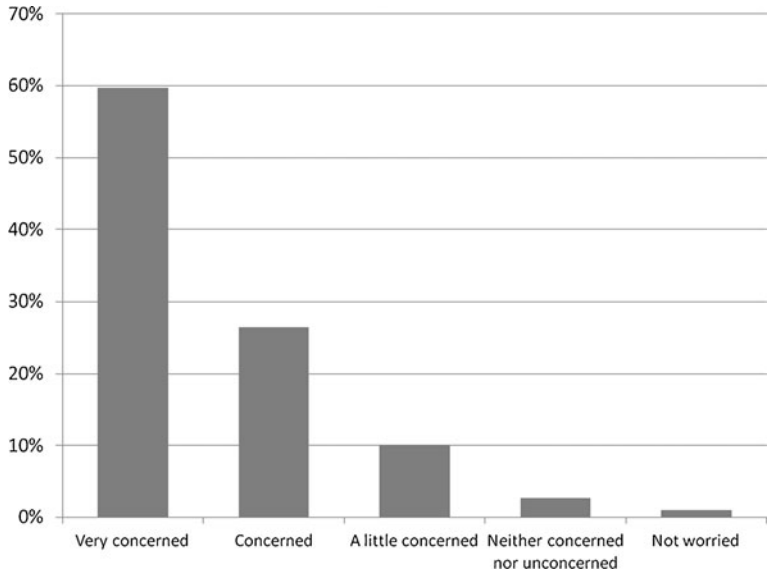

Fig. 2 Respondents' ratings of concern about climate change

groups, participants followed the well-established pattern of exhibiting most concern for those most removed in time or space (Dunlap 1998; Leiserowitz 2003; Asiyanbi 2011). Although the highest concern was expressed for future Costa Ricans (78%), more concern was expressed for industrialized countries (58%) than for Costa Rica itself (50%) or for their family (27%). Conversely, data from Europe suggest that many people are concerned more about those in developing countries (Darier and Schüle 1999; Stoll-Kleeman et al. 2001).

Importantly, the general ratings of concern for respondents' families and communities were higher than has been observed in previous studies. This may suggest that even though respondents' tendency to distance themselves from potential negative impacts remains stable across context, respondents in Costa Rica may feel more direct threat than those in North America and Europe. Potential differences in the intensity of concern between the local community and the entire country were also assessed. Respondents were asked to indicate which impacts they thought most important at the community and national level.At the national level, concerns about impacts are dominated by drought (38% of respondents) followed by food shortages (21%). Both of these could be interpreted as large-scale catastrophic events. Drought and famine remain important concerns at the local level (16 and 10% respectively), but a greater diversity of impacts is identified. Several that do not appear as particularly important from a national perspective are more important locally such as poverty and heat waves (11% at local and 5% at the national level). Other issues such as conflicts over water use, human epidemics, problems and changes with crops, and fires are also more commonly identified at the local (cited by between 4% and 7%) rather than national level (less than 3%).

These data offer a different glimpse into concern across distance or aggregation. While there is intense concern for large-scale disasters such as drought or famine at the national level, the diversity of issues locally could reflect the varied daily experiences of individuals. It is likely that some respondents interpret issues like poverty and disease as a direct personal threat. Exploring variations in concern across communities has begun in public perception studies (Palutikof et al. 2004; Zahran et al. 2006) and is an important area for further examination.

As seen in these results, respondents consistently express concerns about water resources. This was accentuated when respondents were asked to rate climate change in relation to a number of others issues (Table 3). The mid to low level of concern for climate change when compared to other environmental issues has been observed across nations (Dunlap 1998;

Table 3 Most important topics that interviewees indicated as priority for discussion by the legislators

The most important topic for discussion in the country (%)		The most important environmental topic for discussion in the country (%)	
Education	43.6	Water pollution[a]	61.0
Public safety	19.4	Deforestation	11.5
Health	12.2	Climate Change	9.6
Climate Change	10.9	Air pollution	6.9
Employment	7.8	Urban growth and urbanization	4.8
Road safety	3.5	Disappearance of wild plants and animals	3.5
Prevention and emergency care	2.6	Beach pollution	2.6

[a] Both of these questions asked respondents to rank list of issues by importance. Unfortunately water was not included in the first question (policy issues in general). However, the strength of concern expressed over this issue when asked explicitly about environmental issues suggests widespread and deep concern

Brechin 2003). In the Costa Rican case, climate change is rated far below water pollution as an environmental concern.

