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People's understandings, perceptions of, and emotions towards climate change

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I declare that the research for these publications was solely my own work and that I am the lead author. I also confirm that appropriate credit has been given within the thesis where reference has been made to the work of others.

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Abstract

Climate change is a global issue; one whose perception involves an ontological status whereby multiple perspectives enact its existence. Whilst biophysical scientific disciplines, such oceanography or conservation biology, have presented objective evidence of this climatic phenomenon, social science disciplines, such as sociology, politics, or psychology, have sought to explain how climate change is perceived and addressed by people. This thesis is about this subjective facet of climate change. It endeavours to engage with the worldwide interest in comprehending how people build their understanding and knowledge of climate change, but also takes a step further to investigate peoples' perception of climate change adaptation and look at emotional responses in respect to this climate issue. The specific aim of my research is therefore to provide insights that could be of value in enhancing our understanding of how people engage with climate change.

Because most studies of peoples' knowledge and perceptions of climate change have been conducted with segments of the general public in the United States, Europe, and Australia, I decided to focus my study on a rather different society, namely that of my own nation, Ecuador. Moreover, here the interest was to investigate a rural community and to contrast the resulting data with those gathered from a sample of academic conservationists worldwide.

In terms of the approach to the study, in being committed to allowing participants the agency to define how they themselves understand this climatic phenomenon, I employed a mixed-mode approach that incorporated qualitative and quantitative data gathering instruments, including face-to-face and online questionnaires, semi-structured interviews and participant observation.

My findings provide a unique insight into the perspectives and realities that form the study populations' understandings of climate change. They suggest that despite the global nature of climate change, it is multiple local and individual realities that ultimately determine peoples' engagement with it. I conclude that action preferences, namely mitigation or adaptation to climate change, tend to be predominantly moderated by people's demographic background. I also suggest a tendency among urban dwellers to perceive climate change as an issue that cannot be tackled individually. Furthermore, because the international trend to cope with climate change highlights the relevance of 'resilience thinking', I argue that the results of my thesis can usefully inform the process of advising policy makers and when developing awareness-raising and educational programmes on climate change.

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Chapter 1

Introduction

1.1. Global warming and climate change knowledge

The origins of scientific knowledge of global warming are rooted in the work of John Tyndall (1859) who was the first to measure the greenhouse effect in a laboratory, concluding that water vapour was the strongest greenhouse gas absorbing radiant heat. In 1896, Svante Arrhenius made the first calculations linking carbon dioxide concentrations with global temperatures, concluding that higher temperatures will be beneficial to prevent future ice ages. Later, Arrhenius's work was strengthened by Guy Callendar (1938) and Gilber Plass (1955) who linked carbon dioxide concentrations with increase global temperatures. In 1958, David Keeling found that carbon dioxide levels were rising. In 1972, John Sawyer warned of potential planetary warming caused by anthropogenic carbon dioxide, while James Lovelock (1973) and Veerabhadran Ramanathan, (1975) found that chlorofluorocarbons were more efficient at absorbing infrared radiation than carbon dioxide. In the same year, the term 'global warming' was established in the scientific literature by Wallace Broecker. Finally, in 1985, the Vostok Soviet Station, showed evidence from ice-cores that carbon dioxide and the temperature had gone up and down together in wide swings in past ages.

The consensus reached from all these scientific findings was that the global climate system has never been stable and that all greenhouse gases play a role in climate stability. The evidence also concluded that the concentration of carbon dioxide might well have been exacerbated by the industrial burning of fossil fuels. In response to this growing body of scientific knowledge, in 1988 the Intergovernmental Panel on Climate Change (IPCC) was officially established, and in 1989 Nations and media included climate change in their agenda encouraged by the UK Prime Minister Margaret Thatcher (Carvalho & Burgess 2005; Carvalho 2007; Hulme, 2013 p.2-4). Thatcher's involvement in this scientific arena gave way to a climate change narrative coupled with a growing research on the same topic.

Global warming and climate change research have since grown and diversified enormously. The knowledge developed has been mainly addressed subsequently by biophysical sciences, but it has also been covered by the perspective of social sciences. The conclusions of these bodies of research are summarised in the five IPCC reports (1990-2014). Essentially the IPCC suggest that in order to

successfully tackle anthropogenic climate change the involvement of individuals and communities it is required, as well as, considerable increase in knowledge and awareness among people so as to achieve the necessary human behavioural change. Ever since the IPCC made its recommendations, efforts to tackle climate change have shifted from mitigation strategies to adaptation strategies (Hulme 2013 p.52-57), with education and concern widely accepted as a crucial part of engaging people actively with this issue.

In pursuing the IPCC goals, many entities signed up to this global cause including several agencies of The United Nations, such as FAO[1], UNEP[2], WHO[3], some No-Governmental Organisations including Greenpeace, politicians such as former US vice-President Al Gore, and some key religious leaders such as Pope Francis. Many campaigns supported by these prominent entities also have been conducted; the most high-profile perhaps being the film "An Inconvenient Truth" by Al Gore 2006. While the efforts put on this and other campaigns succeed to increase awareness and concern among the public, many members of the general public still suffer from fundamental misconceptions about climate change (Bostrom et al. 1994; Reynolds et al. 2010). Indeed, in some cases, the way that messages have been portrayed have been found to foster scepticism and denial instead (Boykoff 2015). Capstick et al. (2015) for instance, suggest that in the past quarter century people's engagement with climate change has swung between 'awareness', 'concern', and 'scepticism'. Another study by Maibach, Roser-Renouf & Leiserowitz (2009), suggested that people, at least in the United States, also engage the subject with 'alarm', 'caution', 'disengagement', and 'dismissiveness'. Both studies suggest that the way people experience climate change differs between individuals. In fact, for some researchers, climate change is experienced and approached in multiple ways and according to cultural realities (Hulme 2015), making it difficult to develop a comprehensive climate change campaign or strategies that can be applied equally to all geographical regions and communities in the world. In this sense, climate change becomes a global issue involving an ontological status that suggests a pluralism whereby multiple perspectives enact its existence (Esbjörn-Hargens 2010).

This thesis is inspired in the multiple realities surrounding climate change. I will endeavour, then, to engage with a worldwide interest to comprehend how people build their understanding[4] of climate change. I will also take a step further to investigate people's perception of climate change

[1] Food and Agricultural Organization of the United Nations
[2] United Nations Environmental Programme
[3] World Health Organization
[4] In this thesis, I will use the Oxford dictionary definition of understanding as the ability to understand something; comprehension.

adaptation and the emotions[5] generated in respect to this issue. These three aspects will guide my thesis. The specific aim of my research is therefore to explore peoples' realities forming their meanings of climate change in order to enhance our understanding of the ways people engages with this issue. I stress the importance of considering these realities when seeking to build strategies to address behavioural changes concerning climate change.

In pursuing my endeavour, throughout this thesis I will present a solid constructivist process combining climate scientific and public knowledge, discourses portrayed by media and politicians, and psychological and sociological factors such as perceptions, understandings, emotions, social interaction, and demographics. By combining these elements, at the end of this thesis I will propose a theoretical model to elucidate the process through which people engages or disengages with climate change. In so doing, I will first address the factors constructing people's climate change understandings. I will afterwards explore the perceptions of climate change mitigation and adaptation. Subsequently, I will involve with the emotions implied in this issue. In the development of these liabilities, I will present empirical data collected in southern Ecuador trough questionnaires with urban and rural dwellers, semi-structured interviews with farmers, and on-line questionnaires with a panel of international academy-based researchers working on conservation[6]. Finally, I will consider these data in the context of the literature reviewed to determine the role of understandings, perceptions, and emotions in the public's engagement with climate change. As far as I am acquainted, no similar study offers a holistic explanation of how individuals construct their understanding and engage with this climatic issue.

1.2. Defining terms and concepts

Notwithstanding that climate change is a global issue and widely spoken within societies, there exist some terms that might be problematic within the climate change discourse. Many of these terms enjoy a highly active existence in the media, political speeches, and scientific research; and so may be misused as to become essentially meaningless in the eyes of many climate researchers. However, for this research purposes, I consider it pertinent to define eight terms/processes that are

[5] Emotions: In this thesis, I follow the definition by Baumeister & Bushman (2008 p.161), who frames emotions as a conscious evaluative reaction to some event wherein the individual knows that is having a reaction.

[6] Academy-based researchers focus on conservation: From now on, they will be called *academic conservationists*. This sample includes lectures, professors, postgraduate researchers, and research assistants. A detailed description of the respondents is shown in the Methodology Chapter. Participating academic institutions is shown in Appendix 4c.

essential to the analysis of climate change knowledge and understanding. These terms were known for the difficulty that the public could have in understanding them. For instance, according to Bostrom et al. (1994), Bord, Fisher & O'Connor (1998), and Reynolds et al. (2010), the general public has problems to conceptually differentiate 'climate' and 'weather', as well as to define the causes and consequences of global warming. Besides, Whitmarsh (2009) suggested that lay people fail to describe the key features of global warming and climate change. In this context I will provide the definitions sharing scientific consensus:

- Climate is created by long-term conditions in the atmosphere, hydrosphere, cryosphere, lithosphere and biosphere, and the interactions between them. Climate is not felt or sensed (Hulme 2014).
- Weather is created by short-term patterns of wind, cloudiness, humidity, atmospheric pressure, precipitation and temperature. Weather describes short-term conditions like unusual rains or droughts. Weather can be felt and sensed (Hulme 2014).
- Global warming is the term established for expressing the gradual increase of Earth's average temperature.
- The causes of global warming, beyond natural explanations, will be primarily the result of an increase in carbon dioxide concentration in the Earth's atmosphere. The largest source of carbon dioxide (78%) is the combustion of fossil fuels coming from energy, industries and transportation (IPCC 2014a).
- The consequences of global warming are represented by the increase in global average temperatures likely related to changes in the climate system. These changes include ocean and surface temperatures, water cycles modifications, ocean ice melting and acidification, ice sheets retreat; snowpack reduction, sea level rise, and alteration in species genetics, growth, phenology and distribution shifts (IPCC 2014a).
- Climate change is the term established for expressing a change in the climate system, which persists for an extended period, typically decades or longer (IPCC 2012).
- Extreme weather events are rare, and there exist few data to enable predictions regarding changes in their frequency or intensity. The more unusual the event, the more difficult it is to identify long-term changes (IPCC 2012).
- Climate-related impacts are part of an ongoing debate, whose premises need a further test since climate change is not an independent causal agent of these impacts (Hulme 2014) with other social, economic and political stressors playing a role as well. Such impacts include disruption

of food production and water supply, damage to infrastructure and settlements, morbidity and mortality, and consequences for human health and well-being (IPCC 2014a).

Whilst in this thesis epistemological terms of climate change will be used to analyse climate change public knowledge, it is not intended to judge people's knowledge as valid or erroneous but to understand the sources informing their knowledge and subsequent understanding.

Additionally, there are three supplementary terms that need to be clarified at this point for them will help to frame the final discussion of this thesis:

- Mitigation: is a human intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC 2014a). There are multiple measures with a range of technological and behavioural options for sustainable development that are consistent with different levels of mitigation (2014a. p, 19-28). These measures include but are not limited to, changes in consumption patterns, e.g. mobility demand and mode, household energy, and choice of longer-lasting products (individual level). Low energy demand, integrated urban planning, urban redevelopment and investments in new infrastructure and building (community level). Portfolios of energy efficient and forest conservation policies, reduced travel demand, and policies governing agricultural practices (national level). Whilst mitigation can be performed at diverse levels to reduce carbon footprints, the scientific consensus coined by the IPCC claims that an effective mitigation requires international cooperation, one that will not be achieved if individual agents advance their own interest independently (2014a. p, 6). These claims are based on the rationale that climate change is a global commons issue that has the characteristics of a collective action problem in that most of greenhouse gases emission by any agent (e.g. individual, community, and country) accumulate over time, mix globally, and affect other agents. Indeed, despite the growing number of climate change mitigation policies, annual greenhouse emissions grew more rapidly than in the past three decades (2014a. p, 8), even during the global crisis in 2008-2009 (Peters et al. 2012). Consequently, the scientific consensus suggests that despite the individual intentional behaviour to reduce the sources of carbon dioxide emissions, effective mitigation is a difficult path insomuch as the current economic models in which societies worldwide live upon prevail. From a governance perspective, mitigation is a top-down model whereby numerous measures are socialised so they are taken at individual, communal, regional or national level.
- Adaptation: is the process of adjustment to actual or expected climate and its effects by moderating, avoiding harm or exploiting opportunities (IPCC 2012; IPCC 2014b). Similar to mitigation, adaptation provide a range of complementary measures for managing risk of climate-related events. Some of them involve: risk communication systems between and within decision makers and local

citizens, sustainable land use planning, ecosystem management, improvement of health surveillance, water supply, sanitation, irrigation and drainage systems, and better education and awareness (2012. p, 29). Adaptation measures often take an actor-oriented view that focuses on the choices that particular agents make based on their preferences, institutional interests, power, capabilities, and on the information they have available (IPCC 2012 p, 48). In this sense, adaptation to climate change often refers to the decisions specific actors may take. The scientific consensus offered by the IPCC acknowledges that disaster risk management and adaptation to climate change could be achieved by learning from current mix of actions used by communities to reduce, transfer, and respond to levels of risk (IPCC 2012 p, 49). The rationale of these claims is that there is a historical record of previous efforts to manage and adapt to climate variability over a wide range of timescales. These efforts provide a basis for learning via the assessment of responses, interventions, and recovery from previous impacts. Whilst the scientific consensus recognises that such adaptive measures did not always succeed, it asserts that these measures constitute a plausible model for long-term efforts. From a governance perspective, adaptation is a bottom-up model whereby the individual and communal measures may influence on upper decision-taken levels.

- Resilience: is the capacity of a system to absorb disturbance and reorganise so as to retain essentially the same function, structure, feedbacks, and identity (Walker & Salt 2012, p.3-4). Simply saying, is the ability to cope with disturbances and keep functioning in much the same way. Resilience focuses on the study of intertwined social-ecological systems which behave as complex adaptive systems (Biggs, Schlüter & Schoon 2015, p. 5-10). According to Walker & Salt (2012), adaptive complex systems involve three requirements: components that are independent and interacting, some selection process at work on those components and on the results of their interactions, and variation and novelty are constantly being added to the system. A good example to understand a complex adaptive system is a farm producing potatoes, which involves the farmer, the farming practices, the crop, the soil, and the market. These components interact and change over time. From a resilience perspective this changes as well as disturbances are not necessarily negative but an inherent feature of socio-ecological systems that presents ongoing opportunities for renewal and improvement (Biggs, Schlüter & Schoon 2015, p. 9). Resilience takes a system view that considers multi-interacting agents and their relationships in and with complex socio, ecological, and geophysical systems (IPCC 2012). From a governance perspective, resilience is a collective governance whereby mitigation and adaptation measures interact to achieve the resilience of a social-ecological system.

1.3. Engaging with peoples' climate change understandings

Climate change includes an objective side assembled by biophysical evidence and a subjective side that is suggested to be socially and culturally constructed, wherein psychological, political, and social aspects intertwine to build an understanding of this climatic phenomenon. For instance, Kalof (1998) suggests that public perceptions of environmental issues depend on mass media and on how viewers interpret the content. In the subject of climate change Carvalho & Burgess (2005) and Antilla (2010) indicate that while the media plays a central role in the social construction of risk, political actors have played by far the most influential role in shaping climate change risk. On the same topic, Antilla (2005) specifies that the mass media have even prevented a more extensive understanding of climate change for the public and policy makers. Regarding cultural aspects, Vedwan & Rhoades (2001) and Vedwan (2006) indicate that climate change perceptions are structured by the dynamic of human-environment relationship that makes possible the comprehension and interpretation of changed climatic conditions. Moreover, Hulme (2015) proposes that different cultural ways of living and human experiences of weather mediate an understanding of climate. Social interaction has also been found by Leombruni (2015) to be a stronger predictor of climate change belief, such that the more a person talks with family or friend about climate change, the stronger their belief. Finally, Weber (2016), suggests that climate change perceptions are dominated by vivid experiences amplifying thus early accounts that climate change perceptions are influenced by structural, psychological, social and cultural factors. Whilst this socio-cultural construction is often pointed to in these researches there are limitations in how far the social process through which people construct their understanding of climate change are described.

Evidence from previous research suggests that people's understanding of climate change embraces inaccurate knowledge (e.g. Read et al. 1994; Bord, Fisher & O'Connor 1998; Reynolds et al. 2010; Howe & Leiserowitz 2013; Moloney et al. 2014). The conclusions of these studies contend that climate change mental models consistently include contributors such as pollution, deforestation, ozone layer depletion, and effects such as health and agricultural issues.

Taking into consideration previous postulates suggesting that climate change understanding is a process socially constructed and is assembled via some amount of inaccurate knowledge, I will endeavour to scrutinise this social process. Social constructions have been analysed by Castro (2006) in the study of environmental concern, indicating that the contents of individual minds are shaped by the social atmosphere. So the social is a product of communication and interaction between individual minds. By putting Castro's view in the context of climate change, I hypothesise

that social interactions are shaping an understanding of this climatic phenomenon that might not be inconsistent with the scientific knowledge and evidence.

With the aim of elucidating this assumption, I will use the theory of social constructivism posited by Berger & Luckmann (1966), and explore the social components constructing people's climate change understandings. The central argument of this theory claims that people's knowledge is constructed *a priory* individual experiences in a particular socio-historical context that help people to construct a reality that is meaningful to them. I expect this theoretical framework to be helpful to investigate on respondent's demographic background and to explore the realities assembling their understandings of climate change.

1.4. Understanding the perceptions of climate change adaptation

According to Hulme (2014), climate change adaptation research has become the focus of attention of several researchers. However, adaptation has been mainly addressed as a knowledge, financial, and technocratic issue (e.g., Lobell et al. 2008; Brown & Funk 2014, Pasquini et al. 2015) that has largely overlooked other social and psychological factors (Taylor 2015; Thaker et al. 2016). For instance, Hart & Feldman (2014) indicate that individuals take actions to address an issue such as climate change when they perceive their measures to be effective, suspecting that maladaptive responses are more likely to occur in that climate change messages portray threat without highlighting efficacy or capacity to react. Grothmann & Patt (2005) suggest that people respond to climate change by evaluating the risks that climate change entails for the things they value, concluding that the self-perceived adaptive capacity is a better predictor of adaptive behaviour than household income and home ownership. Finally, Thaker et al. (2016) point out that perceived collective efficacy is a stronger predictor of the capacity of communities to adapt to changes, arguing that raising people's efficacy beliefs to act on the knowledge of climate change adaptation is more effective that increasing public awareness of climate risks. Whilst I support the view that self-estimated efficacy, self-perceived ability, and collective efficacy are critical for an effective adaptation, I hypothesise that these factors are in turn related to an individual psychological state of mind[7] prompted by the impact of climatic changes on people's livelihoods.

According to Eriksen, Nightingale & Eakin (2015) and Taylor (2015 p.7-9), climate change adaptation literature has assumed social symmetries within geographical regions and communities,

[7] In my thesis, I will use the Cambridge dictionary definition which indicates that 'state of mind' is a person's mood and the effect of that mood on the individual's thinking and behaviour.

neglecting that in real situations the diverse social groups experience and respond to climatic changes differently. For instance, Wheeler et al. (2013) suggest that adaptation to climate change is positively associated with younger and healthier farmers, the possibility of successors, innovative and productive farms, and even with climate change beliefs, whereas Carey (2010) and Rojas Hernández (2016) claims that within societies there are social inequalities that need to be taken into account. The latter suggests that social characteristics play a role in giving meaning to climate change adaptation and in adopting adaptation strategies. Therefore, I also hypothesise that demographic characteristics, in particular occupation, shape the state of mind that prompt individuals to self-estimate their capacity to adapt to changes and perceive adaptation.

In summary, I hypothesise that perceptions of climate change adaptation are shaped by a psychological state of mind and that this state varies according to the impact of climatic changes on people's livelihoods. Testing my assumption will require analysing groups of people differing by occupational background, so I will endeavour to work with different social groups which have been in addition marginalised in previous studies.

1.5. Identifying emotional responses towards climate change

Within the psychological aspects contributing to constructing a climate change understanding, emotions have been scarcely addressed in the literature with except a handful of relevant studies. For instance, Maibach, Roser-Renouf & Leiserowitz (2009) suggest that people engage with global warming in six emotional states namely 'alarmed', 'concerned', 'cautious', 'doubtful', 'disengaged' and 'dismissive' categories. In the same token, Doherty & Clayton (2011) added the states of 'anxiety', 'guilt', 'despair', 'grief' and 'denial'. Moreover, Myers et al. (2012) argue that in the context of climate change topics of national security and health have generated sentiments of 'anger' and 'hope' respectively. Finally, Smith and Leiserowitz (2014), found that in regards to global warming people mainly experience 'interest', 'disgust', 'worry', 'hope', 'helplessness', 'anger', or 'sadness'. Whilst these studies have been critical in identifying climate change emotional responses, the results represent unique segments of the public in the United States of America.

Additionally, a person rarely experiences a single emotion (Lazarus 1991 p.67). This is true even for experiments designed to induce specific emotions. For example, Drouvelis & Grosskopf (2016), conducted an experiment to induce 'anger' and 'happiness' in order to encourage pro-social behaviour, finding that happiness was related to 'joy', whereas anger was related to 'irritation'. In

fact, for researchers like Howarth & Sharman (2015), existing climate emotion labels, such as 'alarm' or 'denial', represent opposite poles that fail to include myriad of opinions existing between these extremes. Accordingly, I hypothesise that climate change evokes a wider array of emotional responses that have not been yet explored. In considering this knowledge gap, in this thesis, I will explore the emotions experienced regarding climate change.

Finally, for another group of researchers, engaging emotionally with climate change is most closely associated with demographic variables, suggesting that emotional responses are also linked to individual objective realities. For instance, Stevenson & Peterson (2016) found that 'despair' encourages inaction among adolescents and adults, whereas gender and socioeconomic background may factor into building climate change 'concern'. Additional research in the field, reinforces this idea concluding that gender (McCright 2010; Stokes, Wike & Carle 2015), knowledge, understanding (Malka, Krosnick & Langer 2009; Brulle, Carmichael & Jenkins 2012), and level of education (Barnes, Islam & Toma 2013; Hardesty 2015) are associated with climate change 'concern'. Accordingly, I aim to explore the socio-demographic variables related to the emotional responses aroused in regards to climate change.

1.6. The methodological context and research questions

Because this study aims at in-depth description and understanding of a phenomenon rather than active intervention, an observational research structure with an inductive strategy and a constructivist appraisal were preferred to frame the data collection process. Additionally, in considering previous arguments about the multiple viewpoints involved in perceiving and understanding climate change in spite of its global nature, I preferred a mixed-mode approach[8] which enabled me to collect qualitative and quantitative data necessary to gather evidence from these viewpoints. The arguments behind the selection of a mix-mode approach are based on the postulate by Hulme (2015) and by Esbjörn-Hargens (2010), who claim multiple realities surrounding climate change, whose existence depends on who sees it, how it is approached, and what viewpoints are involved. Against the backdrop of these conclusions, I sought to gather these views by minimising the single interpretation of the researcher to record the lexical categories formulated by study participants when speaking about climate change. Likewise, I conducted my study in the places where participants live and work, where they might be more likely to answer

[8] Mix-mode approach is the term I use in my thesis to describe the joint use of quantitative and qualitative data-gathering instruments. The term was adapted from 'mix-mode design' employed in Bhattacherjee (2012).

questions comfortably. The data-gathering process led me to spend 15 months of fieldwork between 2014 and 2015. The evidence collected aim to address the following questions:

Q1: What understandings of climate change do people in southern Ecuador have, and how do these come about?

Q2: Is climate change adaptation practised by knowledge, physical resources, psychological state of mind, some other factor, or some combination of these?

Q3: How do perceptions of climate change adaptation vary by social divisions and demographic background?

Q4: What are people's emotional responses concerning climate change?

Q5: What demographic variables are associated with peoples' emotions towards climate change?

1.7. Finding a study area and population sample

As I previously mentioned, one of the aims of my study is to identify the individual subjective realities involved when giving meaning to climate change. I also stated that I will endeavour to draw conclusions upon data gathered in social groups that have been marginalised in previous research. In pursuing these aims, I was committed to select a study area and population sample that will fulfil these requirements.

Study area: According to Capstick et al. (2015) and Ming Lee et al. (2015), the vast majority of climate change studies have been conducted in the context of the United States, Europe, and Australia, leaving in ignorance of what people from other parts of the globe know and perceive regarding this climate issue. In considering these claims, I selected my own nation Ecuador, wherein the information regarding climate change is scarce and aimed for crop-pest control modelling under scenarios of climate variability (Rebaudo & Dangles 2015). Information regarding peoples' perceptions of climate change has been focused on reconciling local observations with scientific and historical information concerning the retreat of the glaciers (Rhoades et al. 2006 p.64-72), and to analyse the threats that climate change entails to Andean farmers (Perez et al. 2010).

The studies mentioned above, collected information in the middle and northern Ecuadorian Andes, whereas in the southern Andes, climate studies are represented by a single piece of research by Aguirre et al. (2016 p. 39-46). The scarce information collected in Ecuador, particularly in the southern Andes, added to practical reasons such as the language and my acquaintance with the area,

led the study area selection, which encompasses three provinces in southern Ecuador, namely Loja, Azuay and Zamora Chinchipe.

Population sample: With the aim of collecting data that would help to explore the perspectives of less studied social groups, I considered population samples of subsistence and commercial farmers, academic conservationists, and rural/urban dwellers.

Farmers' livelihoods have been subject of study in the climate change research mainly for their vulnerability to weather changes (e.g., Schmidhuber & Tubiello 2007; Byg & Salick 2009; Brown & Funk 2014), their adaptation capacity (e.g., Lacy, Cleveland & Soleri 2006; Seo & Mendelsohn 2008; Byg & Salick 2009; Cunsolo Willox et al. 2012; Halder, Sharma & Alam 2012; Campos, Velázquez & McCall 2014), and their reliance on weather conditions (e.g., Turner & Clifton 2009; Mertz et al. 2009). In contrasting to this well-researched social group little is known about the perceptions of academic conservationists of climate change adaptation. Few studies researching academics' expert opinions on climate change exist (Nordhaus 1994; Javeline et al. 2013; Moloney et al. 2014). Nordhaus, for instance, indicates that experts from natural sciences voiced grave concern about the ability of natural ecosystems to adapt to climatic changes, whereas for social experts, the degree of adaptability of human economies is seen to be high (1994). The study of Javeline and colleagues suggests that environmental biologists' opinions on climate change are more alarmist predicting larger increases in temperature and higher species extinctions and range shifts (2013). Additionally, Moloney and colleagues conclude that scientists and non-scientists use similar terms to define climate change such as "flooding", "temperature", or "warming" (2014). Finally, and as it was previously mentioned, population samples from the general public, have been widely studied in the urban geographical context of the United States, Europe and Australia (Capstick et al. 2015; Ming Lee et al. 2015), evidencing a need to collect data from less studied geographical regions and rural environments. Against the backdrop of these studies, I hypothesise that farmers, academic conservationists, and rural/urban dwellers in southern Ecuador, may have different perspectives on climate change, so I selected these three groups of people to explore the differences between them in regards of their perceptions and responses to weather changes.

1.8. Organisation of the text

This thesis is comprised of seven chapters including the introduction. Chapter 2 offers the literature reviewed to frame this thesis. Accordingly, this contains the evolution of the climate change debate from scientific to social consensus, the scientific standpoints of climate change adaptation, and the

emotional states implied in the psychological impacts of this issue. Chapter 3 begins by giving the theoretical contextualisation of the research strategy and approach as well as the geographical context in which climate change research has been undertaken. It also provides the justification supporting the selection of the methodology which includes: the research design structure and ethical considerations, the target groups, a description of the research methods, and the data analyses. It also includes more details about the study areas and sampling strategies. The data-gathering instruments, as well as the coding process leading the quantitative and qualitative analysis, are presented in detail in Appendix 1-6.

Chapters 4-6, present the main arguments drawing upon the data gathered over the course of my field work. Chapter 4 looks more closely at the social-constructed process shaping people's understanding of climate change. This Chapter draws on qualitative and quantitative data gathered with farmers and members of the general public in southern Ecuador. Chapter 5 explores the 'state of mind' involved in the perception of climate change adaptation, as well as the demographic variables associated with such perception. This Chapter draws upon the data collected in Southern Ecuador with the same sample of farmers and the general public analysed in the Third Chapter, and from data gathered with a sample of academic conservationists. Chapter 6 scrutinises the emotions experienced regarding climate change. This Chapter focuses on the data collected with the same sample of the general public in southern Ecuador analysed in the Fourth Chapter, and from the same sample of academic conservationist analysed in the Fifth Chapter, to identify the emotions that better represent how participants feel about climate change. Subsequently, I present qualitative data regarding declared reasons for selecting a particular emotion, to later focus specifically on the variables associated with those emotions reported. Additionally, photographic material of the places where the research was conducted will be provided in Appendix 7.

Chapter 7 comprises the final Discussion. This Chapter is framed in the research questions to draw the general conclusions of this thesis. I will focus on the empirical data supporting the theories developed to answer how people construct their understandings of climate change, what factors are involved when adapting to climate change, and what emotion categories are evoked by this issue. In this context, I will offer some theoretical contributions I believe provide significant material to the ongoing debate about peoples' engagement with climate change. I will also mention the limitations of my study that gives way to further research. Here, I will endeavour to synthesise the results of Chapters 4-6 so as to provide what I feel are new insights of what climate change means for people and discuss about their behavioural responses related to these meanings. I will finish concluding the implications that raising 'concern' has for the efforts of the leading global climate change policies

and educational programmes. Taken together the results of my study, I move some way towards enhancing our understanding of the realities and perspectives of this climate issue nestled in people's minds that are necessary to consider when portraying climate change messages.

Chapter 2

Literature review

2.1. Climate change: a debate in constant evolution

In 1859 when John Tyndall measured the greenhouse effect in his laboratory, no one ever though that his discovery would mark the beginning of a scientific debate over the existence of a much bigger phenomenon called global warming. The first discussions in this debate were concentrated on linking carbon dioxide emissions and global temperatures. The most prominent researchers in this debate were Svante Arthenius (1896), Guy Callendar (1938), Gilber Plass (1955), David Keeling (1958), and John Sawyer (1972). Whilst these researchers agreed with higher global temperatures resulted from industrial carbon dioxide emissions, Arthenius and Callendar claimed that higher temperatures will be beneficial to prevent future ice ages, whereas Plass, Keeling, and Sawyer showed rather concerned on warming temperatures and their future impacts. During the first years of the 1970's, there was a scientific consensus in that global temperatures and carbon dioxide emissions increased together, however, the contributions by James Lovelock (1973), and Veerabhadran Ramanathan (1975) informed that chlorofluorocarbons were more efficient at absorbing infrared radiation than carbon dioxide, modifying thus the debate to include other greenhouse gases. These contributions could have diverted the attention from carbon dioxide and its link with higher temperatures as claimed by Oreskes and Conway (2010, p 169-174). Nonetheless, in the same 1975 the term 'global warming' was coined by Wallace Broecker bringing back the vital role of carbon dioxide in countering a planetary warming.

In the 1980's, the scientific debate reached an apparent consensus supported by the evidence presented by the Mauna Loa Observatory and the Vostok Soviet Station. The consensus established at that time is summarised in the following three key points: a) the global climate system has never been stable, b) all greenhouse gases play an important role in climate stability, and c) carbon dioxide concentrations have been exacerbated by industrial burning of fossil fuels. With this scientific consensus, the debate reached its climax with the establishment of the IPCC in 1988. The IPPC would support the theory of a planetary warming caused by anthropogenic carbon dioxide and would condense the findings of scientific studies in periodic reports for the following years.

In the 1990's the scientific debate would take a dramatic turn. Indeed, scientific evidence proved to lose the last word in the climate debate (Hoffman 2015). Ever since the UK Prime Minister

Margaret Thatcher encouraged the inclusion of climate change in the international political agenda, the climate discourse has evolved and transformed into a social debate involving competing beliefs and cultural meanings of climatic changes (Hulme 2013). Physical scientists still fill the shelves with evidence of anthropogenic climate change, yet it is politicians and media who lead the climate debate (Carvalho 2007; Hanningan 2014 p.64). The inclusion of the media and politicians had an enormous impact on people, being the same 1990's the year with the highest percent (80%) of the public having heard or read about climate change in the United States (Nisbet and Myers 2007), and highest percent (89%) of the public very worried on climate change in European countries (Lorenzoni and Pidgeon 2006).

Amid scientific evidence and political voices, big efforts have been placed by the international community to engage the public with climate change in order to motivate actions. However, climate change is no longer a matter of presenting physical evidence or standardising mitigation and adaptation policies but a social debate opposing cultural values and worldviews (Hoffman 2015). In this respect, Vedwan and Rhoades (2001) defend the view that only by studying people's perceptions of climate, researchers will be able to understand how people would react to climate change. Likewise, Mike Hulme in his books *Why we disagree about climate change* (2009, p.26-28) and *Exploring climate change through science and society* (2013, p.8-11), buttresses this view by contending that if we are to make sense of how people engage or disengage with climate change it is essential to understand their voices, meanings, attitudes, aspirations and behaviours. Moreover, Hulme (2015) asserts that climate change is a cultural fact that has provoked a wider range of emotional, aesthetical and spiritual expressions. In the same token, Esbjörn-Hargens (2010) suggests a climate change surrounded by multiple realities that lead to the generation of ontological pluralism involving diverse views that vary according to who and how this climatic phenomenon is apprehended. Finally, Carey (2010) makes important contributions to cultural values and climate change research through his insightful *In the shadows of melting glaciers.* In his work, Carey takes as an example the Peruvian Andean glaciers to elucidate how local knowledge and the perception of authority inform peoples' behaviours and climate change policy. Together, the conclusions of the cited researchers suggest that climate change is a concept that is socially constructed; however, the elements assembling this concept, beyond cultural values and worldviews, are neglected. This thesis is inspired in these additional elements making sense of a concept of climate change.

From prior studies, it is hypothesised that the construction of the climate change concept involves three dimensions that are apprehended by societies according to their realities. These dimensions are: a) scientific knowledge developed by social and biophysical sciences, b) discourses portrayed

by media and politicians, and c) psychological dimensions of climate change. Succinctly, dimensions a) and b) play a role as public information sources about climate change, whereas dimension c) works as a sink that filters the information disseminated which is reflected in individual understandings, perceptions and emotions of climate change. The following paragraphs will review how these dimensions are combined in this constructive process.

Hanningan (2014 p.55-66), suggests that in the construction of environmental problems the use of evocative verbal or visual imaginary is usually employ to command public attention. Hanningan also asserts that for a successful construction of such problems it is necessary among other aspects, a scientific authority validating the environmental claims, popular claimers, media attention, and dramatization of the problem. In this sense, the issue of climate change met these precepts as explained here. The IPCC is the most important legitimised authority voicing the climate scientific consensus. This organization has validated climate change claims through five reports describing the main causes of climate change as well as a wide array of global effects including climate-related impacts such as disruption of food production and water supply, damages in infrastructure, mortality and consequences for human health and well-being (IPCC 2014a). The data shared by the IPCC has been essential in the construction of climate messages portrayed by popular claimers through traditional and digital media, politicians, academia, and other public sources. Indeed, media and political actors have been pivotal to inform and educate the public about climate change (Antilla 2010; Boykoff 2009; Carvalho 2007), and therefore to shape the public understanding of this climatic issue.

However, as any other scientific findings, the IPCC reports usually employ a lexicon that is hard to grasp for lay people, obliging thus journalists to personalise and dramatize climate information whereby authority figures and legitimate spokespersons suffuse the messages to give the appearance of a hot and balanced scientific debate (Boykoff & Boykoff 2007). These journalist tactics have contributed to construct an over simplified climate issue that overlooks other political, social, and economic factors (Boykoff & Boykoff 2007), as well as have failed to make climate change stories understandable and meaningful to readers (Boykoff 2009). Indeed, for Antilla (2005) climate change media articles base their conclusions on other media articles, which has caused the exponential spread of misinformation as well as has prevented a more extensive knowledge of climate change by the public and policy makers. Regrettably, journalist tactics have been extended by politicians and movement leaders such as Al Gore and Greenpeace who, in addition, have dramatized environmental problems to manipulating existent public concerns and perceptions in order to broaden their appeal (Nordhaus & Shellenberger 2007, p.105-108; Hanningan 2014, p.62).

In this respect, Hall (2014 p.27-29) claims that climate communications are characterised by repertoires of 'doom and gloom' that tend to inspire resistance, despair and withdrawal rather than action for change. The impact that these tactics have on people is the key for understanding the grounds for representatives of dimensions a) and b), namely scientists, politicians, and media, to construct dramatic and inaccurate narratives of climate change as a mean to engage the public with this issue.

After a plethora of climate change messages disseminated by media, politicians, and other sources of information, it did not take long for social researchers to start inquiring about the aftermath of these climate change narratives. The first studies looked at people's knowledge of climate change. The conclusions reached by these and subsequent studies, pointed out a lack of climate change knowledge among the public in the United States (Read, et al. 1994; Bord, Fisher & O'Connor 1998; Reynolds et al. 2010; Huxster, Uribe-Zarain & Kempton 2015), European countries (Lorenzoni & Pidgeon 2006; Whitmarsh 2009), and Australia (Harriet & Bulkeley 2000; Petheram et al. 2010). These researchers found that people in the mentioned countries held several fundamental misconceptions and inaccurate knowledge reflected in their failure to reference the main causes and effects of climate change, as well as, in their inability to distinguish conceptual differences between climate and weather, and between climate change and global warming (Whitmarsh 2009). It is worthy to note that these studies point out a similar public knowledge of climate change in diverse 'western'[9] countries, suggesting that similar narratives may have been constructed and transmitted to the public in several geographical regions. These results, arouse a research interest to compare climate change information disseminated with public knowledge of the issue in order to confirm the effect of media y political discourses on the construction of peoples' understandings of climate change.

The dissemination of climate messages between countries is likely to happen insomuch as knowledge is propagated through social interaction with traditional and digital media, family, school groups and other social clusters. Accordingly, Jang & Hart (2015) indicate that postings in social networks such as Twitter mirror the controversy observed in traditional media, whereas Plutzer et al. (2016) suggest the high school teachers in the US echo what media portrays about global warming. Additionally, Leombruni (2015) argue that the stronger a person's network is, the more they talked to friends and relatives about climate change and the stronger their belief in global warming. The conclusions of these studies suggest that in addition to scientific entities, mass-media,

[9] In this thesis, the term western is expressed in a social-economical context

and politicians, public understanding of climate change is constructed by a social interaction that propagates the information portrayed on the issue.

It is perhaps this pattern that motivated communication researchers such as Antilla (2005), Carvalho and Burgess (2005), Boykoff and Boykoff (2007), and Boykoff (2015) to look more closely at the messages portrayed when informing and educating the public about climate change. These authors concluded that the rhetoric constructing the messages was characterised not only by inaccuracy, but by bias and sensationalism. The impact that these sort of messages may have on people was also analysed by other group of researchers who concluded that dire climate change messages may not motivate people to take actions (O'Neill S., Nicholson-Cole 2009; Hart and Feldman 2014; Feldman *et al.* 2015), yet it is the inaccurate, biased, and dramatic messages that lead climate change educational campaigns. As mentioned previously, for researchers such as Haningan (2014) dramatic messages are important for environmental issues to be acted upon. However, for the same author the success of environmental claims may also be tied to the magnitude of audiences that are mobilised around that claim which may fail because some claims are perceived too extreme, too complex or because responses mandate too great a lifestyle sacrifice. Climate change claims are precisely *extreme* as claimed by the IPCC, *complex* because is no longer only a matter of environmental issue but a social phenomenon whereby political, economic, cultural, and psychological factors influence behaviours (Boykoff 2015; Hoffman 2015), and requires a great *lifestyle sacrifices* to reduce carbon dioxide emissions (Nordhaus & Shellenberger 2007, Bronfman et al. 2015).

Dire messages in climate change narratives, then, may not have the same impact as they had in other issues such the ozone layer depletion, for the very nature of the climate debate is too complex to mobilise audiences. In this sense, Hanningan (2014, p.67-68) stresses that for environmental claims to succeed they need distinctiveness, relevance, stature, and familiarity. Thereby, climate change claims require public ability to differentiate readily global warming from other environmental issues (distinctiveness), to see it as a short-distance threat (relevance), to link it to a symbolic reference (stature), and to know well the issue (familiarity). As previously analysed, these four points are absent among the public in that they lack of fundamental knowledge of the issue. What still remain to be undertaken, then, is to collect empirical data in order to analyse if the public's understanding of climate change would engage or disengage them with the climate social debate.

The previous paragraph puts an end to the literature reviewed for dimensions a) and b) regarding the sources of climate change knowledge and their effect on constructing the public understanding of

the issue. Now, the literature review will focus on dimension c) regarding the psychological effects of climate change therein contained. While the majority of studies reviewed are focused mainly on perceptions, it was spotted that the results presented also involve understandings and emotions as it will be later examined. At this point, it is important to mention that the narratives used in the studies that will be detailed below may suggest a likely conflicting existence of terms used by the author of this thesis and by other researchers. However, it was decided to keep the terms used by other authors because they are part of the scientific knowledge disseminated on climate change. Consequently, in the following paragraphs it will be refer to climatic changes although they are correctly denoting weather changes. Similarly, some studies will mention climate-related events as if they were the same as effects of climate change. At the same time, it is important to remember that this thesis does not intent to judge correct or erroneous knowledge but to explore in the elements constructing the public understandings and the subsequent engagement with this issue.

Regarding perceptions of climate change, Nyanga et al. (2011) indicate that farmers in Zambia perceived changes in wet and dry seasons as well as in the frequency of droughts and floods. These authors also assert that people perceived divine entities such as God as the main cause of climate change. Similar findings were presented in a study conducted in Nigeria by Ishaya & Abaje (2008), who indicate that participants have observed that temperature has risen and that rainfall has decreased, as well as have noticed changes in droughts and floods frequency. In a different continent, Carothers, et al. (2014) and Cunsolo Willox et al. (2012) presented similar results from studies conducted with Inuit people in Northern Alaska and Canada. Whilst Carothers and colleagues found that people in Northern Alaska perceived changes in snow amounts, temperature, water availability, fish distribution, and rivers and lake lower levels resulting in socio-economic and cultural changes, Cunsolo Willox and colleagues stress that in Inuit people in Canada have observed changes in local and regional weather patterns including snow amounts and quality, ice quality and stability, frequency of storms, changes in precipitation, and shifts in wildlife and vegetation patterns also resulting in socio-cultural impacts. Likewise, in India, Halder, Sharma and Alam (2012) assert that local communities perceived the impacts of climate change in the forms of increased temperature, cyclones and storms, decreased rainfall, drinking water and river levels, spreading human and livestock diseases, and reduced wildlife and forest resources.

While these studies offer relevant insights of the importance of people as assets to assess changes in weather patterns, other group of researchers validated these findings by connecting such perceptions with real weather data. For instance, in Tibetan villages a study conducted by Byg & Salick (2009) found that changes perceived by villagers regarding temperature, precipitation and glaciers stability

fitted with scientifically recorded changes of the area. Similar results were provided by Howe & Leiserowitz (2013) and Tripathi & Singh (2013). Drawing from a survey applied in the United States, Howe and Leiserowitz found that people's perceptions of weather patterns and data of local weather anomalies were correlated, whereas Tripathi and Singh illustrated that in India famer's perceptions of climate change were related to agro-meteorological data. Additionally, Cobbinah & Anane (2016), presented results from a study conducted in Ghana indicating that meteorological data and local communities' perceptions of weather patterns were aligned.

The results of these studies suggest that the analysis of peoples' perceptions of weather changes is critical for the development of scientific reports of climate change. However, such results should be analysed coupled with local weather data. This is important to bear in mind because there are external variables biasing perceptions as concluded by other group of researchers. For instance, a study conducted by Barnes, Islam and Toma (2013) with Scottish farmers found that the level of formal education determine the extent to which people perceive climate change risks. Their conclusions suggest that farmers with lower levels of education are more likely to perceive the risks. A more international study draw from Gallup World Poll data from 128 countries, indicate that wealthier countries are more aware of climate change and perceived risks in a greater extent and mainly human-caused (Knight 2016). Other researchers claimed that peoples' beliefs bias perceptions but in an asymmetric way, with those who do not believe in global warming more likely to have biased perceptions of their local climate when conditions are inconsistent with their beliefs (Howe and Leiserowitz 2013). In a study undertaken in Switzerland, Shi, Visschers and Siegrist (2015) indicate that people's perceptions of climate change are influenced by climate knowledge and cultural worldviews. They concluded that people who know more about climate change tend to be more concerned about this issue whereas people with individualistic and hierarchical worldviews were more willing to change behaviours and to accept policy measures to mitigate climate change. Finally, Weber (2016) presented a valuable review article resuming climate change perception literature. In there, he concluded that peoples' perceptions of climate change are influenced by personal experiences with weather changes, political ideology, gender, age, and nationality.

The aforementioned studies provide evidence to conclude that the climate change concept and understanding previously reviewed are additionally constructed by perceptions. Such perceptions are in turn nourished by objective and subjective variables, e.g. knowledge and individual experiences with weather changes, which interact with each other in a particular geographical context. Consequently, the examination of peoples' understandings of climate change needs to

combine their knowledge acquired from science, politicians, media, and social interaction with their perceptions and experiences of weather changes.

Thus far the literature reviewed of peoples' perceptions of climate change analyses the perception of this issue in general terms. Yet, there is another group of researchers interested in analysing how climate change adaptation is perceived and embraced. The climate adaptation research is more than an academic or scientific trend; it is a chronological alignment to the social debate of climate change. According to Hulme (2013, p.7), the twenty-first century saw the world economic activity shifting away from traditional hegemonic countries to new economic coalitions such as BRIC (Brazil, Russia, India, China). In climate change terms, these coalitions translated into the rise of global emissions of greenhouse gases and into questions of justice and development to elucidate whether mitigation strategies were the most appropriate for these newly emerging economies (2013). Adapting to climate change, then, emerged as a more central part of the debate giving way to the research of peoples' perceptions of climate adaptation.

2.2. Public perception of climate change adaptation: scientific divergences over adaptation

Adaptation to climate change has been treated differently in diverse studies and highly related to vulnerability. Some researchers sustained that despite of adaptation measures and other socio-economic variables, poor countries are more vulnerable and will suffer more the damages of climate change because of their location (Mendelsohn, Dinar & Williams 2006). In a report published on the scientific basis of climate change, Houghton et al. (2001) assert that people from developing countries are less adaptable than people from other geographical regions because they are more reliant on natural resources. Likewise, Tol et al. (2004) claim that developing countries and poor people, in general no matter where they live, are more vulnerable to climatic changes because their exposure is higher and their income and adaptive capacity is lower. Lower incomes have been linked to climate impacts by Schmidhuber & Tubiello (2007), Ishaya & Abaje (2008) and summarised in the IPCC report (2014) suggesting that people's vulnerability and likely adaptation to climate change is determined by poverty and lower grosses. Finally, Lobell et al. (2008) and Brown & Funk (2014) claim that farmers from food-insecure regions, namely parts of Americas, Africa and Asia, are more vulnerable to climatic changes because there are largely expose to weather variations and depend on the investment in technological sophistication to increase food production. Some researchers, backing this idea and assert that under the changing climatic conditions, indigenous peoples in Canada are not able to access to wild food (Cunsolo Willox et al.

2012), whereas in India local communities cannot continue their traditional agricultural practices (Halder, Sharma & Alam 2012).

The assumptions of the aforementioned studies, stress the idea of passive societies that would not react to climatic changes in the absent of financial resources and technology, being poor people, developing countries, and farmers the most vulnerable and more difficult to adapt because they fail to meet these external resources. However, Adger, Arnell & Tompkins (2005) and Adger et al. (2009) argue otherwise claiming that adaptation to climate change depends on society endogenous factors such as values, perceptions, processes and power structures within societies. In this respect, there are several studies supporting the view of strong social networks and collective behaviour as essential for adaptation. Ensor and Harvey (2015), for instance, asserted that social learning through local participation for information sharing and knowledge building benefit adaptation measures. In a study conducted in India, Thaker et al. (2016) found that perceived collective efficacy predicts the capacity of communities to adapt to undesirable changes such as drinking water scarcity. Thaker and colleagues, highlight the importance of perceived collective efficacy in that the implementation of adaptation measures depend on how convinced are individuals of their community's ability to adapt. By comparing the Hurricane Katrina disaster on the Unites States with the Tsunami in the Indian Ocean, Aldrich (2010) suggests that economic resources are not sufficient for adaptation. Aldrich found that despite of lower financial aid and more people harmed, Tsunami victims in Tamil Nadu recovered quickly from the disaster than Katrina victims because of their social networks and bonds tying citizens together. Moreover, Grothmann and Patt (2005) compared case studies from urban Germany and rural Zimbabwe and found that risk perception and perceived adaptive capacity are the main determinants for adaptive behaviour. Finally, Hart and Feldman (2014) claimed that when people perceive that they are able to take actions to address an issue and that their action will be effective they are likely to adopt actions.

Other bodies of climate change adaptation literature mainly conducted with farmers and indigenous people sustenance the premise that people always adapt to changes despite the adversities. For instance, Turner and Clifton (2009) found that indigenous people in British Columbia, Canada have adapted historically to changes innovating in the face of unseasonable rainfalls. These peoples created innovative solutions to harvest and dry seaweed and spring salmon in anachronistic months. Similarly, Salick, Fang & Byg (2009) indicate that traditional and indigenous people in Tibet have always tried to adapt to emerge weather conditions and offered adaptation techniques such as cultivating alpine medicinal plants. Wheeler, Zuo and Bjornlund (2013) found that Australian farmers' beliefs in climate change are negatively associated with adaptation to climatic changes.

Their results indicate that farmers who believe in climate change do not plan to expand their farm or increase the irrigated area but are more likely to change crops and implement more efficient irrigation systems. Another study in South America, found that farmers adjust their crop choice to fit local climate conditions indicating that if climate changes the crops distribution across the landscape will shift as a respond to a new climate (Seo and Mendelsohn 2008). In the Nile Basin of Ethiopia, a study by Deressa et al. (2009) found that farmers faced warmer temperatures with soil conservation practices, adapted crop varieties, altered planting dates, and use of irrigation. A study conducted in Mali suggests that farmers adapt to the variety of sorghum crops based on rainfall and will plant additional varieties when they can afford to do so (Lacy, Cleveland and Soleri 2006). In Mexico, Campos, Velázquez and McCall (2014) found that small-scale farmers adapt to climatic changes via diversifying their crops, switching seasonal crops, and using irrigation and agro-insurance. Campos and colleagues concluded that these adaptation strategies depend not on money but on the formal education, age and general understandings of risks. Regarding education, Adger et al. (2009), IPCC (2014b. p, 29), and Pasquini et al. (2015), claim that adaptive capacity is built among other factors by access to information, education, knowledge, and awareness of the impacts of climate change.

Yet, another group of researchers took the debate of climate change adaptation even further indicating that real vulnerabilities rely on social inequalities and injustice. In this arena of knowledge, a bulk of studies centred their analysis on Latin American countries. For instance, Rojas Hernández (2016) asserts that the real vulnerability that people in Latin America face against climate change is rooted in historical social inequalities, indicating that the strategies to cope climate change must overcome poverty and reduce inequality. In this respect, Eisenstadt and West (2017) contend that conceptualizations of vulnerability indeed should be tailored to the particular experiences of individuals in Latin America that involves indigenous worldviews, whereas Kronik and Verner (2012, p. 97-111) assert that indigenous peoples are constantly adjusting their productive activities to cope with the effects of climatic changes according to their worldviews, yet, their resilience may be enhance by well-functioning overgenerational practices common among indigenous communities. In the same token, Corral-Verdugo and Pinheiro (2009) stress that Latin American countries share a deal of environmental and social problems that do not only include biodiversity loss but subsistence and the fight against impunity and social injustice, conditions that are not supportive for sustainability and that need to develop conceptual and methodological approaches that correspond to the idiosyncrasies of the region. In the praxis, the most emblematic Latin American project to tackle climate change, although unsuccessful, was the *Yasuni ITT* in Ecuador. Contrary to the Kyoto Protocol it did not look at carbon markets but to avoid its emission

by keeping oil underground and being compensated by the international community (de Sousa Santos 2011). This project was a response to social inequalities that oil extraction entails when internal policies are fragile to protect people. According to de Sousa Santos (2011), this project was too threatening for global capitalism and oil interests and required a great lifestyle changes in the westerns hemisphere. Its failure only represents the real climate change vulnerabilities that people in Latin America face against western hegemonies. Similarly, Carey (2010) claims that the success of climate change adaptation projects in Andean countries and worldwide will depend as much on understanding social relations and power dynamics insomuch as local resistance to adaptation measures may have to do with who is proposing them and with what the plan recommends. Carey's insights take as basis the threats of glacier melting in Peru to shown how the imposition of foreign neoliberal policies deepen local vulnerabilities to glacier disasters which increased after privatization of glaciers and energy derived from them.

The claims of the aforementioned authors challenge the scientific evidence of the necessary factors for adapting to climate change. Thereby, the debate is no longer about the data generated by scientists but as the information that is interpreted, transmitted and received by the public. According to Hoffman (2015), physical scientists do not have the final word in the public debate of climate change since the conclusions validated by the scientific community is filtered by the public through their own worldviews. This deserves more attention in considering that the implementation of strategies to cope and adapt to climate change depend not only on regulatory bodies but on the daily choices made by individuals (Rojas Hernández 2016). It is therefore pivotal to recognise what sort of filters people use to understand, perceive, and emotionally experience climate change.

Succinctly, it can be inferred that farmers and indigenous people adapt to climatic changes based on their beliefs, worldviews, understandings, education and other demographic factors. In this sense, as suggested by Adger, Arnell & Tompkins (2005), it is difficult to differentiate climate responses from other demographic, cultural, and economic responses. For instance, Petheram et al. (2010) found that indigenous groups in Australia continually returned to discuss non-climate-related issues despite the researchers intentions to collect views on adaptation to climate change. In a study conducted in Sahel by Mertz et al. (2009), it was found that despite farmers' perceptions of reduced rainfall it was farm equipment, fertilizers, and seed the drivers of adaptation strategies. Similarly, other group of researchers suggest that any factor threatening peoples' livelihoods prompt adaptation to emerged changes (Mbow et al. 2008; Below et al. 2015). Thereby, in this thesis it is assumed that people will adapt or at least will try to adapt by trial and error to climatic changes regardless exogenous factors, such as money or technology, or endogenous factors such as the self-

perceived collective or individual adaptive capacity. It is hypothesised a rather state of mind that prompt individuals to adapt when their livelihoods are jeopardised and their needs are not met. A situation that is claimed to have been present among Latin American societies since their inceptions (William Miller 2007, p. 11-26), and why not to say since the establishment of the first human nomadic groups.

Learning more about local adaptation strategies have particular significance, when considering that more than 50% of the world's population live in rural environments that depend directly on agricultural livelihoods (McIntyre et al. 2009), and that the global population need to ensure its increasing demands for food (Godfray et al. 2010; Wheeler & von Braun 2013). Therefore, farmer's adaptation to weather changes emerges as an issue that concerns everyone. In this regard, Godfray et al. (2010) suggest that optimising the already existent complex landscape of production should be paramount more than setting an only goal seeking the mere maximising of the productivity.

On the other hand, adaptation studies among non-farmers and non-indigenous have been mainly conducted in the United States, Europe and other western countries. The study by Ford, Berrang-Ford & Paterson (2011) is very substantial in this respect in that it summarises the adaptation patterns in western European countries, North America, New Zealand and Australia. Their findings suggest that adaptation strategies in these countries are documented in the transportation, infrastructure, and utilities which are motivated by weather anomalies such as hurricanes. There are certainly big differences among regions regarding adaptation strategies and the motives triggering them. Thereby, while in developing countries is about subsistence and social inequalities, in developed countries is about risks assessment and awareness. These differences may be well extended to occupations and places of residence, yet there are few studies comparing variations of opinions on climate change adaptation between or within occupations and places of residents.

As previously observed, research collecting opinions on climate change adaptation regarding the occupation have been mainly conducted with farmers, with an existent small proportion of studies conducted with scientists or academic experts. The work by Nordhaus (1994), compared groups of social and natural scientists and concluded that whilst social scientists agreed that human economies will readily adapt to the impacts of climate change, natural scientists voiced deep concern about the ability of natural ecosystems to adapt. Drawing from a survey applied to environmental biologists to learn their opinion on biotic responses to climate change and potential adaptation strategies for plants and animals, Javeline et al. (2013) concluded that the higher biologists self-assessed their knowledge of climate change, the higher their estimation of future temperature increase and species extinction. In another study, Moloney et al. (2014) compared the opinions of the general public and

scientists/academics and found that both groups refer to climate change by using similar terms such as ‘ability to adapt’, ‘impact’, and ‘inevitable’, but only scientists/academics utilised terms such as ‘mitigation’ and ‘carbon management’. The conclusions of these studies suggest that within scientist opinions regarding climate change adaptation differ, with biological scientists less confident about natural system’s capacity to adapt to climatic changes. Ecologists and biologists have been previously characterised as alarmists and pessimist always worried on plants and animals (Nordhaus & Shellenberger 2007, p. 39). Yet, Javeline et al. (2013) contend that biologist should inform policy makers because of their self-reported knowledge and number of publications on the topic. Gruber et al. (2015) argue otherwise, and suggest that when it comes to climate change adaptation there are some roles most suitable for academics and scientists to fulfil and others that are more appropriate for local actors. Whilst the arguments of these studies suggest a dispute between scientists/academics, they also highlight a divergent viewpoint from that of farmers regarding adaptation stressing an interest of comparing the perceptions between these social groups.

With regards to places of residence, studies comparing opinions of climate change adaptation between rural and urban residents in developing countries are neglected with existing studies concentrated on the United States, Europe, and Australia (Capstick et al. 2015; Ming Lee et al. 2015). In addition to the geographical location, previous studies rather looked at knowledge, awareness, and perceptions of climate change to establish correlations with gender, age, and country (Byg & Salick 2009; McCright 2010; Stokes, Wike & Carle 2015; Knight 2016). Comparing the opinions and perceptions of rural and urban residents regarding climate change adaptation, then, stands out as a research question that needs to be further explored.

In short, the literature reviewed about climate change adaptation, suggest that there is a tendency among biologists and ecologists to perceive climate adaptation as a difficult path, whereas farmers in Africa, Asia and the Americas seem to adapt to weather changes. Urban environments of western countries also seem to adapt though in a different manner than farmers in rural environments. Thereby, adaptation to climate change emerges as a mechanism that is perceived and embraced through different demographic lenses creating multiple subjectivities that obscures the establishment of a single adaptation framework. In this respect, Taylor (2017, p. 7) suggests that climate change literature present adaptation as a technical process of planned social engineering forgetting that communities are not homogenous and that vulnerability and adaptation is determined by pre-existing social differentiation. Likewise Eriksen, Nightingale & Eakin (2015), propose re-framing adaptation as a socio-political process struggling over authority, knowledge and subjectivities across scales by multiple actors. In the same token, Eriksen and colleagues argue that

what is perceived as positive adaptation to one social group may be seen as mal-adaptation to another. Similarly, Adger et al. (2009) mention that what may be a limit for adaptation in one society may not be in another suggesting that adaptation to climate change is socially constructed and depends on societies' ethics, knowledge, risks, and cultures. Moreover, Clayton et al. (2015) indicate that there is a need to identify non-financial factors influencing in the adoption of climate change behaviours. This complex idea of multiple subjectivities involving climate change adaptation may be well extended to the individual, in that members of the same community may perceive and embraced adaptation differently. Thus, the collection of the opinions on climate change adaptation of farmers, rural/urban residents, and academic-based researchers working in conservation, are demanded to build and buttress the idea of multiple adaptation frameworks within the analysis of the person's place of residence and demographic background particularly occupation.

2.3. Psychological impacts of climate change: the emotional states implied

When commencing this Chapter, it was mentioned three dimensions interacting each other to construct a climate change concept. The precedent paragraphs explained at length one part of the dimension c) regarding peoples' perceptions of climate change. Nonetheless, this dimension is constituted by a more pervasive psychological aspect called emotions. Hulme (2015) asserts that climate change has provoked a wider range of emotional expressions. Indeed, there are several studies analysing the spectre of emotions evoked by climate change, although they are more implied than direct mentioned.

Because the social debate of climate change has circa of three decades, a group of researchers examined how the public in the United States, Europe and Australia has engaged over the years with this climatic issue. Their conclusions, though concentrated at analysing public concern and scepticism, provide significant insights about the emotional states buttressing this social debate. For instance, Nisbet and Myers (2007) analysed Gallup polls from 1987 to 2007 and found that public opinion in the US on climate change have shifted over the years between 'concern' and 'scepticism' with more people concerned in 2006 and 2007 and more sceptic in early 1992. In 2009, Maibach, Leiserowitz & Roser-Renouf added other emotional labels to the spectre of 'concern' and 'scepticism' dividing the US public in segments according to some emotional states such as 'alarmed', 'doubtful', and 'dismissive'. In later years, Capstick et al. (2015) conducted a similar analysis but based their conclusions on 33 studies worldwide to examine the trends of public perception over the past quarter century. Their findings suggest that public perception of climate

change had a period marked by growing public ‘concern’ between mid-1990s to mid-2000s, followed by increasing ‘scepticism’ in some nations between mid- to-late 2000s, and by an apparent later stabilisation of public ‘concern’ in the 2010s. Although scepticism is not an emotion, it is salient that the studies reviewed report scepticism rather as ‘doubtful’ in an emotional context between belief and disbelief. Thereby, scepticism may be well analysed as a collective emotion in the climate change debate. Collective emotions are felt because one member of a group is exposed to an emotion-eliciting event (Caillaud *et al.* 2016). For Caillaud and colleagues, when individuals judge their group to be responsible for an event, such as climate change, and if they identified with that group they may experience a collective emotion of ‘guilt’ or ‘shame’, and in this case of ‘doubtful’ or ‘scepticism’

The idea of labelling the public opinion of climate change in two polarised states, namely ‘concern’ and ‘scepticism,’ is seen as problematic by Howarth and Sharman (2015). These researchers claim that current labels such as ‘dismissive’, ‘denial’, ‘sceptic’, ‘alarmist’ or ‘concern’ obscure particular middle points of view involved in the climate social debate, asserting that more research is necessary to unveil other types of labels existing between ‘concern’ and ‘scepticism’. Thereby, current literature fails insofar as it lacks of sufficient evidence about non-polarised opinions on climate change. However, the analysis of the psychological impacts of climate change may provide these middle opinions. For instance, Doherty and Clayton (2011) point out that self-reported emotions are common in the climate debate. Although these researchers did not collect first-hand evidence, they were able to identify in climate change literature some emotional states such as ‘disgusted’, ‘hopeful, ‘helpless, ‘sad’, ‘depressed’, ‘guilt’, ‘anxiety’, ‘despair’, and ‘worry’. A relevant study that indeed collected first-hand evidence was conducted by Smith and Leiserowitz (2014), who presented to a sample of people in the United States a list of emotions to evaluate how these people feel about global warming. Their results indicate that people mainly experience ‘interest’, ‘disgust’, ‘worry’, ‘hope’, ‘helplessness’, ‘anger’, or ‘sadness’, concluding that people experiencing concern are more likely to support national climate and energy policies. The claims of the above mentioned studies suggest that middle opinions on climate change may well be analysed through emotions.

Other group of researchers extended the importance of emotions in the climate debate but focused on single emotions. For instance, Garvey (2010) placed his attention on the importance of ‘guilt’ as an emotion that may motivate people to take actions on climate change. Aitken, Chapman & McClure (2011), analysed the effects of experiencing ‘powerlessness’ on individual and collective engagement in climate change significant behaviours. They concluded that individuals who feel

more powerless are less likely to take action on climate change and to consider this issue an important factor when changing their behaviours. Heyd (2010) also analysed 'powerlessness' but in a different way, indicating that when governments fail to implement measures for mitigation and adaptation to climate change, citizens tend to feel inoperable. Ojala (2012; 2015) focused her research on the impacts of 'hope' on climate change pro-active behaviour, concluding that 'hope' can be positively or negatively associated with engagement depending on the sources of 'hope'. Thus, hope based on positive reappraisal and trust in lay people and other social actors is a motivational force, whereas hope based on denial of the seriousness of climate change is negatively associated with climate engagement. Myers et al. (2012) tested framed messages of health and national security to arouse 'hope' and 'anger' about climate change. They found that a national security message arouses 'anger' among some segments of the US public, whereas health messages arouse some 'hope'. Stevenson and Peterson (2016) delved deeper on 'hope' and 'concern' suggesting that both sentiments are related to proactive behaviour. Finally, Barnes, Islam and Toma (2013) and alleged that 'confusion' or 'denial' are commonly when exploring climate change perceptions and that such sentiment is related to the sources of information particularly those from conservation bodies and government.

Yet, other group of researchers brought back to the debate studies of public concern on climate change, but this time offered some socio-demographic variables influencing climate change concern. For instance, Brulle, Carmichael and Jenkins (2012) found that media coverage and elite cues from politicians and advocacy groups have a significant impact on US public concern over climate change. Drawing from a survey data conducted in Switzerland by Shi, Visschers &Siegrist (2015) and in Canada, China, Germany, Switzerland, the UK and the US by Shi et al. (2016) these researchers stressed that people with more knowledge about the causes of climate change is more concerned about the issue. Shi and colleagues also found that gender, age, and country play a role in the public concern over climate change whit women and younger individuals in the UK and women in Germany more concerned.

The impact of knowledge, gender, age, and country on climate change concern is buttressed by other researchers. Regarding knowledge, Malka, Krosnick & Langer (2009) argue that knowledge of global warming is associated with public concern which varies according to trust in scientists and party identification. McCright (2010) goes further connecting knowledge and gender with levels of concern, his findings revealed that women exhibit higher levels of both knowledge and concern on climate change. Hardesty (2015) argues otherwise, indicating that College grade level and environmental knowledge are not related to levels of concern for the environment. In an analysis of

global concern of climate change, Stokes, Wike & Carle (2015) found that US women, young people and those with lower incomes are more likely to express concern. Stokes and colleagues also mentioned that Latin-Americans and Sub-Saharan Africans are more concerned about the impacts of climate change. Ming Lee et al. (2015) extended the idea of the influence of the country of residence on public concern but linked to political orientation. They claim that citizens in the US who are liberals and democrats and those with high levels of civic engagement are more likely to express concern about climate change. Political orientation has been also associated with the other extreme of public concern by Whitmarsh (2011). This researcher contends that people with right-of-centre political views and low-environmental values are more sceptical about climate change. More research involving demographic variables such place of residence, level of education, and household income have been also found as strong predictors but related to climate change awareness (Ming Lee et al. 2015). Finally, Bronfman et al. (2015) link economic status with higher levels of concern and environmental behaviour.

As rewarding though it may be, the conclusions of the aforementioned studies neglected that a person experiences various emotions at the same time (Lazarus 1991 p.67), particularly secondary emotions which arouse from the combination of two or more emotions (Coon & Mitterer 2010, p.341-342). Even in experiments inducing single emotions people tend to feel various emotions as found by Drouvelis and Grosskopf (2016). These researchers tried to induce 'happiness' and 'anger' to persuade pro-social behaviour and found that when inducing 'happiness' people also experienced 'joy' and 'warmth' and when inducing 'anger' people also felt 'fear', 'sadness', and 'irritation'. In the analysis of 'confusion', Sisgold (2009) claims that people feeling confused are indeed experiencing an emotional disequilibrium amid two sentiments. Likewise, Baumeister, Stillwell & Heatherton (1994) delved deeper in the analysis of 'guilt' stressing that this emotion has the form of guilt itself and 'shame' each with its own action tendency. Similarly, TenHouten (2016), postulated 'resignation', 'submissiveness', and 'shame' as the three additional emotions experienced by people feeling powerless and that previous studies failed to identify. The assumptions of these studies, suggest that a joint analysis of the group of emotions experienced by people towards climate change is required to understand the action tendency to cope with this issue. This brings back the claims by Howarth and Sharman (2015) about identifying other types of labels between 'concern' and 'scepticism'. Additionally, Clayton et al. (2015) acknowledge that there is a need to identify the circumstances under which individuals take action alone or collectively. In this sense, the analysis of emotions provides a prevailing tool to elucidate the individual action tendency to cope with a climatic change.

Emotions are pervasive drivers in the decision making process in that they influence judgments and choices (Lerner et al. 2015). Emotions are linked to basic adaptive behaviour such as attacking, fleeing, seeking consolation, helping others and reproducing (Coon & Mitterer 2010, p.341). Indeed, emotions motivate or halt actions to avoid anti-social behaviour (Baumeister & Bushman 2008, p. 181-183). For instance, Wang & Wu (2016), determined that 'pride', 'guilt', 'respect', and 'anger' have a positive influence on the intention of sustainable consumption choices. According to Mayerfeld Bell (2012, p. 54), sentiments of 'concern' are often appealed to raise among consumers the desire of purchasing goods. In an analysis of 'confusion', D'Mello et al. (2012) contend that 'confusion' influence positively on the learning process. These researchers indicating that this emotion is triggered when a person is forced to make a decision during an ongoing mismatch between incoming information and prior knowledge that instigates to a cognitive disequilibrium. In regards to 'shame' and 'guilt' Niedenthal, Tangney & Gavanski (1994) and Silfver (2007), offered that both emotions involve negative self-evaluations, but only 'guilt' involves specific behaviours with reparative action. For these researchers an ashamed person feels small, worthless and powerless to take action, whereas a guilty person experience remorse and regret and would enhance moral and pro-social behaviour. 'Powerlessness' is perhaps the most solid emotion preventing action. In this respect, Ajzen (1991) asserted that a person feeling powerless self-judged a low level of control over a situation preventing behavioural achievement and action. In the research area of 'anger', Baumeister & Bushman (2008, p. 194) asserted that angry people are highly motivated to take action although effective or desirable actions are rarely chosen, indeed angry people often make poor choices.

In relation to climate change research, Doherty and Clayton (2011) claim that emotions determine people's behaviour and that an effective management of them is optimal to unfold the psychological impacts of climate change. In the same token, Caillaud et al. (2016) argue that public discussions about causal agents of climate change generally evoke negative collective emotions of 'shame', 'guilt' and 'powerlessness' in that they transfer responsibility to governmental systems playing down the role of individual responsibility and increasing support for the status quo and confidence in a system that contributes to climate change. 'Shame', 'guilt', and 'powerlessness' have been also analysed by Brügger et al. (2015) who claim that when people feel that they are not able to mitigate or to adapt, they may deny responsibility for causing and acting on climate change. These researchers also argued that for people to make amends for what they feel guilty for, various preconditions need to be met, namely assumed responsibility, awareness of response options, and belief in their self-efficacy. Finally, 'powerlessness' has been highly correlated to lower levels of climate change action (Aitken, Chapman & McClure 2011).

In a nutshell, the literature reviewed thus far about the psychological impacts of climate change suggests that this issue deploys a wide array of emotional states that may explain the middle points hidden in the polarised climate debate. The emergence of these emotional states, also suggest that the public's engagement with this issue may well be reflected in the kind of emotions climate change arouses in people. As with perceptions, the kind of emotions that are aroused in people varies according to cultural conditions. With this respect, Evans (2001, p. 18) claims that there are specific emotions that will not develop unless special conditions are in place, conditions that are provided only by particular cultures. Some examples of these emotions are 'guilt', 'shame', and 'powerlessness. In this sense, it becomes necessary to collect first-hand evidence to confirm the emotion categories implied in previous research. These emotions include, but are not limited to 'guilt', 'concern', 'confusion', 'powerless', 'indifference', 'scepticism'. First-hand evidence should also bestow people the agency to report by themselves the grounds for experiencing certain emotional states. This is important, for specific emotions will be identified only by content analysing genuine peoples' words. Finally, because the experience of some types of emotions is associated with socio-demographic variables, it is relevant to elucidate what demographic variables are involved.

Succinctly, in the development of this Chapter it was observed that climate change has shifted from a scientific debate over its existence to a social debate that involves political agendas, media attention, and diverse cultural values, worldviews, multiple realities, local knowledge, and the perception of authority and power. Together, these arguments suggest that more than a physical phenomenon climate change is a concept that is socially constructed whereby scientific knowledge, discourses portrayed by media and politicians, and psychological aspects, namely perceptions and emotions, contribute to engage or disengage the public with this climatic issue. With this as a backdrop, in the next Chapter I will delve deeper into the methodological approach, research structure and strategy, and methods that may be more suitable to examine this socially constructed process.

Chapter 3

Methodology

The initial subject of this Chapter is the theoretical contextualisation of the research strategy and approach followed by the geographical context of climate change research. Thereafter, the focus is on methodological approach and ethical considerations that had driven the research design structure and selection of the study area and target groups. Subsequently, the emphasis is on the sampling strategy and the survey instruments selected. The Chapter finishes by describing the data analyses carried out.

3.1. Theoretical contextualisation of the research strategy and approach

In the previous Chapter, it was observed that the public understandings of climate change and their subsequent engagement is adjusted to local and individual perceptions and emotions. It was also suggested that the concept of climate change and its effects, are socially constructed bringing into line to local objective realities. Indeed, among the scientific community, it is widely accepted that the global effects of climate change are experienced locally and according to people's worldviews (IPCC 2014a; Hulme 2013). An eloquent example of this process is provided by Mark Carey (2010) who built his insights from one of the most iconic visual representations of global warming to draw his conclusions. Carey delved deepen in the study of shrinking Andean glaciers in Peru and found that this phenomenon has been only tangentially related to climate, science, or climate change. In his analysis, Carey argues that the real threats that people face against glaciers melting are a matter constructed by historical processes that are associated with social inequalities and power structures. He also stresses that people threaten by glaciers melting are mobilise to take actions only when the measures proposed to them do not opposed their cultural beliefs and do not undermine their societal structure of power. Carey's claims have been buttressed by Rojas Hernández (2016), who contends that one of the central issues that societies face against climate change, particularly in Latin American, is related to social injustice, whereas Mayerfeld Bell (2012) argues that there is a striking unevenness in the distribution in environmental costs and benefits that can lead to the sidelining of concern and action about environmental consequences. For Mayerfeld Bell, peoples' lives are guided by the possibilities of their social situation and by their vision to what those possibilities are

(2012, p. 37-38). That is to say people may grow concern about climate change and take actions to avoid its damages, based on the possibilities offered by the society in which they developed. Therefore, in order to elucidate people's engagement or disengagement with climate change and to confront the impacts of this issue it is essential to become acquainted with the society in which climate discourses are produced.

According to Rojas Hernández (2016), a society is a living and highly complex organism whose members' behaviours and motivations are unknown, for each society and each of its members may react differently to the same phenomenon. The uncertainty characterising human behaviour is linked to cultural factors insomuch as behaviours are socially constructed (Hanningan 2014, p. 31-32). Social constructions have been analysed by Bohensky et.al. (2015, p.143-145) in the field of resilience, who assert that insofar as resilience is partly driven by decisions taken by actors it is necessary an understanding of actors' mental models. For these researchers, mental models are culturally constructed and function as schema that describes and make meaning of understanding and experience the world through language, metaphors and power structures. In the field of environmental concern, it is contended that despite the arguments that public perceptions of environmental issues depend primarily on the mass media, the effects of the media on the popular consciousness depends on how the content is interpreted by the audience because readers and viewers socially construct their meaning of media texts and imaginary (Kalof 1998). Similarly, Mayerfeld Bell (2012) claims that a society constitute the circumstances in which people make environmentally significant decisions bringing the idea that environmental actions are taken according to the circumstances a society constructs. Environmental discourses are also claimed to be socially constructed in that the concept of nature and environment can only be conceived through the language that people employs to talk about it (Hanningan 2014, p.73-75).

The concept of social construction has been extended to the field of climate change, whereby it is argued that climate physical data and statistical models are filtered through multiple worldviews and perspectives (Hoffman 2010).This idea of social construction has been mainly claimed by (Hulme 2015) who asserts that the way climate change is experienced varies between individuals and societies in world. Hulme's arguments has been expanded by other researchers, who stress that public perception, concern, scepticism, and emotions towards climate change are socially and culturally constructed (Vedwan & Rhoades 2001; Carvalho & Burgess 2005; Grothmann & Patt 2005; Antilla 2010; Leombruni 2015; Weber 2016). Here, psychological, economic, political, and historical aspects intertwine to construct an understanding of this climatic phenomenon. This

constructivist view has been advanced by Esbjörn-Hargens (2010), who concluded that climate change is defined and surrounded by multiple realities and viewpoints. In this sense, the selection of a research approach for this thesis should rely on subjective experiences and multiple perspectives as conductors to elucidate what kind of meanings has climate change to people and how they engage or disengage with the issue.

With the aim of finding such research strategy that would help to frame the methodology and data collection process within the characteristics of multiple realities perceiving the same phenomenon, a post-positivist approach came across. However, this approach incorporates an ontological and epistemological belief of a single reality that can only be approximated and constructed through research and statistics and that it not relies on subjective experiences (Creswell 2009, p.6-9; 2013 p.23-37). Yet, judgments and decisions in the domain of climate change have been largely driven by positivist research underestimating subjective personal experiences (Weber 2016). Positivist research, moreover, ignores that the social context in which people live and interact is subjective and may change over time (Creswell 2009). On the contrary, a constructivist approach examines all different social views shaping the construction of peoples' understandings of the world they live (Creswell 2009). Constructivism holds assumptions that individuals develop personal meanings of their experiences, a key aspect of consideration when examining peoples' perceptions of, and experiences with climatic changes. Moreover, constructivism integrates ontological and epistemological beliefs of multiple realities that are constructed through our lived experiences and interactions with others, and co-constructed between the researcher and the researched (Creswell 2013, p 24, 37). In the arena of constructivism, the theory of social construction of reality posited by Berger & Luckmann (1966) is a classic and perhaps one of the most intelligible to comprehend how societies build their understanding of the world.

According to this social theory, human knowledge evolves in society *a priori* of individual experiences which will be constructed according to a particular social and historical context. Given that individuals are part of society since birth, an inevitable social interaction occurs between members of the society wherein individual knowledge is shared through language, creating a reality that is subjectively meaningful. The society thus accumulates a pool of knowledge that is transmitted from generation to generation. However, before this knowledge is transferred, a process of institutionalisation and legitimation occurs. The institutionalisation imparts basic knowledge, named by Berger and Luckmann as *recipe knowledge*. The ordinary person tends to accept these recipes as objective realities without questioning them. As a result, society communicates an

unchallenged knowledge to the next generation, which in turn transmits this knowledge to even further geographical spaces without knowing the origins of such knowledge. A knowledge paradigm is thereby created, which will endure as institutions control this knowledge, and societies legitimise it. As observed when commencing this Chapter, this theoretical perspective has been considerably developed in environmental and climate change issues and will be considered in this thesis to guide the exploration of those elements that help individuals construct their understanding of climate change. Thereby, what it has been here described provide what I believe are the foundations for selecting constructivism as the research strategy for this thesis.

3.2. Geographical context of climate change research

In regards to the issue of climate change, Capstick et al. (2015) argue that there is a bias toward studies of public perceptions of climate change in developed countries whilst the climate impacts are felt around the globe. Ming Lee et al. (2015) support this argument indicating that current research on public perceptions of climate change has been dominated by studies from Australia, the United States and Europe. Both studies analysed the international trends in public perceptions and awareness of climate change and based their conclusions on research published in the past quarter century (Capstick et al. 2015) and Gallup Polls (Ming Lee et al. 2015) collecting data from urban dwellers. That is to say there is a tendency to analyse the perceptions of urban members of the general public, whereas little attention has been given to particular groups such as academy-based researchers working in the field of conservation. According to Gruber et al. (2015), climate change measures should be draw by bringing together the perspectives of a broad and diverse group of stakeholders including among others, academics and scientists in that a share feedback from participants from all sites allows to clarify the roles of universities and other social institutions in climate change plans. Yet, as it was observed in Chapter two, Section 2.2, research conducted with academics is sparse (e.g. Nordhaus 1994; Javeline et al. 2013; Moloney et al. 2014; Aguirre et al. 2015), whose findings point out differences in the perceptions of climate change between scientific disciplines as well as between scientists and non-scientist, suggesting a variety of opinions worthy to analyse.

Those studies that have been undertaken in other geographical regions and with different social clusters have usually gathered data from groups of farmers though about measures to adapt to climate change. This was introduced at length in Chapter two, Section 2.2. Succinctly, the accounts therein describe that farmers' livelihoods, in particular in the context of developing countries, have

been studied in relation to climate change mainly in order to understand for their vulnerability to changes (e.g., Schmidhuber & Tubiello 2007; Byg & Salick 2009; Brown & Funk 2014), their adaptation capacity (e.g., Lacy, Cleveland & Soleri 2006; Seo & Mendelsohn 2008; Cunsolo Willox et al. 2012; Halder, Sharma & Alam 2012; Campos, Velázquez & McCall 2014), or their reliance on weather conditions (e.g., Turner & Clifton 2009; Mertz et al. 2009). Yet, there is a tendency among a group of researchers to use the view of western lenses to judge non-western communities' understandings, vulnerabilities and perceptions of climate change. indeed, according to Taylor (2015, p. 6) and Eriksen, Nightingale & Eakin (2015), current climate change adaptation literature neglects how different social groups experience and respond to climatic changes, while simultaneously failing to view pre-existing social differentiation as an important vector of vulnerability.

Those researchers, who came to acknowledge the relevance of gathering the opinions of other worldviews, have traditionally collected data from indigenous communities. For the sake of this research I will centre on the Latin America region and the book by Kronik and Verner (2010) helps to summarise the vulnerabilities and adaptive capacity of indigenous peoples in Latin America and the Caribbean. Kronik and Verner claim that the impacts of climate change falls disproportionally on indigenous groups not only because they live in intimate ways with their natural systems but because of their dependence of cultural and social cohesion. For these authors, fundamental for many indigenous peoples is to keep the balance between human, natural and cosmological realms, so when changes occur, for example, weather conditions, indigenous people look to themselves and trust their institutions and practices to find the agent causing the imbalance in order to apply rectifying actions (2010, p.4). The ways indigenous populations cope with changes varies along the Americas and depend on the region they live, be it the Andes, the Amazon basin, or the Caribbean and Central America. For instance, the work by Perez et al. (2010) points out Andean folks face the threats of climate change in Bolivia, Ecuador, and Peru through intercropping, holding different plots in different ecological zones, and matching plating dates and crop varieties with rainfall patters, whereas Seo & Mendelsohn (2008) claim that the distribution of crops across the landscape in Argentina, Brazil, Chile, Colombia, Ecuador, Uruguay and Venezuela, is determined by farmers' responses to a new climate. In Mexico, Campos, Velázquez & McCall (2014) found that farmers cope with changes based in their general understanding of the climate risks and their detailed knowledge of physical environment.

Whilst the abovementioned studies give good insights on the vulnerabilities that indigenous groups face against climate change as well as on the adaptation measures they take; I believe it would be

fair-minded to acknowledge that such vulnerabilities and measures are shared with the full range of social groups that constitutes Latin America. That is to say despite societies in this region are extremely rich in geographical, climatic, ethnic and cultural diversity, their members share similar priorities such as daily subsistence as well as environmental problems and injustice (Corral-Verdugo and Pinheiro 2009). In this sense, other ethnic groups such as *mestizos*[10] are as good assets as indigenous populations for perceiving weather changes and assessing adaptation measures, yet they may provide a different perspective of the same issue. Mestizos are one of the largest ethnic groups in Latin America, therefore there is quite much to collect from the perspectives of this social group in order to inform our understanding to construct a wider array of conceptual and methodological approaches that corresponds to the idiosyncrasies of the region.

In the Latin American region, I will focus on my own nation Ecuador. As any other Latin American country, Ecuador is considered as multi-ethnic, pluricultural and megadiverse. These characteristics have been included in its national planning policy through the establishment of the *Plan Nacional de Buen Vivir* or *Sumak Kawsay*. This plan incorporates highly innovative political constitutions that contain the promise of alternative conceptions of the state (plurinationality, participatory democracy), of development (good living), and of human rights including the rights of nature (de Sousa Santos 2011). In the area of climate change, the country counts with a National Strategy that incorporates mitigation and adaptation measures, a National Secretary, a State Policy, and an Interinstitutional Committee (MAE 2012, p. 8). Additionally, the Central Government formulated two emblematic projects aimed to reduce carbon dioxide emissions and deforestation rates, *Socio Bosque* and *Yasuní ITT*. Both projects received large international and national media attention because of the polemics raised around the failure of Yasuní ITT and the apparent success of Socio Bosque. Generally speaking, Ecuador is characterised by a constant fight against neoliberal development plans and the inclusion of more autochthonous environmental ideologies and cosmovisions (Vanhulst 2013), added to multiple views that the public has developed on a range of climate-related issue (Eisenstadt and West 2017). These particularities make Ecuador an appealing country to analyse the perceptions and perspectives of climate change.

Similar to other countries in the region, much of the climate change research in Ecuador has focus on indigenous populations. Here, the work is concentrated on the perceptions of weather and climate variability. For instance, Rhoades, Zapata Ríos and Aragundy (2006) found that indigenous

[10] In Ecuador, mestizos comprise mixed ancestry of Spaniards and South American indigenous as well as mixed ancestry between white populations and Ecuadorian Mestizos. Together, mestizos represent the 71% of the Ecuadorian population.

agriculturalists perceived the effects of climatic changes on water availability, glaciers retreat, and rainfall patterns as well as some climate-related effects on people's behaviour and traditional indigenous knowledge. The work by Zavgorodniaya, Costales and Enríquez (2016, p.114-115) conducted with three indigenous communities in central and northern Ecuador, found that the communities shared the perception of varied rainfall patterns which is in turn aligned to meteorological data of the region. Rebaudo and Dangles (2015) ran simulations of pest control management under different scenarios of weather variability with potato growers in Ecuadorian Andes and determined that farmers improve their pest management over time but that such improvement decrease in the presence of temperature variability. They also found that temperature variability produce heterogeneity in farmers' pest control strategies. In the southern Andes, the information is sparse and is represented by the single study by Aguirre et al. (2016 p. 39-46), who rather analysed the opinions of experts concerning the vulnerability of the southern region to climate change. Finally, Eisenstadt and West (2017) collected data regarding the cosmovisions of Amazonian indigenous in central Ecuador and found that individuals who held indigenous cosmovisions, support western science, and live proximate to oil extraction tend to believe in climate change, concluding that indigenous cosmovisions are strongly correlated to the propensity to believe in climate change and to share the view of western environmentalism.

The findings of the abovementioned studies raise questions regarding the demographic background of the informants as well as on the type of questions used. In the study by Eisenstadt and West, for instance, it was noticed that participating indigenous are part of organizations such as ECUARUNARI[11], and PACHACUTIC[12] who work closely with local ecologist groups such *Acción Ecológica* and *Yasunidos* whose interests seek to create and maintain protected areas with lighter human presence in the sake of climate change. According to Rojas Hernández (2016), environmental organisations are claimed to share a vision that is disconnected from the view of traditional rural indigenous farmers and dwellers with lower incomes whose livelihoods assiduously need to extent their agricultural frontier and deplete forests to survive. Thereby, for this thesis purposes it was considered necessary to collect data from social groups that have not collaborated before with any type of environmental organisations with the aim avoiding biased answers. This brings back the idea of collecting opinions and perceptions of social groups that have been scarcely approached for climate change purposes such as *mestizo* farmers and dwellers residing in rural and urban areas. Additionally, in considering that environmental contents are socially constructed

[11] Ecuador Runacunapac Riccharimui, Movimiento de los Indígenas del Ecuador.
[12] Movimiento de Unidad Plurinacional

(Kalof 1998; Mayerfeld Bell 2010), I believe that the opinions and perceptions of *mestizos* dwellers and farmers may differ from those of indigenous populations in that their belief systems about climate change are constructed in different social atmospheres.

Regarding the questions used to collected data, it was observed that terms such as 'climate change' or 'global warming' were directly asked to participants when gathering their perceptions of this issue; this was actually observed in the whole climate change literature reviewed. Because the concept of climate change is socially constructed (Hulme 2015; Esbjörn-Hargens 2010), I believe that the use of these terms may influence participants' answers in that societies help to construct individual mental models (Bohensky et al. 2015, p.143-145). Therefore, data collection instruments should find alternative manners to bring the topic very carefully in such a way that it does not influence the answers. This should be accompanied by multiple data collection instruments that help to cover the wide spectre of understandings, perceptions of and emotions of diverse social groups.

3.3. Research design structure and ethical considerations

The overarching goal leading the research was to obtain an in-depth insight of the processes through which people construct their understandings, knowledge, perceptions, and emotions towards climate change. According to Newing (2011 p.46), when the nature of the research aims at in-depth description and understanding of a phenomenon rather than active intervention, an observational research structure is recommended. Consequently, this study was developed under this type of structure. In so doing, the primary data gathering approach was to record what the verbal categories these study participants articulated when considering climate change, with the research conducted where participants live and work, where unbiased answers were more likely to be provided. Depending on the aims and questions, observational research can be structured as a case study or comparative case study, with a cross-sectional and/or longitudinal design. For Newing, a cross-sectional design is recommended when planning to draw inferences about the characteristics of a large population in order to: a) facilitate a comparison of cases within a population, or b) to reveal relationships between different features of the samples (2011, p.49). Taking into consideration that this research partially sought to compare cases within samples, and to establish associations between demographic variables and the knowledge, perceptions and emotions generated towards this climatic phenomenon, a cross sectional design was preferred for this study.

3.4. Study area and sample selection

3.4.1. Study area

As it was previously observed, the paucity of information collected in Ecuador, specifically in the southern Andes, coupled with language issues and my acquaintance with the area, informed the particular study area selection. The chosen study area encompassed three provinces in southern Ecuador: Loja, Azuay and Zamora Chinchipe (Figure 3.1). According to INEC from 2010, the province of Loja has a population of some 450,000 inhabitants spread in 16 Municipalities. The 44% of the economically active population is committed to agriculture with coffee, maize, sugar cane, rice, beans, peanuts, and manioc, among the most outstanding products. The city of Loja is the capital of the province and embraces nearly half of the population with a mean of 3.8 people per household. The 21% of the population is active in commerce; followed by a 13% working in agriculture, 11% active in construction activities, another 11% work in education and 9% is active in industrial activities.

In the province of Azuay, the study area selected was the Municipality of Oña. The area lies at the extreme southern end of the province (Figure 3.1.) and has a population of some 3000 inhabitants spread in 12 villages, comprising 744 households, with an average of 3.2 people per household (INEC 2010). All villages are a major source of agricultural products for the region, with subsistence agriculture representing 67% of the jobs (Iñiguez Gallardo et al. 2013). The Municipality of Oña is moreover characterised by a high outmigration rate of people who have left the area to work in coastal plantations (2013).

In the province of Zamora Chinchipe, the area selected was the Village of Palanda, with the specific village selected using the means explained in the Subsection 3.4.2 on research methods. Palanda has close to 1700 rural inhabitants (INEC 2010). The primary economic activity is agriculture (71%), dominated by subsistence farms including coffee, tropical fruits and cattle rearing (Gobierno Provincial Zamora 2011 p.3-13).