Though overall patterns of Costa Rican climate concern were not radically dissimilar from those observed in Europe or North America, there were some important differences. Notably, more people were convinced climate change was already happening, there were high levels of concern about climate change, and many of the impacts identified were relatively direct even though respondents were not necessarily expecting personal impacts.

4.3 Actions and engagement

A third major theme of the study was assessing adaptation and mitigation behaviours and responsibility for action. When asked who should be responsible for leading actions addressing climate change, the majority response was government followed by the citizens themselves (Fig. 3). The high value placed on government action, combined with distrust of the information provided by government, and perhaps uncertainty about its ability to effectively deal with climate change, is not a unique finding to Costa Rica. Other studies have also pointed to tensions between distrust of governments and high expectations for governments to lead collective actions (Poortinga and Pidgeon 2003). It has been repeatedly found that personal actions are linked to trust that the key institutions considered responsible for climate change are also taking actions (Darier and Schüle 1999; Stoll-Kleeman et al. 2001; Lorenzoni and Pidgeon 2006; Dietz et al. 2007). This mismatch of governmental distrust and perceptions of governmental responsibility could lead to feelings of frustration and disempowerment (Lorenzoni and Pidgeon 2006). The related argument that actions are not warranted because of insufficient collective action, rendering any effort useless, have been observed at both the individual (Norgaard 2006; Semenza et al. 2008) and policy levels elsewhere (Nisbet and Myers 2007).

The high level of citizen responsibility indicated in these results is intriguing for two reasons. First, information about climate change from friends and family was

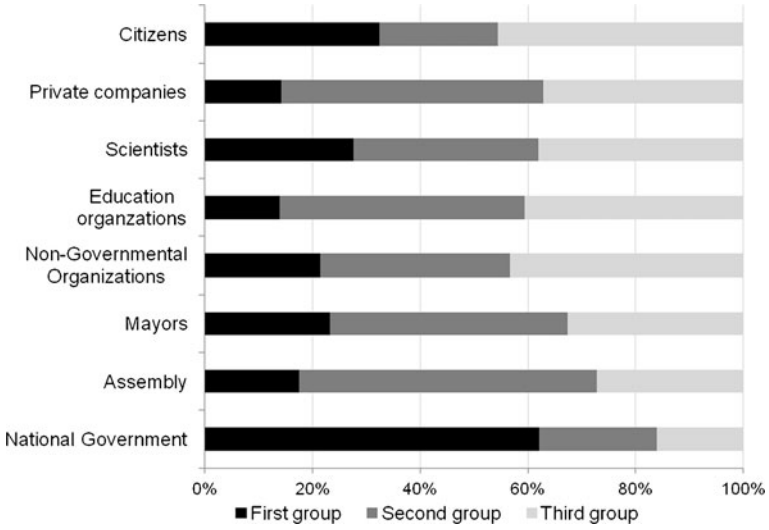

Fig. 3 Respondents allocation of responsibility to different actors for taking action on climate change ordered by the group of importance

regarded with mistrust, but respondents also indicated that private citizens bear responsibility for addressing climate change. Second, this emphasis on individual action seems somewhat high compared to other studies. For example, Zwick and Renn (2002) found that 27% of respondents in their German study felt individuals should take responsibility for addressing climate change, well below responsibility assigned to the political (50.2%), industrial (52.1%) and scientific (42.0%) realms. Similarly, strong expectations of government and industry action emerge from more qualitative studies in the UK (Lorenzoni et al. 2007). Poortinga and Pidgeon (2003) find high levels of support for public involvement in decision-making about climate change, but this focuses more on involvement in policy discussions than on expectations for specific mitigation actions or policy responsibility as in Costa Rica. The heavy emphasis on citizen responsibility, combined with distrust of the information provided by friends or family, may suggest that Costa Ricans feel that other ordinary citizens need to take mitigation actions, but that they are poor sources for advice about what types of actions might be appropriate. It is possible that this combination of responsibility and lack of information may make meaningful collective or local action more difficult. Although some efforts are being taken to reduce vulnerability to climate extremes, Costa Rica has adopted a climate change policy that emphasizes mitigation (MINAET 2009). Participants were asked about their mitigation actions in light of this policy direction (Table 4).