For practical reasons, notably my close acquaintance with the area, the city of Loja was selected for sampling urban participants, whereas the rural areas of Celica, Pindal San Pedro and Oña were selected randomly with the help of the throw of two dice and a map of the southern Ecuadorian region. In the map, 21 villages were identified, which were assigned numbers from 11 to 31 in order to avoid combinations between one and ten that would never be combined with two dice. For example, when die A made three and die B made one, the selected village was 31 instead of 4. Subsequently, the villages were picked according to the combination of numbers generated by both

dice. The city of Loja and the villages of Celica, Pindal, San Pedro and Oña were preferred for collecting quantitative data (Table 3.1). The reasons for selecting four rural areas are explained in Subsection 3.5.1 regarding sampling strategy.

Additionally, the rural villages of Olmedo, Chaguarpamba, Vilcabamba, Quilanda, Espíndola, Oña, and Palanda were included for collecting qualitative data (Table 3.1). The reasons for selecting these villages are explained in detail in Subsection 3.5.2 regarding sampling strategy.

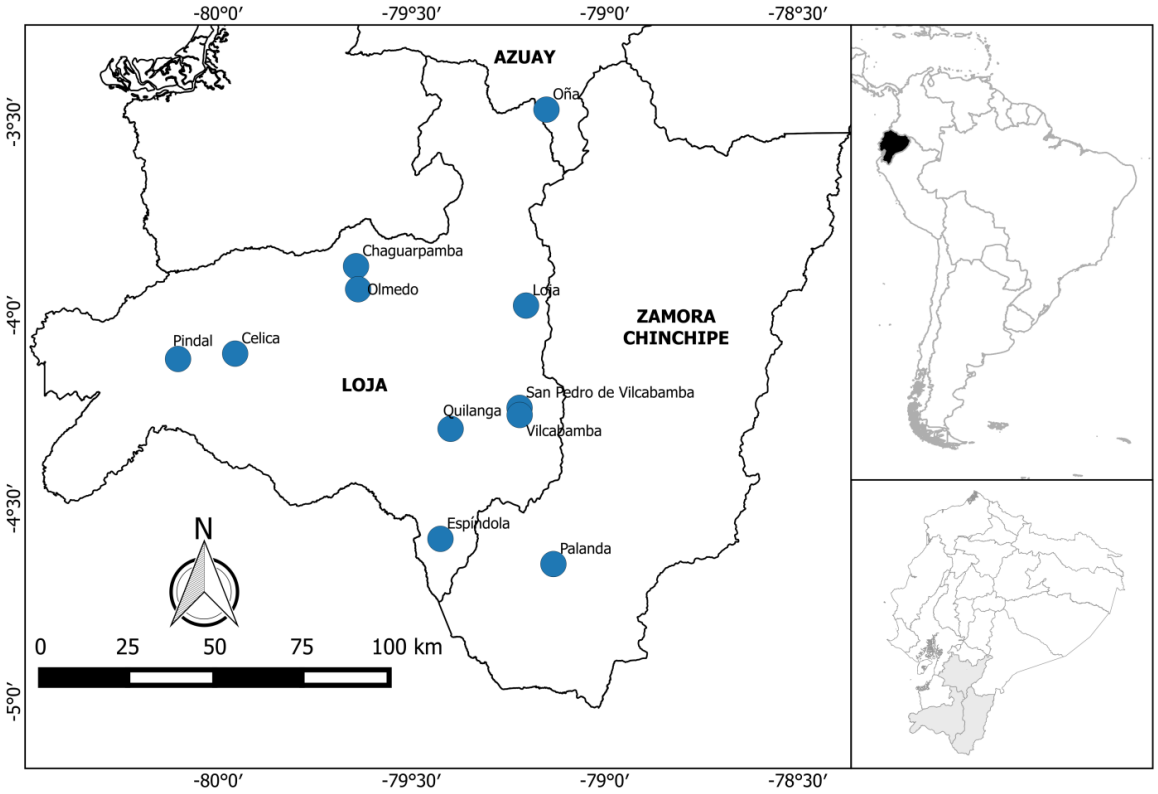


Figure 3. 1: Study area. Dots show the places where data was collected.

	Village	Approach	Technique	Instruments
1.	Oña	Qualitative Quantitative	Participatory Face-to-face	Interviews/Participant observation Questionnaires
2.	Olmedo	Qualitative	Participatory	Interviews/Participant observation
3.	Chaguarpamba	Qualitative	Participatory	Interviews/Participant observation
4.	Vilcabamba	Qualitative	Participatory	Interviews/Participant observation
5.	Quilanga	Qualitative	Participatory	Interviews/Participant observation
6.	Espíndola	Qualitative	Participatory	Interviews/Participant observation
7.	Palanda	Qualitative	Participatory	Interviews/Participant observation
8.	Loja	Quantitative	Face-to-face	Questionnaires

9.	Celica	Quantitative	Face-to-face	Questionnaires
10.	Pindal	Quantitative	Face-to-face	Questionnaires
11.	San Pedro	Quantitative	Face-to-face	Questionnaires

Table 3. 1: Type of approach, techniques, and data-gathering instruments used in each village visited.

3.4.2. Target groups

The background literature presented along this Chapter revealed three aspects that informed the selection of the target groups: a) the social groups from which most of data on the perceptions of climate change have been collected come from urban members of the general public in developed countries, b) data collected from non-western worldviews have rather focused on the vulnerabilities of farmers and indigenous and on the strategies applied to adapt to climatic changes, and c) little interest has been placed to collect the perceptions of *mestizos* in Ecuador, and of academics and scientists worldwide. Additionally, it was considered that there are endogenous variables between and within these social clusters that inform the behaviours, understandings, perceptions, and emotions of their members. Therefore, this study engages with:

Mestizo *rural and urban dwellers*: this group includes members of the general public randomly selected regardless their occupation.

Mestizo *commercial and subsistence farmers*: this group involves farmers whose livelihoods depend on agriculture either for self-maintenance or for trading.

Panel of academic conservationists: this group comprises academics and researchers working in any area of conservation worldwide.

These groups of people provided in-depth insights to explore outer and inner differences on how social groups understand, perceive, respond, and emotionally experience weather changes.

3.5. Research methods

Esbjörn-Hargens (2010) proposes that climate change is a phenomenon embracing many realities and viewpoints that emerge when different individuals interpret their experiences of weather. In expanding this view, Hulme (2015) proposes that climate is an idea mediated between the human experience of ephemeral weather and the cultural environment animating this experience. Together, both postulates suggested that climate change elicits multiple viewpoints shaped according to the context in which individuals grow and develop - thereby creating a complexity that no single scientific discipline and method can address in its entirely (Esbjörn-Hargens 2010). In considering

the human dimensions of climate change research, Upham et al. (2009 p.24) matched with these postulates, recommending researchers avoid examining people's understandings and knowledge of this climatic phenomenon through the use of single tools, such as quantitative surveys.

Whilst data collected through single methods are claimed to incorporate inherent biases (Creswell & Plano Clark 2011 p.5), collecting data through mix-methods is recommended for its strength to combine qualitative and quantitative approaches (Creswell 2009 p.15; Newing 2011 p.58). In a mixed-methods approach, often called 'mix-mode design' in social research, the combined use of qualitative and quantitative data-gathering instruments helps generate more accurate insights into a complex social phenomenon that are not available for either type of data alone (Bhattacherjee 2012 p.35). Hence, this research used a mixed-mode approach, aiming for complementarity and seeking convergence across qualitative and quantitative data. Quantitative face-to-face and virtual techniques allowed the collection of data necessary for making inferences from the sample to the general population and identifying statistical differences in the relationship between the different sets of data. Qualitative interviews and participant observation techniques allowed the collection of data that would facilitate an in-depth comprehension of how people perceive and construct their understanding of climate change.

Qualitative and quantitative data were collected through face-to-face and online questionnaires, semi-structured interviews, and participant observation. The data collection process started applying face-to-face questionnaires. Simultaneously, a semi-structured interview coupled with participant observation was employed. Online questionnaires were applied at the same time as other approaches kept developing. The process followed as well as the sampling size and strategy used in each procedure is below detailed:

3.5.1. Face-to-face questionnaire

Sample size

According to the latest Ecuadorian National Census (INEC 2010), the study areas selected have ~450,000 inhabitants. By entering this number in a web survey sample size calculator (http://www.surveysystem.com/sscalc.htm), at 95% of confidence level, and 5 confidence intervals, a minimum necessary sample size of 383 people was calculated. This size was required for making further inferences to the general population. Because this study is aimed at comparing cases within samples and establishing associations between demographic variables and the knowledge, perceptions and emotions, it was decided to split the sample into two subgroups, one for rural and

one for urban areas. For the sake of convenience, each subgroup was therefore calculated at 200 people in urban areas and 200 people in rural areas.

Sampling strategy- Criteria used to select participants

In order to ensure that all urban residents had an equal probability of being picked, a simple random sampling strategy was used, wherein respondents were approached in leisure public places as explained in the following subsection of the procedure. The sample unit was that of the individual person. Because respondents were randomly approached in public places, the age of 18 years old was preferred in considering that in Ecuador the adulthood is reached at 18 and no parent's consent form was needed. As it was explained in Subsection 3.4.1, the city of Loja was selected for surveying urban residents.

A similar simple random sampling strategy as well as a sample unit of the individual person, was used to surveying rural residents. Because rural areas are distant from each other and this study is aimed at drawing conclusions about meaningful differences between rural and urban residents, it was decided to split the sample of 200 people into four villages, namely: Oña, San Pedro, Celica, and Pindal (Figure 3.1). The selection process of the villages was explained in Subsection 3.4.1 on the study area. The decision of splitting the sample into four communities was based on the criteria of Newing (2011 p.81), who recommended a minimum of 50 cases per subgroup for statistical analysis. The final sample included 50 people in each rural village selected.

Procedure

Urban respondents were approached during their leisure time in public places such as parks, pubs, churches, bus stations, etc. Rural respondents were approached in parks and after church and market time during the weekends. During weekdays, respondents were contacted at their households at different times of the day, in order to increase the chances of finding different members of the family, and avoid applying the questionnaire only to students or housemakers. Questionnaires were applied from April 2014 to January 2015.

Questionnaire structure

The questions were designed to gather data about knowledge, understandings, perceptions of adaptation and mitigation, and emotions. In pursuing this endeavour, the studies by Read et al. (1994), Bostrom et al. (1994), Whitmarsh (2009), and Reynolds et al. 2010) were considered as a base to draft questions concerning people's climate change knowledge and perception. In exploring the emotions, a cluster of ten categories was created. These were set up upon the climate change emotional responses previously identified (e.g., Maibach, Roser-Renouf & Leiserowitz 2009;

Garvey 2010; Doherty & Clayton 2011; Aitken, Chapman & McClure 2011; Brulle, Carmichael & Jenkins 2012), namely, 'concern', 'guilt', 'anger', 'confusion', 'powerlessness', 'optimism', 'scepticism[13]', 'happiness', 'indifference' and 'calm'. According to Lazarus (1991), a particular emotion category could validly be created for each word and depends on theoretical and research purposes. In my study, the purposes validating the creation of these ten emotion categories are rooted in need to compare the results with previous researchers. The creation of the cluster moreover, is aimed at scrutinising what emotion categories are the most selected by people to represent their feelings about climate change and identifying other types of emotions that be may be experienced when choosing a particular category from the cluster. The identification of these latter additional emotions was compared with the work by Lazarus (1991), Baumeister, Stillwell & Heatherton (1994), Lewis & Granic (2000), Silfver (2007), Aitken, Chapman & McClure (2011), Ojala (2015), and TenHouten (2016).

Consequently, additional questions that have not been yet explored on the topics of emotions and perceptions of climate change adaptation were added, as well as demographic questions. In total, 14 queries were created, involving two Likert scale questions of six and two statements respectively, seven checklist questions, and five open-ended questions. A pilot test was then conducted with people living in the same study areas before outlining the final version of the questionnaire (Appendix 1). Eventually, these queries provided six data sections:

a) Personal data: age, place of residence (rural/urban), gender, and occupation.

b) Climate change understanding of causes and consequences.

c) Personal risk perception of climate change.

d) General knowledge of climate change and climate processes.

e) Perception of climate change adaptation and mitigation.

f) Emotions towards climate change.

Respondent's description:

The total population sample included 400 respondents wherein the majority were male (57%) between 18-30 years old (41%) and between 31-40 years old (23%). The main respondent's occupation in rural areas (N=200), was primarily distributed in professional workers (22%), farmers

[13] Although scepticism is not an emotion, the literature with which this study will be compared, address scepticism as 'doubt' in an emotional level between belief and disbelief. Hence, in this study scepticism is addressed as an emotional response.

(21%), and unskilled workers (17%). In urban areas (N=200), respondent's occupation was mainly distributed among professional workers (34%), and students (27%). Professional workers included scholars/lecturers, school teachers, government employees, doctors, nurses, and lawyers. Unskilled workers included business owners, workers, homemakers, and chauffeurs (Appendix 4a).

3.5.2. Semi-structured interviews

Sample size

Given that qualitative research techniques are more appropriate for collecting detailed information about people rather than seeking to make generalisations for the population based on demographically representative samples (Creswell 2013 p.157), an initial target sample size of 30 farmers was set. This sought to complement and compare the data obtained from the quantitative survey approach by drawing data from farmers, who as it was previously explained, are reliant on weather conditions (Turner & Clifton 2009; Mertz et al. 2009). Because climate change adaptation is claimed to respond to money and technological factors (Lobell et al. 2008; Ishaya & Abaje 2008; Brown & Funk 2014), the sample of 30 farmers was right after splitting into two groups including 15 subsistence farmers and 15 commercial farmers. The aim was to identify differences between these two types of farmers regarding climate change adaptation. However, by following the principle of saturation (Glaser and Strauss, 1967, in Newing 2011 p.75), the sample size grew as clear data patterns emerged only after 32 subsistence farmers had been interviewed, whereas the commercial sample size decreased as clear data patterns emerged after having interviewed nine farmers.

Sampling strategy-criteria used to select participants

The sample unit was a household. Taken into consideration that changes in climate typically occur every 30 years (IPCC 2012), all participants selected had lived in the area at least 30 years and be above 30 years old. A targeted sampling strategy was used to select informants. Subsistence farmers were selected by using a community contact in the village of Oña, who introduced me to community members by visiting their farms. Commercial farmers were instead selected by first analysing the primary agricultural production in the study areas, represented by coffee, maize, rice, and sugarcane (Senplades 2015, p.25). Whilst maize, rice, and sugarcane are produced in specific geographical areas; coffee is grown uniformly in the majority of villages in the study areas selected (Senplades 2015, p.30). Hence, coffee growers were chosen to represent commercial farmers. Farmers were picked after attending the coffee contest "*la taza dorada*" which each year gathers together coffee producers in Ecuador and after attending the coffee fair called "*Bracamoros*" put on

yearly for southern coffee growers. During these events, coffee producers were approached and asked for their telephone numbers and for receiving me at their farms in later days. All producers approached accepted to collaborate with the study. The villages were therefore selected according to the places where the coffee farms are located. The villages selected were Olmedo, Quilanga, Espíndola, Vilcabamba, Chaguarpamba, and Palanda (Figure 3.1).

For clarification purposes, see Table 2.1 which resumes the villages surveyed through qualitative and quantitative approaches and describes in detail the approach, technique, and instrument used in each village to collect data.

Procedure

Subsistence farmers were approached at their farms at the time indicated by them. I was hosted by a community member three days a week for six months, so it was feasible to visit the farms at any time. All farmers were asked to talk for approximately 90 minutes about their daily activities. A semi-structured interview was used to guide the conversation, as well as blank pieces of paper to collaboratively draw seasonal calendars in order to identify changes in agricultural activities (Appendix 7g). Commercial farmers were first contacted by phone and then visited at their farms at the date indicated by them. Commercial farmers were asked to talk for approximately two hours. Same data collection instruments, such as the interview guide and paper for seasonal calendars were used. Interviews were conducted from July 2014 to July 2015.

Interview structure

The interview schedule was designed to gather data on questions that have not been yet exploring on how farmers construct their perception and understanding of climate change, and how they adapt to changes. Thus, the schedule used questions related to farm production processes, changes perceived on the production, and strategies incorporated to face changes. Demographic queries, as well as climate change interrogations, were also added to the schedule (Appendix 2). Eventually, all these questions provided four data sections:

a) Personal attributes: gender, age, years living in the community, type of farmer (subsistence/commercial).
b) Farm production: all processes implemented to ensure food production, distribution, stability, access, as well as changes observed overall the production practices, including weather changes.
c) Adaptation techniques incorporated to tackle changes: all actions performed to address changes including weather changes and their perceptions of adaptation.

d) Climate change understanding.

It was deemed critical in this study to mention the terms 'climate change' and 'global warming' only at the end of the interview in order to avoid influencing the narrative by importing any biases associated with these terms and instead give informants the opportunity to introduce the topic by themselves. The interview schedule was piloted with people living in the same study areas to identify repeated questions, technical language, and other issues that could hinder effective conversation.

Informant's description

The majority of farmers interviewed were female (58%). Most of the farmers were in the age of 51-60 years old (33%), and 41-50 years old (25%) respectively. The majority of subsistence farmers planted for self-consumption (34%), whereas the majority of commercial farmers sell their production in national markets (63%). Six types of farmers were identified:

- Subsistence farmers who sell in retail markets what is left on the farm,
- Subsistence farmers who plant for self-consumption but also for selling in retail markets,
- Subsistence farmers who plant to sell in local and regional retail markets,
- Subsistence farmers who only consume their production and do not sell anything,
- Commercial farmers who sell in local markets; and,
- Commercial farmers who sell in national markets.

3.5.3. Participant observation

According to Puri (2011, p.86-89), participant observation provides first-hand information about what people say and do, allowing the researcher to gain a personal sense of what it feels like to live study participant's lives and to reach a better position to interpret their actions. As has been explained in the methodological approach and ethical considerations subsection, I considered crucial to conduct the research in the places where participants live and work. Hence, participant observation was preferred in order to gain an in-depth insight into farmer's daily activities and experiences with climatic changes. The data collected through this qualitative means helped corroborate and complement data gathered during the interviews and survey research. By participating in informant's activities, moreover, it was possible to compensate the time spent by participants in the interview. The data gathered was stored in photos and field notes (Appendix 7a-f).

Procedure

During the interviews, all farmers invited me to visit the farm, and I offered myself to help with their agricultural activities. I was allowed thus to work alongside informants with activities such as planting, weeding, harvesting, and feeding guinea pigs and sheep. Local retail markets and coffee events were also visited to observe the dynamic of farmer's trade activities. This participatory process eventually provided data on the following topics:

- Traditional and new agricultural practices,
- Types of seeds, and crops,
- Fertilising practices and types of fertilisers,
- Size of the farms,
- Food consumed and traded with other community members,
- Planting and harvesting months,
- Weather patterns,
- Adaptation techniques to tackle changes, and
- Farmer's agricultural issues.

The process, along with the interview and meal times, lasted at least five hours; therefore, only one farm a day was possible to visit. Extra visits dedicated only for socialising with farmers were also part of this method.

Farm's description

The average farm's size for subsistence farmers was 800 m^2, including the household, an orchard and the planting area, which all farms had. Cows and sheep are taken to communal areas to grass. In the absence of communal areas, pieces of land are rented. Small animals such as guinea pigs and chickens live on the farm. The main cultivation practice is rotated crops, with potatoes, wheat, barley and maize, among the crops alternated. When maize is planted, beans are planted along. In the orchards are grown herbs and short-cycle crops such as lentils, peas, etc. Younger farmers have included in the farm, greenhouses and new crops such as tree tomato [*Solanum betaceum*].

The average farm's size for commercial farmers was 1.8 has. These farms are known as *fincas integrales*, which include the household and a planting area that mingle different types of crops with coffee, banana, orange, lime and other tropical fruits among the most common crops. Beans are also grown in the farms. Coffee growers usually owned different pieces of land in various places in the villages, in order to make possible the management of *fincas integrales*. All coffee growers rely economically on several products from the farm.

3.5.4. Online questionnaire

Sample size

Online questionnaires are claimed to have advantages for data gathering, notably saving time and costs for researchers, as well as gaining access to groups of individuals with specific interests that would be otherwise difficult to reach (Wright 2006). However, online surveys also involve significant disadvantages concerning representativeness and establishing a sampling frame that should be considering when calculating a sample size. Regarding this latter, Newing (2011, p.79), suggest that online questionnaires should set a sample size at about 30 percent higher than it is needed to minimise non-response rates.

In considering these advantages and disadvantages, an online questionnaire was preferred for collecting and comparing data between academic conservationists in different countries. The sample size was then set by considering the non-response rate, and taking into account that a comparison study between two or more populations requests at least 30 cases per subgroup to reach an internal validity (Denscombe 2014). Hence, the number of participants was selected by setting a minimum of 30 people while anticipating a 30% of non-response rate, thereby obtaining a target total of 39 people per country.

Sampling strategy-criteria used to select participants

The sampling unit was the individual. Any lecturer/scholar, professor, postgraduate researcher, or research assistant working in all areas of conservation around the world were suitable for participating. Respondents had to teach or research at any university or scientific institution full or part time and were selected by using a snowballing sampling strategy. Institutions, in turn, were selected according to the researchers and supervisors' key contacts.

Procedure

By using researchers' and supervisors' group and personal e-mail addresses from different academic institutions in the world, a link to an online survey was sent out. Researchers' and supervisors' key contacts were, in turn, asked to circulate the survey link with other colleagues. A total of 362 respondents representing 98 academic institutions, from 36 countries filled the questionnaire (Appendix 4b, c). However, excepting only three countries, the target number of 39 people was not achieved. Consequently, the countries were grouped according to the regions they belong to, with North America, Latin America, Europe, Africa, Asia, Oceania, and the Middle East among the groups. Within the new groups, only North America, Latin America and Europe, reached the 39 people necessary for further inferences and comparison; therefore, in order to reach an

internal validity, cases from Africa, Oceania, Asia, and the Middle East were grouped as Other Regions. The link to complete the survey was open from April 2014 to April 2015.

Questionnaire structure

The Survey-Monkey web application was used to design the survey and store responses. Because the online questionnaire sought to make comparisons between the general public and academics on climate change knowledge, their perceptions of climate change adaptation and mitigation, and their emotions, a similar structure to the face-to-face questionnaire was designed for surveying academic conservationists. However, this included an additional Likert scale question of six items regarding knowledge of climate processes (Appendix 3, section d). With the aim of reaching more people and reduce misunderstandings, the questionnaires had English and Spanish versions. Finally, in order to identify language mistakes and misunderstandings, the questionnaire was piloted with graduate students from the University of Kent for the English version, and academics from the Universidad Técnica Particular de Loja, for the Spanish version. The final form of the online questionnaire eventually provided data of academics' demographic characteristics, knowledge of climate processes, perceptions of climate change adaptation and mitigation, and emotions towards this climatic phenomenon.

Respondent's description

The total population sample included 362 academic conservationists, wherein the majority of respondents were male (54%) between 20-30 years old (43%) and between 31-40 years old (38%). Likewise, the majority of respondents lived in urban areas (73%) and were majorly postgraduate researchers (32%), and lecturers/professors (28%). Respondents came mainly from Europe (50%), specifically from England, Germany, France, Spain, Switzerland, Poland, Romania, Belgium, Portugal and Italy. Respondents from Latin America represented the 35% of the sample and came specifically from Ecuador, Chile, Brazil, Argentina, Colombia, Mexico, Costa Rica, and Puerto Rico. Respondents from North America represented the 11% of the sample, coming from the United States (36 respondents), and Canada (5 respondents).

3.6. Data analysis

3.6.1. Face-to-face questionnaire

Data from face-to-face questionnaires were analysed by using the statistical package IBM SPSS 22. Each of the six sections structuring the questionnaire was first analysed separately and later cross-

referenced with other sections in order to establish associations between respondent's demographic background and their climate change understandings, knowledge, perceptions, and emotions.

Respondent's demographic data (section a) such as age, gender, place of residence, and occupation, were analysed using descriptive statistics to calculate frequencies. Occupations were grouped as professional workers, farmers, skilled workers, semi-skilled workers, unskilled workers, retired and unemployed. A list of occupations integrating each group is shown in Appendix 4a.

The two open-ended questions regarding respondents' understandings of climate change causes and consequences (section b), were content-analysed, codified, and grouped into 19 categories for the causes and 17 categories for the consequences. A coding book with details of the codes, examples of responses, and inclusion/exclusion criteria, it is presented in Appendix 5F. Additionally, Chi-square tests were carried out between the answers and participant's demographic data to examine differences between urban and rural respondents. This test was selected given that the types of variables crossed were binomial.

The closed-ended and open-ended question regarding climate change personal risk perceived (section c), were analysed separately. The closed-ended question was analysed by calculating frequencies, whereas the open-ended question was content-analysed, codified, and grouped into ten categories (Appendix 5H). Additionally, Chi-square tests were carried out between the answers and participant's demographic data to examine differences between urban and rural respondents.

The Likert scale type question of six items and one close-ended question regarding respondent's knowledge of climate processes and climate change (section d) were analysed using descriptive statistics to calculate the frequencies.

The analysis of the data collected in section a) to d) was used to answer the first research question regarding respondents' understandings of climate change. Therefore, this analysis was subsequently framed in the context of a constructivist approach by using the theory of social construction of reality posited by Luckmann & Berger (1967). The core principle of this theory is that individuals' knowledge is constructed *a priory* personal experiences in a particular socio-historical context that help individuals to build a meaningful reality. The aim of using this constructivist analysis is to investigate on respondent's demographic background to explore on how participants from southern Ecuador construct their understandings of climate change. The results from this analysis were later compared with the qualitative results obtained from the interviews.

The Likert scale questions regarding respondents' perceptions of climate change adaptation and mitigation (section e), were analysed using descriptive statistics to calculate frequencies. Additionally, a classification tree type CHAID was carried out to determine whether respondent's demographic characteristics are associated with the perception of climate change adaptation and mitigation. CHAID classification tree analysis are recommended for examining Likert scale data since it identifies associations between variables, but more importantly, it defines the respondent's profile selecting a particular option (Aldás Manzano 2013). Hence, this analysis was helpful to identify the demographic profile of participants supporting climate change adaptation or mitigation. The aim of this analysis was to answer the second and third research questions regarding respondents' perception of climate change adaptation. The results were later compared with those obtained in the interview, participant observation, and online questionnaire.

The checklist question and open-ended question regarding respondent's emotions towards climate change (section f), were analysed separately. The closed-ended question was first analysed by calculating frequencies of the emotions selected. Additional Chi-square tests were then conducted to identify associations between respondent's demographic background and the category of emotion selected. A multinomial regression was also carried out in order to test the same relation between the emotions selected and respondent's demographic background. However, the information provided no statistical significance for any of the combinations ran between age-occupation-place of residence-gender and the emotions selected. The open-ended question was qualitatively analysed by using respondents' actual words. Thereafter, the analysis focused on identifying additional emotion categories. These, in turn, were created according to emotions literature suggested by Lazarus (1991), Baumeister et al. (1994), Lewis & Granic (2000), Silfver (2007), Aitken, Chapman & McClure (2011), and Ojala (2015). The analysis of section f) aims to answer the fourth and fifth research question regarding respondents' emotions towards climate change. The results obtained were later compared with those from the online questionnaire.

3.6.2. Semi-structured interview

Data from interviews, including seasonal calendars, were analysed through a multi-step iterative process. The interviews were first transcribed, and later content-analysed, codified and grouped into categories to the build theories according to the coding procedure suggested by Saldaña (2013) and Bazeley (2013). Seasonal calendars were also coded and grouped into categories. The initial coding

process was conducted manually and later by using the software NVivo 10. A detail description of the coding process is shown in Appendix 6b.

The responses in each of the four sections structuring the interview guide were first analysed separately. The results obtained were later cross-referenced with the results of other sections in order to establish associations between informant's demographic background and their climate change understandings and perceptions of adaptation to this issue. The interview results were eventually compared with the participant observation outcomes and the quantitative results obtained in both questionnaires in order to provide more robust results.

Informant's personal data (section a), were analysed through attribute coding with age, gender, type of farmer [subsistence/commercial] and data format [interview transcripts, field notes, photos, and seasonal calendars] among the codes.

Data regarding farm production, including types of crops, ploughing, etc. (section b), were first analysed through primary code entries. The creation of primary codes (parent code), was based on the literature reviewed on food production, distribution, and access suggested by Gregory, Ingram & Brklacich (2005); Vermeulen et al. (2012); Wheeler & von Braun (2013). A subcoding process was then applied in order to enrich the entry. The subcodes were developed from the data obtained. Categories were later created based upon the codes and according to the different levels of food production and changes in overall aspects of the farm management. Several grandchildren subcodes were obtained from the parent code (Appendix 6b). The analysis was strengthened with data collected from participant observation, including field notes and photos. The subcoding type was chosen for its practicality to organise data coming from different sources into categories and subcategories (Saldaña 2013). Given that weather changes observed were primordial for this research, a separate subcoding process was applied for weather changes and its impacts with the aim of linking them later with the adaptation techniques incorporated to address these types of changes.

Data regarding farmers' perceptions of adaptation and techniques incorporated to tackle changes (section c), were also analysed through primary code entries and subcoding (Appendix 6F). The creation of primary codes (parent code) was based on a review of key texts on climate change adaptation (Lacy, Cleveland & Soleri 2006; Seo & Mendelsohn 2008; Byg & Salick 2009; Campos, Velázquez & McCall 2014). The subcodes were developed from the data set. The results of this analysis were later cross-referenced with the results obtained in sections a) and b) regarding

informant's personal data and farm production practices, as well as, with the results from participant observation and both types of questionnaires (section e). Eventually, this analysis provided evidence of the relationship between informant's demographic background and their responses to climatic changes, and of the differences between survey and interview respondents regarding their perceptions of climate change adaptation. This analysis aims to answer the second and third research questions regarding peoples' perceptions of climate change adaptation.

Data regarding climate change understanding (section d), were analysed using a causation coding process. This type of coding is recommended to identify causal relationships informing outcomes came about (Saldaña 2013). Hence, informants' conceptual models of climate change understandings were analysed by using a causation coding in order to examine how they construct their understanding of climate change (Appendix 6G). The results of these analyses were later cross-referenced with the results obtained in section a) and b) regarding informant's personal data and farm production practices, and with the results obtained in the participant observation and face-to-face questionnaires (sections b and c). Eventually, this analysis provided evidence of the process involved in constructing informants' understandings of climate change and the association with their personal data, as well as, of the differences between survey and interview respondents regarding their understandings of climate change. This analysis aims to answer the first research question looking at the understandings that people from southern Ecuador have about climate change.

3.6.3. Participant observation

With the aim of complementing and strengthening the data collected in the interviews, field notes and photos obtained from participant observation were analysed along by using the same coding process used in the analysis of interview data, namely primary code entries and subcoding. The coding process was analysed with the software NVivo 10. Data analysis of participant observation aims to answer the first three research questions regarding people's understanding of climate change and perception of climate change adaptation.

Field notes included thoughts and direct descriptions of the activities observed. With the aim of avoiding the single researcher's interpretation of the events, only the notes describing the processes and activities observed were codified. Such activities included: type of farms; crops planted; trade activities; social interaction; adaptation techniques, weather patterns, food consumption, among the

most relevant observations. Photos of these processes and activities were taken in order to capture the observations made (Appendix 7 a-f).

3.6.4. Online questionnaires

Data from online questionnaires were analysed using the statistical package IBM SPSS 22. The analysis sought to examine what academic conservationists know about climate change and to gain an understanding of their perceptions of adaptation and emotions towards this climatic phenomenon. The results of the analysis were eventually compared with those obtained with general public and farmers.

Respondents' personal data (section a) such as age, gender, place of residence, and occupation were analysed using descriptive statistics to calculate frequencies. Since the online questionnaire was applied to academic conservationists, the occupations were grouped as Postgraduate researchers, scholars/lectures, professors, and research assistants.

Data regarding academics' understandings of climate change causes and consequences (section b), as well as personal risk perceived (section c), were content-analysed, codified, and grouped into the same categories used for the face-to-face questionnaire (Appendix 6F1, G1). However, because this thesis aims to compare data regarding climate change understandings only between members of the general public, the analysis of sections b and c of the online survey will not be reported in the subsequent chapters and will be considered for further research.

The Likert scale question of 11 statements regarding academic conservationist's knowledge of climate processes and climate change (section d), were first analysed by calculating frequencies. Thereafter, a CHAID classification tree analysis was carried out with the aim of identifying differences among respondent's demographic background. The classification helped to define the respondent's profile supporting the climate change knowledge questions.

The Likert scale question regarding respondent's perception of climate change adaptation and mitigation (section e), was first analysed by calculating the frequencies of respondents supporting these topics. Thereafter, a classification tree type CHAID was carried out in order to determine whether respondent's demographic characteristics were associated with their level of acceptance of climate change adaptation or mitigation. The results of this section were compared with those obtained from the general public in southern Ecuador in order to answer the second and third research question regarding peoples' perceptions of climate change adaptation.

Data regarding respondents' emotions towards climate change (section f), were first analysed by calculating the frequencies for each of the emotions selected. Chi-square tests were then conducted to identify associations between respondent's demographic background and the categories of the emotions selected. A multinomial regression was also carried out in order to test the same relationship between the emotions selected and respondent's demographic background. However, the information provided no statistical significance for any of the combinations ran between age-occupation-country of origin-gender and the emotions selected. Thereafter, the analysis focused on identifying additional emotion categories. Similarly to the face-to-face questionnaire, this analysis was conducted according to emotions literature suggested by Lazarus (1991), Baumeister, Stillwell & Heatherton (1994), Lewis & Granic (2000), Silfver (2007), Aitken Chapman & McClure (2011), and Ojala (2015). The results of this section were compared with those obtained from the general public in southern Ecuador in order to answer the fourth and fifth research questions regarding peoples' emotions towards climate change.

In essence, this research has been designed to ensure that the perspectives of people who have been marginalised in previous studies are transmitted. From the social science view, the design offers a holistic explanation regarding subjective aspects involved in engaging people with climate change, namely understandings, perceptions and emotions. I expect the evidence presented in the following chapters to enhance our understanding of the multiple perspectives and realities involved in the process of constructing peoples' climate change understandings, and perceptions, as well as, of the psychological implications of emotions in the action behaviour regarding climate change. With this as a backdrop, the next chapters delve deeper into the subjective aspects of climate change that might be essential in developing policies and educational programmes.

Chapter 4
The social construction of climate change understanding

4.1. Introduction

Climate change is a physical phenomenon, with social implications intertwining political, economic, cultural, and psychological factors that influence attitudes, beliefs, perceptions and behaviours (Boykoff 2015). These social characteristics of climate change have been examined extensively. For instance, political studies argue that climate change has been both politicised by hegemonic groups and de-politicised by the general public (Swyngedouw 2010). The broadcast of climate change scientific knowledge has required translation into more colloquial terms (Boykoff & Boykoff 2007), which has resulted in the inclusion of the climate change narrative into communication research. Psychological factors have also been examined when exploring people's perception of climate change, concluding that the public engagement with this global issue has fluctuated among awareness, risk, and scepticism (Capstick et al. 2015). Additionally, climate has been connected to cultural meanings leading some researchers to the analysis of the diversified ways in which people experience this climatic phenomenon (Vedwan & Rhoades 2001; Hulme 2015; Hoffman 2015). Whilst such studies often suggest that climate change is socially and culturally constructed, I identify some limitations to describe the social process through which people construct their understanding of climate change.

Previous research (e.g., Read et al. 1994; Bord, Fisher & O'Connor 1998; Lorenzoni & Pidgeon 2006; Reynolds et al. 2010; Huxster, Uribe-Zarain & Kempton 2015), concluded that peoples' understandings of climate change are assembled by partial and inaccurate[14] knowledge, demonstrating several fundamental misconceptions to be widely held. While the findings of these studies have been relevant in the field of social research of climate change, the reasons why people have an inaccurate knowledge of this climatic issue remain unclear. The most convincing explanation, offered by communication research, suggests that the media and political actors play a fundamental role in shaping peoples' knowledge and perceptions of climate change (Carvalho 2007; Boykoff 2009; Antilla 2010), bringing back the notion of social constructions.

Social constructions have been identified in the creation of environmental discourses (Hanningan 2014, p. 31-32), the formation of mental models of resilience (Bohensky et.al. 2015, p.143-145), the

[14] In this thesis 'inaccurate knowledge' refer to inaccurate scientific knowledge.

increase of environmental concern (Kalof 1998; Mayerfeld Bell 2012; Hanningan 2014) and the definition of a climate change concept (Leombruni 2015).This idea of social construction has widely addressed by Esbjörn-Hargens (2010) who contend that climate change is driven by multiple subjective perceptions and realities, whereas Hulme (2015), Hoffman (2015), and Weber (2016) buttressed these previous accounts by claiming that the way climate change is experienced varies between individuals and societies in world. Thereby, the analysis of peoples' understandings of climate change requires an approach that relies on subjective experiences and multiple perspectives to elucidate what kind of meanings people have formed around this issue. Yet, judgments and decisions in the domain of climate change have been largely driven by positivist research underestimating subjective personal experiences (Weber 2016).

With this as background, a constructivist approach was selected to examine all different social views shaping the construction of peoples' understandings of the world they live. Constructivism holds assumptions that individuals develop personal meanings of their experiences, which is relevant to take into account when examining peoples' perceptions of, and experiences with climatic changes (Creswell 2009; 2013). Particularly, I selected the theory of social construction of reality posited by Berger & Luckmann (1966) to explore the process through which people construct their understanding of climate change. The claims of this theoretical perspective are explained at length in the Methodology Chapter, Section 3.1.

In summary, I will present a solid constructivist process framed by the theory of social construction of reality. In this endeavour, I will combine historical, political, and psychological factors to propose a theoretical model to elucidate the process through which people construct their understanding of climate change. In pursuing this aim, I will first engage with historical scientific knowledge regarding global warming and climate change. I will afterwards assess the information most widely disseminated and spoken about the phenomenon. Subsequently, I will present empirical data on climate change knowledge and perceptions collected in southern Ecuador through questionnaires with urban and rural residents and semi-structured interviews and participant observation with farmers. Finally, I will consider these data in the context of the historical scientific knowledge and the most widely disseminated information, to determine which of them fits better with the respondents' knowledge and understandings of the topic. As far as I am aware, no similar study offers a holistic explanation of how individuals construct their understanding of climate change.

4.2. A short history of global warming and climate change knowledge

In Chapter 1, I presented a detailed description of the historic-scientific context surrounding global warming and climate change knowledge. For the purposes of further analysis, I will summarise this knowledge in the following points:

- Between 1938 and 1975 the scientific evidence pointed out that carbon dioxide concentration and temperatures were linked and that they had gone up and down together in wide swings in the past ages.
- In 1975 the term global warming was established in the scientific literature by Wallace Broecker.
- The scientific consensus reached from this evidence was that the climate system has never been stable with all greenhouse gases playing a role in such stability.
- The evidence also concluded that the concentration of carbon dioxide might well have been exacerbated by industrial burning of fossil fuels
- In 1988 the term climate change was coined through the establishment of the IPCC.
- 1989 climate change is incorporated into the international agenda encouraged by the UK Prime Minister Margaret Thatcher.

Likewise, in the course of Chapter 1, I presented eight terms/processes relevant in the construction of accurate climate change scientific knowledge. These terms enjoy an active life in formal and informal social intercourse, though paradoxically they are commonly misunderstood and misinterpreted by people (Read et al. 1994; Bord, Fisher & O'Connor 1998; Lorenzoni & Pidgeon 2006; Huxster, Uribe-Zarain & Kempton 2015). Therefore, for the purposes of this Chapter I recommend to read Chapter 1, Section 1.2., about the terms and concepts of climate, weather, global warming, causes and consequences of global warming, climate change, extreme weather events, and climate-related impacts.

4.3. Production and dissemination of climate change information

Due to the intangibility and uncertainty that characterises climate change, the media and political actors are essential sources to inform and educate the general public (Antilla 2010; Boykoff 2009; Carvalho 2007). However, according to Carvalho & Burgess (2005) and Boykoff (2015), the way in which climate change has been presented by media and politicians is characterised by inaccuracy[15], bias and sensationalism, which has confused rather than clarified the scientific understanding of the

[15] Similar to inaccurate, in this thesis inaccuracy refers to scientific inaccuracy.

topic. In respect to inaccuracy and bias, (Boykoff & Boykoff 2011) claims that scientific findings usually employ a lexicon that is hard to grasp for lay people which oblige journalists to personalise and dramatize climate information in an over simplified and biased issue that overlooks other political, social, and economic factors. Nonetheless, these sorts of messages have failed to make climate change stories understandable and meaningful to readers (Boykoff 2009). Indeed, for Antilla (2005) climate change media articles base their conclusions on other media articles, which has caused the exponential spread of misinformation as well as has prevented a more extensive knowledge of climate change by the public and policy makers.

Regarding sensationalism, Hanningan (2014 p.55-66) suggests that when constructing environmental problems, the use of evocative verbal or visual imaginary is usually employ to command public attention. Hanningan also asserts that for a successful construction of such problems it is necessary among other aspects, a scientific authority validating the environmental claims, popular claimers, media attention, and dramatization of the problem. These aspects are found in the climate change arena. For instance, the IPCC is the legitimated authority validating climate changes claims, movement leaders such as Al Gore and Greenpeace are the most iconic claimers dramatizing environmental problems to manipulating existent public concerns and perceptions in order to broaden their appeal (Nordhaus & Shellenberger 2007, p.105-108). Climate change has received extensive media attention which has been accompanied by dramatized climate information as previously observed. That is to say climate change messages have followed the logic of the construction of environmental problems in order to succeed in the dissemination and acceptance of this issue, an strategy that has been efficacious in that more and more people worldwide believe in the existence of climate change and are concern about the effects of this issue (Lorenzoni and Pidgeon 2006; Nisbet and Myers 2007; Capstick et al. 2015).

In exploring the type of information disseminated, I looked at the messages transmitted by some of the most influential entities in climate change campaigns since its origins. During this endeavour, I found examples of inaccuracy in the reporting or understanding of climate change in important sources of information, wherein correct and erroneous evidence is combined to inform the public. These messages include climate change causes, namely [16]*more people, land cultivation, deforestation, burning fossil fuels and pollution*. Consequences such as *floods, droughts, heat*

[16] Italics are used to represent actual quotes

waves, famine, disease, war, and terminology used comprising *additional global warming, carbon dioxide pollution*. The quotes, speeches and press notes analysed are presented in what follows:

Margaret Thatcher, 1989	(…) the main threat to our environment is more and **more people**, and their activities: • The **land they cultivate** ever more intensively; • The **forests they cut down** and burn; • The mountain sides they lay bare; • The fossil fuels they burn; • The **rivers** and the **seas they pollute**.
Al Gore, 2006	The scientists tell us that the tundra in danger of thawing contains an amount of **additional global warming pollution.**
The Guardian, 2012	A **changing climate isn't just about floods, drought and heatwaves.** It brings erupting volcanoes and catastrophic earthquakes too.
Greenpeace website, 2013	There will be **more flooding, more droughts, more disease, more famine and more war**, creating hundreds of millions of **refugees**.
Pope Francis, 2015	**Carbon dioxide pollution** increases the acidification of the oceans and compromises the marine food chain.
Barack Obama, 2015	(…) to roll back **the pollution we put into our skies…**

Similarly, I found examples of inaccuracy during an internet research conducted in November 2015 and March 2017 using the search engine 'www.google.com' for the terms 'environmental pollution', 'air pollution', 'global warming', and 'burning fossil fuels'. The research provided similar images of air pollution for all the terms searched (Figure 3.1), suggesting that global warming is a matter of air pollution. This partly explains why people have been found to understand climate change in a pollution framework as suggested by Bord, Connor & Fisher (2000) and Lorenzoni & Pidgeon (2006).

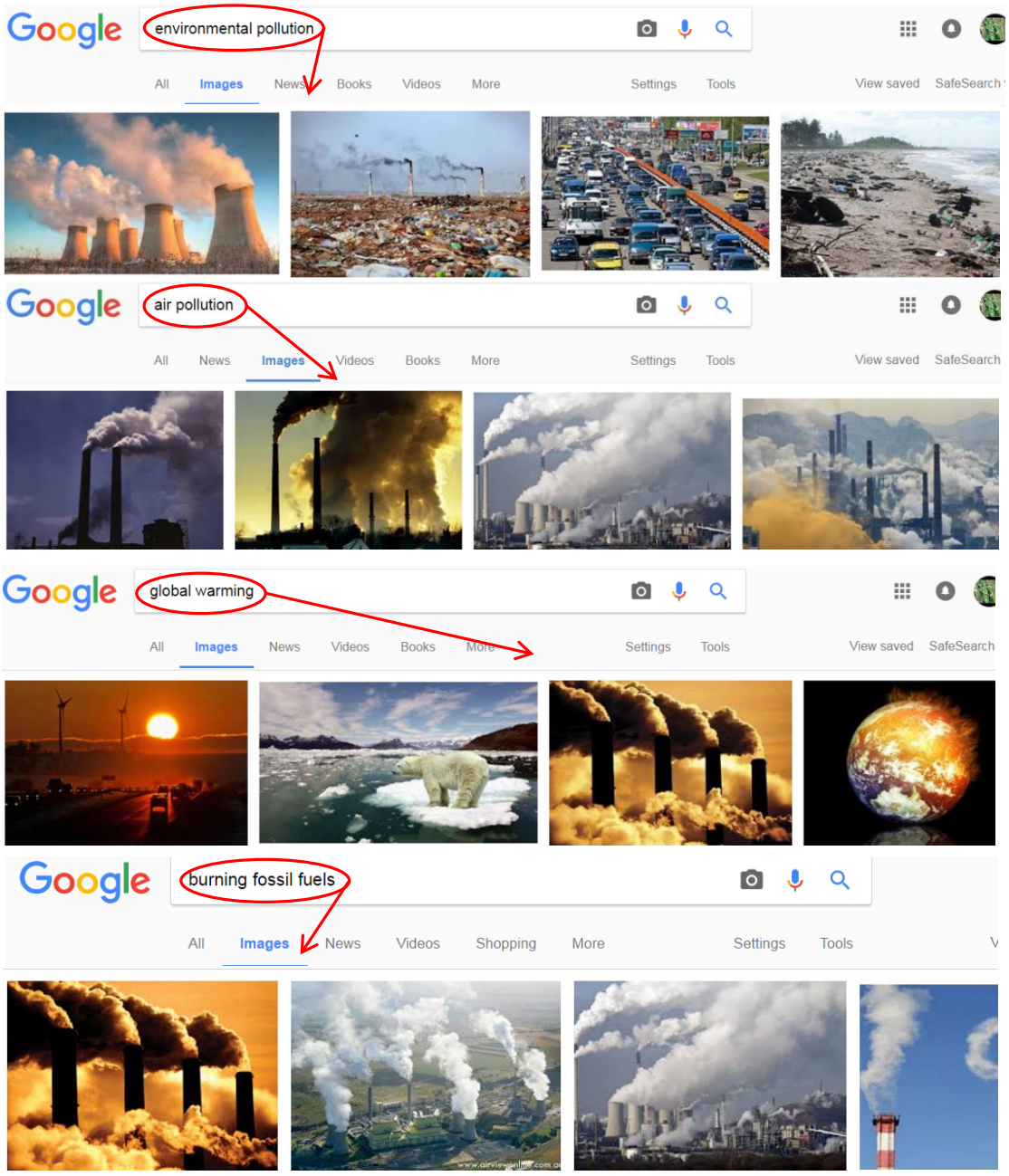


Figure 4. 1: Screen captures obtained when searching for the terms 'global warming', 'burning fossil fuels', 'air pollution', and 'environmental pollution' Retrieved from www.google.com. 2017.

This fusion of correct and erroneous information found in public discourses and internet search, partly explains why people, including highly educated segments of the public, suffer from fundamental misconceptions about climate change (Read et al. 1994; Lorenzoni & Pidgeon 2006; Reynolds et al. 2010). For example, a body of research suggested that people understand climate change in terms of air pollution (e.g., Bord, Connor & Fisher 2000; Whitmarsh 2009; Huxster,

Uribe-Zarain & Kempton 2015), and that experiencing air pollution is significantly related to the belief that climate change is real and caused by human activities (Whitmarsh 2008). Information connecting 'air pollution' and 'global warming' can be observed in the above images producing similar descriptions of pollution for both terms. Other types of studies suggested that people tend to use local weather events to make inferences about global climate, and attribute weather fluctuations like hot spells to global warming (e.g., Read et al.1994; Moloney et al. 2014). This type of information has been transmitted in the media as can be observed in the narrative used by The Guardian to talk about climate change. Furthermore, other studies found that health effects are mentioned by individuals as one of the main consequences of climate change (e.g., Bostrom et al. 1994; Read et al. 1994; Reynolds et al. 2010). This public understanding of climate change as a pollution-health issue has led some researchers to conclude that frameworks involving health and pollution may motivate people to engage with climate change in that individuals whose health has been affected by air pollution are generally more interested in climate change (Whitmarsh 2008; Myers et al. 2012). Information connecting health and climate change can be observed in the narrative used by Greenpeace in the above passages.

Examples of bias were detected in the climate change information examined, in particular towards deforestation as illustrated by the passages below. For example, in spite of the fact that the primary anthropogenic cause of global warming is the combustion of fossil fuels in energy, industries and transportation, a strong emphasis has been placed to promote the protection of the tropical forest. Al Gore, for instance, claimed that "the management of forest is the single most important strategy for solving climate crisis". Greenpeace even used the term "world's rainforests", when referring to deforestation. For some people, this rhetoric might violate the sovereignty of the countries where rainforests are located, as was stated by Former Brazilian President Ignácio Lula da Silva in 2009, who called upon the world to "understand that the Amazon has an owner, and that is the Brazilian people". Besides, promoting global warming as a deforestation concern may lead people to frame it as a pro-general environmental issue as has been found in several studies (e.g., Bord, Connor & Fisher 2000; Steadman 2004; Turner & Clifton 2009; Islam, Barnes & Toma 2013; Hart & Feldman 2014), or as an issue related to human values (Corner, Markowitz & Pidgeon 2014).

Margaret Thatcher, 1989	(…) We are seeing the **destruction on a vast scale of tropical forests** which are uniquely able to remove carbon dioxide from the air.
Al Gore, 2006	We should take bold steps to **stop deforestation** (...) So; better **management of forests is one of the single most important** strategies for solving the climate crisis.

Greenpeace website, 2013	Climate change is caused by the build-up of greenhouse gases from burning fossil fuels and the **destruction of areas that store massive amounts of carbon like the world's rainforests**.

Finally, examples of sensationalism were found in the search of climate change information, wherein dramatic rhetoric has been used expressing words such as *the greatest threat, killing people, catastrophic, and serious consequences*, as shown in the passages below. Whilst Hanningan (2014) observes the importance of dramatic narratives for environmental issues to be acted upon, according to O'Neill & Nicholson-Cole (2009); Feinberg & Willer (2011) and Myers et al. (2012), these sorts of narratives of climate change foster scepticism, and discourage doubtful and dismissive segments of the public, which may lead the public to disengage and learn less about the topic.

Greenpeace website, 2013	**Climate change is the greatest environmental threat humanity** has ever faced and the biggest challenge… **The impacts of climate change** are **already responsible** for **killing** an estimated 315,000 **people** every year and damaging ecosystems. And **this is just the beginning**; the science predicts that anything more than 2°C rise in global temperatures puts us on the road to potentially **catastrophic problems**.
Pope Francis, 2015	(…) If present trends continue, this century may well witness extraordinary climate change and an **unprecedented destruction** of ecosystems, with **serious consequences for all of us**.

Apart from the semantic problems of inaccuracy, bias, and sensationalism examined above, there is fundamental confusion in that what is often reported in a climate change framework rather pertains to global warming. For instance, *greenhouse gases from burning fossil fuels* exacerbate global warming, not climate change. Effects such as *disruptions on ecosystems* and *temperature increase* are global warming impacts, not climate change impacts. Similarly, a conceptual differentiation between weather and climate is absent, given that extreme weather events such as *floods, droughts and heatwaves* are informed as climatic changes. This lack of conceptual differentiation echoes previous observations that individuals confounded the terms weather and climate, and failed to distinguish global warming from climate change (Whitmarsh 2009). Whilst this thesis do not intend to judge correct and erroneous knowledge, it is important to bold these elements in that they are part of the messages shared by media or political actors which in turn help to give meaning and construct an understanding of climate change.

4.4. Participant's knowledge, perception and understanding of climate change

Social research of climate change has been substantially biased toward public perceptions in developed nations, whilst we remain ignorant about public understanding in developing countries such as in South America (Capstick et al. 2015). In addressing this gap, I will draw upon data collected in southern Ecuador through surveys applied with rural and urban dwellers, and interviews conducted with subsistence and commercial farmers.

As mentioned in Chapter 3, survey data were analysed through descriptive statistics. The answers to the open questions were content-analysed and sorted into categories according to the type of responses given. In exploring whether respondents from urban and rural areas understand climate change differently, Chi-square tests were carried out. Interview data was content-analysed, coded and sorted into categories according to the topics addressed.

The findings from the survey and interview stages are presented separately to elucidate what study participants in rural and urban southern Ecuador know[17], perceive and understand about climate change. I hypothesise that study participants have an understanding of climate change assembled with inaccurate knowledge as found in other studies (e.g., Read et al. 1994; Bord, Fisher & O'Connor 1998; Reynolds et al. 2010; Howe & Leiserowitz 2013; Moloney et al. 2014). I also hypothesise that rural and urban participants understand climate change differently. To test this assumption, I included in the analysis four survey questions about causes and consequences of climate change, and on the perception of personal risk (Appendix 1). As I mentioned in Chapter 2, farmer's reliance on weather conditions has positioned them as good observers of climatic changes (Turner & Clifton 2009; Mertz et al. 2009). Hence, with the aim of comparing these survey results and exploring in-depth participants' understandings of climate change, I will present relevant data from the interviews, this time focusing explicitly on the agricultural sector, involving and contrasting subsistence and commercial farmers.

4.4.1. Rural and urban dwellers' understanding of the causes of climate change

Respondents were asked via an open-ended question to explain what is causing climate change. In response to this issue, an extensive array of reasons was provided by rural (N=200) and urban

[17] In this thesis, knowledge is addressed as technical and theoretical knowledge of climate change. Traditional knowledge is excluded from the analysis.

participants (N=200). These reasons were subsequently grouped into 19 main categories as summarised in Figure 4.2. The criteria used to establish the categories are presented in Appendix 5F.

Pollution, deforestation, unfriendly environmental attitudes, industry and transportation, and greenhouse gases were reported as the leading five causes of climate change, suggesting a partial inaccurate understanding of the phenomenon (Figure 4.2a). Some survey participants misunderstood the question, providing answers such as natural disasters, scientific reports, and own experiences with weather changes. Other respondents expressed an accurate knowledge mentioning global warming as the cause of climate change. The following quotations[18] illustrate some of the answers provided for the five most cited categories:

> The environmental pollution and overexploitation of natural resources, *Urban respondent 17*.
>
> The indiscriminate logging and chemicals sprayed, *Rural respondent 221*.
>
> Human beings do not properly use their culture, littering rivers and other places. Rivers, oceans, streams are polluted with garbage and other non-organic stuff, *Rural respondent, 235*.
>
> The planet cannot longer bear the damage we do… the air is polluted by industries and cars, *Rural respondent 295.*
>
> Because industries' accelerate the emission of greenhouse gases, *Urban respondent 37*.

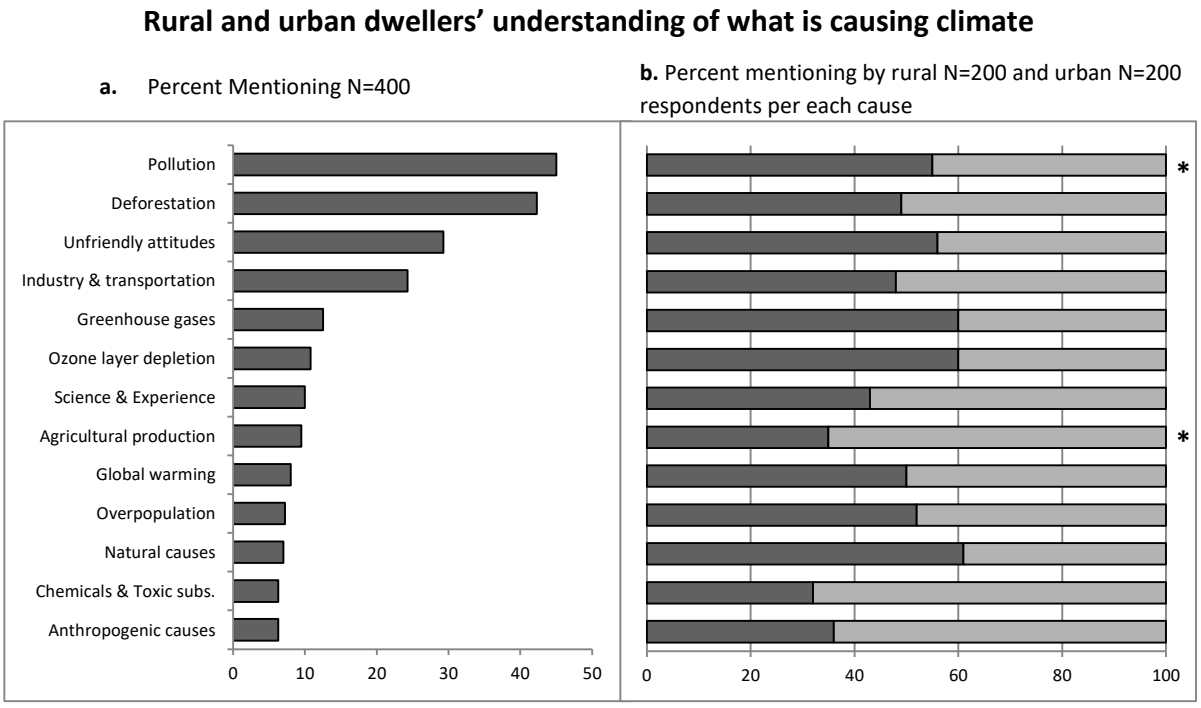
Rural and urban respondents varied in their knowledge about the leading causes of climate change. More specifically, Chi-square analysis found that for example, urban respondents tended to name pollution more often than rural respondents[19] (Figure 4.2b). Further analysis of these answers suggests that urban and rural participants understand pollution slightly differently. Thus, for urban participants "*pollution is caused by industries and motor vehicles growth*" Respondent 25, whereas for a rural respondent, industries and vehicles are contributors, but more importantly "*environmental pollution is caused by the usage of fungicides, herbicides, etc.*" Respondent 34. This result suggests that the same causing agent is understood differently according to participants' reality.

The rural and urban respondents both tended to identify agricultural production as a predominant cause of climate change as illustrated in the following quotations: "*Because of the overuse of chemical products in agriculture*" Urban respondent, 52; "*Because of the use and abuse of*

[18] All participants' quotations in this thesis have been translated from Spanish by author.
[19] Chi-square value obtained for the association between survey participant's place of residence and pollution as a cause of climate change: [$X^2(1,400) = 4.040$, $p < .028$.].

fungicides in agriculture" Rural respondent, 264. However, it is salient that agriculture was slightly more commonly mentioned by rural respondents as found in the Chi-square analysis[20] (Figure 4.2b).

Excepting pollution and agricultural production, no significant differences between urban and rural survey participants were reported for the remaining categories. These results suggest that regardless of the place of residence, the majority of the causal agents of climate change are similarly understood among all participants. Such understanding comprises inaccurate knowledge in that it is mainly seen as a general environmental issue, with deforestation, unfriendly environmental attitudes, ozone layer depletion, chemicals emissions, overpopulation, and policy and technology as part of the causal agents.



*p<0.05; **p<0.005; ***p<0.000

Figure 4. 2: a) Percentage of most frequently mentioned causes of climate change according to survey participants. b) Percentage of each cause split for urban (dark grey) and rural (light grey) participants: Responses provided to an open-ended question. Only causes mentioned over 5% are shown.

4.4.2. Farmer's understanding of the causes of climate change

In the interview, several answers were provided by subsistence (N=32) and commercial farmers (N=9) in response to the question what have you heard about climate change? The answers were

[20] Chi-square value obtained for the association between survey participant's place of residence and agricultural production as a cause of climate change: [X^2 (1,400=3,604, p < .042].

coded to identify explanations of what is causing climate change. These were later grouped into five main categories for the analysis of causes (Figure 4.3). The criteria used to code the answers are provided in Appendix 6G.

Farmers identified similar causes as survey respondents, with pollution, ozone layer depletion, deforestation, burning, and Earth's warming as the leading causes of climate change (Figure 4.3). Interestingly, pollution was also understood by farmers as agrochemicals polluting the air as illustrated in the following quotations: "*What we sprayed in the air, screws us all… there is so much spraying polluting the air*" Subsistence farmer, 20. In other cases, the sentiment expressed highlights their own agricultural activities as contributors: "*The ozone layer is destroyed by the chemicals we use…people sometimes burn as well, and that smoke and pollution and other things… I think it's because of that*" Subsistence farmer 12.

This understanding shared between rural survey participants and farmers interviewed that associates pollution with agricultural production, was better appreciated during participant observation processes wherein it was possible to partake of sowing and fertilisation activities (Appendix 7.d). During these activities it was observed that farmers use agrochemicals to fight pests, particularly those who can afford it, as well as keep the traditional slash and burn practices in the farm to prepare the land for sowing. Likewise, it was readily observed that no industries or car pollution occurred in the area but agricultural plots (Figure 4.4.). All this gives meaning to construct an understanding of pollution caused by agricultural activities rather than cars or industries.

Additionally, farmers placed great emphasis in the ozone layer depletion, which, according to their answers, has made them feel more intense sunlight, as illustrated in the following quotation:

> Climate change is a matter of environmental pollution… it's been said that it has changed a lot and that because of the ozone layer depletion you can notice that sometimes the sun burns and you have to dodge the sun because it burns, *Subsistence farmer 1*.

Finally, global warming and deforestation were also often reported by interviewees as causes of climate change, and again the sentiment expressed involves their own agricultural activities, as causal agents as following quoted:

> I heard that because of global warming and the pollution that we generate there are these climatic changes that affect all of us, crops and people, *Subsistence farmer 16*.
>
> Global warming is caused by the ozone layer depletion, by the misuse of agricultural land. It's been said that we contribute to this because we cut down the forest that keeps the humidity and generates rain. So it's been said that this contributes to these changes *Commercial farmer 6.*

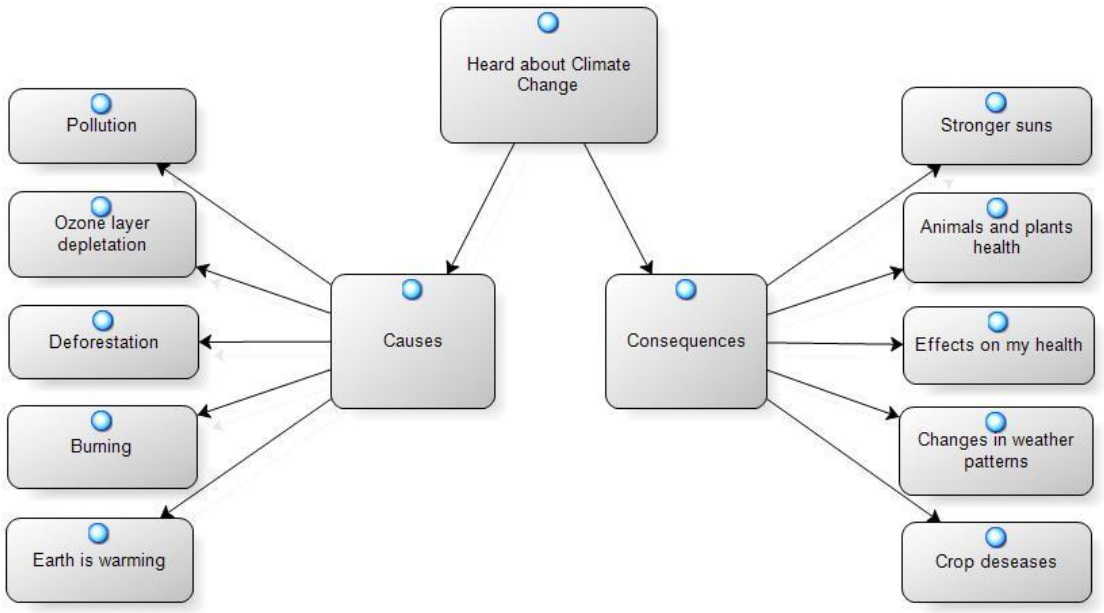


Figure 4. 3: Causes and consequences of climate change according to Subsistence N=32 and Commercial N=9 Farmers interviewed in rural areas in southern Ecuador.

Figure 4. 4: Landscape photography of the places where the interviews were applied. Photos on the top show the household distribution in the villages and on the bottom are shown some of the farms approached.

Based on these interview results, I suggest that subsistence and commercial farmers have a similar understanding as rural and urban dwellers about what is causing climate change. Such understanding involved inaccurate knowledge of a general environmental issue caused by pollution, ozone layer depletion, deforestation, and burning. The responses also revealed traces of accurate understanding among interviewees, who mentioned global warming as a cause of climate change.

Additionally, it is worth to note that the narrative used by farmers to explain their understanding of the topic, often started with phrases such as "*it's been said*" or "*I heard*", as if retrieving information heard in the past. This information is later incorporated to the reality they know as mentioned in the following quotations: "*It's been said that weather has changed and that it rains when it should not… because of that the plants are getting damaged"* Subsistence farmer 14.

4.4.3. Rural and urban dwellers' understanding of the consequences of climate change

Respondents were asked via an open-ended question to explain what would be the consequences of climate change. In response to this issue, an extensive array of answers was provided by rural (N=200) and urban participants (N=200). These answers were subsequently grouped into 17 main categories as summarised in Figure 4.5. The criteria used for defining the categories are presented in Appendix 5G.

According to survey participants, health effects, natural disasters, agricultural effects, ecosystem disruptions and weather alterations are the main five consequences of climate change (Figure 4.5a). Particularly salient are the extensive array of answers denoting concern about health, including: *skin cancer, skin diseases, spread and emergence of new epidemics, cold, laryngitis, pharyngitis, pneumonia, allergies, respiratory illness and diseases caused by intense sunlight*. An apocalyptic narrative was also found, wherein catastrophic effects were mentioned such as *death of people, death of animals and plant species, the extinction of life on Earth*. The following quotations illustrate some of the answers provided for the five most named categories:

> Larger population with health problems, *Urban respondent 9*.
>
> More severe natural phenomena such as floods, hurricanes, tsunamis, drought, storms, etc., *Rural respondent 37*.
>
> Right now crops no longer produce like they used to, *Rural respondent 201*.
>
> Species extinction and ecosystem services loss, *Urban respondent 52*.
>
> It rains, and it is cold at the same time the sun is up, *Urban respondent 198.*

The answers with which main consequences were identified suggest some variation between urban and rural respondents. More specifically, Chi-square analysis found that rural respondents tended to name agricultural effects[21], and lack of water availability[22] more frequently than urban respondents (Figure 4.5b). Notwithstanding this difference, the answers to the open-ended question suggest similar reasons for rural and urban participants mentioning agricultural effects with answers focused on crop production and food availability, as noted in this example: "*Few or too much rain would affect crop yield, meaning less food*" Respondent 50. However, the answers provided to account for the lack of water availability suggest that urban and rural participants understand water availability differently. Urban respondents tended to express a simple lack of water availability, as indicated in this quotation: "*there will be water shortage*", whereas rural participants tended to include water availability for agricultural activities as mentioned by this respondent "*there will be scarcity of drinking water to keep planting crops and raise animals*". This latter difference suggests that the same consequence is understood differently by participants and that it is linked to their place of residence.

The Chi-square test also indicates that urban respondents tended to name disruptions in ecosystems more frequently than rural respondents[23] providing answers such as *biodiversity loss* or *species extinction*. The test further indicates that rural respondents named pollution more often than urban respondents[24] to identify the consequences of climate change (Figure 4.5b).

Excepting agriculture, water availability, ecosystem disruptions, and pollution, no significant differences between urban and rural participants were identified for the remaining categories. These results suggest that regardless of the place of residence, the most frequently cited climate change consequences are similarly understood among all participants. Such understanding comprise inaccurate knowledge predominantly represented by health issues, but also by extreme weather events and climate-related impacts, with natural disasters such floods and storms, and social and economic effects as part of the consequences.

[21] Chi-square value obtained for the association between survey participants place of residence and agricultural effects as consequence of climate change: [$X^2(1,400) = 21.981$, $p < .000$.].
[22] Chi-square value obtained for the association between survey participants place of residence and lack of water availability as consequence of climate change: [$X^2(1,400) = 11.481$, $p < .001$.].
[23] Chi-square value obtained for the association between survey participant's place of residence and ecosystem disruptions as consequence of climate change: [$X^2(1,400) = 3.250$, $p < .047$.].
[24] Chi-square value obtained for the association between survey participant's place of residence and pollution as consequence of climate change: [$X^2(1,400) = 5.582$, $p < .014$.].

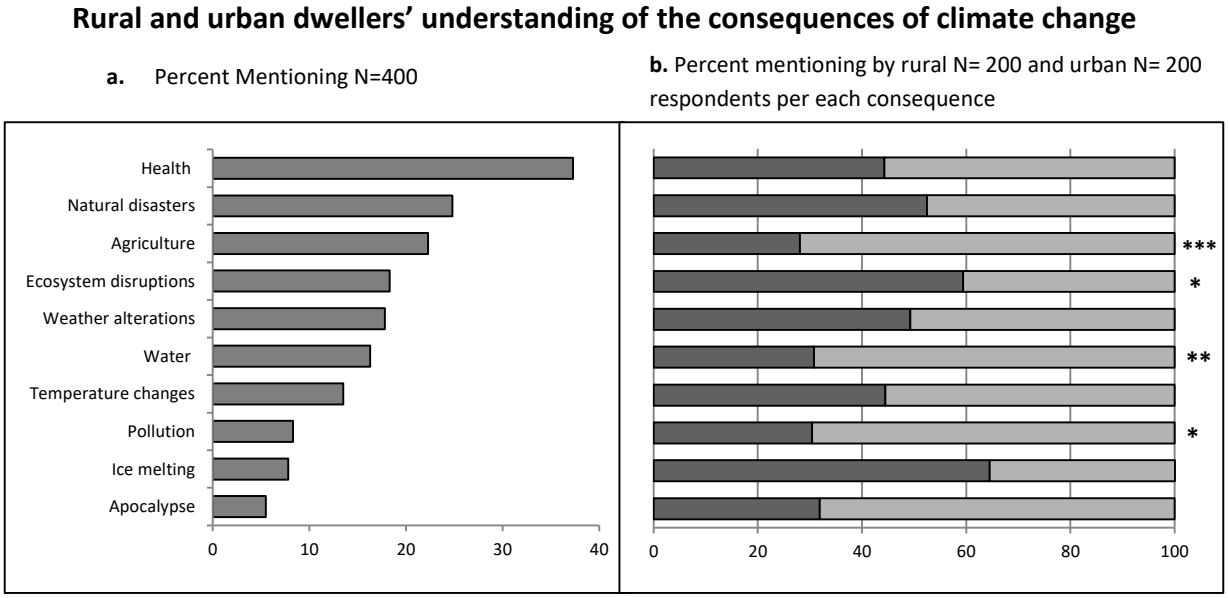


Figure 4. 5: a) Percentage of most frequently mentioned consequences of climate change according to survey participants. b) Percentage of each consequence split for urban (dark grey) and rural (light grey) participants: Responses provided to an open-ended question. Only consequences mentioned over 5% are shown.

4.4.4. Farmer's understanding of consequences of climate change

In the interview, subsistence (N=32) and commercial farmers (N=9) provided an extensive array of answers in response to the question what have you heard about climate change effects. The answers were coded to identify explanations of what are the effects of climate change. These were later grouped into five main categories for the analysis of consequences (Figure 4.3). The criteria used to code the answers are provided in Appendix 6G.

According to farmers interviewed, human, animals and plants health effects, more intense sunlight, changes in weather patterns, and crop diseases are the main consequences of climate change (Figure 4.3). It is interesting that similar to survey results, farmers interviewed tended to be concerned about health. The responses provided included human diseases such as: *allergies*, *skin cancer* and *skin damages*. Additionally, equal importance was placed on crop and animal health, as illustrated by the following quotations:

> I heard that this…layer… it's broken because of pollution. The ozone layer is broken, and this is why the sun is burning and damages our skin, and also damages plants and animals, *Subsistence farmer 3.*

> What is heard is that suns are stronger and this is why plants and animals are destroyed, *Subsistence farmer 11*.

It stood out that farmers tend to associate these health issues with pollution, and ozone layer depletion, suggesting a general environmental understanding of the topic. Equally outstanding is that farmers cited their own outdoor agricultural labours to construct a description that explains their perception of the ozone layer depletion in relation to intense sunlight radiation impacting on their health as in the following quotations:

> There are months when the sun is stronger because of a… layer or whatever…the intense sun damages the skin. I used to work jacketless, but now just an inch of sun and you get skin cancer, *Subsistence farmer 27*.

> The sun, the skin, the diseases… we have headaches now. Before we used to walk hatless, *Subsistence farmer 10*.

During participant observation processes, it was visible that farmers certainly do not work outdoors hatless and cover themselves as much as they can as response to climatic conditions under which they work namely intense sunlight and cold temperatures (Appendix 7.d, e). However, I believe that this also is part of traditional farmers' outfits that are observed in all rural areas in southern Ecuador.

Changes in weather patterns were also reported to damage crops and animals, as well as to alter production techniques:

> Well, the sun is more intense. I see it in agriculture and crops. Cassava, for example, it can be seen that sometimes the rain is pouring and the day after the sun is intense, and that worries us because cassava gets rotten, *Commercial farmer 6*.

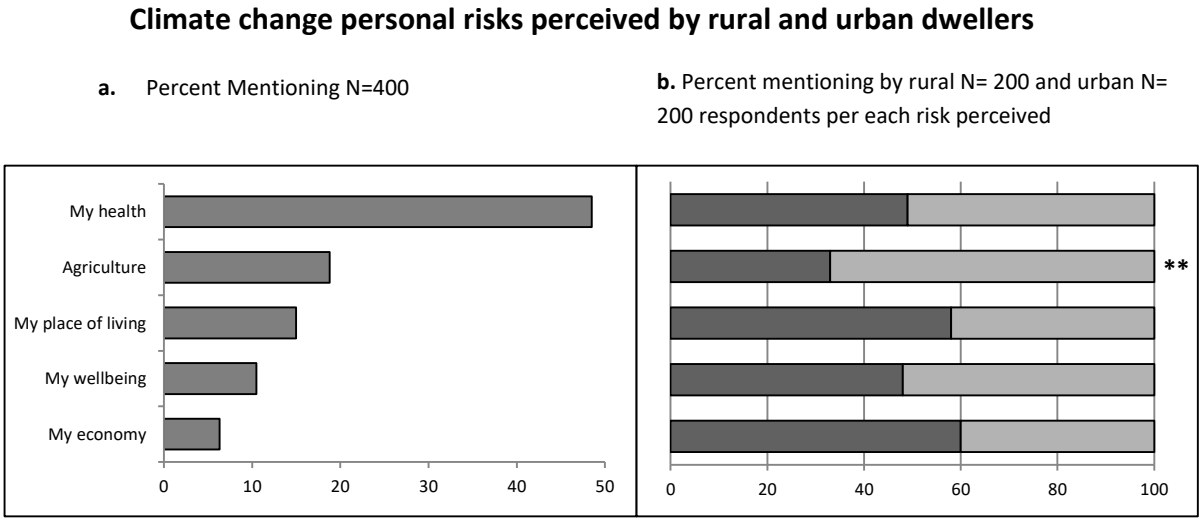
> There is more frost these days, so we have to spray the crops to produce, *Subsistence Farmer 11*.

In synthesising these interview results, I suggest that subsistence and commercial farmers understand similarly the consequences of climate change as a health issue caused mainly by pollution and the ozone layer depletion. This understanding denoted an inaccurate knowledge base of this climatic phenomenon.

4.4.5. Rural and urban dwellers' perceptions of climate change personal risks

With the help of a yes/no question, survey participants were first asked to state if they believe that climate change might be a threat to them personally. The majority of respondents (79%) agreed with this statement. In order to reduce a biased interpretation of these results, respondents who agreed with the statement then were asked to elaborate their answers explaining in an open-ended

question the reasons why they perceive climate change as a personal threat. A wide range of answers was provided in response to this request which was grouped into 11 categories (Figure 4.6). The criteria used for defining each category are presented in Appendix 5.



*p<0.05; **p<0.00; ***p<0.000.

Figure 4. 6: a) Main categories of climate change personal risk perceived reported by survey participants. b) Percentage of each risk split for urban (dark grey) and rural (light grey) participants: Responses provided to an open-ended question. Only consequences mentioned over 5% are shown.

Survey participants who perceived climate change as a personal risk did it on the grounds that it might impact their health, agricultural activities, place of living, wellbeing, and economy (Figure 4.6a). Other types of responses expressed concern about extreme weather events, effects for future generations, or denoted empathy for species and biodiversity loss. Some positive effects were also mentioned as voiced by this Respondent "*I like temperature changes, right now Loja is warm*". The following quotations illustrate some of the answers provided for each of the five most named categories:

> Changing climate helps to develop flu symptoms and affects people's health, *Urban respondent 45*.
>
> I will have to use more chemicals to process food and to raise the animals that are nationally consumed, *Rural respondent 31*.
>
> It affects the environment where we live in different ways, floods, landslides, droughts, *Urban respondent 27.*
>
> If I live on this planet it affects me directly or indirectly, commodity costs, skin cancer risks due to excessive UV rays, natural disasters reduce the quality of life, *Rural respondent 59*.
>
> When it's raining people don't go out, and that affects my business, *Urban respondent 22*.

The main personal risks perceived suggest some variation between rural and urban participants. More specifically, the Chi-square analysis found that rural respondents named effects on agriculture more frequently than urban respondents[25] (Figure 4.6b). Additionally, an analysis of the answers to the open-ended question suggests that urban and rural participants perceived risks for agriculture differently. For instance, urban participants tended to perceive risks for agricultural production as indicated in the following quote: "*drought and intense rains damage crops*", whereas rural participants tended to view risks more often in terms of food supply as cited in this example: "*Because of climate change there will be less production and therefore food shortage*". These results suggest that the same 'risk' is perceived differently and according to the place of residence of participants.

Except for the risks perceived in agriculture, no significant differences between urban and rural participants were identified for the remaining categories. This result suggests that regardless of the place of residence, the majority of climate change personal risks are similarly perceived among all participants, which are mainly seen as a health issue.

It is worth to note that health problems were frequently mentioned by survey participants concerning both the consequences of climate change and the personal risks perceived (Figure 4.5 and 4.6). These results suggest that there is an association whereby respondents' knowledge of the consequences of climate change seems to partly shape their perception of the risks of climate change. The relevance of noting this connection will be elaborated later in Section 4.5. Some examples of commonly referenced ailments included: *skin cancer, skin diseases, cold, fever, rhinitis, pharyngitis, pneumonia, allergies,* and *respiratory diseases*. Additional responses associating survey participant's knowledge of climate change consequences with perceived risk, linked health threats to general environmental issues such as *ozone layer depletion*, *toxic gases*, or *intense sunlight* as mentioned by the following respondents: "*Since we are losing the ozone layer, skin damages are occurring*" Urban respondent 19. "*It affects health with respiratory diseases, skin cancer, due to the emission of toxic gases and sun irradiation*, Urban respondent 52. "*Sunlight is too intense; one must wear a hat otherwise the sun is unbearable… and that affects my head; it gives me skin rash or stains*" Rural respondent 201.

[25] Chi-square value obtained for the association between survey participant's place of residence and agricultural impacts as climate change personal risk perceived: [$X^2(1,400) = 10.256$, $p < .001$.].

Finally, the perceived risks apparently have been incorporated into the daily activities of those surveyed, suggesting that their climate change risk perception has also been partly shaped by the reality they live in, as illustrated in the following quotations:

> It affects us all because it will be too hot, and we agriculturalists won't be able to cultivate our lands causing food shortage, *Rural respondent 321*

> We don't longer know when it's winter or summer, so I don't know when I should sell summer or winter clothes, *Urban respondent 2*.

4.4.6. Farmer's understanding of climate change personal risks

In the interviews, commercial (N= 9) and subsistence farmers (N=32) were asked to explain the ways climate change is affecting them personally. In response to this question, an array of answers was provided which were grouped into two categories. The criteria used to code the answers are presented in Appendix 6G.

According to commercial and subsistence farmers, climate change would impact them personally either on their health or agriculture, as illustrated in the following quotations:

> …With the sun on the skin… animals as well, and crops! At night there is frost, which affects our health, and also affects animals and plants, *Subsistence farmer 11.*

Similar to survey participants, the perceived risks seem to have been understood from the perspective of the reality that farmers live, with intense sunlight affecting predominantly farmers' skin health as the following quotes illustrates:

> Climate change…!the air! !sure! Because I breathe.., and that would affect my body. For example, too much sunlight affects me… sometimes it is too strong… and from time to time I have headaches from too much sun, *Subsistence farmer 5.*

It is important to highlight that a similar pattern to that found with rural and urban dwellers stood out with subsistence and commercial farmers, wherein health issues were frequently mentioned for both the climate change consequences and the personal risks perceived. This association buttress early observations accounting that participants' knowledge of the consequences of climate change is partly shaping the perception of the risks.

When combining the answers from survey and interview participants, I conclude that rural and urban dwellers as well as farmers tend to understand climate change as a general environmental issue mostly caused by pollution and deforestation, whose consequences will primarily impact health conditions. Likewise, both types of participants tend to perceive climate change as a personal

risk on the grounds that it will affect their health predominantly. These results, however, are more associated with a lack of basic technical knowledge of climate change similar to that found by Read et al. (1994), Reynolds et al. (2010), Myers et al. (2012), and Moloney et al. (2014).

4.4.7. Rural and urban dwellers' knowledge of the greenhouse effect, weather, climate, global warming and climate change

The results obtained in the previous subsections suggested that the majority of study participants lack fundamental knowledge of the leading causes and likely consequences of climate change. In considering these results I included the analysis of two survey questions regarding the greenhouse effect, and conceptual distinction between weather, climate, global warming, and climate change. Survey respondents (N=400) were asked in a close format question to state what the greenhouse effect is. The results found that 71% of respondents reported that they did not know the answer, suggesting a lack of knowledge on this matter. Additionally, with the help of a Likert scale-type question, survey participants were asked to agree or disagree with six statements formulated out of the main misconceptions found in previous studies (Bostrom et al. 1994; Read, et al. 1994; Bord, Connor & Fisher 2000; Reynolds et al. 2010), (Figure 4.7.).

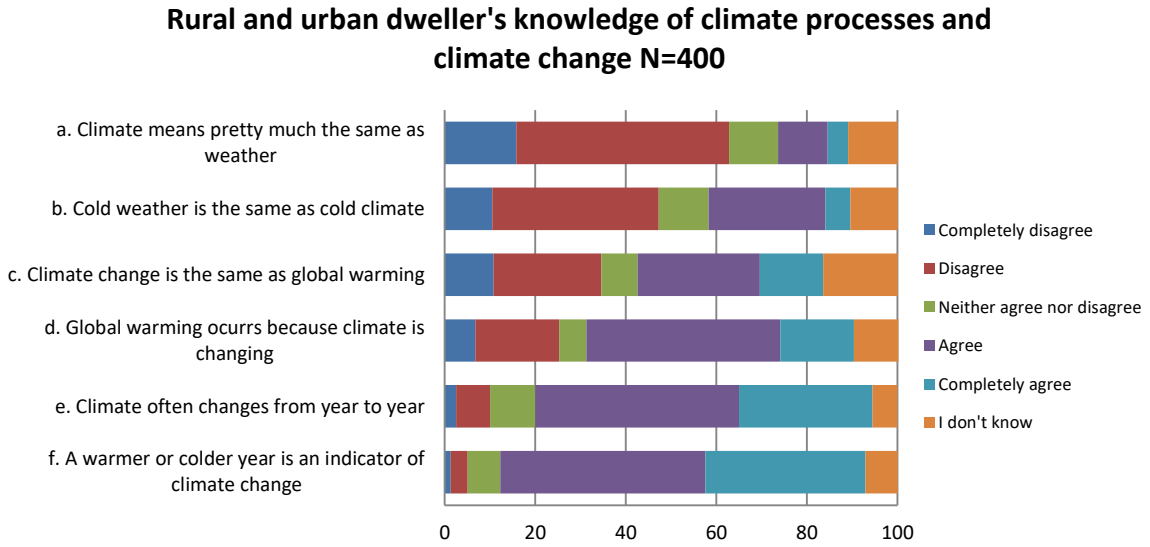


Figure 4. 7: Level of agreement of 400 survey respondents (urban N= 200, rural N=200) with six statements on weather, climate, and climate change.

Statements **a** and **b** tested respondents' understanding of weather and climate as essentially the same thing, whereas statements **e** and **f** examined whether respondents understood that climate changes on an annual basis. If respondents agreed that weather is the same as climate, then they

should also agree that climate changes from year to year or that a warmer or colder year is an indicator of climate change. The majority of respondents indicated that they disagreed (47%) or completely disagreed (16%) with sentence **a,** and that they disagreed (37%) or completely disagreed (11%) with statement **b**, suggesting that they understood that there is a difference between weather and climate. However, the majority of respondents indicated that they agreed (45%) or completely agreed (30%) with sentence **e,** and that they agreed (45%) or completely agreed (35%) with sentence **f**, suggesting that these respondents understood climate to change on an annual basis. To confirm that climate has changed, it is necessary that a region experience changes to the average weather over an extended period, typically 30 years (IPCC 2001). Weather, on the other hand, is variable and changes even on a daily basis. How is it possible then, that respondents differentiate weather from climate, but somehow understood both terms as equals? A plausible explanation for this contradiction lies in the language. In Spanish *"tiempo"* refers to both weather and time; which clarifies the differentiation between *tiempo* and *clima*. Therefore, I argue that respondents disagreed with statements **a** and **b** because of the obviousness of the question. This argument is strengthened by some of the answers provided in the open-ended questions regarding consequences of climate change such as: *rainy climates, daily abrupt climate changes, climate changes too much*. All these answers rather refer to changes in weather but were directly connected to responses about the consequences of climate change.

Sentences **c** and **d** examined whether respondents understand global warming and climate change as the same thing. The majority of respondents indicated that they agreed (27%) or completely agreed (14%) with sentence **c,** and that they agreed (43%) or completely agreed (16%) with sentence **d**, suggesting that global warming and climate change means essentially the same for the majority of survey participants.

4.5. Matching climate change scientific knowledge, information disseminated and data collected

In this section, survey and interview results are analysed together in the context of the scientific knowledge and the information disseminated early presented in Sections 4.2 and 4.3, to determine which of them fits better with the study participants' knowledge, perceptions and understandings of the topic.

Survey and interview results suggest that study participants tend to understand climate change causes and consequences in three main ways: pollution, health, and general environmental issues. It

is worth to note that the answers provided combined scientific knowledge with information disseminated by media and politicians. Scientific knowledge is thus represented by responses such as global warming, greenhouse gases and carbon dioxide emissions derived from industries and transportation. The information disseminated is represented by responses such as pollution, deforestation, ozone layer depletion, extreme weather, and climate-related events dominated by health and agricultural effects (Figure 4.2., 4.3., and 4.5.).

A similar understanding has been widely found by researchers in other geographical contexts, particularly among the public in the United States (Read, et al. 1994; Bord, Fisher & O'Connor 1998; Reynolds et al. 2010; Petheram et al. 2010; Huxster, Uribe-Zarain & Kempton 2015), European countries (Lorenzoni & Pidgeon 2006; Whitmarsh 2008; 2009), and Australia (Harriet & Bulkeley 2000; Petheram et al. 2010). These studies conclude that lay people consistently mention pollution, deforestation, ozone layer depletion, greenhouse gases, carbon dioxide emissions, industries and transportation as climate change causal agents. As for the effects, there is a tendency to state that climate change may trigger extreme weather events, like floods and natural disasters impacting health and agriculture.

While I cannot prove that study participants have consumed the same information disseminated in other countries, the similarities with the findings mentioned above, suggest that participants' knowledge and understandings of climate change have been constructed by similar mainstream information that mingles correct and erroneous evidence. For instance, one farmer interviewed offered: "*I heard in the news that we are polluting and making the layer thinner… I listened to that on the radio*". These findings are hardly surprising given that public understanding of global climate change is strongly influenced by media constructions of scientific knowledge as suggested by Antilla (2010). However, these constructions have distorted climate change information in order to create more dramatic reports (Boykoff 2009), which have been in turn propagated by political actors (Carvalho & Burgess 2005; Carvalho 2007). Indeed, politicians were found to have played by far the most powerful and effective role in shaping climate change awareness among the public between the 1980s and 2000s (Carvalho 2007).

The effects of the media and politicians on people's consciousness depends on how the content is interpreted by the viewers (Kalof 1998). It is in this context where individual experiences play a role in the interpretation of information through a perception route called matching-recognition processing (Berstein, 2010). For clarity of description, I will explain this process using the answers provided by a survey participant as an example. In the matching-recognition process, the brain takes incoming information '*car's smoke*' and compares it with information stored in the memory '*air is*

polluted by vehicles'. If the brain finds a match, recognition takes places '*the air is polluted by cars*'.

This perception process was identified among study participants who apparently have matched their prior knowledge with their immediate environment to construct a meaningful understanding of climate change. For instance, for a large proportion of urban participants, in the cities, transportation and industry burn fossil fuels that are visually apprehended as smoke coming from these sources and verbally referred to as pollution. In contrast, for the majority of farmers in rural areas, pollution is perceived as herbicides and fungicides sprayed in the air. This understanding is meaningful in rural Ecuadorian environments which are dominated by agricultural plots (Figure 4.4). Deforestation is one of the main environmental issues Ecuador faces which is broadly propagated by central and local governments to raise awareness among the general public (MAE, 2014 p. 5-9). In considering that study participants tended to understand climate change as a general environmental issue, it is plausible that they have matched their deforestation knowledge with climate change. Finally, in a country located on the equator the sun might beats quite strongly, in particular at midday, so for both rural and urban participants, intense sun and warmer temperatures are readily matched with global warming and climate change concepts.

The discussion above suggests that participant's prior knowledge is relevant in the process of shaping an understanding of climate change. According to Berstein (2010), the role of prior knowledge in the matching-recognition processing is primordial in particular when sensory information is ambiguous. Climate change and global warming are concepts that are precisely ambiguous, abstract and intangible for many people (Antilla 2010; Hulme 2015). The results of my study, suggest that the matching-recognition process has operated helping participants to retrieve their *a priori* knowledge, to complement their sensed experience in order to make sense of their understanding of this climatic issue. This process was observed overall in the results, but it was especially noticeable when similar information regarding health and agricultural impacts was provided for both the consequences of climate change and the personal risks perceived (Figures 4.3., 4.5. and 4.6.). For instance, participant's 'prior knowledge' regarding the *ozone layer depletion* has been combined with 'sensory information', namely *intense sunlight*, to produce a 'meaningful input' in this case *skin damages* and subsequent *cancer*.