Several mitigation behaviours were frequent. For example, large majorities of respondents reported turning off lights, unplugging appliances and using energy saving lightbulbs. As has been observed in other studies (Norton and Leaman 2004; Kirby 2004; Semenza et al. 2008), higher proportions of respondents are engaged in energy-related activities than in other activities. Compared to other studies, public transit use is higher in Costa Rica, a finding explored in more depth below. Overall most people (80%) reported having engaged in at least 5 of the stated behaviours. In order to gain greater insight into these choices, respondents were also asked to indicate why they engaged or didn't engage, in each activity.

Protecting the environment appears to be a central reason for: recycling, explicitly participating in environmental campaigns, buying recycled materials and avoiding companies that damage the environment. In contrast, saving money is cited as the main reason behind household energy-saving behaviours, such as unplugging appliances and turning off light bulbs. Motivations for transportation behaviours are the most multi-faceted. Respondents indicated that habit, money, health, convenience and the lack of facilities were all factors in their decisions about transportation. The importance of the availability of facilities is highlighted when it is considered that only 48% of participants report having a car or motorcycle.

Other studies have examined exogenous barriers to individual actions. For example, in a series of studies in the United Kingdom, participants cited everything from social norms, to the lack of physical facilities, to technological lock-in as major exogenous barriers (Lorenzoni et al. 2007). Work in the United States has also highlighted the obvious importance of physical infrastructure in making actions more or less feasible (Semenza et al. 2008). As Patchen states, "people are more likely to take environmentally helpful actions when they have realistic options for doing so" (2010, p. 62).

The situation in Costa Rica, as with many developing countries, is somewhat different. Portions of the population may be prevented from engaging in "environmental behaviour" as defined in North American and European studies due to similar barriers reported elsewhere, but large portions of the population are grappling with ongoing poverty and are facing entirely different sets of behavioural choices. Attending to the reasons behind engagement in

Table 4 Individuals' mitigation behaviours and the correspondent reasons (as percentage of respondents)

Sector	Mitigation behaviours	Reasons					Others		
		Engagement (%)	Saving money	Protect envir't	Own health	Habit	Convenience	Lack facilities/ equipment	Other[a]
Transport	Walk or Bike to work or study	52.8	14.6	3.1	41.5	23.9	3.4	1.8	1.7
	Use public transit	74.6	21.9	2.9	2.9	39.8	3.2	8.7	0.7
	Carpool	47.5	33.2	6.2	2.9	34.4	0.3	1.3	7.3
Energy	Turn off lights when leaving the room	95.2	78.8	12.7	0.6	14.8	0.0	0.0	0.4
	Uses energy efficient lightbulbs	75.5	81.9	17.8	1.7	7.0	0.0	0.0	0.3
	Unplug appliances not in use	82.6	73.8	11.7	6.3	11.7	0.0	0.0	0.0
Waste	Recycle glass, aluminum, and other materials	52.7	2.9	87.6	2.5	5.1	0.3	0.3	0.4
Consumer choices	Buy organic food	50.8	3.8	10.9	78.8	2.3	0.1	0.0	1.5
	Make effort to buy recycled materials	41.3	4.2	86.2	2.3	3.7	0.0	0.0	1.0
Campaign	Avoid buying products from companies known to harm the environment	53.8	1.3	89.6	5.0	2.5	0.1	0.0	0.5
	Participate in campaign for the environment	19.9	1.4	82.8	4.1	4.5	0.0	0.3	2.4

[a] Respondents were offered the opportunity to name any other reasons. When analysed, convenience (in terms of time and distance), and the lack/availability of facilities or equipment were the most common so were given their own category within the 'other' category

behaviours is important; how many people in Costa Rica would take public transit if they had a car? The reasons cited in Table 4 suggest that environmental concerns figure only occasionally as a key motivation for action, hinting at the difficulty Costa Rica could have in meeting its carbon neutral commitments as efforts are also actively taken to tackle poverty and development.