Similar matching-recognition processing has been found in the context of climate change by other studies of perception using interviews or open-ended survey questions. For instance, Byg & Salick (2009) found that Tibetans believe that glaciers are melting because of garbage, whereas Whitmarsh

(2008) suggests that individuals experiencing air pollution were more likely to consider that climate change is real. Likewise, Howe & Leiserowitz (2013) contend that global warming beliefs bias the perception of seasonal temperature, particularly on those who do not believe global warming is happening. The findings of these studies suggest that peoples' knowledge acquired by earlier experiences or beliefs match to create an understanding of climate change. Indeed in a study conducted in Switzerland by Shi, Visschers and Siegrist (2015) it was found that people's perceptions of climate change were influenced by climate prior knowledge and cultural worldviews.

Finally, the results of my study strongly suggest that survey participants lack a clear concept regarding the greenhouse effect and that they do not conceptually differentiate weather from climate or climate change from global warming. These results are hardly surprising given that these terms have been used interchangeably when presenting mainstream information on climate change. The lack of differentiation between these terms has been found by other studies (Bostrom et al. 1994; Read et al. 1994; Bord, Connor & Fisher 2000; Whitmarsh 2009; Reynolds et al. 2010), suggesting thus that individuals' understanding of weather, climate, global warming and climate change is constructed similarly in different societies worldwide.

In summary, the analysis carried out to compare climate change scientific knowledge, information disseminated and data collected, demonstrates that participants' knowledge, perceptions and understandings of climate change fit better with the mainstream information presented by printed and digital media and by politicians than with current scientific knowledge about global warming and climate change. I argue, therefore, that mainstream information combining correct and erroneous evidence has been disseminated beyond western countries reaching remote areas like small villages in southern Ecuador. The implication that this sort of information has for governments and the general public is a matter of further research.

4.6. The construction of climate change understanding

In the preceding section, I presented evidence to discuss that study participants possess a similar inaccurate knowledge of climate change to that found in previous research. I also discussed that their knowledge fits better with the information disseminated by mainstream media than with scientific knowledge. Moreover, I argued that their perception of climate change is constructed with prior knowledge and sensed experiences. Together these tenets suggest that climate change is a socially constructed concept. Indeed, climate change perception, concern, scepticism, and beliefs are suggested to be processes that are socially and culturally constructed (Kalof 1998; Vedwan & Rhoades 2001; Carvalho & Burgess 2005; Grothmann & Patt 2005; Antilla 2010; Leombruni 2015;

Weber 2016). While I support the view of these researchers, I take this idea further arguing that people's inaccurate knowledge, and therefore their understanding of climate change is also socially constructed. In engaging with this assumption, I will propose a theoretical model which represents the social construction of climate change understanding (Figure 4.8.). As I mentioned at the beginning of this chapter, I will build this model by using the theory of social construction of reality by Berger & Luckmann (1966).

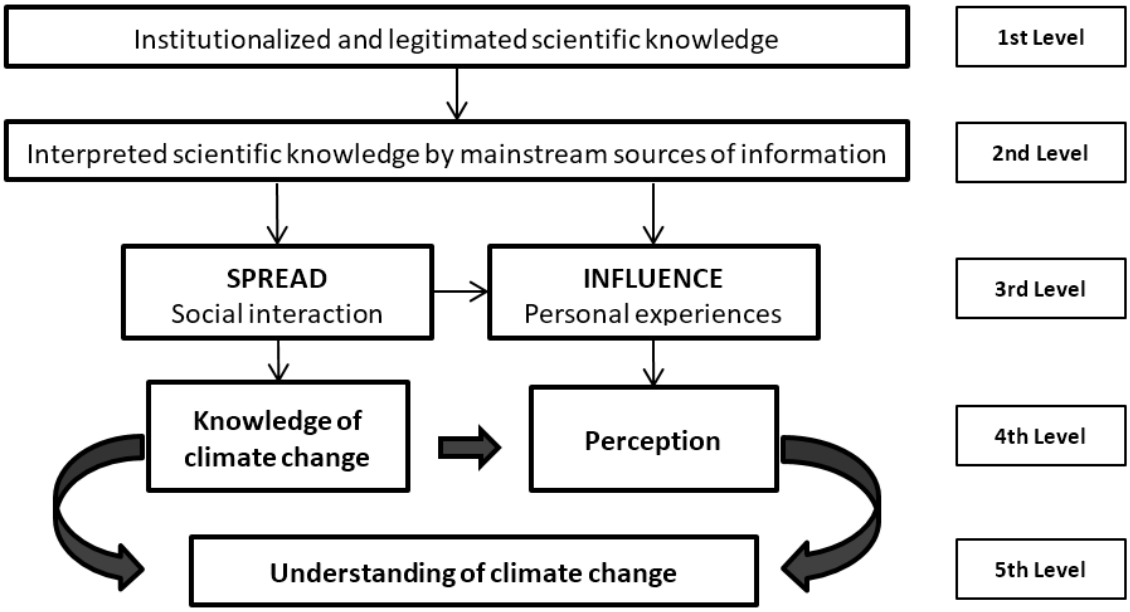


Figure 4. 8: Theoretical model built by Author to describe the social process through which individuals may reach an understanding of climate change.

First level: according to this model, the construction process begins with the scientific knowledge historically presented, which states that the greenhouse effect has been altered since the industrial revolution, with human activities burning tonnes of fossil fuels responsible for releasing excessive 78% of carbon dioxide into the atmosphere. This increase in carbon dioxide emissions has, in turn, increased global temperatures, which are likely to change global climate causing an increase in sea levels, ice caps melting, snow pack retreat, and species shift (IPCC, 2012). This scientific knowledge received public attention after it was included in the international political agenda (Carvalho 2007; Hulme 2013). Since then it has been institutionalised mainly by natural scientists and legitimated by the IPCC as the organisation acknowledging and disseminating such knowledge under the name of climate change (Hulme & Mahony 2010; Hulme & Mahony 2013; Lorenzoni & Whitmarsh 2014).

Second level: in this level, the scientific knowledge has been interpreted by mainstream sources like media and political actors, who have transmitted distorted information (Boykoff & Boykoff 2007) and created more sensationalist stories (Antilla 2010). I will summarise two examples of these types of stories which have become the *recipe knowledge*[26] of climate change:

a) Climate change is caused by greenhouse gases derived from industrial pollution burning fossil fuels and from the destruction of world's forests, which in turn increased global temperatures.
b) Climate change is the greatest threat humanity faces since it is responsible for increasing floods, droughts, ecosystems disruptions, economic loss, poverty, famine, health illness, and wars.

Whilst the labours of mass media and political actors to translate scientific knowledge into dramatic narratives is important for environmental issues to be acted upon (Hanningan 2014, p. 64-65), it is vital to take into consideration that climate change has transcendent the arena of science and media as well as the characteristics of an environmental issue. That is to say raising awareness and concern of climate change is no longer about acknowledging scientific evidence or receiving political and media attention but about finding common and neutral ground for a wide range of views involved in the climate social debate. In the words of Hoffman (2015, p.4-7) public understanding of climate change do not lack of scientific information or media coverage but intentional or unintentional avoid of that information as response to diverse cognitive, cultural, political, and economic values. Therefore, climate change should not be viewed as a mere environmental issue but as a matter that has to be compatible with the values of policy-makers and the multiple views of local populations. Indeed, the use of dramatic messages in the climate change narrative has been found by other researchers to foster scepticism among members of the general public, particularly those who are dismissive and doubtful (e.g., Whitmarsh 2008; O'Neill & Nicholson-Cole 2009; Feinberg & Willer 2011; Myers et al. 2012). These researchers moreover suggest that dramatic narratives rather lead members of the public to disengage and learn less about the topic. Thereby, the use of dramatic narrative should be carefully incorporated when campaigning on climate change in that the same narrative may induce concern or scepticism depending on the values of the person filtering the information.

Third level: this level embraces two parallel phases. The first phase is a collective process whereby the *recipe knowledge* is shared through social interaction. According to Leombruni (2015), social

[26] Recipe knowledge is the term used by Berger & Luckmann to express the transformation of the information received into a knowledge that is no longer questioned by people.

networks are essential dimensions to include in models of climate attitude formation and change, Leombruni indeed found that the stronger a person's network or the more they talked to friends and family about climate change the stronger their belief in that it is happening. Thanks to the facilities offered by modern communication systems like 'Twitter'; social networks have extended allowing this *recipe knowledge* to spread and shared between societies worldwide as it was found by Jang & Hart (2015), who indicate that 'tweets' mirror the controversy observed in the traditional media when covering climate change. Plutzer et al. (2016) even suggest that middle and high school teachers in the United States, copy other social actors by repeating scientifically unsupported claims in classrooms. The second phase of this level is an individual process whereby the *recipe knowledge* influences sensed experiences with weather. This latter occurs because external information such as media contents are interpreted on an individual level as suggested by Kalof (1998). Together both phases propose a likely explanation to earlier demands on research on how information-processing biases affect responses to climate change (Clayton et al. 2015). I offer then that the spread information of climate change influences individual experiences with weather to later inform their perception and potential responses to climate change as I will elaborate in the next level. However, given that this information is partially inaccurate, the responses may be potentially ineffective, although this latter argument needs further research.

Fourth level: the information spread in the previous level had enabled study participants to create a pool of knowledge. Nonetheless, since the information is inaccurate, biased, and sensationalist, individuals have constructed a rather distorted knowledge, as was also found in other studies (e.g., Boykoff 2009). This knowledge contains a dearth of global warming scientific knowledge and abundant interpreted information assembling levels 2 and 3. Moreover, at this level, the knowledge constructed is combined with personal experiences to influence in turn peoples' perceptions of climate change through a matching-recognition process. This psychological process matches individuals' *a priori* knowledge with their sensed experiences with local weather and reality. In my study, the matching-recognition processing was more noticeable when similar answers were provided to inform for both the knowledge of climate change consequences and the perceived personal risks.

Fifth level: in the last level, the knowledge acquired, and the perception shaped towards climate change will join to forge an understanding of this climatic issue. As I previously discussed the information assembling this understanding is rather distorted explaining thus why people hold several misconceptions as found in other studies (e.g., Read et al. 1994, Bord, Fisher & O'Connor 1998; Lorenzoni & Pidgeon 2006; Reynolds et al. 2010; Huxster, Uribe-Zarain & Kempton 2015).

With this as a backdrop, I argue that while the view that media and political actors play a significant role in the assemblage of people's understanding of climate change (Carvalho 2007; Boykoff 2009; Antilla 2010), social interaction and individual experiences fixes this inaccurate knowledge more deeply. This argument is supported by a study conducted in the United States, whose results demonstrate that the more respondents felt they knew about climate change, and the less information they felt they needed, the stronger their belief in the phenomenon (Leombruni 2015).

People have grown up with this knowledge of climate change and have incorporated it into their reality to make sense of their understanding. For them what they know and understand is enough to interact with society, and therefore they never question the facts upon which this knowledge has been created, legitimating thus the *recipe knowledge* of climate change. This understanding will remain as long as people judge this knowledge as sufficient and adequate for their daily intercourse with society. In this context, the *recipe knowledge* of climate change is translated into deforestation, pollution and health issue, aspects that have led previous researchers to conclude that the view of a health and pollution framework may prompt people to engage with this climatic issue (Whitmarsh 2009; Myers et al. 2012). However, I argue that since these frameworks have been incepted in a 'western' society they overlook the multiple non-western views claimed to be involved in the climate debate (Esbjörn-Hargens 2010; Hulme 2015), as well as may alienate people from their local realities. Thereby, people should be taught about the responsibility they have to inform themselves and others with valid evidence and facts of the real vulnerabilities that people face in their local areas. As Kronik and Verner (2012, p.97-111), Rojas Hernández (2016), and Eisenstadt & West (2017) contend in the Latin America context, conceptualizations of vulnerability of climate change should be tailored to the particular experiences of individuals that involves their local worldviews. This is vital to bear in mind in countries like Ecuador wherein development plans such as the Sumak Kawsay are rather aligned with local cosmovisions and problems such deforestation are mainly related to social inequalities. In addition, I disagree with Whitmarsh (2008, 2009) in that while the use of 'air pollution' as springboard brings the concept of climate change closer to familiar and cognitive domains, it may also induce emotional responses leading people to avoid the issue as I will discuss in depth in Chapter 6.

Succinctly, the evidence presented in my study suggests that people's understanding of climate change is a socially constructed process whereby scientific knowledge, media, political actors, social interaction, individual experiences, and perception play a role. Whilst these factors have been analysed in previous research (e.g., Kalof 1998; Vedwan & Rhoades 2001; Carvalho & Burgess

2005; Vedwan 2006; Antilla 2010; Hulme 2015; Leombruni 2015; Weber 2016), this is the first work combining these factors to construct a theoretical model explaining this social process.

4.7. Conclusion

Throughout this Chapter, I have described a process that is socially constructed and influenced by historical, political, and psychological factors. During this endeavour, I explained how people's interaction with society help them to create a pool of knowledge that is later shared between generations and between geographical places thanks to the facilities of modern communication. The conclusion I draw from this Chapter is that the people's knowledge, perceptions and understandings of climate change in southern Ecuador, is similar to the understanding in other countries, despite considerable differences in the social, cultural, economic and geographical realities. This understanding, involves western views of deforestation, pollution and health issues that overlook real vulnerabilities that people in Ecuador face against climate change. Social research should, therefore, investigate the implications of imported messages of climate change on the establishment of climate change policies in non-western countries. Finally, it was observed that climate messages have been translated into dramatic narratives following the logic of constructing successful environmental claims. However, since these messages have been found to foster scepticism among some members of the public, I conclude that climate change should not be considered as a mere environmental issue but as a matter involving multiple worldviews whereby political, economic, cultural, and cognitive factors filter the messages received. As far as I am aware this is the first study offering a holistic explanation of how individuals reach an understanding of climate change.

Chapter 5
Perception of climate change adaptation: demographics matters

5.1. Introduction

After climate change mitigation strategies failed to reduce carbon dioxide emissions, strategies built around the concepts of adaptation and resilience have emerged as better tools for facing this global challenge (Hulme 2013, p. 7-8). Nonetheless, climate change adaptation research has mainly addressed it as a financial and technocratic issue (Lobell et al. 2008; Brown & Funk 2014) and has largely overlooked other social and psychological factors that can be seen as critical for implementing an effective adaptation strategy (Taylor 2015, Thaker et al. 2016). These include parameters such as self-estimated efficacy, collective efficacy, and the ability to adapt (Grothmann & Patt 2005; Hart & Feldman 2014; Thaker et al. 2016). Other writers argue that knowledge is also necessary for adaptation (Adger et al. 2005, Pasquini et al. 2015). In my study, I hypothesise that climate change adaptation is rather a psychological state of mind prompted by the impact of climatic changes on people's livelihoods; a state of mind wherein financial and technocratic resources are not pivotal for adaptation and knowledge does not guarantee that adaptation measures are taken. Moreover, climate change adaptation literature tends to assume social symmetries within geographical regions and communities. Such social symmetries are absent in real social groups, particularly in agrarian environments (Eriksen, Nightingale & Eakin 2015, Taylor 2015). Therefore, I also hypothesise that inherent social divisions play a role in the psychological state of mind that prompt individuals to self-estimate their capacity to adapt to changes and perceive adaptation.

To test the assumption above mentioned, I will analyse and compare data collected through face-to-face questionnaires with urban and rural residents in southern Ecuador, online questionnaires from a panel of academic conservationists around the world, and semi-structured interviews with subsistence and commercial farmers in southern Ecuador. The objectives are to elucidate the degree to which: a) climate change adaptation is led by knowledge, physical resources or by a psychological state of mind, and b) the perception of adaptation to climate change is influenced by inherent social divisions and demographic background.

In pursuing the objectives of this Chapter, I will first present the rationale concerning climate change adaptation. Subsequently, I will present the data collected for the different social groups studied, and then later focus specifically on the relation between farmers and academics. Finally, I will consider these data in the context of literature reviewed to elucidate the assumptions here

raised. This study offers information that contributes to understanding local realities and values that are claimed to be poorly represented in the adaptation literature (Eriksen, Nightingale & Eakin 2015).

5.2. Theoretical background

The risks associated with climate change vary across regions and depends on various factors, including the extent of mitigation and adaptation strategies (IPCC 2014a). Mitigation strategies have largely failed to reduce carbon dioxide emissions (Hulme 2013 p. 9), giving way to adaptation as a more suitable approach to coping with climatic changes. State simply, adaptation is defined by the Oxford dictionary as the process of changing to suit the environment, whereas, climate change adaptation is defined as the process of adjustment to actual or expected climate and its effects, by moderating or avoiding harm (IPCC, 2014).

Notwithstanding, both definitions are inclusive for all possible adjustment strategies, according to Taylor (2015, p. 7) the climate change adaptation literature has focused mainly on technical or social engineering strategies wherein economic resources are pivotal to adopt adaptation strategies. These aspects may be true for certain type of western societies as it was found by Ford, Berrang-Ford & Paterson (2011), who claim that the adaptation patterns in western European countries, North America, New Zealand and Australia, are summarised in strategies related to transportation, infrastructure, and utilities. Additionally, Adger et al. (2009) and Pasquini et al. (2015) argue that knowledge, among other factors, influence on the way climate adaptation decisions are made. Indeed, knowledge, economic, technocratic, and institutional resources are necessary for adaptation. However, these resources are not as critical to the process of adaptation as are collective efficacy and social learning (Ensor & Harvey 2015; Thaker et al. 2016), the self-estimated ability to adapt (Grothmann & Patt 2005), and the self-efficacy to respond (Hart & Feldman 2014). Those who support this view claim that individual and collective self-efficacy to respond to changes form an important “bottleneck” through which urgent action must pass, and which are therefore more vital to adaptation than monetary or physical resources. Whilst I support this view, I hypothesise that such self-estimate efficacy is underpinned by a psychological state of mind, which in turn is prompted by the impact of climatic changes on people’s livelihoods. That is to say people try to adapt to changes by trial and error regardless their beliefs on the efficacy of their actions, particularly when their livelihoods are jeopardised. This has been a common story in Latin American countries since pre-Columbian civilisations (Williams 2010, p.11-26).

Likewise, Taylor (2015, p. 6) and Eriksen, Nightingale & Eakin (2015) point out that adaptation literature fails to view pre-existing social differentiation as an important vector of vulnerability, which imagines homogeneous communities that neglect how different social groups experience and respond to climatic changes. This view is supported by a group of researchers who assert that real vulnerabilities for adapting to climate change are rooted in social inequalities, particularly in Latin American societies (Rojas Hernández 2016; Eisenstadt & West 2017). In addition, other writers such as Wheeler et al. (2013) suggest that adaptation is positively associated with younger and healthier farmers, the possibility of successors, innovative and productive farms, and even according to beliefs about climate change. The latter suggestions are that inherent social divisions play a role in the adoption of adaptation strategies. Therefore, I also hypothesise that social divisions and demographic background shape the state of mind that prompt individuals to self-estimate their capacity to adapt to changes and perceive adaptation.

In adopting this position, three groups of people of differing occupation background and geographical area were selected to explore their understanding of climate change adaptation. These groups are farmers, academic conservationists, and rural and urban dwellers. At this point it is important to remind that what it follows may appear to conflict earlier accounts regarding the conceptual differentiation between terms such as “weather” or “climate” or “climate change” and “global warming”. However, as explained in Chapter 2 it was preferred to keep the terms used in the literature reviewed because they represent the climate scientific knowledge shared.

Farmers’ livelihoods, in particular in developing countries, have been studied in climate change research mainly for three reasons. The first responds to farmers’ vulnerability to global warming. According to Byg & Salick (2009) people depending on agriculture are heavily affected by climate change given their constant outdoor activity, whereas according to Houghton et al. (2001) people from developing countries are less adaptable than other people to the consequences of this global phenomenon. Tol et al. (2004) and Mendelsohn et al. (2006) buttress these arguments, suggesting that farmers in developing countries are more vulnerable because they are directly reliant on natural resources to meet their basic needs, whilst Schmidhuber & Tubiello (2007) and the IPCC report 2014 indicate that such vulnerability responds to people’s poverty and lower incomes. Likewise Brown & Funk (2014) argue that farmers in food-insecure regions are more vulnerable because climate variations reduce production and increase costs.

The second reason for the focus on farmer livelihoods responds to farmers’ reliance on weather conditions, which is seen to make them good informants when it comes to analysing changes in the weather. Turner & Clifton (2009) for instance, point out that weather changes affect farmers and

local people's access to water and food quality. This reliance to climatic conditions, according to Rogan et al. (2005) position farmers as great observers of changes in weather and land composition. Farmers also have been found to have a very clear memory of the years dominated by extreme climatic conditions and other significant events leading to disturbance of their production (Mertz et al. 2009), as well as to notice physical environmental changes (Carothers et al. 2014) such as temperature increase, rainfall decrease, and changes in droughts and floods frequency (Ishaya and Abaje 2008). Additionally, for another group of researchers farmers' observations of weather patterns and changes are aligned usually with local meteorological data (Byg & Salick 2009; Howe & Leiserowitz 2013; Tripathi & Singh 2013; Cobbinah & Anane 2016) which make them good sources of information for developing reports of weather changes.

Finally, farmers and local peoples have been analysed in the climate change adaptation literature in a polarized manner regarding their adaptation capacity. Thus, whilst some researchers claimed that weather changes decrease indigenous people's access to wild food (Cunsolo Willox et al. 2012), or reduce people's ability to continue their traditional agricultural practices (Halder, Sharma & Alam 2012), other bodies of research suggested that farmers rather try to adapt to emerged weather conditions (Salick, Fang & Byg 2009). According to Turner & Clifton (2009), farmers continue innovating to face the changes by prompting themselves with creative solutions. Farmers are also acknowledged as possessing valuable adaptation strategies recognizing and responding to changes in climate parameters by including strategies such as crop switching (Seo & Mendelsohn 2008), diversifying their productive activities in different landscapes (Campos, Velázquez & McCall 2014), or by implementing short and long cycle crop varieties (Lacy, Cleveland & Soleri 2006).

Contrasting this well-researched relationship between farmers and weather little is known beyond the development of scientific knowledge about the perception of academic conservationists of climate change adaptation. Few studies researching academics' expert opinions on climate change exist (Nordhaus 1994; Javeline et al. 2013; Moloney et al. 2014). In the first study, Nordhaus assessed the opinion of social and natural scientist experts in climatic change. Their findings indicate that experts from natural sciences voiced deep concern about the ability of natural ecosystems to adapt to climatic change, suspecting severe economic effects, whereas social experts, mainly economists, expressed that the degree of adaptability of human economies is so high that the impact of global warning would be "essentially zero". Economists also claimed that the time frame, over which the climatic changes are expected to take place, is sufficient to allow developments of new strategies (1994). In the second study, Javeline and colleagues evaluated expert environmental biologists' opinions on climate change, who predicted greater increases in future temperature and

larger impacts of climate change, including higher species extinctions and range shifts (2013). Additionally, Moloney and colleagues analysed what the general public and academics/scientists think about climate change. Their findings conclude that both communities, irrespective of the group with which they identify, use similar terms to define climate change such as "ability to adapt", "impact", and "inevitable", but only academic/scientists used words such as "mitigation" and "carbon management" (2014).

Finally, as I discussed in Chapter 3, members of the general public particularly urban dwellers have been studied to analyse their knowledge and perception of climate change (Read et al. 1994; Bord, Fisher & O'Connor 1998; Reynolds et al. 2010; Howe & Leiserowitz 2013 and Moloney et al. 2014). However, little is known yet about the opinions they have about adaptation to climate change. In addition, population samples from urban dwellers have been widely studied in the geographical context of the United States, Europe and Australia (Capstick et al. 2015; Ming Lee et al. 2015). Hence, I considered contributing with empirical data from less studied geographical regions about people's perception of climate change adaptation.

In short, I assume that farmers, academic conservationists, and rural and urban dwellers understand and perceive climate change and adaptation differently and that such differences occur between and within these groups. In pursuing the elucidation of these assumptions, I will draw upon the data obtained from participant observation processes and interviews applied to subsistence and commercial farmers in southern Ecuador, from the survey conducted with rural and urban residents also in southern Ecuador, and from the on-line survey carried out with academic conservationists in 36 countries.

5.3. Results

As I mentioned in Chapter 3, interview data were analysed through inductive coding of transcripts and against the seasonal calendars drawn by participants. From the formal interviews and participant observation, I was able to delineate four salient themes regarding farmers' weather observations, impacts of weather changes on subsistence practices, solutions incorporated to cope with changes, and opinions of adaptation to weather changes. Survey data from face-to-face questionnaires were first analysed through descriptive statistics. CHAID classification tree tests were then carried out, in order to test whether rural and urban respondents differently perceive climate change adaptation and mitigation. Survey data from online questionnaires were also first

analysed through descriptive statistics. CHAID classification tree tests were then carried out, in order to test whether academic respondents prefer adaptation or mitigation of climate change according to their demographic background.

The findings from the interview and survey stages are presented separately in order to elucidate how study participants perceive and understand weather changes and adaptation. Survey data from face-to-face and online questionnaires are analysed together in order to determine differences between rural/urban dwellers and academics regarding their perceptions and preferences on adaptation and mitigation strategies.

I hypothesise that climate change adaptation is a psychological state of mind shaped by the impact of climatic changes on people's livelihoods. I also hypothesise that inherent social divisions and demographic background shape such psychological state of mind that prompt individuals to self-estimate their capacity to adapt to changes and perceive adaptation.

To test these assumptions, in the first stage, I will focus on participant observation data and on four interview questions about weather changes, impacts of changes in agricultural practices, adaptation techniques incorporated to cope with emerged weather changes, and opinions to handle unexpected situations. I will focus explicitly on the agricultural sector, involving and contrasting subsistence and commercial farmers. In a second stage, I will concentrate on a set of Likert scale survey questions collecting data on climate change knowledge, and this time focus on the academic section, involving and contrasting respondents' geographical origin. In a third final stage, I will emphasise on two Likert scale statements collecting opinions towards adaptation and mitigation. This time I will compare views between rural/urban dwellers and academics.

5.3.1. Interview and participant observation results

a. Farmers' weather observations of changes

In the interview, participants were asked about the changes occurring in the area regarding their agricultural activities. It was important for the researcher at this stage to avoid using the terms 'climate change' or 'global warming' in the conversation with the aim of allowing participants to bring the topic by themselves. Numerous responses were provided when asking subsistence (N=32) and commercial farmers (N=9) to talk about the processes of planting and harvesting. The responses given were first pictured in a seasonal calendar (Appendix 7g), and later freely spoken to capture

the changes occurred in the processes indicated in the calendar. The criteria used to code the answers were focus on weather changes which can be seen in Appendix 6F.

According to farmers' testimonies, they have experienced changes mainly in rainfall patterns and frost frequency (Figure 5.1). Curiously, rainfall changes are perceived differently among informants. Thus, whilst for some farmers, there is "less rain", for others there is "more or too much rain" as expressed in the following quotations "*I wasn't able to plant potatoes because it was raining a lot. Today is a beautiful day, but it has been raining, just now I can plant*" Subsistence farmer 25. "*Well… the rainy season has changed a little bit. Before it started raining since December... Now there is almost no rain, the weather has changed, and it rains in different months"* Commercial farmer 6.

Other groups of farmers saw the precipitation as being the same but as arriving late in the year, whilst for other still weather has always been different with years dominated by rain, and years dominated by drought, as illustrated in the following quotations: "*We used to plant in January, when it's raining time, but nowadays it is delayed, it comes* [rain] *in March*" Subsistence farmer 17. *"This year* [2013] *has been a wet year. 2009 was also a rainy year; sadly, I lost everything I planted, but the following year was better, and I harvested quite a lot"* Commercial farmer 3. *"Some years are rainy, and some years are not, although nowadays it rains when it wants to"* Subsistence farmer 4.

An analysis of the informant's demographics, suggests that the specific community farmers live in plays a role in this difference of perception among farmers. The communities in which informants were approached, like the rest of southern Ecuador, are characterised by a complex climatic regime that varies according to the latitude, longitude, solar radiation, atmospheric currents, land cover, and, perhaps most importantly, the Andes relief effect (Maldonado 2002 p. 7-15). Here the lower latitudes (4000m. max) and division of southern Andes, enable the penetration and distribution of humid and dry air coming from the Pacific Ocean, desertification, the circulation of humid air coming from the Amazon to montane floors, and the formation of many micro-climates. In this context, it is worth of note that informants living on the south-east side at higher-altitude areas dominated by a higher rainfall regime distributed uniformly along the year tended to identify more rain, whilst those living on the south-west side at lower-altitude areas strictly marked by rainy and wet seasons with only four months of rain tended to identify less rain or delayed rainy seasons (Apppendix 7 b, f).

Furthermore, only farmers living on the south-east side at higher-altitude areas claimed that there are more "frosty days" than in the past. The following quotations express what is here discussed "*There is more "*lancha*"* [Phytophthora infestans] *or frost this is how we call it. It damages potatoes, and it burns them…"* Farmer 7. "*There are frost and colder days that damage plants, sometimes there is more and sometimes there is less* [frost]" Farmer 20.

Frost is related to *Phytophthora infestans*, in that in Andean regions low temperatures at nights lead to frost. Low temperatures followed by high humidity in the mornings and intense sunlight at midday, favours the growth of the fungus Iñiguez (2015, personal communication). Consequently, it is reasonable that only farmers living at higher altitude areas have identified this temperature issue given that farmers living in lower-altitude are less exposed to cold days. The damages caused by frost on crops were appreciated during participant observation (Appendix 7, e upper right photo) whereby it was visible that in the absent of measures to cope with frost, crops become unusable. Nonetheless, this was only observed in farms owned by older and traditional agriculturalists without any commercial interest for their production.

b. Impacts of weather changes in agricultural practices

Changes in rainfall patterns and frost frequency are not the only events that are experienced differently by farmers. In order to understand these changes farmers were asked to converse about the effects of such changes on agricultural activities when drawing the seasonal calendars. The answers provided matched on four main categories namely: crop damages, delaying planting seasons, interrupting ploughing, and interrupted irrigation (Figure 5.1). The criteria used to code the answers can be seen in Appendix 6F.

For a group of farmers delayed rainy seasons damage crops, whereas for other groups of farmers the problem of delayed rainy seasons derives in late planting seasons. An informant expressed: "*I planted in September, October, November, but it was dry, and the corn did not grow, and peas got damaged…, drought did not let us irrigate*" Subsistence farmer 17. "*Prior it used to rain between October and November, so we had water to plant, right now we are already in November, and we still have no rain, it has rained but not enough to plant*" Commercial farmer 2.

For another group of farmers, less or more rain also delay planting seasons, whereas for another group of farmers less or more rain interrupts ploughing, irrigation and therefore planting. Some informants expressed "*winter don't let us plant, there was too much winter, today it is better [a sunny day], this is why we are ploughing, God wanted the weather stays so*" Subsistence farmer

13. "*When it rains a lot it is not possible to plough and weed…*" Subsistence farmer 11. "*Lately in these years, it rains less. There is little water to irrigate and plant…*" Commercial farmer 6.

Conversely, for yet another group of farmers, changes in weather, specifically more rain, is perceived as positive given that no irrigation is longer needed, as expressed by some subsistence farmers "*There is lots of water right now, so we don't longer need irrigation*" Farmer 10. "*The amount of water has increased, now everyone can irrigate, now everyone drinks and eat*" Farmer 5.

Additionally, those subsistence farmers identifying higher frost frequency, also tended to agree that frost is damaging crops, as expressed by the following informants: "*In summer time there is frost, and it destroys the crops,* lanchas *destroy a lot*" Farmer 11. "*Now there is more frost, and that frost damages the plants*" Farmer 20.

As it was found with weather observations, impacts of weather changes on agricultural activities are experienced differently by informants and according to the community that they live in. Farmers living in drier areas in the south-west have experienced less or delayed rainfall damaging crops and affecting irrigation and subsequent planting. Farmers living in south-eastern areas, dominated by higher rainfall regimes and colder temperatures, have experienced more or too much rain and frost, also damaging crops and affecting ploughing and subsequent planting. Additionally, this latter group has also experienced positive effects on irrigation derived from more rain.

c. Farmer's adaptation techniques incorporated to cope with emerged changes

During the same interview and participant observation activities, and after farmers explained the effects of the perceived weather changes on their agricultural activities, they were asked to describe how they have tackled these effects. The results suggest that regardless of farmers' perceptions and experiences with local weather, changes in rainfall patterns and frost frequency have prompted farmers to come up with solutions. The answers provided matched on eight main strategies: switching planting months, stopping rain fed agriculture, greenhouses, irrigation systems, new crops, new seeds, more spraying, and buying food in markets (Figure 5.1). The criteria used to code the answers can be seen in Appendix 6F.

For one group of farmers, crop damages caused by delayed rainy seasons had led them to switch planting months as illustrated in the following quotations: "*The planting season for wheat, lima beans, used to be in January and February, but now we plant when we can. I don't longer plant*

in this month; I plant a month after… or a month before" Subsistence farmer 5. "*Barley and wheat are sometimes planted in January, but when there is rain, and when there is not, we wait until there is rain to plant"* Subsistence farmer 7.

Other groups of farmers, particularly those highly dependent on rainfall for irrigation, have opted to leave rain fed agriculture, often called *temporal*, and use irrigation systems as explained by the following informants: "*There is no longer a rainy season, this is why we stop planting* temporal. *Now we plant with irrigation, only those who have irrigation system can plant…*" Commercial farmer 5. "*Coffee quality is much better with irrigation because it controls the conditions required by coffee plants. Without irrigation, we are conditioned to what the weather says, whereas with the other* [irrigation] *we can control everything*" Commercial farmer 1.

The group of farmers regularly facing crop damage caused by frost or rain, have decided to start planting in greenhouses, spraying their crops more frequently, or simply buying food in markets, as illustrated by the following quotations: "*In winter time everything is lost… there is too much water, whereas in the greenhouse it is different because the water doesn't fall inside, it is protected! Everything outside does not have protection*" Subsistence farmer 14. "*In this time the frost comes and damages potatoes,* lancha *is how we call it, there was not as much as we have now, so now we have to spray the crops*" Subsistence farmer 10. "*When plants are damaged by frost or pests, I rather buy onions or potatoes in the market, because I need to invest a lot to buy sprayers and fertilisers. If I don't use them I don't harvest anything*" Subsistence farmer 11. Furthermore, farmers opting for greenhouses have taken advantage of this technique, not only by protecting their crops but also by expanding the variety as expressed by this subsistence farmer: "*Outdoors frost damages crops, whereas with greenhouses we plant new crops such as tomato and* babaco, *which are delicate to be planted outdoors*" Subsistence farmer 22. The construction of greenhouses, was observed when visiting younger farmers with interest of commercialising their production.

Finally, for other groups of farmers facing crop damage caused by pests, a good coping strategy has been to try new seeds as illustrated in the following quotation: "*We live with* la Roya [Hemileia vastatrix], *but atmospheric and climatic conditions have spread it and made it stronger, therefore we have looked for new varieties resistant to* la Roya *and drought"* Commercial farmer 3.

An analysis of informant's demographics suggested some differences between subsistence and commercial farmers, and within subsistence farmers. Commercial farmers, for instance, are led by

markets to keep and look after coffee plantations, who had implemented strategies such as irrigation systems, improved seeds, pesticides, and fertilisers. An informant expressed: "*If we control* la Roya, *we will harvest so that we can sell coffee. It is no longer organic, but without pesticides, we don't have production*". For subsistence farmers, labour force and resource availability such as enabled seeds, unoccupied land, and ploughman, are the main factors that led them to switch planting months. A subsistence farmer expressed: "*I planted in advance because I had some* papitas bolonas *[potato variety] ready to sow and because I had vacant land, ploughman, and yoke. If I hadn't had them, I would not have done it*"

Within subsistence farmers, their age seemed crucial in regards to the adaptation strategies they adopt. Younger farmers, for instance, have extended their business beyond local retail markets, and have a tendency to build greenhouses, try new crop types, implement irrigation system, and invest in fertilisers and pesticides. The following informant expressed: "*Elders have planting seasons, but now the weather has changed a lot. Now we have to treat well the crops by spraying them if we do not do that then the crops are lost. We have to look after the crops"* Elder farmers did not have any commercial interest and tended to keep traditional agricultural practices. This included planting and harvesting months as explained by this farmer: "*Here in this land, it is a tradition to plant and harvest in the time that it has to, it is not like in other lands*"

Notwithstanding these differences, it is important to mention that both subsistence and commercial farmers did not rely only on one type of product premising on *economic diversification* as illustrated in the following quotation: "*A farmer works with coffee, chickens, manioc* [yuca], *pigs, plantain, etc.*" Commercial farmer 4.

Overall, weather observations, experiences with weather changes, and strategies to cope with changes vary according to the type of farmer and the community where they live. Consequently, adaptation strategies are not uniform for subsistence or commercial farmers (Figure 5.1).

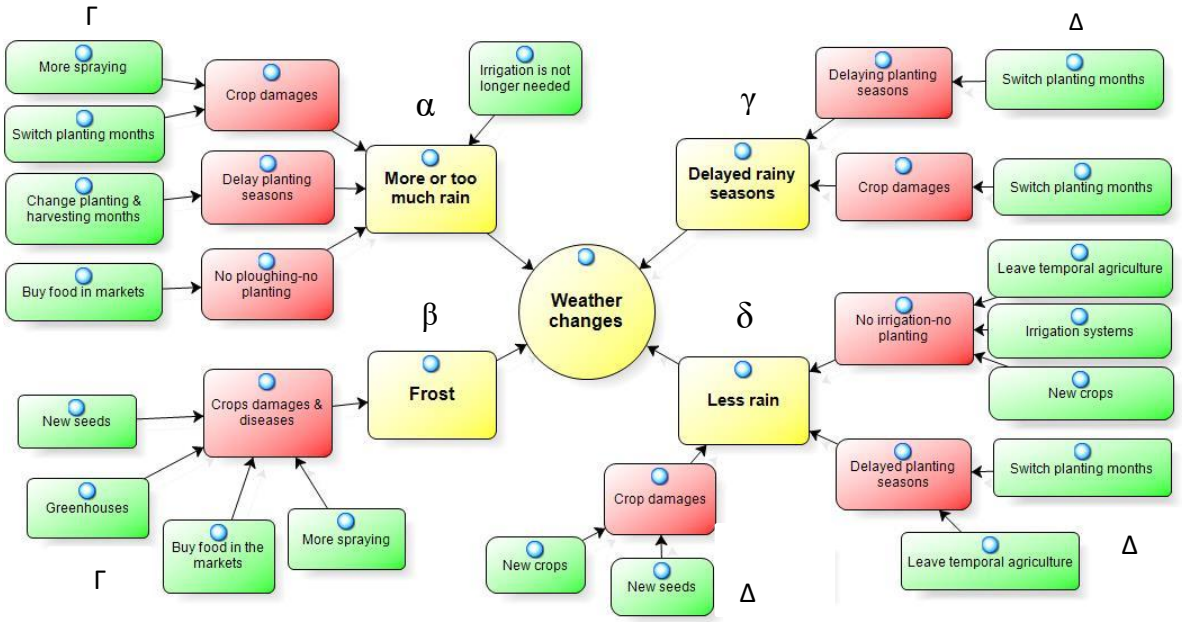


Figure 5. 1: Qualitative model expressing the responses of 41 farmers (Subsistence N=32, Commercial N=9). In yellow the weather changes mentioned, in red the problems caused by these changes and in green the solutions that have been taken. The model was made up of parents, children nodes and its relationships in NVIVO. For clarity of interpretations α: data gathered in the South-East area. β: data gathered in high altitude areas. γ and δ: data gathered in the South-West area in lower altitudes. Δ: solutions incorporated by commercial farmers. Γ: solutions incorporated by subsistence farmers.

d. Perception of adaptation to weather changes: managing unexpected situations

Notwithstanding, farmers have already spoken about adaptation strategies, it was important to understand how farmers perceive adaptation. Thereby, interview informants were asked to give their opinions on their perception of adaptation to weather changes. Regardless of the community and type of farmer, the results suggest a predisposition among farmers to adapt, an attitude that has been in some cases inspired by the parents, and in other cases by their experience. The criteria used to code the answers can be seen in Appendix 6F. In what follows are presented some of the answers provided:

> My father taught me to work hard and have the passion of each thing I do, the rest will be given in addition. One must adapt otherwise you will be screwed up… so it is… the whole world has to adapt… When you work hard, there is not such a thing as bad years… we have to diversify the production, have a home orchard/garden to ensure our food. *Commercial farmer 7.*

> Prior it used to rain between October and November. Now it is November, and we just have the rain that soothes the land dryness. You have to adapt to the *temporal* [weather]. If it starts raining in December, then you should start planting… If I wait until January, then I will be lost... *Subsistence farmer 23.*

Additionally, the opinions expressed encourage academics to gain experience in the farms and learn to adapt, emphasising that tangible resources are not the key to adaptation but good willing and experiences built through joint work with agriculturalists, as it is illustrated below:

> You, who work for the universities, you have to get to know what we do in the countryside, so you will learn how to lead. Without resources but with much good willing and a bit of leadership, we have grown more. You need to create leaders with experience [in the countryside]. We don't need office workers. Here is my finca [farm], you are welcome to come and do experiments with soil, just as I do… *Commercial farmer 1*.

> Universities should take their technicians to come over here to the countryside and live the peasant's reality, experience with our own seeds and plant, have respect for the altitudes of each of the places where we live... These are the realities I have observed... *Subsistence farmer15*.

The suggestions made by farmers regarding the lack of physical resources to adapt were validated during participant observation, wherein the unavailability of sophisticated technology and hard work prevailed in each of the farms visited (Figure 5.2).

Figure 5. 2: Techniques used by farmers to tackle weather changes. A: home-made fertilisers. B: greenhouses. C and G: irrigation systems. D: experiments with coffee seeds. F: new crops of tree tomato [*Solanum betaceum*]. H: crops diversification in coffee farms. I: organic commercial fertilisers.

Finally, it is noteworthy to mention that in the above presented farmer's quotations it was identified a tendency among farmers to use the term 'weather' when explaining their agricultural activities. This is salient in that usually people fail to differentiate 'weather' from 'climate' as discussed in Chapter 4.

5.3.2. Online and face to face survey results

a. Academic conservationists' climate change knowledge

In the online survey, by using a Likert scale format, academic conservationists (N=362) were firstly asked to agree or disagree with 11 statements regarding knowledge of climate and climate change processes. The majority of academics indicated that they agree with all statements denoting that most of the respondents knew the function of the greenhouse effect, ice sheets, oceans, clouds, and other factors influencing the climate system. The majority of respondents also conceptually distinguished climate from weather and climate change from global warming, suggesting that most of academics surveyed possess an accurate knowledge (Figure 5.3).

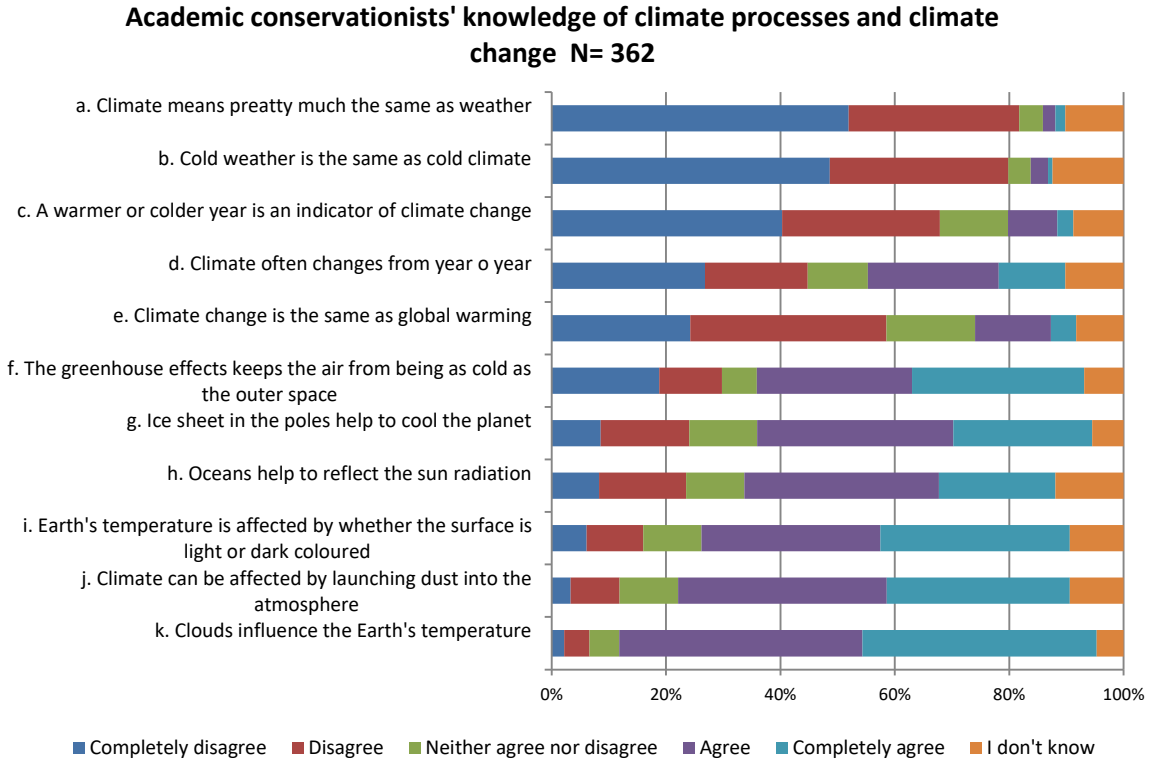


Figure 5. 3: Level of agreement of 362 academic conservationists with 11 statements on weather, climate and climate change

In order to test differences among respondent's geographical origin, a CHAID classification tree analysis was conducted. Due to the lower number of respondents in Africa, Asia & Oceania, and the Middle East, these were grouped into one category namely 'Other Regions'. The analysis suggests that Europeans and North Americans performed better in five knowledge questions. For instance, more Europeans and North Americans indicated that they completely disagreed with statements "b", "c" and "d" and that completely agreed with statement "j" and "i" (Figure 5.4). No other difference was detected in the analysis indicating that regardless of their region of origin, academics surveyed knew about the majority of climate and climate change questions.

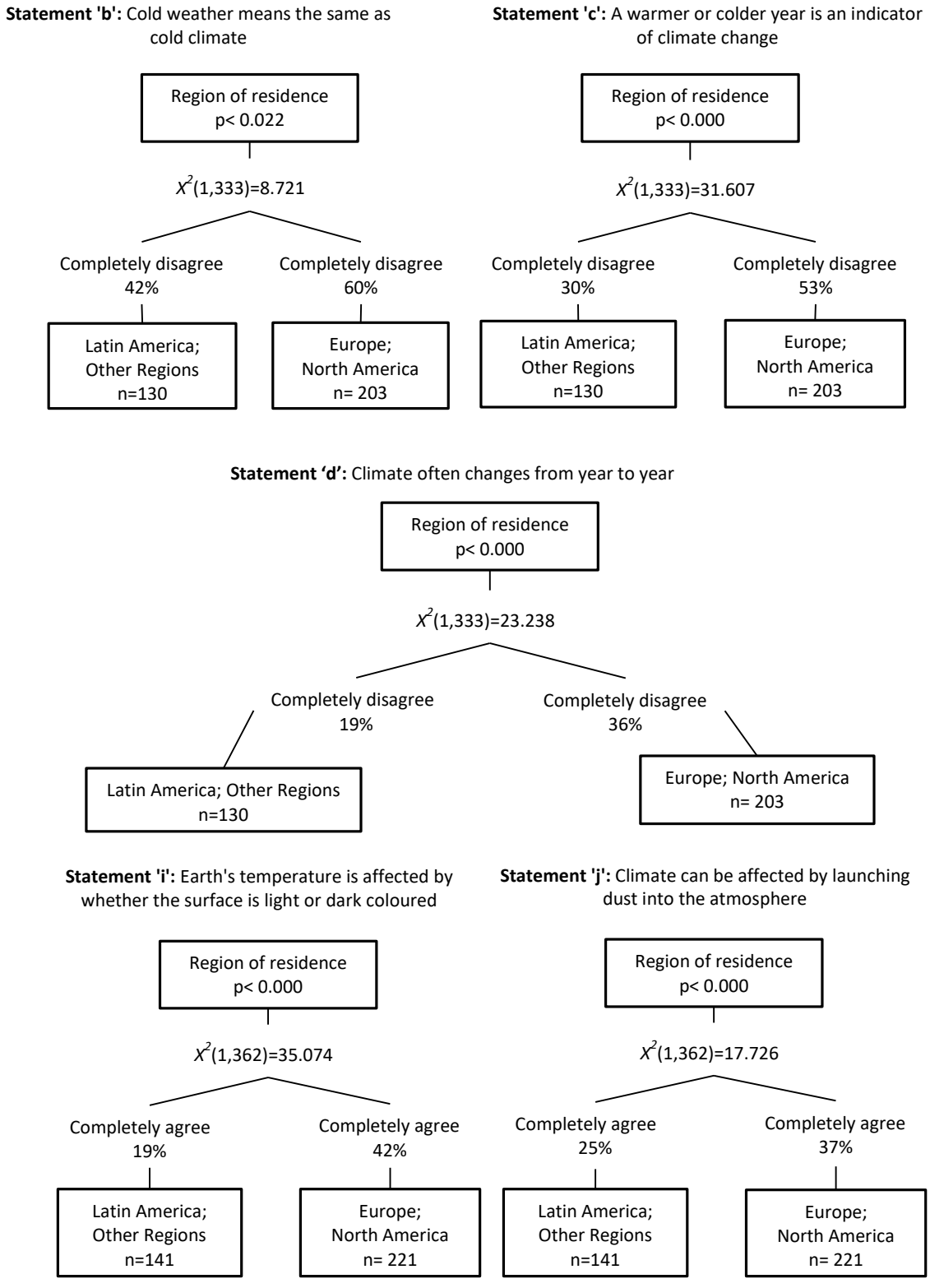


Figure 5. 4: Classification tree models for predicting academic conservationist's knowledge of five climate change statements. Total sample size is N=362. For clarity of the interpretation 'Other Regions': countries located in Asia, Oceania and the Middle East.

b. Academic conservationists' perception on adaptation

In the online survey, after academics gave their answers to knowledge questions, by using a Likert scale format again, respondents were asked to agree or disagree with the following statements:

- "Humanity should adapt to climate change and move on"
- "Humanity should stop CO2 industrial emissions"

The majority of respondents indicated that they disagree (31%) or completely disagree (27%) with the first statement, whereas, they agreed (40%) or completely agreed (24%) with the second statement. These results suggest that academics conservationists tend to prefer mitigation over adaptation strategies to tackle climate change. Moreover, the CHAID analysis indicated that more Latin American respondents completely disagreed with adapting to climate change (Figure 5.5).

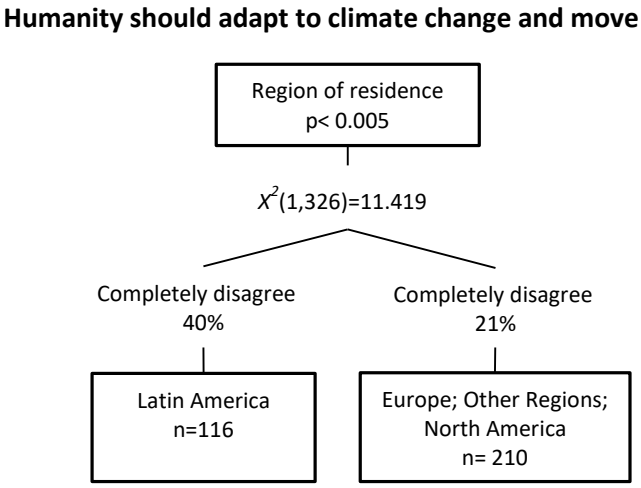


Figure 5. 5: Classification tree models for predicting academic conservationists' perceptions of climate change adaptation. Total sample size is N=362. For clarity of the interpretation 'Other Regions': countries located in Asia, Oceania and the Middle East.

c. Rural and urban dwellers' perception on adaptation

In the face to face survey, rural and urban respondents (N=400) were asked the same climate change adaptation and mitigation questions:

- "Humanity should adapt to climate change and move on"
- "Humanity should stop CO2 industrial emissions"

The majority of respondents (43%) indicated that they disagree with the first statement. However, the next largest group (18%) indicated that they agree with the same statement. Likewise, more respondents indicated that they agree (38%) or completely agree (32%) with the second statement. Whilst these results suggest a similar perception between academics and rural/urban dwellers to prefer mitigation over adaptation, it was highlighted a difference in that perception concerning the preference for adaptation strategies (Figure 5.6).

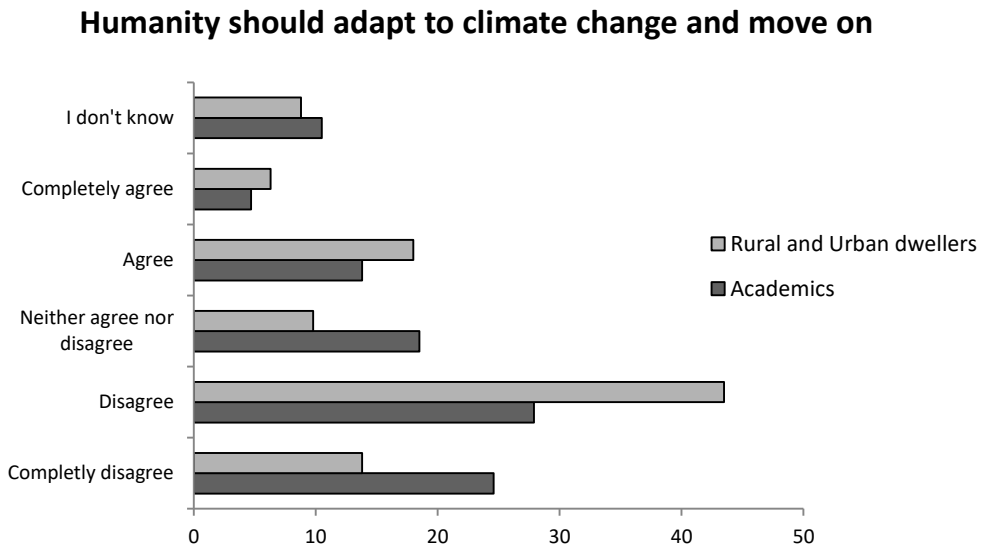
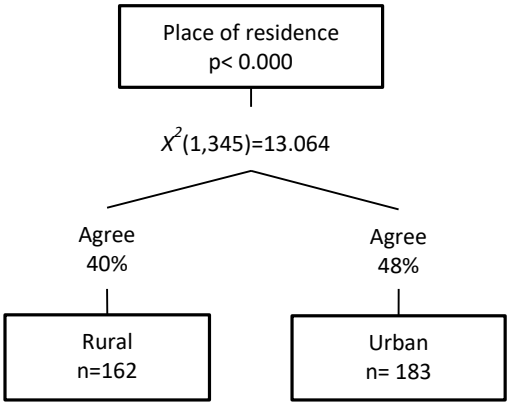


Figure 5. 6: Percentage of academics (N=362) and rural and urban dwellers (N=400) that agreed with adaptation. The answers were provided to a Likert scale question.

Because of this difference in the perception among rural and urban dwellers, a CHAID classification tree analysis was conducted. The results indicate that more urban respondents agreed with the mitigation statement (Fig. 5.6.a), and disagreed with the adaptation statement (Fig. 5.6.b). That is to say are rural respondents who agreed with adaptation. Within the group of rural dwellers, the CHAID analysis pointed out that more unskilled workers and farmers agree with adaptation (Figure 5.6.b). These results are similar to those found at the interview stage; wherein farmers revealed a strong tendency to adapt to climatic changes.

a. Humanity should stop CO2 emissions



b. Humanity should adapt to climate change and move

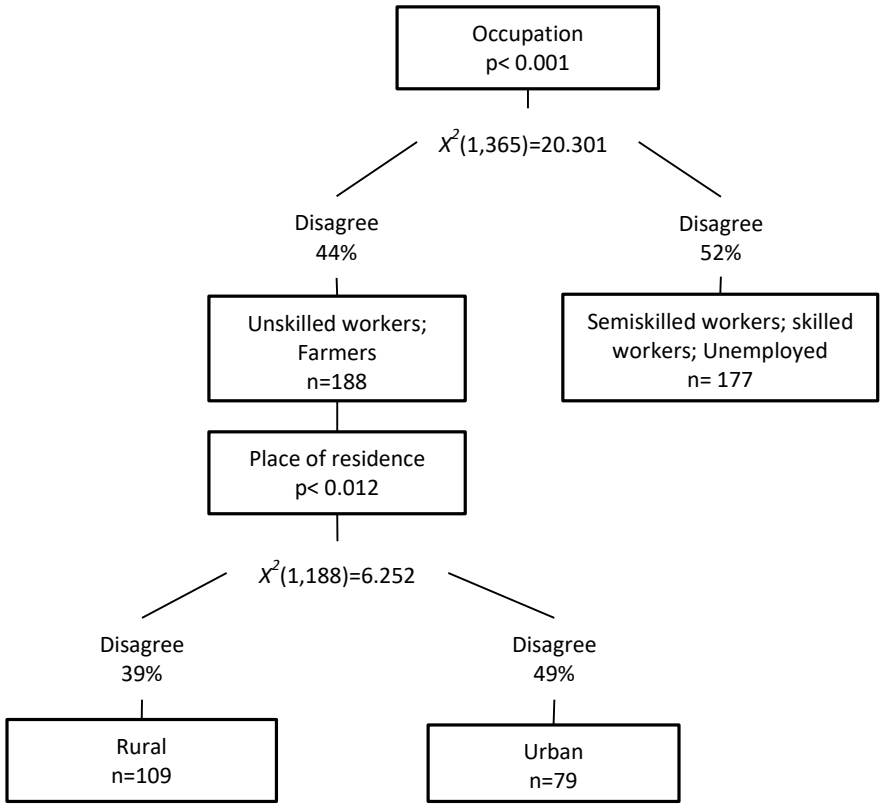


Figure 5. 7: Classification tree models for predicting the perception of rural and urban dwellers regarding a) climate change mitigation and b) climate change adaptation. Total sample size is N=400 (Urban N=200; Rural N=200).

In short, the results suggest a similar perception on climate change adaptation that is shared between farmers interviewed and surveyed. In this sense, both groups agreed with the statements suggesting adaptation to climatic changes, a perception that in the case of farmers interviewed, is applied in the praxis of their daily activities in that they had already taken actions to adapt to emerging climatic changes. On the contrary, academic conservationists, who demonstrated to possess accurate knowledge of climate change, tended to disagree with adaptation measures and prefer mitigation. This tendency among academics is shared with urban dwellers who also preferred mitigation over adaptation.

5.4. Discussion

In this section, survey and interview results were analysed together in the context of the scientific knowledge in order to elucidate if climate change adaptation is a psychological state of mind shaped by the impact of climatic changes on people's livelihoods, and if such state of mind differs according to social divisions and demographic background.

5.4.1. The state of mind of adaptation

In the first instance, this study sought to understand whether adaptation to climatic changes is led by a psychological state of mind, or by knowledge and physical resources. In pursuing this goal, it was first necessary to use the results from Chapter 4 regarding farmer's knowledge and understanding of climate change. The results therein described indicate that both farmers interviewed and surveyed understand climate change as a phenomenon caused by pollution, ozone layer depletion, deforestation, burning, and Earth's warming, mainly triggering more intense sunlight affecting primarily animals, plants and humans' health. In simpler words, farmers tended to lack accurate knowledge and suffer misconceptions regarding climate change.

In this Chapter, it was analysed the answers provided by farmers interviewed concerning their daily agricultural activities. When doing so, it was noticeable that weather changes, particularly changes in rainfall patterns were constantly mentioned by informants. When comparing these data with farmer's understanding of climate change, it was highlighted a mismatch between farmer's observations of weather changes and their understanding of the concept of climate change. Thus, when the question was direct to gather opinions on climate change, answers such as *the ozone layer depletion* and *pollution* were predominant, whereas when asking about daily agricultural activities, answers involving *changes in rainfall patterns* and the term 'weather' were predominant. Against the backdrop of these conclusions, I argue that whilst farmers are aware of the emerging weather

changes, they are not aware of the concept of climate change as claimed by Rhoades et al. (2006) and Nyanga et al. (2011), who indicate that farmers are aware of climate change and are able to articulate climate change impacts because of their observations and perceptions of weather changes.

In this context, I stress that the concept of climate change becomes a foreign definition that is been tied to local knowledge by researchers for the sake of scientific purposes. My results, in fact, suggest that farmers tackle the problems derived by the negative effects of weather changes because they are facing agricultural issues that are needed to be acted upon not because they are aware of climate change. Neither they are aware of climate change because they notice weather changes, indeed they don't know what climate change is. That is to say farmers cope with weather changes with creativity and enthusiasm because they recognise that these changes interfere with their livelihoods. In addition, the results indicated that farmer's own initiative rather than money and technology has been pivotal to adaptive practice. Farmers interviewed, for instance, have conducted their own experiments to find suitable seeds for their farms, or have used self-made fertilizers and irrigation systems to cope with emerging weather changes as shown in Figure 5.2.

Likewise, of all surveyed individuals from rural and urban areas, who also tended to lack of accurate knowledge regarding climate change, it was only unskilled workers and farmers who agreed with adaptation. These results suggest that farmer's lack of knowledge does not interfere with their understanding of adapting to weather changes. In contrast, academic conservationists were found to possess more accurate knowledge regarding climate change. Nonetheless, they tended to disagree to adapt to the same climatic phenomenon. Taken together, these results suggest that knowledge is not a determining factor to adapt to this issue. Therefore, unlike Adger et al. (2009) and Pasquini et al. (2015), who claim that adaptive capacity towards climate change is built, among other factors, by access to a knowledge base of the impacts, I argue that technical knowledge does not necessarily lead to adaptation. Yet, I believe that knowledge foster or reinforce beliefs that may adversely impact upon adaptation perception, as were found in Australia where farmers believing in climate change were less likely to be adapting their farm overall (Wheeler et al. 2013).

These results suggest that adaptation to climate change is rather a 'state of mind' than a knowledge issue or technocratic strategy. A state of mind that is driven by changes interfering with peoples' livelihoods. According to Cambridge Online Dictionary, 'state of mind' is a person's mood and the effect of that mood on the person's thinking and behaviour. In this context, weather changes are likely to interfere with farmers' livelihoods, and this interference to be channelled by a state of mind that will lead individuals to action or inaction.

In this respect, previous research conducted by Mbow et al. (2008) and Below et al. (2015) indicate that populations adapt to any factor influencing their livelihoods, these factors may well be extended to weather changes as suggested by the results of this thesis. This assumption does not discard other socio-psychological forces such as self-estimated efficacy and ability to adapt (Grothmann & Patt 2005; Hart & Feldman 2014; Thaker et al. 2016) but suggests that these forces are linked to whether people feel prompted to adapt. According to Grothmann & Patt (2005) people respond to climate change when the threats impact the things they value, I argue that what people value are their livelihoods and when these are affected a 'state of mind' is prompted. This state of mind evaluates the impact of weather changes on livelihoods and determines action or inaction informing farmer's subsequent behaviour. This argument is supported by the results obtained from study participants' occupational background, wherein farmers whose livelihoods depend on weather conditions are willing to adapt, whereas academic conservationists and urban dwellers whose livelihoods do not depend on weather conditions disagree with adaptation.

Similarly, in this study, the use of climate change as a focus to consider agricultural practices revealed a 'state of mind' amongst farmers that demonstrated enormous concern regarding pollution and health issues. Conversely, when simply asked about agricultural issues, an attitude emerged that expressed self-estimated efficacy and ability to adapt to weather changes observed. Simply saying, changes in themselves motivate farmers to adapt when their livelihoods are affected.

Adaptation has been part of life since its origins in evolutionary biology. Strategies adopted among peoples to cope with weather changes and reduce impacts of climatic hazards have been well presented by a growing number of researchers. These studies consistently found that farmers and indigenous peoples have historically adapted to emerged weather conditions by innovating a range of techniques (Turner & Clifton 2009), adjusting their crop choice according to local climate conditions (Seo & Mendelsohn 2008; Mertz et al. 2009), implementing short and long cycle crop varieties (Lacy, Cleveland & Soleri 2006), or diversifying productive activities in different landscapes (Mbow et al. 2008, Campos, Velázquez & McCall 2014). In its simplest definition, adaptation is the result of reacting to suit different conditions. Therefore, when people face changes their state of mind will influence their efficacy and ability to adapt, and will inform how they tackle emerging conditions regardless of monetary or physical resources, a condition that has shaped the history in regions such as Latin America (William Miller 2007, p. 11-26). Money and technology are indeed important for climate change adaptation as claimed by Brown & Funk (2014) and Lobell et al. (2008). Nonetheless, as it was previously mentioned, the absence of these physical resources would not prevent farmers from adapting when their livelihoods are impacted by climatic changes.

Research conducted with farmers in Ethiopia (Deressa et al. 2009) also support this view. This research found that decreasing precipitation to increase the likelihood of using soil conservation and changing crop varieties, whereas higher levels of precipitation had the opposite effect with regard to the likelihood of implementing adaptation techniques.

It is noteworthy that whilst scientists are very concerned about farmers' ability to adapt to climate change (e.g. Cunsolo Willox et al. 2012; Halder et al. 2012; IPCC 2014b), farmers in southern Ecuador, as well as in other countries, have already developed their own adaptive strategies using the resources available, their own initiative and creativity. I argue therefore, that reliance on natural resources (Tol et.al, 2004; Mendelsohn et.al, 2006) or lowering incomes (Schmidhuber & Tubiello 2007; IPCC 2014b), do not make people from developing countries more vulnerable and less adaptable to the consequences of this global phenomenon, at least not because of the lack of adaptation attitudes. The real vulnerabilities that farmers face against climate change, particularly in the Latin American context are rather related to social inequalities as claimed by Corral-Verdugo and Pinheiro (2009), Carey (2010), Kronik and Verner (2010) and Rojas Hernández (2016). That is to say knowledge, money, or new technologies may not be what people need to adapt to climate change but measures that help them to tackle with social injustice, structures of power, access to credits, and governmental representatives.

In addition, the results of this study identified that some of the mechanisms incorporated by farmers to cope with climatic issues involve strategies such as 'buying food in markets' that relies on external economic factors which can be absent in a near or distant future. These sorts of measures need further attention in order to ensure an effective adaptation among farmers in rural environments. In this context, it is worthy to note that despite the preference of academic conservationists for mitigation strategies, they might usefully encourage themselves and young researchers to work on improving or strengthening farmers' adaptation strategies, just as the informants in this study were demanding from universities. Thereby, research is necessary to propose adaptation strategies that fit with local realities in order to advice policy makers as suggested in previous research (Gruber et al. 2015). Furthermore, in countries like Ecuador, which is far from being a main contributor of carbon dioxide emissions, measures should be directed to strength adaptation strategies insomuch as climate change impacts are expected to disrupt people's livelihoods particularly to those social groups at the bottom of the decision making chain (Kronik and Verner 2010, p. 125,130). Adaptation in Latin America is crucial, place it behind mitigation may lead to a self-underestimating efficacy and hence a lesser ability to adapt, which may persuade individuals to see climate change as "powerful" (Taylor 2015 p.191-192), and an "out of control"

element of nature (Swyngedouw 2010). In this sense, it draws the attention that more Latin American researchers from the panel of academic conservationists tend to prefer mitigation over adaptation in that in the region there is a need for research to identify socio-political vulnerabilities that could prevent an effective adaptation. I also speculate a relationship between these results and the outcomes obtained in Chapter 6 regarding the emotional responses towards climate change which suggests that climate change is appraised as a big unsolvable problem that cannot be tackled individually.

Finally, this research has been conducted in an individual level, presenting some limitations to explore into the collective capacity and social learning previously found as predictors to adaptation (Ensor & Harvey 2015; Thaker et al. 2016). Further research is therefore needed to offer evidence regarding the effects of collective efficacy and social learning processes on the perception of climate change adaptation in the Latin American context.

5.4.2. Social asymmetries and adaptation

Climate change does not affect everyone equally (Taylor 2015 p.73), and this inequality does not uniquely respond to income or access to technology as has been claimed by some researchers (e.g. Brown & Funk 2014, IPCC 2014b). This inequality also responds to inherent social divisions (Taylor 2015 p. 73-74), and differences in perceiving environmental changes and adapting food systems (Gregory, Ingram & Brklacich 2005). For researchers such as Carey (2010) and Rojas Hernández (2016) social divisions are reflected in the inequalities to access resources and governmental representatives. In my study, social divisions were identified on participant's demographics, such as place of residence, type of farmer, and age, which were found to have marked inequalities among farmers in their capacity to implement adaptation strategies in order to cope with weather changes. These social divisions were even identified within the same group of farmers. In what follows, I will describe how these demographic divisions align with the adaptation measures implemented.

Place of residence: the results suggested that for informants living in higher altitudes with uniformly distributed rainfall along the year, there was a tendency to perceive more precipitation, to experience impacts related to more rain, and to adopt tools such as the use of greenhouses, in order to prevent risks derived from more rainfall. Conversely, for informants living in lower altitudes strictly marked by dry and rainy seasons, the tendency was the perception of a reduction in

precipitation, with the appropriate adaptive strategies implemented taking the form of irrigation systems.

Type of farmer: the evidence gathered from interviews and participant observation, suggest some tendencies wherein commercial farmers are driven by markets to implement strategies that prevent risks and reduce impacts derived from climatic changes. There was also a tendency among commercial farmers to improve their production, with irrigation systems, improved seeds, pesticides and fertilisers as some of the strategies adopted. By comparison, subsistence farmers are driven by resource availability such as enabled seeds, ploughman, unoccupied land, and labour force to implement strategies such as switching planting months or type of crops, which help them to cope with weather changes and ensure food availability.

Age: the results suggest a tendency among young subsistence farmers to sell beyond local markets, to invest in fertilisers and pesticides as well as to implement strategies such as greenhouses, new crops, and irrigation systems. The strategies implemented look for reducing the impacts of weather changes and prevent risks. Elder subsistence farmers, on the contrary, are the most traditional type of subsistence farmers. Their production tends to ensure food availability and had no commercial interest, thus keeping traditional agricultural practices including planting and harvesting months. I may say that this latter type of farmer is the most vulnerable group to weather changes. Nonetheless, unlike that which is claimed by the IPCC and other researchers (e.g. Schmidhuber & Tubiello 2007; Lobell et al. 2008; Brown & Funk 2014), such vulnerability does not respond to money or technology but to a lack of self-interest or rooted traditions influencing their state of mind and therefore their self-estimated ability to adapt.

On the rural and urban dwellers sample, the place of residence and occupation were identified as social divisions marking differences to prefer action strategies of adaptation or mitigation of climate change, wherein more skilled[27] and semi-skilled workers living in urban areas tended to agree with mitigation of climate change. Conversely, more farmers and unskilled workers living in rural areas tended to agree with climate change adaptation. As I previously discussed, there is an international tendency among farmers to adapt to weather changes (Lacy, Cleveland & Soleri 2006; Seo & Mendelsohn 2008; Turner & Clifton 2009; Mertz et al. 2009; Deressa et al. 2009; Tripathi & Singh 2013; Campos, Velázquez & McCall 2014). Consequently, I argue that farmer's need to ensure

[27] See completely list of occupation in Appendix 4a.

their livelihoods lead them to perceive adaptation as a measure that helps them to continue their agricultural activities.

On the academic conservationist sample, only the region of origin was identified as a social division marking differences to perceive climate change adaptation, wherein more Latin American respondents tended to be more reticent towards the idea of adaptation. Although this is a curious result; I found some limitations to inform the reasons why more academic conservationists from Latin American countries, disagreed with adaptation. However, based on the results concerning knowledge of climate processes and climate change wherein Latin Americans did not perform as good as Europeans and North Americans, it is speculated a likely biased information that is disseminated in Latin America by International Cooperation or other institutions that is focused on the reduction of greenhouse gases and health issues, as observed for instance in the WHO[28], UNEP[29], and FAO[30] Spanish websites.

Furthermore, it is worth mentioning that this tendency found among academic conservationists to prefer mitigation strategies brings back the argument for the effects of weather changes on livelihoods. That is to say, academics' incomes do not dependent on weather conditions and therefore can afford supporting mitigation strategies to reduce carbon dioxide emissions. This situation may be exacerbated in the geographical context of Europe and North America wherein is demanded to reduce greenhouse emissions and therefore to support mitigation strategies, as well as, wherein adaptation strategies take the form of transportation, infrastructure and utilities (Ford, Berrang-Ford & Paterson 2011). Both arguments speculating biased information disseminated in Latin America and the support of Europeans and North Americans for mitigation need further research as it will be discussed in Chapter 7.

Additionally, from the literature, it is known that academics from social and natural sciences differ in their opinions on climate change adaptation, with more natural scientists concerned about the ability of natural ecosystems to adapt to climatic changes and the likely severe economic effects (Nordhaus 1994). Indeed, natural scientists, including conservationists, are acknowledged by their environmentalist tendencies, which has raised critics for their looming pessimism and lack of pragmatism (Nordhaus & Shellenberger 2007, p. 217-220), well documented in Hulme's work "Why we disagree about climate change" (2009, p. 61-68). Despite this tendency, the story of

[28] http://www.who.int/mediacentre/factsheets/fs266/es/
[29] http://www.undp.org/content/undp/es/home/climate-and-disaster-resilience.html
[30] http://www.fao.org/climate-change/es/ http://www.fao.org/3/a-i7175s.pdf

climate change has been shaped mainly by natural scientists, which in turn keep changing climate science questions, representations, metaphors and communication that have led to different psychologies of risk and philosophies of decision making (Hulme 2013, p. 8-9). Notwithstanding I have some limitations to differentiate the disciplines to which academic respondents belong, the results indicated that academic conservationist surveyed were less open to the idea of adaptation. Hence, I argue the conclusions drawn by Javeline and colleagues (2013) who state that environmental biologists should inform climate change policy makers because of their scientific knowledge. The results of my study indeed shown that academic conservationists possess an accurate scientific knowledge of climate change but have a tendency to prefer mitigation over adaptation measures that may lead to a biased advice. I argue therefore that climate change knowledge is not the only variable to consider when deciding who should advise policy makers. Instead, a multidisciplinary team, including social and natural scientists, may be a more neutral and objective body of advisement.

In short, the results of this section suggest that adaptation to climate change is perceived differently among social groups. This perception is influenced by inherent social divisions and demographic background that lead to a psychological state of mind that prompt people to self-estimate their capacity to adapt to changes.

5.5. Conclusion

Overarching perspectives of money and technocracy surrounding adaptation overlook the fact that this process is part of human evolution and that as such, has always been present among societies to cope with environmental changes such as climate. This is particularly true when such changes negatively affect to livelihoods, whose impacts prompt people to take action for addressing undesirable situations. Adaptation is, therefore, not equal for everyone, not even within the same social groups in the same geographical region for two reasons: a) both weather changes and adaptation are perceived differently by individuals, and b) peoples' vulnerabilities to climate change are a matter of local socio-politic inequalities. These elements shape a psychological state of mind leading people to self-estimate their capacity to adapt to changes and to react regardless of their climate change knowledge or financial and technocratic resources. Indeed, farmers do not connect their understanding of climate change with their perceptions and observations of weather changes, nor have needed modern technology to adapt. However, some of the mechanisms incorporated by farmers to cope with climatic changes require further attention in order to reach an effective

adaptation. Succinctly, adaptation emerges as an inherently social process that is constantly coping with changes and incorporating solutions to everyday life problems.

Chapter 6
How do people feel about climate change?

6.1. Introduction

Emotions are powerful drivers of decision making (Lerner, et.al 2015), strongly influencing the way people think and learn (Baumeister & Bushman 2008 p.161). In relation to climate change, emotions are important to analyse because they strongly influence the way people engage with the subject (Maibach, Roser-Renouf & Leiserowitz 2009), as well as help to explain the psychological impacts of this phenomenon on people (Doherty & Clayton 2011).

Much of the research literature that has engaged with the issue of climate change has associated it with specific emotional labels, notably: 'alarm', 'concern', 'doubt', 'disengagement', 'confusion', 'indifference', and 'guilt', among others (Maibach, Roser-Renouf & Leiserowitz 2009; Doherty & Clayton 2011; Aitken Chapman & McClure 2011). However, a person rarely experiences a single emotion, not even in experiments designed to induce specific emotions (Drouvelis & Grosskopf 2016). In this Chapter, I will present empirical evidence to debate that the labels of emotions used in previous research have been over-simplistic and that the research in question has neglected other emotion categories that may be involved when experiencing 'concern', 'guilt', or 'scepticism' towards climate change. I will also explore the relationship between participant's socio-demographic variables and their reported emotional experience with regard to this climatic issue.

It is with this focus that the data collected through face-to-face conducted questionnaires with urban and rural residents in southern Ecuador, and online questionnaires completed by academic conservationists in 36 countries will be analysed. The population samples were selected to enrich the cross-cultural research element beyond the 'western viewpoint' claimed by Ming Lee et al. (2015) to have been garnered in research confined to Australia, Europe and the United States, and extended to include academic-based researchers focused on conservation, who rarely have been subjects of such studies beyond contributing their expert opinion on the issue (Nordhaus 1994; Javeline et al. 2013).

In pursuing the abovementioned objective, in this Chapter, I will first present data concerning participants' reported emotions about climate change. Subsequently, I will present qualitative data regarding declared reasons for selecting a particular emotion category, to later focus specifically on those variables associated with those emotions reported. Finally, I will consider these sets of data in

the context of the literature reviewed to discuss the assumptions raised. Overall, I will present novel information regarding peoples' emotions towards climate change and will provide evidence that should be of value in developing more effective global educational programs of climate change.

6.2. The emotional aspects of climate change

Climate change is a matter of geophysics and biodiversity as much as a psychological phenomenon awaking various emotional states (Doherty & Clayton 2011). Emotions influence thinking and learning in that they help drive people to anticipate or avoid actions that lead to anti-social behaviour (Baumeister & Bushman 2008, p.181-183). Emotions influence actions at the individual or collective level, in this sense when individuals judge their group to be responsible for an event, and if they identified with that group they may experience a collective emotion of 'guilt' or 'shame' that will lead them to react (Caillaud *et al.* 2016). Thereby, emotions become into powerful drivers of decision making (Lerner et al. 2015) whose analysis is vital in the climate change arena given the importance of policy and behavioural changes required in addressing this issue.

In the context of climate change, Doherty & Clayton (2011) delved deeper into the psychological impacts of climate change and found links between emotions and behaviour responses towards this issue. Drawing from literature, these authors were able to identify emotions of 'anxiety', 'worry', 'guilt', 'helplessness', 'denial', and 'apathy', among others (2011). Other groups of researchers analysed the way people engage with climate change and identified six key emotional labels including 'alarm', 'concern', 'caution', 'disengagement', 'doubt' and 'dismissiveness' (Maibach, Roser-Renouf & Leiserowitz 2009). Other types of studies focused on the tendency of public opinion on global warming and found that 'concern' and 'scepticism' are the two most common emotional states self-reported by the public when asked about climate change (Nisbet & Myers 2007; Capstick et al. 2015; Howarth & Sharman 2015). Furthermore, a group of studies focused on single emotion categories and examined for instance the variables influencing public 'concern' about climate change (McCright 2010; Brulle, Carmichael & Jenkins 2012; Hardesty 2015; Shi et al. 2016), and on climate change awareness and risk perception (Ming Lee et al. 2015). Still other research analysed the key role of sentiments of 'guilt' in fuelling peoples' actions (Garvey 2010; Brügger et al. 2015), whereas Aitken, Chapman & McClure (2011) concentrated on 'powerlessness' as an emotional response that prevents action towards climate change, which according to Heyd (2010) is aroused when governments fail to implement measures for mitigation and adaptation. Moreover, Stevenson and Peterson (2016) explored on 'hope' and 'concern' suggesting that both sentiments are related to proactive behaviour.

In the field of risk perception, Whitmarsh (2008) suggests that respondents whose health has been affected by air pollution tend to be more 'pessimistic' about the impacts of climate change, whereas Leombruni (2015) found that individuals with positive feelings toward the environment are less 'sceptical' about climate change. Additionally, a study by Barnes, Islam & Toma (2013), suggests that 'confusion' is common when exploring climate change risk, knowledge and perception. Other group of researchers suggest that framing climate change as a national security issue foster 'anger' among segments of the public that are dismissive and doubtful about climate change (Myers et al. 2012), whilst Heyd (2010) argue that economic, social, and political conditions have led individuals to believe that their responsibilities regarding climate change are 'inoperable'. Positive emotions are mentioned less in the literature, with the exception of Ojala (2012, 2015), who delved deeper into the relationship between 'hope' and climate change among young adults and found that young people who experience hope based on denial to the seriousness of climate change, feel in higher extent low self-efficacy to influence their own life compared to those who possess constructive hope. That is to say the same type of emotion may have a different impact on individuals depending on their environment and values, it is therefore important not only to determine the sorts of emotions with which people identified themselves most, but to collect the grounds for a person to experience any sort of emotion in regards to this issue.

With the aim of exploring the emotional states experienced in the subject of climate change, the key texts aforementioned were drawn upon to inform the development of a cluster of ten emotion categories with, 'concern', 'happiness', 'anger', 'powerlessness', 'guilt', 'confusion', 'optimism', 'calm', 'scepticism', and 'indifference' among the categories. In considering the issue of climate change outside the usual sites of Australia, Europe and the United States (Ming Lee et al. 2015), I presented this cluster of emotions to groups of 200 rural and 200 urban residents in southern Ecuador, who were asked to select the emotions that they experience when talking about climate change. Moreover, research on emotional responses to climate change has not been conducted yet with academic conservationists, who, with the exception of the work by Nordhaus (1994); Javeline et al. (2013); and Moloney et al. (2014), have been subjects of study only to collect their expert opinions on the issue. So, I presented the same cluster of emotions to 362 academic conservationists, drawn from 36 nations worldwide with the aim of complementing this cross-cultural research. Details of the sample selection are shown in Chapter 3.

According to Lazarus (1991, p.67), a person rarely experiences one single emotion at a time. For instance, when a person experiences sadness, s/he also experiences one or more of the following:

'guilt', 'anger', 'anxiety' and even 'hopelessness' to cope with a situation. Even in experiments wherein a particular emotion was induced, other types of emotions were recorded among participants (Drouvelis & Grosskopf 2016). With this as a backdrop, I assume that in the context of climate change, the analysis of emotions has been rather simplistic. Consequently, I will identify other associated emotions that may be involved when respondents select any particular emotion from the cluster with the aim of elucidating the middle opinions involved in the climate debate which according to Howarth and Sharman (2015) are absent. In pursuing this aim, study participants were asked in an open-ended question to declare the reasons for their selection of the emotions presented.

Finally, demographic variables of gender (McCright 2010; Stokes, Wike & Carle 2015), knowledge and understanding (Malka, Krosnick & Langer 2009; Brulle, Carmichael & Jenkins 2012), level of formal education (Barnes, Islam & Toma 2013; Hardesty 2015), age, country, and place of residence (rural/urban) (Maibach, Roser-Renouf & Leiserowitz 2009; Ming Lee et al. 2015; Stokes, Wike & Carle 2015), have been found to be associated with emotional responses of climate change 'concern', awareness and risk perception. In this context, I will explore participant's age, gender, place of residence, and occupation/academic position, in order to identify any associations between the emotions selected and participants' demographics.

6.3. Participant's emotions towards climate change

The data provided in the survey conducted with the general public in rural and urban areas in southern Ecuador, and in the on-line survey conducted with academic conservationists in 36 countries, revealed some interesting patterns. In seeking greater analytical possibilities, these countries were grouped into four regions: Europe, Latin America, North America, and Other Regions. The reasons for this grouping are detailed in Chapter 3.

The initial focus of analysis was on participants' most selected emotions from the cluster. Thereafter, it moved to an open-ended question concerning the reasons stated for the emotions selected. The aim of this second step was to identify the additional emotions associated with the primary emotion selected. This identification of additional emotions, was compared with the work by Lazarus (1991), Baumeister, Stillwell & Heatherton (1994), Lewis & Granic (2000), Silfver (2007), Aitken et al. (2011), Barnes, Islam & Toma (2013), Ojala (2015), and TenHouten (2016).

As mentioned in Chapter 3, survey data from both face-to-face and online questionnaires were analysed through descriptive statistics. In order to test associations between demographic variables and the emotions selected, Chi-square tests were then carried out. Findings from rural/urban dwellers and academic conservationists are presented separately below.

6.3.1. Rural and urban dwellers

a. Most selected emotions

In the face-to-face questionnaire, respondents from rural and urban areas (N=400) were asked to select from a cluster of ten emotion categories those that best represent their feelings regarding climate change. Multiple options were allowed. The majority of respondents selected 'concern', followed by 'guilt', 'powerlessness', 'anger', and 'confusion'. 'Optimism', 'calm', and 'happiness' were less frequently selected. 'Indifference' and 'scepticism' were the least selected in the list (Figure 6.1).

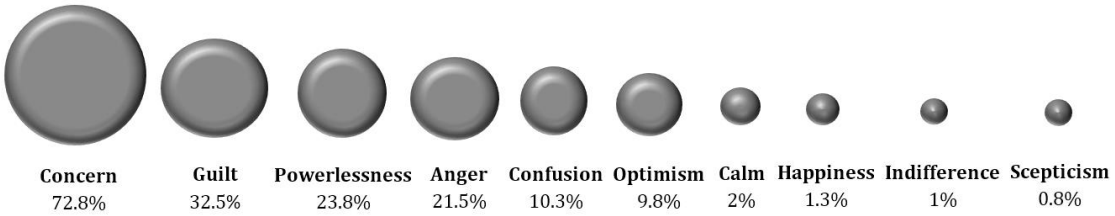


Figure 6. 1: Frequency of the emotions selected by rural and urban dwellers in regard to climate change (N=400). Multiple selections were allowed.

b. Additional emotions identified

Having selected from amongst the designated emotions categories, respondents were asked in an open-ended question to state the reasons for their choice. Drawing on the work by Lazarus (1991), Baumeister, Stillwell & Heatherton (1994), Lewis & Granic (2000), Silfver (2007), Aitken Chapman & McClure (2011), Barnes, Islam & Toma (2013), and TenHouten (2016), a qualitative analysis of the answers produced eight additional emotions: 'anxiety', 'fear', 'hopelessness', 'shame', 'irritation', 'frustration/pessimism', 'bewilderedness', and 'doubt'. In addition, emotional responses of 'anger' were identified among the reasons reported for selecting 'powerlessness'. Examples of respondent's explanations, as well as the additional emotions identified are presented in Table 6.1.

Emotion explored	Examples of respondent's answers (Translated from Spanish by author)	Additional emotions identified
Concern	*"Future generations" "The effects that it will have in our life" "The damages that might cause to nature"*	Anxiety
	"Humanity will disappear" "Long winters" "extreme droughts" "The lack of food" "Water shortage" "Natural disasters" "Ice caps melting" "Population growth" "Industry growth" "Drastic scientific data"	Fear
	"There is no solution to the problem"	Hopelessness
	"I am concerned because my attitude hasn't changed"	Shame
	"Industrialized countries and authorities are not concerned about it" "People do not care"	Irritation
Guilt	*"We all are guilty because we all pollute the environment. It is my fault, my responsibility" "Human beings are guilty" "Man is guilty"*	No additional emotion identified
	"We don't do anything to conserve and stop polluting" "We use chemicals for our crops" "I could do much more but I don't" "Because I think I contribute to it" "Because of my life style" "I use aerosol cans" "I generate waste" "I use vehicles and electronic devices that pollute" "I travel by plane" "I emit CO2" "I do not recycle" "I am consumerist" "I say nothing to the authorities"	Shame
Powerlessness	*"Nobody cares" "First world countries do not take actions to fix this problem instead they manufactured cars, fight wars, etc." "Governments don't take drastic measures to take care of the environment" "Big industrialized nations hold all the power and no one can stop that evil" "Whilst some people do something, there are others who do not do anything to change the situation"*	Anger
	"I don't have the authority to force people to take care of the environment" "I can't enforce the law" "My efforts don't matter, industries won't stop polluting" "I cannot raise awareness among people of a higher social level" "My personal change won't make others change" "I want to do things but I don't have the means to do it" "It is a huge job to educate humanity to take care of the planet" "As an isolated person I am not able to remedy what others do on a global scale" "We cannot stop development or pollution"	Frustration/Pessimism
	"I don't do enough" "Recycling is not enough" "I don't have enough knowledge" "I don't know how to act" "At my age there isn't much that I can do"	Shame
	"Uncertainty" "Unexpectedly nature will get tired of too much contamination and will react"	Anxiety
Anger	*"All developed country rulers do nothing to stop polluting the planet" "No one does anything to defend nature against mining companies, oil industries and deforestation" "No one cares they just whine"*	Irritation
	"Of all serious consequences and disasters" "Of the likely effects on economy and agriculture"	Anxiety
	"There is no solution" "I don't have the authority to make decisions" "We don't have anyone that listens to us" "We can't do our outdoor jobs"	Frustration
	"I do nothing" "I don't do enough"	Shame
Confusion	*"I don't know how my actions will affect the environment" "I don't understand much about this theme"*	Shame
	"Weather is changing" "People are confused about crop blooming" "We should not fall in the trap of green capitalism"	Bewilderedness
	"There are many positions and the decisions made are not effective to address climate change" "I don't know the reasons why people don't decide to change their mind"	Irritation
	"I don't know when the warming will end"	Anxiety
	"There is a disagreement between anthropogenic and natural causes"	Doubt

Table 6. 1: Examples of answers provided by rural and urban dwellers for selecting a particular emotion from the cluster and the additional emotion categories identified.

The most commonly identified additional emotion categories among rural and urban dwellers were 'shame', 'anxiety', 'irritation' and 'frustration' (Figure 6.2). These categories were primarily related to participants' most selected emotions, namely 'concern', 'guilt', 'powerlessness', 'anger', and 'confusion'.

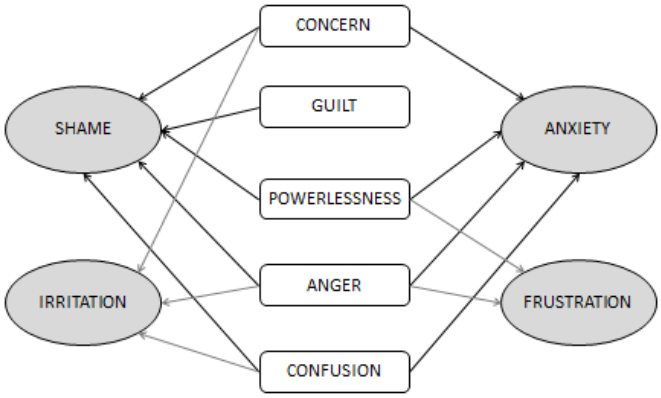


Figure 6. 2: Associations between the most selected emotions and the additional emotion categories identified among rural and urban dwellers.

Positive emotions such as 'optimism', 'calm', and 'happiness', were selected to a much lesser extent, totalling just 13% of the responses provided by participants. Drawing on the work by Lazarus (1991), Baumeister, Stillwell & Heatherton (1994), Lewis & Granic (2000), and Ojala (2015), a qualitative analysis of the answers identified 'hope' as an additional emotion when selecting 'optimism' and 'calm'. In addition, emotional responses of 'optimism' were identified among the reasons for selecting 'happiness' and 'calm'. Examples of respondent's explanations, as well as the additional emotions identified are presented in Table 6.2.