A similarly patchy pattern is observed in respondents' engagement in adaptation behaviours. Although the *National Law on Emergencies* dictates the creation of local and regional committees mandated to create and promote local emergency plans (CNE 1993) a minority of respondents know their community (17%) or work (36%) emergency plan, or have a list of emergency phone numbers (47%). However, large majorities already engage in behaviours designed to protect against either droughts storing water before expected shortages (74%) or cleaning drainage systems before heavy rainfall (79%) These exploratory results suggest that people may be more able or willing to undertake actions within their own immediate control, and which could have immediate implications on their wellbeing in the advent of extreme events. Finally, participants were also asked to indicate their level of policy support (Table 5).

With the exception of an explicit policy designed to increase penalties for environmental harms, all of these options are based on policies actually being implemented somewhere in Costa Rica.[7] Two messages emerge from these data. First, there is wide support for general environmental policies. Further studies of the trade-offs involved in such policy choices would be useful to more clearly identify the contours of policy support, but the public is clearly amenable to environmental protection as a goal overall. Second, water policies are an issue of public contention, both in terms of the development of new hydroelectric dams, and in terms of the price of water. This is not surprising considering that current water policies have gone through intense political debates and negotiations as attempts have been made to define prices and allocate tax revenue to watershed ecosystem restoration (Ponce 2006). In this respect, economic (MIDEPLAN 2010) and climate change policy (MINAET 2009) prescriptions can further fuel controversy around water resources management by emphasizing the expansion of hydroelectric projects as a means for both adaptation and mitigation objectives. When interpreting respondent concern about drought, flooding and water pollution, it becomes clear that within the range of issues affected by climate change, water issues could be the most crucial

5 Conclusions

Costa Rica, like many other developing countries, is seriously considering implementing mitigation and adaptation policies. These trends raise important questions about the engagement of developing country publics in climate change policy support and action. This study stems from the first representative national survey focused on climate change in Costa Rica and explored three main themes – knowledge, concern, and engagement – in comparison with existing North American and European studies. An avenue for further work is to deepen the analysis of underlying drivers of engagement and concern, and to investigate the role that values or other social-psychological variables may have in this context.

[7] With the exception of "I" all policies are actually pursued in Costa Rica. Policy "C" is only in San Jose, policies "D" and "E" refer to the use of oil tax revenues for PES.

Table 5 Respondent support for climate change related policy options

Policy issue	NO (%)	YES (%)	NEUTRAL (%)
A) Building more hydroelectric dams to use less oil in power generation	19.2	72.3	8.6
B) Replacement of gasoline with biofuels as part of the blends at the pump	7.3	84.9	7.9
C Vehicle restriction, prohibiting traffic through plate numbers in cities	8.2	86.1	5.6
D) Use of tax dollars to plant trees	5.5	91.8	2.4
E Use of tax dollars to protect forests from deforestation	2.2	96.2	1.5
F) Use of tax dollars to support environmentally friendly agricultural production	1.5	97.2	1.3
G) Build more hydroelectric dams to avoid power rationing in the dry season	16.6	75.1	8.4
H) Increase the cost of water to preserve watersheds	37.9	52.5	9.7
I) Increase controls and penalties to reduce environmental abuses	4.3	91.2	4.4
L) Strengthen emergency committees to be prepared for natural disasters	1.2	97.0	1.8

However, due to the extremely limited range of data existing from developing countries on this subject, this article is largely descriptive and aims to contribute to baseline understandings of public perceptions of climate change in the developing world.

Many of the Costa Rican results resonate with North American and European studies although there are several important differences. This study suggests that climate change knowledge in Costa Rica is limited; many people do not understand the scientific underpinnings of climate change, although there is a strong sense of some anthropogenic element. Two key differences in climate change knowledge appear in Costa Rica. First, deforestation was more commonly recognized as a factor in climate change than it has been elsewhere. Second, participants accorded a relatively low level of trust in family and friends as sources of information. The centrality of reforestation as a strategy within Costa Rica for both environmental protection and revenue generation could explain the greater awareness of deforestation in Costa Rican. Possible explanations for the dynamics of trust in Costa Rica are less clear. Respondents may not feel that other members of the public have sufficient accurate information, but they may also have greater trust in scientists and other institutional players than has been observed in Europe, and particularly in the United States.

The levels of climate change concern reported in this study are also comparable to those observed elsewhere although they are on the higher end of the scale. Strikingly, as with other studies, concern is more acute for distant others, even to the extent that more concern is expressed for citizens of industrialized nations than for communities themselves. However, slightly elevated levels of concern for family and community and for localized impacts such as poverty and heat waves lend credence to the hypothesis that developing country residents may have higher awareness of their general vulnerability regardless of climate change (Bord et al. 1998; Brechin 2003; Leiserowitz 2005). Similarly, a majority of respondents report engaging in adaptation behaviours designed to minimize ongoing climatic impacts. These results suggest that the climate change, when presented as an abstract concept, is perceived as an event that will happen to other people in other places, but that citizens are already taking actions to protect themselves from pre-existing threats which may be augmented by climate change. Perceptions of vulnerability may not necessarily heighten concerns about climate change, but it is logical that people will take whatever actions they can to protect themselves from easily imaginable, or already experienced, threats.

Several interesting findings relate to the self-reported engagement in mitigation behaviours. At first glance it appears that Costa Ricans are enthusiastically embracing environmentally friendly transportation and energy efficiency behaviours. However, these activities must be interpreted against a backdrop in which many factors, including access to resources and financial limitations, are shaping such behaviours. Many instances of what would qualify as "environmental behaviour" in a developed country context are merely aspects of daily life triggered by the immediate financial constraints faced by respondents.

These findings highlight the challenges facing many developing countries wishing both to address poverty and to generate income through mitigation. For example, if financial constraints are a major factor in encouraging public transit use, reductions of these constraints may presumably lead to an increase in private automobile use. While this is entirely understandable, it may also undermine Costa Rican efforts to seek financial support through NAMAs based on "merit" (demonstrated through domestic emission reductions and carbon neutrality), if such merit is defined primarily as involvement in mitigation. As has been well demonstrated in other studies, people are least likely to engage in climate change actions that require significant sacrifice (Bord et al. 1998; Dietz et al. 2007). Actions that citizens would otherwise desire to perform with an increase in wealth may be seen as particularly sacrificial, and thus unlikely to be adopted.

Furthermore, this study highlights the importance of doing in-depth survey research on public perceptions of domestic climate policy issues within developing countries. In the case of Costa Rica, finding mixed levels of public support for increasing hydroelectric power helps to elucidate the challenges of implementing a key part of Costa Rica's mitigation and economic strategy, as well as the contention likely to arise in domestic debates around water pricing and hydroelectric power issues.

Overall, this study provides the first nation-wide baseline for public perceptions of climate change in Costa Rica. While Costa Rica's leadership towards carbon neutrality is somewhat specific, its desire to have domestic mitigation actions recognized by international funding is not. In light of increased consideration for NAMAs and the potential they hold for revenue-generation in developing countries, the creation of effective and feasible domestic mitigation policies within developing countries demands a better understanding of public perceptions. Within Costa Rica the public has relatively low understanding of climate science but is concerned about climate change, and believes it is already happening. Simultaneously, many individuals are involved in some mitigation and adaptation behaviours, but the reasons for engagement are tied to immediate circumstances and likely do not reflect only climate change concerns. As the country seeks to increase public wealth it is possible that mitigation may become more difficult, presenting a challenge to its mitigation goals. Similarly engagement in adaptation behaviours reflects concerns of daily life in a developing country and awareness of on-going vulnerabilities to existing hazards with or without climate change. This may have implications for the types of adaptations that are most easily adopted in particular regions and may be worth exploring in more depth as maladaptation remains a threat.

Each country's context for policy development is different; without country specific studies of this kind, domestic dynamics could be overlooked. It is hoped that similar studies in other developing countries will soon start to emerge. Climate change is a global issue, and information about how the majority of the world's population understands and approaches climate change is sorely lacking.