Emotion tested	Examples of respondent's answers (Translated from Spanish by author)	Additional emotions identified
Optimism	*"New generations are more aware and know ways to avoid climate change" "I have hope that people will change their mind" "Campaigns can make it better" "There are scientists in the world creating technology" "I know that with God's help this may change" "There are politicians who can make the change"*	Hope
	"At bad times good face" "I know that this has to stop" "I think we are still on time to contribute with two cents and fight against this phenomenon" "We don't have to sit back and do something"	No additional emotion identified
Happiness	*"I still breathe fresh air not too polluted" "There are many consequences about climate change that we cannot be certain about"*	Calm
	"Humanity is becoming aware to stop global warming	Optimism
Calm	*"It won't affect me that much" "In times like this we have to be calm" "We will get used to weather changes"*	No additional emotion identified
	"Trees are being planted" "Kids are being educated"	Optimism
	"As long as we have God nothing will happen"	Hope

Table 6. 2: Examples of answers provided rural and urban dwellers who selected optimism, happiness and calm and the additional emotions identified.

c. Demographic variables associated with the emotions selected

With the aim of detecting any possible associations between respondent's demographic background and the emotions selected, a Chi-square test was conducted. No significant values were obtained for the majority of the emotion categories explored. The only significant Chi-square value obtained was for the association between 'powerlessness', place of residence, and gender. The analysis suggests that disproportionately more urban than rural respondents selected 'powerlessness'[31]. The analysis further suggests that more male respondents selected 'powerlessness' towards climate change[32].

Notwithstanding no significant difference was found in the Chi-square analysis between selecting 'guilt' and the demographic variables, the data suggested differences regarding the explanations provided in the open-ended question for selecting 'guilt'. Thus, farmers explained that they feel 'guilty' because they deforest or use agrochemicals for their crops, whereas urban respondents felt 'guilty' because they pollute the environment and have a consumerist life style.

6.3.2. Academic conservationists

a. Most selected emotions

Respondents (N=362) were presented the same cluster of ten emotion categories given to rural and urban, and were asked to select those that best represent the way they feel about climate change. Multiple options were allowed. The majority of respondents selected 'powerlessness', followed by 'guilt', 'concern', 'anger' and 'confusion'. 'Optimism', 'calm', and 'indifference' were less often selected. In contrast to rural and urban dwellers, more academic conservationists selected 'scepticism', and none of them selected 'happiness' (Figure 6.3).

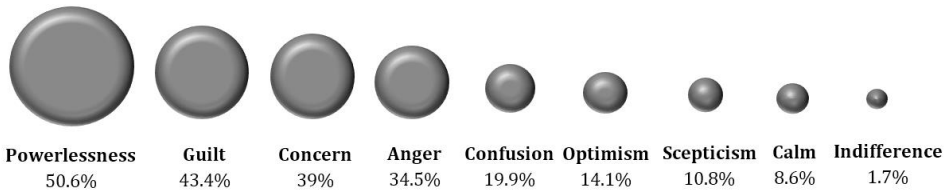


Figure 6. 3: Frequency of the emotions selected by academic conservationists in regard to climate change (N=362). Multiple selections were allowed.

[31] Chi-square value obtained for the association between survey participant's place of residence and the selection of powerlessness from the list: [$X^2(1,400)=3.990$, $p < .046$.].
[32] Chi-square value obtained for the association between survey participant's gender and the selection of powerlessness from the list: [$X^2(1,400)=4.965$, $p < .026$.].

b. Additional emotions identified

In exploring additional emotions in the context of explaining the reasons for selecting any particular emotion from the cluster, the same qualitative analysis conducted with the general public was applied with the academic conservationist sample. Thus, after selecting an emotion from the cluster, respondents were asked in an open-ended question to state the reasons for their choice. From the analysis of the answers, nine additional emotions were identified including: 'frustration/resignation', 'pessimism', 'shame', 'fear', 'anxiety', 'outrageous', 'irritation', 'rage' and 'doubt', most of which were the same as the ones identified with rural and urban dwellers, except 'rage' and 'outrageous' which were identified only for this population sample. The identification of these additional emotions was based upon the same literature reviewed for analysing rural and urban dwellers sample. In addition, emotional responses of 'anger' were identified among the reasons reported for selecting 'powerlessness' and 'concern'. Examples of respondent's explanations, as well as the additional emotions identified are presented in Table 6.3.

Emotion explored	Examples of respondent's answers	Additional emotions identified
Powerlessness	*"Big changes can only be done by politicians and big industries" "It is difficult to change the behaviour of billions of people" "When I do something in my community I don't see any effect on people" I can't do much, my possibilities as a citizen are limited to elections and no party really wants to do anything"*	Frustration/Resignation
	"My government and other world leaders are not doing enough to prevent climate change" "People do not seem overly concerned"	Anger
	"It seems such a big unsolvable problem" "At my level I feel that what I do is a drop in the ocean" "It's too late to stop it" "Even if I changed my life drastically climate change would continue" "Even if we reduce industrialization and other human activities, we won't be able to reverse it"	Pessimism
	"Although I try to do my best I know I still do things that are negative for environment" "It is hard not to contribute considering my life style" "It is a necessary evil to reach development"	Shame
Guilt	*"I don't want to give up to the things that I know contribute to climate change" "I am in my late 50s and my actions years ago are now baked into the CC cake" "I'm using in a daily basis products that contribute to CC" "As a westerner I feel our development has contributed considerably to climate change" "As a privileged westerner, I'm part of the culture that has most contributed to the climate change" "It is the wealth that I am participating in which leads to climate change" "Too much energy used in Europe" "I have not enough commitment to switch to a more natural lifestyle" "I don't have enough money and time to live in a more sustainable way" "I have not done enough in my lifetime to stop this tragedy from happening" "I don't do everything that I could to reduce my own impact and emissions"*	Shame
Concern	*"My parent's generation has sucked the economy and natural resources out of the world and left us to deal with it and won't even acknowledge there is anything wrong" "Humans are not doing enough to tackle CC"*	Anger
	"Because it poses a threat to life on a massive scale" "Human populations will suffer bad times as famine and water shortage" "Loss of life and threats to habitats and global species"	Fear

	"The future is bleak" "Big changes with unknown consequences that are probably harmful" "I don't know if there is going to be a good future for my sons and grandsons"	Anxiety
	"Lobbies influencing on policy seems over dominant - nothing is happening to reduce human impact on climate" "The damage done is irreparable" "The things we can do seem too small to "fix" the problem"	Hopelessness
	"It is a global problem that will disproportionately affect the world's most vulnerable"	Outrageous
Anger	*"Major countries like China and the US have not responded as needed" "Politicians should do more but they become corrupted by industry lobbies and the discourse on economic growth" "I am horrified by behaviours of multinational corporation and countries around the world that seem to ignore the problem as long as they can make money and increase their GDP" "Climate change is a stupid term - if history has taught us anything, the climate was always going to change - change the terminology!" "About the greed involved in creating sceptic propaganda and the resulting political inaction"*	Irritation
	"It doesn't matter our efforts, there other are people pulling the strings"	Frustration
	"There are so many ignorant idiots out there that wouldn't notice if the world fell apart" "People believe too easy in everything and don't use their own brain" "Humanity is that stupid" "Pissed off at what we are doing to our only planet"	Rage
	"Rich people destroy the future of poor folks" "The responsibility has been equally distributed, although we have reached this situation as a result of an unsustainable development controlled by few groups"	Outrageous
	"I know I should do something"	Shame
	"I don't know what would happen in the next years" "Don't know what the real consequences are"	Anxiety
Confusion	*"I have a limited knowledge about CC" "I don't have enough info to have a consistent opinion"*	Shame
	"I don't believe in everything that is said on climate change especially politicians" "Real information is hidden" "We receive a lot of information and even with a scientific background it is hard sometimes to distinguish between what is truth and false" "Media spreads too much different news" "Conflicting messages even from the scientific community" "Contrasted discourses"	Doubt
	"You can act in one way but this's about a collective process and you can't do it for the others" "Humans are supposed to be reasonable creatures but still deny that climate change is real"	Frustration
	"We can die!" "I don't want climate to change"	Fear

Table 6. 3: Examples of answers provided by academic conservationists for selecting a particular emotion from the cluster and the additional emotion categories identified.

The most commonly identified additional emotions among academic conservationists were 'frustration', 'shame', 'anxiety', and 'irritation' (Figure 6.4). These emotion categories were primarily related to participants' most selected emotions, namely 'powerlessness', 'guilt', 'concern', 'anger', and 'confusion'.

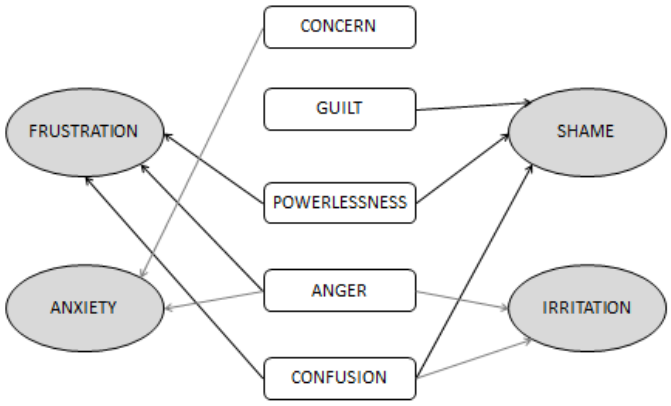


Figure 6. 4: Associations between the most selected emotions and the additional emotions identified among academic conservationists.

In comparing these results with the sample of rural and urban dwellers in southern Ecuador, it was observed that 'optimism', 'calm', and 'scepticism', were also selected in a lesser extent by academic conservationists totalling just 24% of the responses provided by participants. However, academic conservationists selected 'scepticism' to a higher extent as opposed to rural and urban dwellers. During the qualitative analysis of the answers, 'denial' and 'hopelessness' were identified as additional emotions that emerged when explaining the reasons for selecting 'scepticism'. In addition, emotional responses of 'optimism' were identified among the reasons for selecting 'calm'. Examples of respondent's explanations, as well as the additional emotions identified are presented in Table 6.4.

Emotion explored	Examples of respondent's answers	Additional emotions identified
Optimism	*"Throughout history we have adapted to multiple situations" "I think we will go through difficult times but after all it'll be good for evolution" "We'll probably lose charismatic entities like polar bears and coral reefs, but life will go on" "There are scientists working on the effects, causes and public dissemination" "We definitely have the technological means to do what is necessary" "I'm always optimistic" "Planet Earth doesn't need us to exist"*	No additional emotion identified
Scepticism	*"So much bullshit has been told" "Everything is based on simplistic conclusions that are partly true" "Climate gates reduced our trust" "We need experienced scientists studying climate and open-access to the information" "I am unsure whether global climate change can be completely attributed to anthropogenic influence" "A lot of evidence points to natural changes in climate not just greenhouse emissions"*	Denial
	"There is no real political willingness to change things" "Industry overrules all environmental decisions" "Politicians increases scepticism" "I have no faith in politicians and industry leaders to act adequately"	Hopelessness
Calm	*"Living in France even if sea rose for 10m and temperature of 5°C I wouldn't have to move" "Living in a rich country I will feel the*	No additional emotion identified

	consequences less than other people" "Living in a country which can feed its own population I will feel the consequences less than others" "The planet has over 4500 million years and I am just 44, things will happen as they have to" "All predictions are for the future so neither you nor me should be worried"	
	"Humans can adapt to CC" "Ecosystems will adapt" "We have evolved for many years with each change" "My country was an ecological disaster 30 years ago and we made it less polluted, so it's not as bad as it could be.	Optimism

Table 6. 4: Examples of answers provided by academic conservationists that selected optimism, scepticism, indifference, and calm and the additional emotions identified.

c. Demographic variables associated with the emotions selected

With the aim of determining any associations between respondent's demographic background and the emotions selected, a Chi-square test was conducted. No significant values were found for the majority of emotions explored. The only significant Chi-square values were obtained for the association between 'guilt' and place of residence; and between 'optimism', place of residence and gender (Table 6.5).

Feeling		Pearson chi square value				
		Place of residence	**Academic position**	**Age**	**Sex**	**Region**
Guilt		*(2,323)=7,076	----	----	----	----
	Europe	*(2,159)=6,002	----	----	----	
Optimistic		*(2,323)=6,681	----	----	**(1,323)=8,100	----
	Europe	----	----	----	*(1,159)=6,692	

*p<0.05; **p<0.00; ***p<0.000.

Table 6. 5: Significant Pearson chi-square values obtained from the academic conservationist sample when crossing demographic variables with each of the emotion categories explored.

Guilt: The analysis suggests that proportionally more respondents living in urban areas selected 'guilt'. Furthermore, the test conducted separately for each region suggests that more European respondents than those for other parts of the world, in particular from urban areas, selected 'guilt'.

Optimism: The chi-square analysis suggests that proportionally more urban and more female respondents, selected 'optimism' about climate change. The test conducted separately for each region, suggests that in comparison with those from other regions, more female respondents from the European sample selected 'optimism' about climate change.

6.4. Discussion

6.4.1. Peoples' emotions toward climate change

The analysis of emotions allows a better understanding of the implication of psychological factors in the action behaviour towards climate change. Indeed, according to Grothmann & Patt (2005), psychological factors in some cases are stronger predictors of behaviour than economic concerns.

For both, rural/urban dwellers and academic conservationists' samples, 'concern', 'powerlessness' and 'guilt' were the most selected emotions in relation to climate change. These emotions have been identified in previous research on public engagement with the issue, though they have been implied mainly than direct collected (Maibach, Roser-Renouf & Leiserowitz 2009; Doherty & Clayton 2011; Aitken Chapman & McClure 2011; Brulle, Carmichael & Jenkins 2012; Smith & Leiserowitz 2014; Hardesty 2015; Capstick et al. 2015; Howarth & Sharman 2015). However, a person rarely experiences a single emotion (Lazarus 1991, p.67), suggesting that these labels of emotions have been simplistic and neglected the idea that other emotions may be involved when experiencing any particular emotional state regarding climate change. In this respect, researchers like Howarth & Sharman (2015) stress that existing climate change labels, such as 'alarm' or 'denial', represent polar opposites that fail to include myriad of opinions existing between these extremes.

The results of this research support the view that participants selecting 'concern,' 'powerlessness,' and 'guilt' indeed experience other types of emotions, with 'anxiety,' 'fear,' 'hopelessness,' 'shame,' 'anger,' 'irritation,' and 'frustration' being foremost among these additional emotion categories identified. In considering that the majority of emotions tested, excepting 'anger' and 'happiness', are secondary emotions that are aroused when combining two or more emotions (Coon & Mitterer 2010, p.341-342), the emergence of additional emotions was expected. However, it is highlighted that two of the emotions tested, namely 'anger' and 'happiness', are categorised as primary emotions, and were also experienced by participants in the context of other emotions (Tables 6.1, 6.2, 6.3) additional to those found by Drouvelis and Grosskopf (2016), who identified 'joy' and 'warmth' when inducing 'happiness' and 'fear' and 'sadness' when inducing 'anger'. Additionally, in both samples 'confusion' was selected fifth in the list, a noteworthy result in that confusion instigates a state of cognitive disequilibrium that emerges when experiencing more than one emotion (Sisgold 2009; D'Mello et al. 2012). Indeed, studies by Aitken, Chapman & McClure (2011) and Barnes, Islam & Toma (2013) indicate that 'confusion' is common when exploring climate change risk, knowledge and perception. In this context, my arguments suggesting that single

emotion categories have been overly simplistic in representing how people emotionally experience climate change are buttressed, strengthening thus my notion that when people feel concerned about climate change they are actually sensing various emotions as it is suggested by the responses provided by participants when giving the grounds for selecting this emotion category.

Emotions are key factors in the decision making process in that they help people to anticipate or avoid actions (Baumeister & Bushman 2008, p.181-183; Lerner et al. 2015). There are emotions that even have a collective influence in that a person can experience an emotion without direct or personal involvement requiring only that the individual self-recognised as a member of a group (Caillaud *et al.* 2016). Because much of the climate actions require a collective intervention particularly mitigation actions (IPCC 2014a), collective emotions are relevant. For instance, if a person judges their group to be responsible for the CO2 emitted by their country and if s/he identifies with the group, a collective 'guilt' or 'shame' is experienced (Caillaud *et al.* 2016). For researchers such as Evans (2001, p. 18) there are even specific emotions that will not develop unless special conditions are in place, conditions that are provided only by particular cultures. Some examples of these emotions are 'guilt', 'shame', and 'powerlessness'. The behaviour that is triggered by these and other sorts of emotions is known as action tendency which is a subject of analysis for this research purposes. Details of the action tendency associated with the most selected emotions by participants, as well as with the additional emotions identified, are analysed further down to determine the psychological implications imbedded in the proactive behaviour in relation to climate change.

Concern: is a secondary emotion that belongs to the group of 'fear' but it differs from this latter in that it is usually unconsciously directed at existential threats rather than concrete concerns in daily adaptation (Lazarus 1991, p.234-238). People experiencing fear, perceive danger and threat to a greater extent and are more pessimistic (Sutton & Douglas 2013, p. 200-201) rousing thus an action tendency of avoidance or scape (Lazarus 1991, p. 238). People feeling concerned usually experience a combination of two or more emotions (Coon & Mitterer 2010, p.341) such as 'anxiety' and 'hopelessness' whose action tendency is also avoidance or scape (Lazarus 1991, p. 238). In the climate change field, concern has been largely analysed, though previous research accounts suggest that climate change concern encourages action (Stevenson and Peterson 2016) or support to global warming policies (Smith and Leiserowitz 2014). In this context, Mayerfeld Bell (2012, p. 54) contend that sentiments of concern are often appealed to raise among consumers the desire of purchasing goods. Similarly, Bronfman et al. (2015) stress that individuals with higher

environmental concern show tendencies for responsible environmental behaviour. In considering that concern is a compound emotion between two or more emotions, I assert that for people who feel concern to take an action, it is necessary to experience additional positive emotions that motivates them to transform their encouragement and support into real actions. However, as it was discussed previously, in this research 'concern' has largely experienced in the context of emotion categories of 'anxiety,' 'fear,' 'hopelessness,' 'shame,' 'irritation,' 'anger,' and 'frustration,' each with its own action tendency, which, with the exception of 'anger' is mostly resignation, avoidance or inaction (Table 6.6). 'Anger' energizes the person motivating her/him to take action. Some researchers even claim that anger has a positive influence on the intention of sustainable consumption choices (Wang & Wu 2016). However, people feeling 'anger' often make poor choices that can be self-defeating (Baumeister & Bushman 2008, p.194-198). 'Anger', moreover, has been found to lead individuals to a less pro-social behaviour (Drouvelis & Grosskopf 2016). Thereby, I argue that while people feeling anger is highly motivated, their actions are not necessarily productive or efficient. This was observed in the language used by respondents from the academic conservationist sample selecting anger, who used pejorative adjectives such as 'idiot' or 'stupid' to express their anger, suggesting a poor social reaction.

Guilt: this emotion category can be interpreted as a constructive reaction that enhances pro-social behaviour to amend damage (Niedenthal et al. 1994). For instance, Wang & Wu (2016) determined that guilt among other emotions has a positive influence on individuals' intention for making sustainable consumption choices. However, guilt is often also experienced through sentiments of shame (Silfver 2007). Guilt and shame are important in generating moral action (Baumeister, Stillwell & Heatherton 1994). Nonetheless, unlike guilt, shame is regarded as a destructive reaction combining fear and sadness that makes a person to feel small, worthless and powerless to repair the damage (Niedenthal et al. 1994; Silfver 2007; TenHouten 2016). In this study, the qualitative analysis of the answers provided suggests that respondents selecting 'guilt' rather expressed 'shame' (Table 6.1. and 6.4). This result is important to bear in mind, in considering that while guilt prompts action, shame prompts avoidance of the issue, in this case climate change. I argue, therefore, that urgings appealing to a moral behaviour based on guilt for the little actions taken by individuals to reduce their own carbon footprints (Garvey 2010), may incite avoidance to act if the person interprets the message emotionally in the form of shame. What it is here argued is buttressed when contrasting the results obtained in Chapters 4 and 5. In these Chapters, it was discussed that farmers' understanding of the main contributors of climate change involved their own agricultural activities represented in the use of agrochemicals. In terms of emotions, these results suggest that

farmers may feel guilty and make amends for it. However, in Chapter 5 it was observed that farmers actively adapt to climate change by using agrochemicals if they can afford them, suggesting that they rather feel ashamed for using chemicals but will maintain them insofar this is the way to keep their livelihoods. Additionally, climate messages based on guilt may be translated to shame if the person receiving the message also feels powerless to act. This is supported previous findings by Brügger et al. (2015), who claimed that people make amends for what they feel guilty for, only when they believe in the efficacy of their actions. In this research, both population samples studied reported reasons for selecting 'guilt' that suggested that participants experience a subjective inability to react to climate change associated with 'shame'. The emotional category of 'shame' moreover, has been linked with the five most selected emotions (Figures 6.2, 6.4), suggesting that 'shame' is an important affective response that needs further attention when encouraging peoples' actions to climate change.

Powerlessness: refers to a self-judged low level of control over a situation (Ajzen 1991). In the context of climate change, Aitken Chapman & McClure (2011) suggest that individuals who feel more 'powerless' are less likely to take action, they further indicate that individuals with a greater knowledge of climate change also feel more 'powerless' about this issue. This association between higher knowledge and powerlessness was found in this study whereby respondents from the academic conservationist sample selected more frequently powerlessness as well as demonstrated to possess accurate knowledge of climate processes and climate change. Moreover, those study participants selecting 'powerlessness' also tended to express emotional states of 'anger,' 'frustration,' 'hopelessness,' 'shame' and 'anxiety,' each with their own action tendency, though mostly leading to avoidance of an issue (Table 6.6). I argue, therefore, that greater knowledge of climate change may lead to a self-judgment of powerlessness and to the avoidance of this climatic phenomenon. More details about this relationship are discussed in the demographic variables associated with the selection of emotions. The identified additional emotion categories associated with 'powerlessness,' moreover are supported by the findings of TenHouten (2016) who propose that 'anxiety,' 'frustration/pessimism' and 'shame' among other emotional responses, are interior to powerlessness. The results of my study indicate that powerlessness and guilt, accurately said shame, are among the most selected emotions in both study participants' samples. According to (TenHouten 2016), powerlessness activates shame and together, induce individuals to conform to the authority, the power, of one's cultural environment. Additionally, Heyd (2010) asserts that powerlessness arouses among individuals when governments fail to implement measures for mitigation and adaptation. The qualitative analysis of the responses provided for feeling powerless

indeed suggests that participants feel that the governments that represent them '*do nothing about it*'. I argue, then, that individuals experience climate change as an out of control situation over which they have no power and feel ashamed of that. These feelings may well be extended to the community, as it is suggested by (Caillaud *et al.* 2016), who found that groups discussing on the causal agents of climate change experience negative collective emotions related to discomfort and embarrassment. More importantly, these researchers found that individuals ease these emotions by reducing their collective responsibility, and by transferring the responsibility to the system namely industry, overconsumption, transport, allowing them to emphasise their lack of control which in turn increase their support for the status quo and for a system to solve or never solve the problem (2015). In this context, the results of my study suggest that in addition to apprehending climate change as an out of control situation, individuals would rather address this issue by emphasising collective actions, partly explaining the results of Chapter 5 whereby urban and academic conservationists preferred mitigation measures wherein humanity should stop CO2 emissions.

Emotion	Action tendency
Hopelessness	Resignation and inaction rather than struggle.
Guilt	Reparation of the harm.
Shame	It has a maladaptive tendency that prompts a desire to hide or escape.
Powerlessness	Inaction due to the perception that the person has a low level of control over the outcome.
Frustration	Aggressive pursuit of the desired goal.
Anger	Motivation to take action usually accompanied by a maladaptive behaviour.
Fear	Avoidance or escape.
Concern	Avoidance or escape. It is associated to anxiety
Irritation	Motivation to take action usually accompanied by a maladaptive behaviour.

Table 6. 6: Action tendency of the most selected emotions by respondents. Adapted from Lazarus (1991), Lewis & Granic (2000), Silfver (2007), Aitken Chapman & McClure (2011), and TenHouten (2016).

The additional emotions identified in this study, moreover, suggest that those studies that focus on single labels of emotions such as 'concern,' 'guilt,' 'powerlessness,' 'hope,' etc. have been simplistic and have only partially described the way people engaged with climate change. Therefore, I support the viewpoint of Howarth & Sharman (2015) in that there are missed opinions of people between alarmism and denial.

Succinctly, the most selected emotions and the additional emotions identified appear to reference the perception that is profoundly individualistic namely the idea that an individual acting alone

cannot significantly influence the problem. I conclude then that there is a tendency among rural/urban dwellers and academic conservationists to engage with climate change via avoidance or individual inaction. Consequently, unlike Shi et al. (2016) who claimed that climate change campaigns raising concern and awareness had not been a 'lost cause' I argue that these efforts have indeed succeeded in increasing 'concern'. However, these may have also contributed to apprehending climate change as a massive problem that cannot be tackled individually. Additionally, these efforts to raise awareness of climate change has led to the emergence of affective responses, namely 'powerlessness,' 'shame,' 'anxiety,' 'frustration,' 'fear,' among others that reduce individuals' actions to cope with this climatic issue. With that being said, I argue that current climate change campaigns are also leading to defensive reactions that may make people believe that they are just a "drop in the ocean" to tackle this climate issue.

6.4.2. Variables influencing emotions

Different demographic variables have been found to be disproportionately associated with climate change concern, awareness, and risk perception. These included gender (McCright 2010; Stokes, Wike & Carle 2015), knowledge and understanding (Malka, Krosnick and Langer 2009; Brulle, Carmichael & Jenkins 2012; Shi et al. 2016), level of education (Barnes, Islam &Toma 2013; Hardesty 2015), age, country, and place of residence (rural/urban) (Maibach, Roser-Renouf & Leiserowitz 2009; Ming Lee et al. 2015; Stokes, Wike & Carle 2015). However, my findings suggest some differences from the studies mentioned above. For instance, unlike Stokes, Wike & Carle (2015 p.4-10) who found that young people tend to be more concerned about climate change, in my study, age was not significantly associated with selecting the emotional category of 'concern' in any of the population samples studied. Regarding gender, McCright (2010), Stevenson & Peterson (2016), and Shi et al. (2016) found women to express more concern about climate change. In my research, gender was neither significantly associated with selecting 'concern' in any of the population samples studied. Nonetheless, gender was significantly correlated with selecting 'powerlessness' and 'optimism' wherein more male respondents from the rural/urban areas sample selected more often 'powerlessness' and more women from the academic conservationist sample, particularly Europeans, selected 'optimism' more often.

According to TenHouten (2016), males have been traditionally immersed in the paradigm of work and production which lead them to feel predominantly inferior and powerless when they fail in doing so. It may be, therefore, that the self-perception of not being able to cope with the negative

effects of climate change affect more predominantly to men. On contrary to previous research accounts suggesting that women are more prone to feel ashamed and sad than men because they take responsabilities for others at the expense of their own needs (Silfver 2007) or because they have had tradidionally less power and status (TenHouten 2016), I offer that feminist movements, particularly in European countries, may have empowered women to avoid violence and abuse explaining thus their feelings of optimism to change a situation, although this asumption requires more reasearch.

Other types of results suggest that respondents from both participant samples expressed generally 'concern' about climate change. Concisely, members of the academic conservationist sample, who entail more scientific knowledge of climate change (see Chapter 4), did not express a higher degree of 'concern' than rural and urban respondents. This suggests that greater knowledge does not necessarily increase 'concern' as claimed by Malka et al. (2009) and Shi et al. (2016). This view is strengthened by the work of Hardesty (2015 p.11-14), who found that environmental concern did not increase with higher levels of formal education. In addition, respondents from the academic conservationist sample disproportionately selected 'powerlessness' towards climate change more often. Consequently, whilst I agree that more formal education increases awareness of climate change (Brulle, Carmichael & Jenkins 2012; Barnes, Islam & Toma 2013; Ming Lee et al. 2015), I believe that higher levels of formal education also lead to the perception of the self as powerless to cope with climate change, and in some cases, even to scepticism. Although scepticism was not among the most selected emotions, it is worthy of note that it was more often selected by academic conservationists (10.8%) than by rural and urban dwellers (0.8%).

Finally, according to Ming Lee et al. (2015), one of the key predictors of climate change awareness is the place of residence, wherein urban people tend to be more aware of climate change. Whilst I agree with the results of Ming Lee and colleagues, my findings indicate that more urban respondents from the sample of rural/urban dwellers feel powerless and more urban academic conservationists feel guilty (accurately ashamed). I argue then that while more people living in urban areas are aware of climate change, they may also experience sentiments of 'powerlessness' and 'shame', which according to its action tendency, would not necessarily lead them to effective pro-active behaviour as it was previously discussed. In regard of powerlessness, TenHouten (2016) asserts that in rural environments, particularly those with more egalitarian structures, the lack of competiteveness for power and status is common, therefore, individuals tend to feel less powerless. In this context, I offer an alternative explanation adjusted to southamerican socities wherein rural

dwellers have occupied traditionally the lower positions in the hierarchical social structures characteristic of all southamerican countries. In this situation, rural dwellers, particularly farmers, have learnt to deal with everyday-life issues wihtout the intervention of upper powers. This situation, lead them to take actions for survival making them feel more empowered. In regard of shame, the results of Chapters 4 and 5 suggest that despite farmers in rural areas feel ashamed for the use of agrochemicals they will dodge the issue and maintain this practice as a form of adaptation to emerged weather conditions, whereas urban academic conservationists whose livelihoods do not rely on weather conditions will avoid individual action and support collective activities to stop CO2 emissions as a form of mitigation measure. This suggests that emotions of shame and powerlessness may have a different impact among rural and urban dwellers, one that is adjusted to their realities.

Taken together, my results challenge the objectives of ongoing climate change campaigns which aim for education, awareness, and concern. I have presented evidence questioning the effectiveness of being more educated, aware and concerned. Therefore, I believe that climate education programs should equal mitigation measures with local strategies that had made possible the adaptation to a changing climate world. After all, mitigation and adaptation are essential for communities to achieve resilience (Biggs, Schlüter & Schoon 2015, p. 5-10; Walker & Salt 2012). Consequently, unlike other researchers calling to increase public awareness and concern about climate change, such as Brulle, Carmichael & Jenkins (2012) and Shi et al. (2016), I recommend further research on the generation of positive emotions to encourage action. Positive emotions such as happiness, relaxation and optimism, are said to prepare individuals for hard times, helping to develop flexibility, creativity and problem-solving ability (Sutton & Douglas 2013:201). Climate campaigns, then, may well empower individuals to take actions such as adaptation measures. Empowered individuals develop ability to envision desired future states affairs and persist in carrying out plans for attained anticipated goals (TenHouten 2016). It appears that dramatic messages and narratives necessary for environmental issues to be acted upon will not succeed in motivating people to act on climate change (Nordhaus & Shellenberger 2007; O'Neill & Nicholson-Cole 2009; Hart & Feldman 2014; Crow & Boykoff, 2014). Instead, it is 'hope' that emerges as a much more significant predictor of pro-environmental behaviour (Stevenson and Peterson 2016), in particular form of 'constructive' hope that is linked to a high degree of self- perceived efficacy (Ojala 2015).

6.5. Conclusion

This Chapter contributes novel information that aids a better understanding of the psychological implications of emotions in the action behaviour and engagement with climate change. I conclude that the focus of previous studies exploring specific emotions such as 'concern,' 'hope,' 'anger,' etc., may have interfered in the communication of the emotions experienced by participants, as well as, in the identification of other sorts of emotions involved in this climate issue. My research, draws conclusions from qualitative data that examines in-depth the reasons for participants selecting a particular emotion, avoiding thus the single interpretation on the part of the researcher. In this sense, participants had the opportunity to choose among different types of emotions and explain with their own words the reasons for their choice. This process allowed participants to express more accurately the way they feel about climate change and enabled me to identify additional emotions involved. Consequently, I argue that research on climate change emotions should involve and contrast various emotion categories in order to develop more robust interpretations of the way people engage emotionally with climate change. Succinctly, I offer that single emotions, such as concern, are reductionist to define how a person engages with this climate issue. Even though the field of emotions has been hardly studied in climate change research, the existent evidence suggests that by understanding the complexity of the emotions involved in this issue, better communication campaigns may be developed that avoid the 'doom and gloom' narrative that has been linked to lower engagement with the phenomenon. Additionally, an analysis of the reasons for a little presence of positive emotions, such as 'optimism' and 'calm' is recommended to inform global climate campaigns.

Chapter 7

Discussion

Throughout this thesis, I have presented evidence to argue that climate change is understood, perceived, and emotionally experienced through multiple individual and collective viewpoints that ought to be taken into account in designing climate policies and campaigns. Likewise, I have presented evidence to support previous accounts asserting that the public debate is no longer only about the scientific consensus of anthropogenic carbon dioxide emissions or climate models but around competing worldviews and cultural beliefs of people who must accept the constructed science of climate change (Hoffman 2015 p.89; Carey 2010; Rojas Hernández 2016). This is the base upon which the final arguments of this study will be developed, in that I believe that by understanding the full scope of these different views, it may be possible to unpack the multiple dimensions of people's engagement with this climate issue. Thereby, in this thesis, climate change has been considered not only as a matter of biophysical science but as a cross cultural topic whereby the analysis of local political processes, structures of power, local cosmovisions, and psychological views play a decisive role to engage with climate change.

Is in this context that in the following paragraphs I will answer the initial research questions set during the Introduction Chapter. For these purposes, I will use the results of the analysis presented in Chapter 4, 5 and 6 concerning people's understandings, perceptions of, and emotions towards climate change with the objective of providing insights that could be of value in enhancing our understanding of how people engage with climate change. It then addresses the broader implications of my research for questions of adaptation, knowledge, and emotional responses towards this climate issue. In so doing, it offers a theoretical model to explain the factors involved when engaging with climate change while also pointing out further areas for possible future studies.

6.1. The main arguments of this thesis

In considering the multiple worldviews involved in the climate debate (Esbjörn-Hargens 2010; Hoffman 2015), I offer the views from a rather scarcely researched social group with the aim of addressing the first research question which indicates:

Q1: What understandings of climate change do people in southern Ecuador have, and how do these come about? In this respect, it is argued that people's understanding of climate change is similar to that found in other geographical contexts, as well as it is constructed by a combination of factors involving a dearth of scientific knowledge, information disseminated by media and political actors, knowledge acquired by personal experiences, and knowledge shared by social interaction. This suggests that whilst peoples' understandings of climate change are constructed by local realities there is still a global component nourishing the public understanding of climate change through media, political actors or NGO's.

The results of Chapter 4 indicate that participants in southern Ecuador have constructed an understanding of climate change that is assembled with inaccurate knowledge and information including a belief in factors such as pollution or ozone layer depletion as significant contributors. Similar results were reported by Lorenzoni & Pidgeon (2006); Reynolds et al. (2010); Petheram et al. (2010); Howe & Leiserowitz (2013); Moloney et al. (2014); and Huxster, Uribe-Zarain &Kempton (2015), in Europe, the United States, and Australia. This implies that the inaccurate knowledge I encountered in my study may well reflect a worldwide tendency. Indeed, according to Carvalho & Burgess (2005) and Boykoff (2015), the climate change information reported to the general public has been not only inaccurate, but also biased and sensationalist.

Whilst the existence of inaccuracy in climate messages may be considered as collateral damage caused by the translation from a scientific lexicon to a more simple language (Boykoff & Boykoff 2007), bias, and particularly sensationalism, are not appreciated equally by researchers. Hanningan (2014 p.55-66) and Mayerfeld Bell (2012, p. 54), for instance suggests that the use of evocative verbal or visual imaginary is necessary to command public attention and concern to raise among people environmental awareness and friendly behaviour, whereas Antilla (2005); O'Neill & Nicholson-Cole (2009); Hall (2014 p.27-29); and Feldman et al. (2015) describe climate change communications as repertoires of 'doom and gloom' that inspire resistance, despair and withdrawal linked to a low public engagement with climate change rather than action for change. Thereby, current climate messages have contributed to constructing an over simplified climate issue that overlooks other political, social, and economic factors (Boykoff & Boykoff 2007), as well as have failed to make climate change stories understandable and meaningful to readers (Boykoff 2009). Indeed, for Antilla (2005) climate change media articles have spread exponentially misinformation as well as has prevented a more extensive knowledge of the issue.

With this as a backdrop, it is argued that similar climate messages have been constructed worldwide for the sake of raising public awareness and concern of climate change. However, because human

societies have diverse realities, its members may apprehend differently the messages. This was evident in the results of my study wherein, for instance, farmers have constructed a reality whereby pollution caused by agrochemicals and slash/burn activities contribute mainly to exacerbate climate change and blamed themselves because these are part of their own agricultural activities. Whilst farmers' understanding of agrochemicals as a causal agent of climate change is erroneous, slash/burn is indeed. Yet, in analysing these results from the viewpoint of local realities whereby slash/burn activities are necessary for farmers to ensure their livelihoods, I assert that climate messages addressing burning to stop CO2 emission will not prevent burning to happen in an Ecuadorian reality. Instead, people will feel ashamed and will only neglect the messages because they need to ensure the bread on their tables. Simply stated, stop burning is not a reality they can afford. That is to say climate messages constructed in Europeans or North Americans realities wherein 'burning' is suitable for tackling, in societies, such as the Ecuadorian, it is necessary first to take into consideration the grounds for people to keep this and other climate actions that are not aligned to the western constructed science of climate change. In this respect, Rojas Hernández (2016) offers that whilst climate change policies advocating for afforestation in South America favour conservation, they have displaced rural traditional crops such as wheat and vines which has translated into social issues including migration to urban peripheries with the accompanying impoverishment of small producers and their families.

Put in its simplest form, the concept of climate change is constructed individually and collectively according to particular realities formed around human societies; therefore, there is not a single a climate message or policy that would be apprehended equally by all societies worldwide. Still, policies and messages are designed to respond to the demands of western hegemonies. Ecuador is perhaps a good example to understand these arguments. Ecuador signed the Kyoto Protocol which entails support for international mitigation strategies. In order to comply with the agreements signed, former Ecuadorian president Rafael Correa launched the *Yasuni ITT Initiative*. Contrary to the Kyoto Protocol it did not look at carbon markets but to avoid its emission by keeping oil underground and being compensated by the international community, perhaps this latter was what catapulted its failure. According to de Sousa Santos (2011), this project was too threatening for global capitalism and oil interests as well as required a great lifestyle changes in the westerns hemisphere. Its failure only reminds who rules in the international affairs. Locally, Correa's innovative policies and projects were crystallised in the *Plan Nacional de Buen Vivir* or *Sumak Kawsay*. This plan incorporates highly pioneering political constitutions that contain the promise of alternative conceptions of the state, development, and life rights (de Sousa Santos 2011). In addition, Ecuador looks at including more autochthonous environmental ideologies and

cosmovisions (Vanhulst 2013), as well as the multiple views that the public has developed on a range of climate-related issue (Eisenstadt and West 2017). As rewarding though this may be, there is still a long way to go in order to achieve it.

In terms of climate change, the mentioned above is vital for some researchers such as, Corral-Verdugo & Pinheiro (2009), Carey (2010), Rojas Hernández (2016), and Eisenstadt & West (2017), who claim that real vulnerabilities that people in South America face against climate change are related to historical processes that are associated with social inequalities, power structures, and social justice, conditions that are not supportive for sustainability and that need to develop conceptual and methodological approaches that correspond to the idiosyncrasies of the region. Consequently, climate policies and messages need to incorporate these realities into their communicational plans. While some researchers have acknowledged the role of these social issues in the climate debate, these seem to possess a deterministic viewpoint whereby money and technology may solve the problem (e.g. Schmidhuber & Tubiello 2007; Brown & Funk 2014). This brings me to address the second and third research questions that indicate:

Q2. Is climate change adaptation practiced by knowledge, physical resources, psychological state of mind, some other factor, or some combination of these?

Similarly to the concept of climate change, changes in local weather are perceived predominantly locally and individually (Byg & Salick 2009; Cunsolo Willox et al. 2012; Howe & Leiserowitz 2013), strengthening thus my previous arguments suggesting that people engage differently with climate change; and according to their realities. In Chapter 5, I presented evidence indicating that farmers in southern Ecuador have implemented adaptation strategies to cope with the observed weather changes despite their lack of technical knowledge of the concept of climate change or regardless their lack of money or sophisticated technology. These include employing new crops, seed varieties, irrigation and fertilisation systems, switching planting and harvesting months, and the diversification of the household economy into alternative livelihoods. In addition, the evidence suggests that these strategies respond to a state of mind[33] that is prompted by the impact of climatic changes on people's livelihoods.

Yet it is also true that agricultural communities worldwide respond with similar adaptation strategies. For instance, unseasonal and erratic rainfall have been similarly addressed by farmers in Ethiopia, Sahel, Mali, India, and Mexico (Lacy, Cleveland & Soleri 2006; Mertz et al. 2009;

[33] According to Cambridge Online Dictionary, 'state of mind' is a person's mood and the effect of that mood on the person's thinking and behaviour.

Deressa et al. 2009; Tripathi & Singh 2013; Campos, Velázquez & McCall 2014), by switching crop types and varieties, and through implementing irrigation systems and fertilisation practices. In Canada (Turner & Clifton 2009), the same climatic anomaly has been addressed by indigenous people via changing their traditional food systems, constructing and designing outdoors shelters for cutting fish and trays to hang salmon. In Australia (Wheeler, Zuo & Bjornlund 2013) farmers were found more likely to change their crops and adopt more efficient irrigation infrastructure when believing in climate change.

The similarities reported between my results and findings from previous studies suggest that farmers worldwide may be driven by a similar state of mind that prompts them to take actions to adapt and ensure their agricultural production. I argue, then, that farmers from all geographical contexts tend to adapt to weather changes and that it is adaptation rather than mitigation that form the strategy embraced by rural populations, an approach that has particular significance when considering that more than 50% of the world's population live in rural environments that depend directly on agricultural livelihoods (McIntyre et al. 2009), and that the global population needs to ensure its increasing demands for food (Godfray et al. 2010; Wheeler & von Braun 2013). Simply said, farmers optimise their resources to ensure their own subsistence, in so doing it they also ensure the production of food for those living in urban environments. This highlights the importance of working upon farmer's identified adaptation strategies to climate change as a means to ensure food supplies. In this context, adaptation to climate change more than a matter of physicals resources, such as money and technocracy, responds to a state of mind prompted when the livelihoods are threatened. As suggested by Mbow et al. (2008) and Below et al. (2014), people adapt to any factor influencing their livelihoods. Therefore, farmer's tendency to adapt to weather changes emerges as a natural reaction to ensure their livings.

Still, for another group of researchers knowledge is necessary for adaptation (Ishaya and Abaje 2008; Adger et al. 2009; IPCC 2014b; Pasquini et al. 2015). In this regard, the results of my study also indicate that members of the academic conservationist's sample possess an accurate knowledge of climate processes and climate change, as well as, tend to disagree with the idea of adaptation to climate change. These results are similar to those found by (Javeline et al. 2013) and Moloney et al. (2014). Whilst Javeline and colleagues stress the importance for academics/scientists to be consulted about climate change for their vast knowledge on the topic, Moloney and colleagues suggest that only academics/scientists consider phrases such "mitigation" and "carbon management" when discussing climate change. If representative, this may suggest a global tendency among academics and scientists to prefer mitigation over adaptation. Therefore, knowledge does not

necessarily lead to adaptation, instead of, these results robust my arguments on peoples' livelihoods as a factor that prompts people to adapt. Hence, I offer that people's tendency to prefer mitigation or adaptation may be related to their livelihoods. For instance, my results suggested that farmers need to adapt to emerging weather conditions to continue their agricultural activities and ensure survival. On the contrary, the livelihoods of academic conservationists and urban dwellers do not rely on agricultural production and do not depend on climatic conditions. I argue, therefore, that urban dwellers and academic conservationist may prefer mitigation strategies because their survival does not require an instant measure, whereas, farmers have to adopt an immediate solution to keep obtaining their food and income. In short, the evidence suggests that adaptation is perceived by those who not depend on climatic conditions as an approach that should be embraced only when mitigation fails to achieve its goals, whereas, for those who depend on climatic conditions, adaptation has to be adopted immediately to survive.

This tendency is worthy of analysis in that they highlight a dilemma between promoting mitigation or adaptation towards climate change. As Capstick et al. (2015) observed between 2000 and 2007, concern about climate change was widespread and growing with large majorities supporting mitigation policies to reduce carbon dioxide emissions. However, despite the diplomacy and international efforts to reduce global emissions, these have not slowed down significantly (Peters et al. 2012; IPCC 2014b). The difficulty to reduce carbon emissions led global efforts to expand their plans to include adaptation within their agreements (IPCC 2014b). Strategies involving adaptive actions have been the focus of attention of more recent international meetings such as the Copenhagen 2009 and Paris 2015. However, the rapid changes characterising the present era has attracted increasing scientific interest in the resilience approach (Biggs, Schlüter & Schoon. 2015 p.5-7). While resilience rests on adaptation to recovering from unexpected shocks and avoiding undesirable 'tipping points', resilience thinking requires a commitment to mitigate, adapt or transform to face changes (Walker & Salt 2012 p. 2-22). Because mitigation and adaptation are critical to developing resilience thinking necessary for a changing climate world, I argue that climate policies and campaigns need to incorporate local realities, worldviews, and viewpoints that better suit to the human societies under to scope. That is to say, accessing or optimising effective adaptation or mitigation strategies require taking into account social divisions present among human societies, for the same strategy may succeed or fail according to the social group. With this as a backdrop, I will address the next research question:

Q3. How do perceptions of climate change adaptation vary by social divisions and demographic background?