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References

Adelekan IO, Gbadegesin AS (2005) Analysis of the public perception of climate change issues in an indigenous African city. Int J Environ Stud 62(1)

Antilla L (2005) Climate of skepticism: US newspaper coverage of the science of climate change. Global Environ Change-Hum Policy Dimens 15(4):338–352

Asiyanbi AP (2011) "I don't get this climate stuff!" Climate change knowledge, perception and concern among corporate elites in Lagos. Unpublished dissertation, King's College London, United Kingdom

Bales S (2007) Framing global warming in Canada: a frameworks message memo. Frameworks Institute, Washington DC

Bell A (1994) Climate of opinion - public and media discourse on the global environment. Discourse Soc 5 (1):33–64

Billett S (2009) Dividing climate change: global warming in the Indian mass media. Climatic Change 99(1–2):1–16

Blum N (2007) Environmental education in Costa Rica: building a framework for sustainable development? Int J Educ Dev 28(3):348–358

Bord RJ, Fisher A, O'Connor RE (1998) Public perceptions of global warming: United States and International Perspectives. Clim Res 11(1):75–84

Bord RJ, O'Connor RE, Fisher A (2000) In what sense does the public need to understand global climate change? Publ Understand Sci 9(3):205–218

Bostrom A, Morgan MG, Fischhoff B, Read D (1994) What do people know about global climate-change .1. Mental Models. Risk Anal 14(6):959–970

Boykoff MT, Boykoff JM (2004) Balance as bias: global warming and the US prestige press. Global Environ Change-Hum Policy Dimens 14(2):125–136

Brechin S (2003) Comparative public opinion and knowledge on global climatic change and the Kyoto Protocol: the US versus the world? Int J Sociol Soc Pol 23(10):106–134

Brossard D, Shanahan J, McComas K (2004) Are issue-cycles culturally constructed? A comparison of French and American coverage of global climate change. Mass Comm Soc 7(3):359–377

Brouwer R, Akter S, Brander L, Haque E (2007) Socioeconomic vulnerability and adaptation to environmental risk: a case study of climate change and flooding in Bangladesh. Risk Anal 27(2):313–326

Bulkeley H (2000) Common knowledge? Public understanding of climate change in Newcastle, Australia. Publ Understand Sci 9:313–333

Bunce M, Rosendo S, Brown K (2010) Perceptions of climate change, multiple stressors and livelihoods on marginal African coasts. Environ Dev Sustain 12(3):407–440

Carson R, Louviere J, Wei E (2010) Alternative australian climate change plans: the public's views. Energy Policy 38:902–911

Carvalho A, Burgess J (2005) Cultural circuits of climate change in UK broadsheet newspapers, 1985-2003. Risk Anal 25(6):1457–1469

Comité Nacional de Emergencia (CNE) (1993) Organización nacional del País para casos de emergencia o desastre. Comisión Nacional de Emergencia (Direccion de Planes y Operaciones), San Jose, Costa Rica

Darier É, Schüle R (1999) Think globally, act locally? Climate change and public participation in Manchester and Frankfurt. Local Environ 4(3):317–329

Dietz T, Dan A, Rachael S (2007) Support for climate change policy: social psychological and social structural influences. Rural Sociol 72(2):185–214

Dobles R (2008) Summary of the National Climate Change Strategy. Ministry of Environment and Energy, San Jose, Costa Rica

Dunlap RE (1998) Lay perceptions of global risk: public views of global warming in cross-National context. Int Sociol 13(4):473–498

Etkin D, Ho E (2007) Climate change: perceptions and discourses of risk. J Risk Res 10(5):623–641

Fankhauser S, Smith JB, Tol RSJ (1999) Weathering climate change: some simple rules to guide adaptation decisions. Ecol Econ 30(1):67–78
Fletcher R (2010) When environmental issues collide: climate change and the shifting political ecology of hydroelectric power. Peace Conflict Rev 5(1):1–15
GlobeScan (2007) All countries need to take major steps on climate change: Global Poll. Available at: http://www.globescan.com/news_archives/bbc_climate/; accessed March 2011.
Inter-American Development Bank (IADB) (2010) Science, technology, and innovation in Latin America and the Caribbean: a statistical compendium of indicators. Science and Technology Division-IADB, Washington D.C, p 117
Kasemir B, Dahinden U, Swartling AG, Schule R, Tabara D, Jaeger CC (2000) Citizens' perspectives on climate change and energy Use. Global Environ Change 10:169–184
Kempton W (1991) Lay perspectives on global climate change. Global Environ Change 1(3):183–208
Kirby A (2004) Britons unsure of climate costs. BBC Public Opinion Poll. http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/28_07_04_climatepoll.pdf. Accessed March 2011.
Leiserowitz A (2003) Global warming in the American mind: The roles of affect, imagery, and worldviews in risk perception, policy preferences and behaviour. Unpublished Dissertation, University of Oregon, Eugene
Leiserowitz A (2005) American risk perceptions: is climate change dangerous? Risk Anal 25(6):1433–1442
Leiserowitz A (2006) Climate change risk perception and policy preferences: the role of affect, imagery, and values. Clim Change 77(1–2):45–72
Leiserowitz A (2007) International public opinion, perception, and understanding of global climate change, Human Development Report 2007/2008. Fighting climate change: Human solidarity in a divided world. UNDP Human Development Report Office
Löfstedt R (1991) Climate change perceptions and energy use decisions in northern Sweden. Global Environ Change 1(4):321–324
Lorenzoni I, Pidgeon NF (2006) Public views on climate change: European and USA perspectives. Clim Change 77(1–2):73–95
Lorenzoni I, Leiserowitz A, DeFranca D, Poortinga W, Pidgeon NF (2006) Cross-national comparisons of image associations with "global warming" and "climate change" among laypeople in the United States of America and Great Britain. J Risk Res 9(3):265–281
Lorenzoni I, Nicholsoncole S, Whitmarsh L (2007) Barriers perceived to engaging with climate change among the UK public and their policy implications. Global Environ Change 17(3–4):445–459
Lowe T, Brown K, Dessai S, Franca Doria M, Haynes K, Vincent K (2006) Does tomorrow ever come? Disaster narrative and public perceptions of climate change. Publ Understand Sci 15(4):435–457
Maddison D (2007) The perception of and adaptation to climate change in Africa. Policy Research Working Paper (No.WPS4308). The World Bank Development Research Group: Sustainable Rural and Urban Development Team.
McDaniels TL, Axelrod L, Slovic P (1996) Perceived ecological risks of global change. Global Environ Change 6(2):159–171
McKenzie-Mohr D (2000) Fostering sustainable behavior through community-based social marketing. Am Psychol 55(5):531–537
Ministerio de Ambiente, Energía y Telecomunicaciones (MINAET) (2009) Estrategia Nacional de Cambio Climatico. San Jose, Costa Rica: Government of Costa Rica.107 pp
Ministerio de Planificación Nacional y Economia Política (MIDEPLAN) (2010) Plan Nacional de Desarrollo 2011–2014. San Jose, Costa Rica, 256pp
National Institute for Statistics and Censuses (NISC, 2002). Multiple Purposes Household Survey 2000. San jose, Costa Rica; consulted at: www.inec.go.cr/
National Meteorological Institute (NMI) (2010) Second National Communication to the UNFCCC. San Jose, Costa Rica, 265 pp
Nisbet MC, Myers T (2007) The polls trends: twenty years of public opinion about global warming. Publ Opin Q 71(3):444–470
Norgaard KM (2006) "We don't really want to know" - Environmental justice and socially organized denial of global warming in Norway. Organ Environ 19(3):347–370
Norton A, Leaman J (2004) The day after tomorrow: public opinion on climate change. MORI Social Research Institute.
O'Connor RE, Bord RJ et al (1999) Risk perceptions, general environmental beliefs, and willingness to address climate change. Risk Anal 19(3):461–471
Ohe M, Ikeda S (2005) Global warming: risk perception and risk mitigating behavior in Japan. Mitig Adapt Strategies Global Change 10:221–236
Palutikof JP, Agnew MD, Hoar MR (2004) Public perceptions of unusually warm weather in the UK: impacts, responses and adaptations. Clim Res 26:43–59

Patchen M (2010) What shapes public reactions to climate change? Overview of research and policy implications. Anal Soc Issues Public Policy 10(1):47–68
Patt A, Schroter D (2008) Perceptions of climate risk in Mozambique: implications for the success of adaptation strategies. Global Environ Change 18(3):458–467
Pew Research Centre (2009a) Modest support for "Cap and Trade" Policy. News Release. Washington D.C. Thursday October 22, 2009
Pew Research Centre (2009b) Environment, immigration, health care slip down the list. News Release. Washington D.C. Thursday January 22, 2009
Ponce LO (2006) Economic instruments in water management: the case of Costa Rica. Natural and Energy Resources, United Nations Economic Commission for Latin America (ECLAC), Mexico, p 59
Poortinga W, Pidgeon N (2003) Public perceptions of risk, science and governance: Main findings of a British survey of five risk cases. Centre for Environmental Risk, University of East Anglia
Read D, Bostrom A, Morgan MG, Fischhoff B, Smuts T (1994) What do people know about global climate-change. 2. Survey studies of educated laypeople. Risk Anal 14(6):971–982
Reynolds TW, Bostrom A, Read D, Morgan MG (2010) Now what do people know about global climate change? Survey studies of educated laypeople. Risk Anal 30(10):1520–1538
Sandvik H (2008) Public concern over global warming correlates negatively with national wealth. Clim Change 90(3):333–341
Semenza JC, Hall DE, Wilson DJ, Bontempo BD, Sailor DJ, George LA (2008) Public perception of climate change: voluntary mitigation and barriers to behaviour change. Am J Prev Med 35(5):479–487
Shwom R, Bidwell D, Dan A, Dietz T (2010) Understanding U.S. public support for domestic climate change policies. Global Environ Change 20(3):472–482
SPSS Inc (2010) SPSS Base 19.0 for windows. SPSS Inc, Chicago
Stern PC (2000) New environmental theories: toward a coherent theory of environmentally significant behavior. J Soc Issues 56(3):407–424
Stoll-Kleeman S, O'Riordan T, Jaeger CG (2001) The psychology of denial concerning climate mitigation measures: evidence from Swiss focus groups. Global Environ Change 11:107–117
Sundblad E, Biel A, Gärling T (2009) Knowledge and confidence in knowledge about climate change among experts, journalists, politicians, and laypersons. Environ Behav 41:281–302
Takahashi B (2010) Framing and sources: a study of mass media coverage of climate change in Peru during the V ALCUE. Publ Understand Sci 20(4):543–557
Takahashi B, Meisner M (2011) Comparing influences on Peruvian Climate Change Policy: information, knowledge, and concern among political elites. J Intercult Comm Res 40(3):181–202
Trumbo C (1996) Constructing climate change: claims and frames in US news coverage of an environmental issue. Publ Understand Sci 5(3):269–283
Tucker CM, Eakin H, Castellanos EJ (2010) Perceptions of risk and adaptation: Coffee producers, market shocks, and extreme weather in Central America and Mexico. Global Environ Change 20 (1):23–32
United Nations Framework Convention on Climate Change (UNFCCC) (2005) Submission from Papua New Guinea and Costa Rica: Reducing Emissions from Deforestation in Developing Countries: Approaches to Stimulate Action (No. FCCC/CP/2005/MISC.1).
United Nations Framework Convention on Climate Change (UNFCCC) (2009) Copenhagen accord appendix II: Nationally appropriate mitigation actions of Developing Country Parties. Copenhagen, Denmark
Valdivia C, Seth A, Gilles JL, García M, Jiménez E, Cusicanqui J, Navia F, Yucra E (2010) Adapting to climate change in Andean ecosystems: Landscapes, capitals, and perceptions shaping rural livelihood strategies and linking knowledge systems. Ann Assoc Am Geogr 100(4):818–834
Wilson C, Dowlatabadi H (2007) Models of decision making and residential energy use. Annu Rev Environ Resour 32(1):169–203
Yearley S (2000) Making systematic sense of public discontents with expert knowledge: Two analytical approaches and a case study. Publ Understand Sci 9:105–122
Zahran S, Brody S, Grover H, Vedlitz A (2006) Climate change vulnerability and policy support. Soc Nat Resour 19(9):771–789
Zwick M, Renn O (2002) Perception and evaluation of risks findings of the Baden-Württemberg risk survey 2001 (No. 203)