The results of Chapter 5 also suggest that the perception of adaptation and the adoption of adaptation strategies vary between and within social groups. Between studied groups, farmers interviewed and rural dwellers surveyed, including farmers, tend to agree with the idea of adaptation, whereas more urban dwellers and academic conservationists tend to disagree with the same idea. These results suggest that the place of residence and the occupation play a role in the perception of adaptation to climate change, buttressing thus my previous accounts emphasising the role of people's occupation on the preference of adaptation or mitigation measures. Within the group of farmers interviewed, the adoption of adaptation strategies varied according to whether they live in places with more rainfall regimes or not, with the implementation of irrigation systems or greenhouses among the strategies most commonly applied. Within the same group, younger farmers with more interest in commercialising their agricultural production tend to implement adaptation strategies with buying fertilisers, building greenhouses, or trying new seeds and crops, among the strategies most frequently employed. Older farmers, on the other hand, prefer to keep traditional agricultural practices and planting/harvesting months regardless the weather change observed. This, suggest that the place of residence, type of farmer, and age mark a difference among farmers interviewed in the type of adaptation measures adopted. Within academic conservationists, those from Latin American countries tend to disagree more often with the idea of adaptation than those from Europe and North America.

These results, support previous research accounts contending that adaptation literature fails to view pre-existing social differentiation as an important vector of vulnerability while instead imagines homogenous communities wherein similar adaptation measures can be applied (Eriksen, Nightingale & Eakin 2015; Taylor 2015, p.6). In this regard, Carey (2010) claims that the success of climate change adaptation projects in Andean countries and worldwide will depend as much on understanding social relations and power dynamics insomuch as local resistance to adaptation measures may have to do with who is proposing them and with what the plan recommends. Likewise, Mayerfled Bell (2012p, 25-33) argues that despite the potential of global warming to impact everyone's lives; those who do suffer from environmental racism[34] and inequality in the distribution of wealth are generally in worst positions to avoid the consequences. While social inequalities are indeed acknowledged as problematic for adaptation, some researchers have centred their attention on money, suggesting that vulnerability and likely adaptation to climate change are influenced by poverty and lower incomes (Schmidhuber & Tubiello 2007; Ishaya & Abaje 2008;

[34] Environmental racism: is an issue of environmental justice whereby social heritage differences in the distribution of environmental bads and goods. E.g. people of color or people from lower classes are more likely to live in communities with hazardous waste problems (Mayerfeld 2012, p.25).

Brown & Funk 2014). However, in considering that there is a global tendency among farmers to adapt to emerging weather conditions despite their financial opportunities, the claims of these researchers only buttresses the idea that some adaptation literature forgets that the implementation of adaptation measures depend on social divisions and demographic characteristics that is nourished by local values, worldviews, and structures of power.

Hence, climate adaptation policies and campaigns need to re-evaluate reductionist measures such as money, technology or technical knowledge in that for an adaptation measure to succeed it is necessary to involve local culture, attitudes, and more importantly values (Carey 2010; Hoffman 2010; Hulme 2015; Rojas Hernández 2016) that interfere in the state of mind of adaptation. Consequently, judging communities as equal is fallacious in that several cultural and other socio-demographic variables shape peoples' behaviours, perceptions and implementation of adaptation measures as suggested by the results of my study and as it is supported by previous research. Thus, while in western countries adaptation comes in the form of infrastructure and transportation (Ford, Berrang-Ford & Paterson 2011), in non-western countries has the form of switching planting months or self-evaluated adaptive capacity (Grothmann & Patt 2005; Adger et al. 2009; Aldrich 2010; Hart & Feldman 2014; Ensor & Harvey 2015; Thaker et al. 2016).

The design of climate policies and campaigns inspired in local realities may help to improve adaptation measures identified and to propose new measures that encourage people to engage with climate change by taking actions that are within the scope of their possibilities. If people feel empowered on the actions they can perform to tackle a problem, the likelihood for their ideas to become reality is higher (TenHouten 2016). Yet, the global tendency to engage people with climate change has been through raising people's concern (Brulle, Carmichael & Jenkins 2012; Capstick et al. 2015). Concern has been indeed correlated with a pro-active behaviour (Mayerfel Bell 2012; Stevenson & Peterson 2016). However, as asserted by Capstick et al. (2015) levels of public concern have been volatile over the past quarter century and been combined with doubt and scepticism. This suggests that concern has been accompanied with other sorts of emotions that may lead to obtaining a different public reaction from the pursued. In this context, I will address the next research question:

Q4. What are people's emotional responses concerning climate change?

According to the results of Chapter 6, the participating samples from rural/urban dwellers and academic conservationists experience mainly concern, guilt, and powerlessness in regard to climate change. Though more implied than direct collected, these three types of emotions have been

identified in previous research in the United States and New Zealand (Maibach, Roser-Renouf & Leiserowitz 2009; Doherty & Clayton 2011; Aitken Chapman & McClure 2011; Brulle, Carmichael & Jenkins 2012; Smith & Leiserowitz 2014; Hardesty 2015; Capstick et al. 2015; Howarth & Sharman 2015), suggesting an internationally shared tendency to experience similar emotional responses. Yet, my results are novel in that I identified that respondents feeling concerned, guilty and powerless also tend to experience shame, anxiety, frustration, and irritation, all of them characterised by an action tendency leading to avoidance or escape from the issue. Consequently, I sustain that current climate emotional labels such as 'concern' or 'guilt' have been too simplistic to interpret the real range of emotions that people experience regarding climate change and too hasty to draw conclusions about action trends.

Hence, while concern may motivate action (Bronfman et al. 2015; Stevenson & Peterson 2016), I argue that the combination of concern with other types of emotions such as shame or hopelessness may generate maladaptive responses. For instance, shame or hopelessness have an action tendency related to resignation, inaction, avoidance or escape (Lazarus 1998; Silfver 2007). These action tendencies, partially explain why levels of climate change concern have been unstable over the time and have in some of the cases reached denial as found by Brulle Carmichael & Jenkins (2012) and Capstick et al. (2015). Consequently, I argue that while public climate change concern has certainly augmented (Brulle, Carmichael & Jenkins 2012), this may have also led to the perception of an inexistent phenomenon or of a huge issue that cannot be tackled individually. This latter, linked to powerless sentiments which according to my results are among the most selected emotions experienced by study participants. Similarly to shame, powerlessness generates maladaptive responses in that a powerless person react to goal-blockage with a sense of frustration or resignation (TenHouten 2016).

Because there is an international interest to engage people proactively with climate change, this perception of concerned, ashamed or powerless shared among rural/urban dwellers and academic conservationists deserves close attention in that people self-assessed capacity to mitigate or adapt may be rather related to deny individual responsibility for taking actions and rather transfer it to the system as it was found by Brügger et al. (2015) and Caillaud et al. (2016). Therefore, there is a task for social researchers and practitioners to assess ongoing climate change policies and educational programmes in order to ensure an effective public engagement that overcomes single 'concern' or 'shame'. As claimed by Hall (2014 p. 29), 'if the concern is ineffective in these days then the solution is to tell a more positive and inspiring story'. Yet, excepting the work by Ojala (2012,

2015) and Stevenson & Peterson (2016) few studies evaluate the importance of positive messages of climate change for people's emotional responses and subsequent actions.

This rather complex analysis of emotional responses was only possible by avoiding the single interpretation of the researcher and by giving participants the agency to explain for themselves the reasons for them to feel the emotions selected. Nonetheless, the experience of certain types of emotions is also linked to socio-demographic variables as I will address in the final research question:

Q5. What demographic variables are associated with people's emotions towards climate change?

The results of Chapter 6 also indicate that the emotional responses experienced by study participants vary within groups studied suggesting a difference marked by participant's place of residence, gender, and country. Among respondents from the sample of rural and urban dwellers, more male and urban participants selected powerlessness. In regard to gender and powerelessness, TenHouten (2016) claims that sentiments of powerlessness are associated commonly to males for they have been immersed tradittionally in the paradigm of work and production, so when they fail to perform these actions tend predominantly to feel inferior. In regard to place of residence and powerlessness, TenHouten (2016) asserts that in rural environments, particularly those belonging to traditional aborigins with more egalitarian structures, the common lack of competiteveness for power and status lead individuals to feel less powerless.

While TenHounten's claims on the relation between gender and powerlessness may explain why more males from my sample selected powerlessness, I offer some geographical explanations regarding the relation between powerlessness and place of residence that rather respond to historical processs in South America related to hierarchical social structures. In this context, rural dwellers have occupied traditionally the lower positions in the hierarchical structure of southamerican societies. In this position, rural dwellers, particularly farmers, have learnt to deal with everyday-life issues wihtout the intervention of upper powers. This situation, lead them to 'take the bull by the horns', and preform actions for survival, therefore they feel more empowered and less powerless. This argument is buttressed by my results indicating that more rural dwellers and farmers surveyed support the idea of adaptation and my results suggesting that farmers interviewed are constantly adapting to changes. There may be then a conection between the occupation, the emotions experienced, and the support for mitigation or adaptation measures insofar as rural dwellers, particularly in the Latin American context, need to take actions to survive in a hierarchecal society.

Within the academic conservationist sample, more urban respondents from European countries selected guilt. Notwithstanding the emotion category presented to participants was guilt, the qualitative analysis suggests that academic conservationists rather feel ashamed. Moreover, the analysis identified a sentiment of shame aroused by their climate unfriendly lifestyles, their western country origin, and by their participation in a system that largely contributes with carbon dioxide emissions. These results suggest that more European members of this population sample engage emotionally with climate change through shame for their climate unfriendly lifesyles but at the same time for maintaning that lifestyles. Previous research on collective responsibility for environmental problems supports my findings. In a study conducted in France by Caillaud et al. (2016), found that when individuals discuss about climate change they experience collective emotions of disconform and shame which are eased by transferring the responsibility to the system's industry, overconsumption, and transport. Caillaud and colleagues stress that by transferring the responsibility to the system allows individuals to emphasise their lack of control which in turn increase their support for the status quo and for a system to solve or never solve the problem.

In considering that the most selected emotion by academic conservationists was powerlessness, my arguments are valid in that respondents emphasised assiduously their lack of control on the issue and tended to prefer mitigation measures for reducing carbon dioxide emissions. Consequently, there is a geographical connection between supporting mitigation or adaptation measures and the country of origin as it was suspected in Chapter 6. Furthermore, According to TenHouten (2016), shame is an important secondary emotion of powerlessness which as it was previuosly discussed is experienced extensively in urban areas rather than in rural environments. Therefore, it is suspected a hierarchical social structure in Europe that prompt urban individuals to experience more powerlessness and shame.

Finally, more urban female Europeans selected optimism more often. According to TenHouten (2016) and (Silfver 2007), women are more prone to feel ashamed and sad than men. My results suggest a rather different standpoint. In this regard, I offer that the same reasons for rural dwellers to experience less powerlessness may explain the reasons for women to feel more optimistic. That is to say, historically women had less oportunities, power and status than men (TenHouten 2016) similar to that associated to rural dwellers. However, since the 19th century, women have been involved in feminist movements, particularly in Europe, which may have incepted the view of a world of possibilities. Hence, my results suggest a rather different geographical perspective from that that has been associated with females at least with Euro-Australians (TenHouten 2016). It is

however salient that in southern Ecuador no statistical significant connection was found between gender and selecting optimism, suggesting thus a cross-cultural difference that needs further attention.

The responses to the five research questions suggest that people understand, perceive, and emotionally experience climate change differently and adjusted to the environment that surrounds them and to the realities constructed by the societies in which they operate. However, despite these conspicuous differences attributed to collective and individual realities, it draws the attention that a similar process is developed across groups of people and borders to engage with climate change. In Figure 6.1, I will integrate these arguments considering them as groups of sets forming a theoretical model to offer a holistic approach in order to enhance our understanding of how people engage with climate change. In this context, the process has its core in the understandings of this issue. These understandings are shaped by people's knowledge and perceptions of climate change which in turn are informed by scientific knowledge, the information interpreted and disseminated by main sources such as media and political actors, and a social interaction whereby the information is passed within and between society members. The perceptions of climate change are in turn informed by a sociodemographic context wherein the personal experiences with weather changes combined with other social processes such as inequalities and structures of power and demographic variables such as people's livelihoods, will conjugate to arouse particular types of emotions.

Altogether, these variables inform the understandings that will lead people to engage with climate change in the form of supporting individual or collective mitigation or adaptation measures, in the form of 'I need to survive and will do what it takes to do so' or in the form of scepticism and denial of the constructed science of climate change.

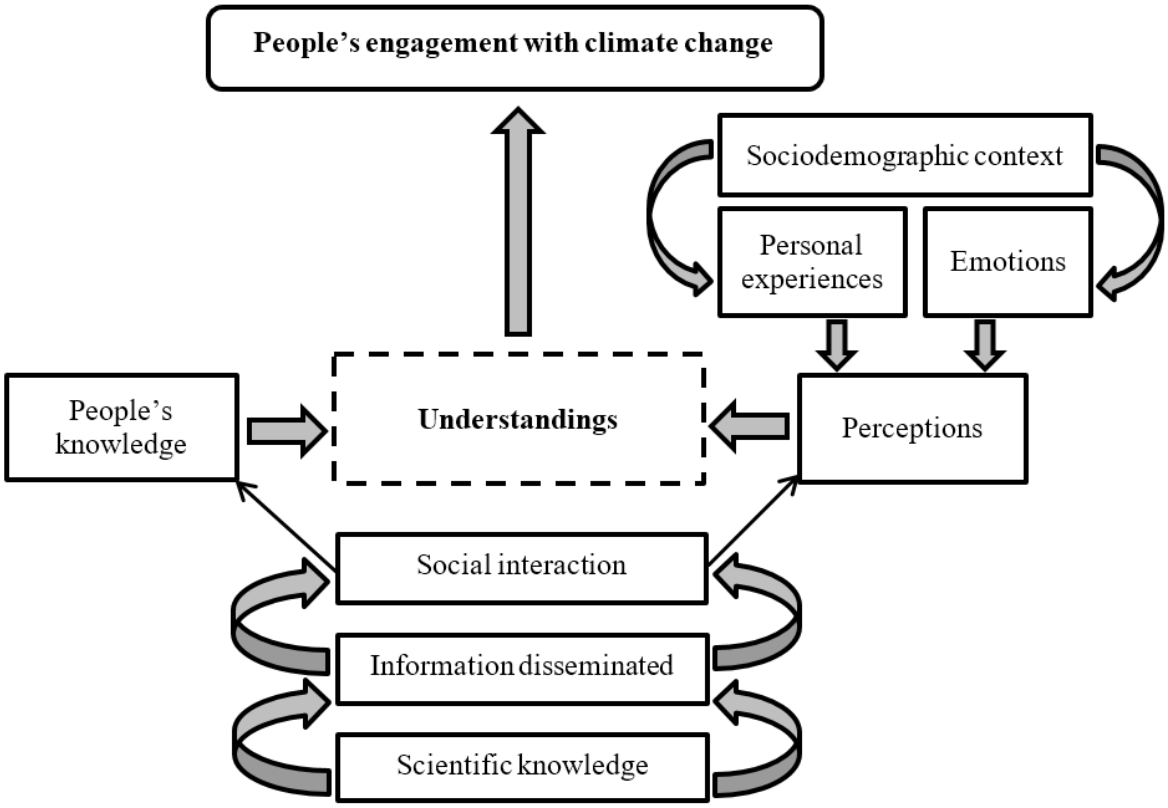


Figure 7. 1: Theoretical model developed by Author to explain how people engage with climate change.

In short, the model suggests that people's engagement with climate change depends on multiple social factors that are relevant for consideration in the design of climate policies and communicational programmes that may help achieve a proactive public engagement with climate change.

6.2. Caveats and further research

As I previously pointed out, there is a tendency among urban dwellers and academic conservationists to prefer mitigation over adaptation to climate change. While I have made an approximation to the likely reasons for supporting mitigation or adaptation, further research is required to gather direct opinions regarding people's preference between these two strategies. Likewise, further research in this area should involve peoples' opinions about resilience as an approach to keep up with rapid climatic changes.

My results involving climate change emotions provided evidence on how study participants feel about climate change suggesting a tendency among urban dwellers and academic conservationists to apprehend this climatic phenomenon as an issue that cannot be tackled individually, accordingly powerless. In considering that more urban dwellers and academic conservationist also tended to prefer mitigation strategies, I offer a potential association between the place of residence, occupation, the emotions experienced and the preference for mitigation or adaptation strategies that requires further attention in order to determine whether the promotion of more positive messages coupled with adaptation measures may have a different impact on people and on their subsequent engagement with climate change. Additionally, although my results suggest that farmers feel ashamed for some of their agricultural practices, I recommend future research to direct collect the type of emotions farmers experience towards climate change.

In this Chapter, I have suggested that people's engagement with climate change is developed through a process that includes understandings, knowledge, perceptions, emotions, personal experiences, social interaction, among other parameters. However, future research in this area might unveil unknown parameters that may also be involved in the development of the perceptions and understandings of climate change. Particular attention could be given to demographic variables such as income as a determinant for engaging people with climate change action strategies, namely mitigation, adaptation or resilience. Income could also be analysed as a predictor of the emotions experienced regarding this climatic phenomenon.

Finally, there is a scope for a broader debate about raising concern to engage people with climate change. This could involve advantages and disadvantages of employing these sorts of strategies, as well as, an analysis of the effects that successful stories of adaptation to climate change may have on people's engagement with this climate issue and their subsequent behaviour.

6.3. A final word

In the process of carrying out this thesis, I came to recognise the need for the scientific community, conservation practitioners, and climate change advocators to combine objective with subjective arguments to overcome their barrier of engaging people with climate change. With this thesis, I am not only moving some way towards enhancing our comprehension of how people understand, perceive, experience, and ultimately engage with climate change, but I am also stressing the importance of transmitting positive and successful strategies to adapt to a rapid climate change. As Hulme (2013 p.54) perceptively observes 'society can make effective adaptation decisions in the

absence of accurate climate predictions what it leaves for us is to strengthen and apply these decisions'. Little is known about the use of successful experiences to adapt to weather changes as a mean to engage people with climate change, as well as, little has been researched about the effects that these types of stories may have on the society's perceptions of this climate issue. What it has been discussed throughout this thesis suggest an opportunity to start using alternative strategies for engaging people with climate change that avoid the 'doom and gloom' characterising ongoing climate change narratives and by involving local cosmovisions and cultural views in the climate debate. This is particularly important in the context of Latin American countries such as Ecuador, wherein the historical and social processes are different from those where current climate policies and campaigns are designed.

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Appendixes

Appendix 1: Face to Face Questionnaire

Climate change social perspectives

No._____

Thank you for taking part of this survey. It will take 15min of your time to fill this questionnaire and by doing it you will help us to:

a) To explore into peoples' perspectives of climate change; and to
b) Identify how people construct their understanding of climate change.

The information provided will be used to obtain a doctoral degree at the University of Lent, United Kingdom. Your anonymity is highly ensured. Please do not feel you don't know the answers since this questionnaire has been designed to explore into your perception and opinion rather than your knowledge.

a. General information

1. ¿What is your age?
   - 20-30 ☐
   - 31-40 ☐
   - 41-50 ☐
   - 51-60 ☐
   - 61-70 ☐
   - 71-80 ☐

2. ¿What is your gender? Masculine ☐ Feminine ☐

3. ¿The place where you live is? Rural ☐ Urbana ☐

4. ¿What is your occupation?

College student	☐	Agriculturalist	☐	Public employee	☐
PhD student	☐	Housewife	☐	School teacher	☐
Scholar	☐	Musician	☐	Nurse/Doctor	☐
Research asistant	☐	Business owner	☐	Private consultant	☐
High school teacher	☐	Retired	☐	Freelancer	☐

Other:
_____

b. Causes and consequences of climate change

5. ¿For what reasons do you think climate is changing? *Make a list of your answers*.

6. In your opinion ¿Which ones could be the consequences of climate change? *Make a list of your answers.*

c. Personal risks perceived of climate change

7. ¿Do you think that climate change is something that is going to affect you personally?

   Yes ☐ No ☐ I don't know ☐

8. If your answer was "no", please continue with question 9. If your answer was "yes", ¿Could you please tell me in which way is going to affect you? *Please right down your answer*.

_____

d. General knowledge of climate change and climate processes

9. How much do you agree or disagree with each of the following statements? *Please tick only one box on each line*

	Completely agree	***Agree***	***Neither agree nor disagree***	***Disagree***	***Completely disagree***	***Don't know***
a. Climate change is the same as global warming						
b. Global warming is occurring because the climate is changing						
c. Cold weather means the same as cold climate						
d. Climate often changes from year to year						
e. Climate means pretty much the same as weather						
f. A warmer or colder year is an indicator of climate change						

10. ¿Do you know what the greenhouse effect is? Si ☐ No ☐

11. If your answer was “no” please continue with question 10. If your answer was “yes” Please write your answer down.

_____

_____

e. Perception towards climate change adaptation and mitigation

12. How much do you agree or disagree with each of the following statement? *Please tick only one option.*

	Completely agree	***Agree***	***Neither agree nor disagree***	***Disagree***	***Completely disagree***	***Don’t know***
Humanity should adapt to climate change and move on						
Humanity should stop CO2 industrial emissions						

f. Climate change emotions

13. ¿How do you feel about climate change? *Please, tick the boxes for all that apply.*
14. Could you explain why you feel in the way you have selected.

Concerned	☐	*because*
Guilty	☐	*because*
Powerless	☐	*because*
Angry	☐	*because*
Optimism	☐	*because*
Happy	☐	*because*
Confused	☐	*because*
Indifferent	☐	*because*
Calm	☐	*because*
Sceptic	☐	*because*

¡Thank you for your help! If you have any question, please contact Veronica Iñiguez to mvi6@kent.ac.uk or mviniguez1@utpl.edu.ec

Appendix 2: Interview guide

A. AGRICULTURALIST INFORMANT PROFILE DATA *(Ask directly for Information)*

Code name: _____

Community of Permanent Residence: _____

Type of farmer: SUBSISTENCE COMMERCIAL

Gender: MALE FEMALE

Age: _____ *(Number of years round up)*

Agriculturalist informant questioning route (2014-2015)

B. FOOD

1. Food production: Do you produce the same crops and animals than before? / What have changed? What reasons have led these changes? What changes respond to climatic changes?

   Probes:
   - What crops have you planted this year and what kinds of animals are you raising?
   - Are these the crops the same that your parents or grandparents have always grown?
   - Are these the animals the same that your parents or grandparents have always raised?
   - If the types of crops or animals have changed, ask: Why did you start using them?
   - What kinds of agricultural practices that you use are successful (e.g., fertilize, controlled burning for grazing, weeding, yoke, plough machine)? *Try asking to explain the process of planting potatoes*.
   - The agricultural practices you have are the same that your parents or grandparents had?
   - If it has changed, what has it changed? And why did you change your agricultural practices?
   - What in your opinion is the main problem agriculturalists face?

2. Food access and affordability: How do people ensure their access to food? How do they distribute their food? Does the type of food consumed have changed? What has motivated these changes? Do these changes in food consumption have to do with climate change?

   Probes:
   - Do you and your family use everything you produce, or do you sell or trade some of it?
   - What produce are for self-consumption, what produce do you sell? And what produce do you trade?
   - Did your parents or grandparents use to trade the produce? Tell me about it
   - Tell me about the dishes your parents or grandparents used to cook

- Do you eat the same food that you used to as a kid? If no, why you don't eat it any longer?
- Tell me about the food that you have to buy in the market or shops. Did your parents or grandparents use to buy food in the markets? What food?

3. Food stability: does food production (crops and animals) produce in the same amount than before? If not, what has happened? Does climate change has something to do with increasing or decreasing food produced?

   Probes:
   - Do you produce more or less than that you used to produce before? Tell me about it
   - What about animals, do you have the same number of animals that you have now, what happened?
   - What about your parents, do they have the number of animals and produce the same as before? What has changed?
   - Do you have crops diseases that you did not have before? Tell me about them
   - What else about your farm or land you use for agricultural purposes do you see changing?

C. ADAPTATION

4. Adaptation: How farmers respond to changes including climatic changes if mentioned? Have farmers' agricultural systems changed over the years?

   Probes:

   - What do you plant in the different months of the year? *Use seasonal calendar*
   - What do you harvest in the different months of the year? *Use seasonal calendar*
   - Have you or your parents always planted and harvested in these months?
   - If something has changed related to planting and harvesting months, would you please explain me what has led these changes?
   - What have you do to tackle these changes?
   - Is there any crop that you cannot longer produce here? What had happened?
   - Is there any crop that you think it will grow in this area, but you don't have it?
   - If so, what crops would you start planting if you could? Why would you do it?

D. CLIMATE CHANGE

5. Climate change: tell me about the changes you have seen in the last 30 years around you, what are the big changes? What is the main concern about changes? *Use examples like changes in forest, water, etc.*

   Probes
   - Tell me about the changes you have seen in the area.

- Should something be done about bad changes? What do you think it can be done?
- If climate change or global warming has been yet brought up to the conversation, ask about it directly. Have you ever heard about climate change? Tell me what you have heard.
- What do you know or think about climate change?
- Do you think that a climate change is going to affect you? Tell me about it.

Thanks for your help!

Appendix 3: Online Questionnaire

Online Survey Template

Welcome!

Thank you for taking the time to fill this questionnaire. It should only take up to 20 minutes of your time. By completing this questionnaire:

a. You will be helping to build up a better understanding of climate change; and
b. You will be contributing to knowledge about climate change from an academic perspective;

The information that you provide will be used for a PhD research project conducted at the University of Kent, United Kingdom, and your anonymity is assured. Please don't worry if you feel you don't know the answers, the questionnaire is intended to evaluate your understanding and perception.

a. General Information

1. What is your age? 20-30 ☐ 31-40 ☐
   41-50 ☐ 51-60 ☐
   61-70 ☐ 71-80 ☐
2. What is your gender? Male ☐ Female ☐
3. Is your place of residence? Rural ☐ Urban ☐ Suburban ☐
4. Which country are you from? _____
5. In what University or Academic Institution do you work? _____
6. What is you academic occupation?

Master's student ☐ PhD Student ☐

Lecturer ☐ Research assistant ☐

b. Causes and consequences of climate change

7. Why do you think the climate is changing? *Make a list your answers*.

8. What do you think might be the consequences of the climate change phenomenon? *Make a list of your answers.*

c. Personal risks perceived of climate change

9. Do you think climate change is something that is affecting or is going to affect you personally?

Yes ☐ No ☐ don't know ☐

9a. If no, skip to question 10. If yes, in what ways is it affecting you, or is it going to affect you? *Please write down your answer*.

_____

d. General knowledge of climate change and climate processes

10. How much do you agree or disagree with each of the following statements? *Please tick only one box on each line*

	Completely agree	***Agree***	***Neither agree nor disagree***	***Disagree***	***Completely disagree***	***Don't know***
a. Climate change is the same as global warming						
b. Global warming is occurring because the climate is changing						
c. Cold weather means the same as cold climate						
d. Climate often changes from year to year						
e. Climate means pretty much the same as weather						
f. A warmer or colder year is an indicator of climate change						

11. How much do you agree or disagree with each of the following statements? *Please tick only one box on each line*

	Completely agree	***Agree***	***Neither agree nor disagree***	***Disagree***	***Completely disagree***	***Don't know***
a. The greenhouse effect keeps the air from being as cold as outer space						
b. Climate can be affected by launching dust into the atmosphere						
c. Ice sheets in the poles help to cool the planet						
d. Oceans help to reflect the sun radiation						
e. Clouds influence the earth's temperature						
f. The temperature of the Earth is affected by whether the earth's surface is light or dark colored						

e. Perception towards climate change adaptation and mitigation

15. How much do you agree or disagree with each of the following statement? *Please tick only one option.*

	Completely agree	***Agree***	***Neither agree nor disagree***	***Disagree***	***Completely disagree***	***Don't know***
Humanity should adapt to climate change and move on						
Humanity should stop CO2 industrial emissions						

f. Climate change emotions

16. How do you ***feel*** about climate change? *Please tick the boxes for all that apply, and explain why you feel in the way you have selected.*

Concerned	☐	*because*
Guilty	☐	*because*
Powerless	☐	*because*
Angry	☐	*because*
Optimistic	☐	*because*
Happy	☐	*because*
Confused	☐	*because*
Indifferent	☐	*because*
Calm	☐	*because*
Skeptic	☐	*because*

Thanks a lot for your help! If you have any comments or questions regarding this questionnaire or the research, please feel free to contact Veronica Iñiguez at mvi6@kent.ac.uk.

Optional: If you feel like leaving comments for any of the questions above, write them down in the box below.

Appendix 4: Lists

a. List of occupations identified in the face to face questionnaire

Type of occupation	Occupations included within each type
Students	College students, master students, PhD students.
Agricultural workers	Farmers.
Semi-skilled workers	Musicians, locksmith, build makers, sculptors.
Skilled workers	Research assistant, private consultant, freelance, secretaries, mechanics, carpenters, mason.
Unskilled workers	Housewife, business owners, chauffeur, workers.
Professionals	College lecturer/scholar, high school teacher, primary school teacher, government employee, lawyer, agronomist, veterinarian, physiotherapist, nurses, doctors.
Retired	
Unemployed	

b. List of participating countries

Latin America	North America	Europe	Africa	Asia & Oceania	Middle East
Argentina	United States	United Kingdom	Kenya	Philippines	Syria
Brazil	Canada	Germany	Ethiopia	India	
Mexico		Switzerland	South Africa	Turkey	
Ecuador		France	Uganda	Indonesia	
Chile		Poland		Bangladesh	
Costa Rica		Spain		Tibet	
Puerto Rico		Romania		Malaysia	
Colombia		Belgium			
Bolivia		Sweden			
		Portugal			
		Cyprus			
		Malta			
		Italy			

c. List of participating academic institutions

LATIN AMERICA	NORTH AMERICA
Mexico: ECOSUR (College of Southern Border), UNICACH (Science and Arts University of Chiapas), Universidad Autónoma de Chiapas, Colegio de Posgrados COLPOS, Universidad Nacional Autónoma de México, Universidad de Guadalajara, Universidad Autónoma de Chapingo, Instituto Tecnológico del Valle de Morelia, Centro de Investigación Científica Yucantán. **Argentina:** Universidad Nacional de Córdoba, Universidad Nacional de Cuyo. **Ecuador:** Universidad Católica del Ecuador, Universidad Técnica Particular de Loja, Universidad de Cuenca, Escuela Superior Politécnica del Litoral, Universidad Nacional de Loja, Universidad del Azuay, Universidad Espíritu Santo, Universidad de Guayaquil. **Puerto Rico:** University of Puerto Rico.	**United States:** State University of New York College of Environmental Science and Forestry, Central University of Florida, City University of New York, University of Oklahoma, University of Washington, Umass Amherst (Universidad de Massachusetts Amherst), University of California, University of Georgia, University of Idaho, University of Minnesota, University of Utah, University of Nebraska, Onondaga Community College, University of

Costa Rica: Centro Agronómico Tropical de Investigación y Enseñanza CATIE. **Brazil:** University of Brasilia, University of Sao Paulo, Universidad Estadual de Campinas, Jardín Botánico Jundiai, Facultade de Ensino Superior e Formacao Integral. **Chile:** Universidad de Concepción. **Colombia:** Universidad de la Amazonía.	Milwaukee Wisconsin, Middlebury College. **Canada:** University of British Columbia, University of Ottawa, University of Toronto, University of Dalhausie.
EUROPE	**AFRICA**
Switzerland: ETH Zurich (Politechnical Federal School of Zurich), University of Zurich. **Spain:** CSIC (Superior Council of Scientific Investigations), Universidad Rey Juan Carlos, Universidad Autónoma de Madrid, Universidad Pablo de la Olavide, Estación Biológica Doña Ana, Universidad de Sevilla, Universidad de Alicante, Universidad de Vigo, Universidad de Oviedo, Universidad de Alcalá, Universidad Compluténse de Madrid, Universidad Autónoma de Barcelona, Universidad Politécnica de Valencia, Universidad Europea de Energía y Medio Ambiente, Universidad de Granada. **France:** Agro Paris Tech, Bordeaux School of Agronomy, Higher Normal School of Lyon, Francois Rabelais University, National School of Geographiques Sciences, National Museum of Natural History, Pierre and Marie Curie University, SupAgro Montpellier, University of Occidentale Brittany, University of La Rochelle, **Romania:** Babes-Bolyai, Romania, Ovidius University, Unviersity Bucharest. **Poland:** Jagiellonian University, Polish Academy of Science. **Sweden:** Lund University, University of Uppsala. **Cyprus:** Open University Cyprus. **Germany:** Max Planck Institute for Chemical Ecology, Technical University of Dresden, UFZ (Helmholtz Centre for Environmental Research), University of Cologne, University of Göttingen, University of Leipzig, University of Munster, University Osnabruck, Universität München, University of Oldenburk. **Belgium:** University of Antwerp. **United Kingdom:** University of Kent, New Castle University, University of Stirling. **Portugal:** Universidad de Lisboa, Universidad de Coimbra. **Italy:** Universita degli Studi di Padova.	**Kenya:** Kabarak University, Kenya University, Moi University. **Ethiopia:** Addis Ababa.
ASIA & OCEANIA	**MIDDLES EAST**
India: Anna University Guindy, Gulbarga University. **Phillipines:** Gregorio Araneta University. **Malasya:** University of Malaya.	**Syria:** Damascus University.

Appendix 5: Coding book developed for Face to Face and Online Questionnaires

FACE TO FACE QUESTIONNAIRE		ONLINE QUESTIONNAIRE	
A. AGE	**CODE**	**A. AGE**	**CODE**
18-30	1	20-30	1
31-40	2	31-40	2
41-50	3	41-50	3
51-60	4	51-60	4
61-70	5	61-70	5
71-90	6	71-80	6
B. GENDER	**CODE**	**B. GENDER**	**CODE**
Male	0	Male	2
Female	1	Female	1
C. PLACE OF RESIDENCE	**CODE**	**C. PLACE OF RESIDENCE**	**CODE**
Rural	0	Rural	1
Urban	1	Urban	2
		Suburban	3
D. OCCUPATION	**CODE**	**D. ACADEMIC POSITION**	**CODE**
Students	1	Master student	1
Agricultural worker	2	PhD student	2
Semi-skilled worker	3	Lecturer	3
Skilled worker	4	Research assistant	4
Unskilled worker	5	Other position	5
Professional	6		
Retired	7		
Unemployed	8		
E. PROCEDENCE	**CODE**	**E. PROCEDENCE**	**CODE**
Loja	1	Latin America	1
San Pedro	2	North America	2
Celica	3	Europe	3
Pindal	4	Africa	4
Catamayo	5	Asia & Oceania	5
		Middle East	6

FACE TO FACE QUESTIONNAIRE: Criteria to code open-ended questions			
F. CLIMATE CHANGE CAUSES: Why do you think climate is changing?			
CAUSES	**EXAMPLES OF ANSWERS**	**CODE**	**INCLUSION/EXCLUSION CRITERIA**
Natural causes CC1	"Volcanoes", "El Niño", "solar cycles", "Milankovic cycle", "evolution", "Earth's rotation", "increase of solar activity"," variation in the energy we receive from the sun"	Ticked (1) No ticked (0)	**Inclusion:** statements related with inherent Earth's bio-physical changes, and natural eventualities. **Exclusion:** statements regarding ocean feedback, loss of albedo and permafrost. A category for each of these three statements was created. Natural eventualities mentioned in a natural disaster context were also excluded and categorized as "natural disasters /effects".
Anthropogenic activities CC2	"Human activities", "it's man's fault", "our own activities"	Ticked (1) No ticked (0)	**Inclusion:** statements specifically mentioning "human, man, or anthropogenic activities" but without mentioning what kind of activities. **Exclusion:** statements such us human pollution, anthropogenic emissions, and similar, were categorized according to the factor accompanying the words human or anthropogenic. e.g. human pollution was categorized as pollution, and anthropogenic emissions as emissions.
Pollution CC3	"Pollution from human activities", "environmental pollution", "noise", "human pollution", "increase of pollutants", "smog",	Ticked (1) No ticked (0))	**Inclusion:** statements using the word pollution, pollutants or smog. **Exclusion:** A statement where the word pollution or synonyms was not used, and were pollution was related with industry and transportation.
Deforestation CC4	"Logging", "fires", "land use changes", "urbanization", "forest lost", "destruction of carbon sinks", "habitat loss", "reduce of green areas", "remove of natural vegetation cover"	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning processes of change from any type all natural vegetation to any human system. **Exclusion:** a statement where any direct or indirect land uses change was mentioned.
Overpopulation CC5	"Too much people in the world" "overpopulation" "multiplication of people"	Ticked (1) No ticked (0)	**Inclusion:** statements pointing to "lots" of people. No exclusion was necessary given that the statements were straightforward at mentioning overpopulation.
Ozone layer depletion CC6	"Depletion of ozone layer", "aerosol cans", "CFC's".	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning the ozone layer depletion and the use of its contributors such as aerosols cans, and CFCs. **Exclusion:** statements using the word aerosols when mentioned in the context of greenhouse gases.
Greenhouse gases CC7	"Gasses emission", "anthropogenic gas emissions", "global warming effect", "Greenhouse gasses"	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning gasses emissions in a general context such as "greenhouse gases emissions" or "methane emission". **Exclusion:** statements naming only and specifically carbon, methane, nitrogen in the context of industry, vehicles, greenhouse effect, agriculture, permafrost melting, and ocean's cycles.
CO2 emissions CC8	"Use of carbon filters", "carbon emissions", "Too much carbone dioxide in the atmosphere".	Ticked (1) No ticked (0)	**Inclusion:** statements naming specifically CO2 as a contributor to climate change and statements mentioning CO2 along with other gases.

			Exclusion: statements naming CO2 as a result of fossil burning, permafrost melting, and ocean absorption.
Industry and Transportation CC9	"Chemicals produced by cars and manufacturing", "cement production", mismanagement of industrial waste", mining industry", "nuclear and toxic waste", "oil industry", industrialization", "emissions of gases by industries and also by vehicles"	Ticked (1) No ticked (0)	**Inclusion:** statements addressing all means of transportation and industrialization as the main driver to climate change. Statements using specific industries such as cement, chemical, nuclear, oil, and mining were also included. **Exclusion**: statements using industry and transportation as a result of fossil fuel usage.
Unfriendly environmental attitudes CC10	"Consumerism", "misuse of energy", "capitalism", "unawareness", "not recycle", "globalization", "life style", "plastic over use", "over use of electronic devices", "hunt", "poor waste management", "littering", "misuse of water and subsoil".	Ticked (1) No ticked (0)	**Inclusion:** all type of unfriendly environmental attitudes and behavior, as well as all forms of consumerism and misuse of energy and others resources. Statements mentioning lack of environmental awareness were also included. **Exclusion:** activities regarding development, policy and technology.
Toxic gases and chemicals CC11	"Perfumes", "too much toxic gases", "too much chemicals", "biochemical", "Chemicals over use" "chemical waste".	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning the use of chemicals, toxic substances, toxic waste, and other chemical products. **Exclusion:** statements mentioning chemicals in an agricultural context.
Development, Policy & Technology CC12	"Environmental laws", "multinational interests", "wars", "human development", "the mindset of solving current problems without thinking of the future-managers and policymakers".	Ticked (1) No ticked (0)	**Inclusion:** statements pointing to economic and human development, as well as policies behind these processes. Statements expressing technology as a cause of climate change were also included. No exclusion was made given that the statements were straightforward at mentioning policies, development or technology.
Agriculture CC13	"Too much cows", "overgrazing", "cattle grazing", "methane coming from cows", "burning agricultural lands", "fungicides", "herbicides", "rise pads".	Ticked (1) No ticked (0)	**Inclusion:** statements regarding agricultural production coming from cows, crops fertilization, pesticides and chemicals. **Exclusion:** statements mentioning methane, and chemicals when not mentioned in agricultural context.
Modified Genetic Organisms CC14	"Use of modified genetic organisms"	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning the word genetic modified organisms. No exclusion was made given that the statements were straightforward at mentioning GMOs.
Self-experience & Science CC15	"Family stories", "scientific reports", "personal research", "temperature data", "stronger sunlight", "changes in local weather", "too much rain"	Ticked (1) No ticked (0)	**Inclusion:** statements expressing personal experience with: weather changes, scientific work, personal observations, scientific reports, climatic reports. **Exclusion:** statements mentioning changes in global climate.
Natural disasters (effects) CC16	"Sea level rise", "more deserts", "ice sheet/caps melting", "acid rain", "habitat degradation", "human diseases", "species migration", "global warming".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing general information of the likely effects of climate change rather than causes. **Exclusion:** statements where a personal experience was mentioned like "the rainy season is not the same".

Burning Fossil Fuels CC17	"Use of fossil energy", "fossil fuel consumption", "fuel combustion".	Ticked (1) No ticked (0)	**Inclusion:** statements using any of the words (burning, fossil, fuels) and synonyms as (burning oil, fossil carbon, fuel combustion). **Exclusion:** all statements mentioning CO2, or greenhouse gases.
Global Warming CC18	"Greenhouse effect", "global warming", "temperature increase"	Ticked (1) No ticked (0)	**Inclusion:** statements expressing global warming or describing the greenhouse effect to express a temperature warming. **Exclusion:** all statements mentioning greenhouse gases.
Undefined CC19	"Because of the epoch", "the environment", "I don't know", "no answer".	Ticked (1) No ticked (0)	**Inclusion:** statements were the answers given were confusing, denoting a lack of understanding of the question and blank spaces.

F.1. ANSWERS PROVIDED ONLY IN ONLINE QUESTIONNAIRES			
Albedo CC20	"Loss of albedo", "ice sheets melting", "ice caps melting", "glaciers melting", "glacier retreat", "increase of desert surface reflecting more sunlight", "decrease of polar ice sheets that reflect sunlight and absorbs more heat".	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning melting of ice, ice caps, and glaciers leading to a loss of albedo. **Exclusion:** statements mentioning permafrost melting, and when the phrase ice/ice sheet/caps melting was mentioning in a general context rather than in a loss of albedo context.
Permafrost melting CC21	"CO2 from permafrost melting", "black Carbon released into atmosphere settling on ice sheets and expediting their melting", "methane release due to higher temps at the Poles", "plow vegetation in Tundra which has previously stored carbon", "melting ice from northern Siberia and release methane", "methane release in the Arctic regions".	Ticked (1) No ticked (0)	**Inclusion:** statements indicating the process of permafrost melting. No exclusion was made given that the statements were straightforward at mentioning the permafrost melting process.
Ocean's feedback CC22	"Feedback from water cycles", "the plankton dies and again releases the CO2 is had stored", "alterations on water ability to absorb carbon because of acidification", "changes in ocean temperature", "methane released from ocean floor", "warmer oceans and reduced CO2 absorption".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing changes in ocean's feedback and its likely consequences. It was assume that the ocean feedback was a cause rather than an effect. No exclusion was made given that the statements were straightforward at mentioning the ocean feedback process.
G. CLIMATE CHANGE CONSEQUENCES: Why do you think would be the consequences of climate change?			
CAUSES	**EXAMPLES OF ANSWERS**	**CODE**	**INCLUSION/EXCLUSION CRITERIA**
Health Effects CCE1	"Respiratory diseases", "lung cancer", "epidemics", "skin cancer", "decrease in life expectancy", "health problems".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing health issues and all forms. **Exclusion:** statements mentioning diseases, pest or outbreaks without specifying human diseases or outbreaks. Statements expressing human extinction or death with any further explanation were also excluded

Effects on Ecosystems CCE2	"Biodiversity loss", "pristine/primary forest extinction", "species extinction", "fragmentation", "ecosystem services loss", "change of oceans salinity", "soil erosion", "alteration of ecosystems", "loss of genetic resources", "natural resources depletion".	Ticked (1) No ticked (0)	**Inclusion:** statements addressing loss, changes, and disruption of ecosystems and biodiversity in general, as well as statements mentioning ocean acidification and deforestation. **Exclusion:** statements mentioning single words such as "world extinction" and "migration", statements expressing disruption in water cycle, and statements mentioning depletion of natural resources when mentioned in an economic context.
Effects on Agriculture CCE3	"Crop loss", "poor agricultural production", "You can no longer plant", "no agricultural yield", "food shortage for animals", "pests", "shift in crops growing regions", "crop failure", "shorter area available for food production", "food insecurity", " impacts on crops", " more artificial food"	Ticked (1) No ticked (0))	**Inclusion:** statements expressing disruption in agricultural processes including planting, food security, and diseases. Agricultural issues derived from droughts or desertification was also included. **Exclusion:** statements expressing agriculture issues derived from economic situations as well as one word answers like "famine" or "hunger". Positive effects related to agriculture, adaptation processes such as "modification in agriculture", and statements such as "changes in vegetation" were also excluded.
Economic Effects CCE4	"Joblessness", "city damages", "wellbeing worsening", "life style changes", "expensive products", "rising food prices", "Less travelling" , "Lack of vital resources" "house' damages".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing economic issues, ranging from prices to property damages, or when expressing unconformity to satisfy basic need, life quality or leisure activities. Statements mentioning "decrease of natural resources" were included only when mentioned in an economic context. **Exclusion:** all economy issues related with human conflicts, natural disasters, and agricultural processes (food security). Statements mentioning the word ecosystem services were also excluded.
Effects on Weather CCE5	"Intense sunlight", "extreme temperatures", "less rain", "seasonal variation", "strong radiation", "we don't know when it will be rainy or sunny", "drastic weather changes" "Heavy rain", "changes regarding heat", "rainy weather" "Unbearable warming", "too much cold or too much warm"	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning changes in local climates or weather patterns such as precipitation, temperature and seasons. Statements expressing single phrases such as "extreme weather events" with any further explanation were also included. I also included statements expressing climate changes or environmental changes when mentioned in a local weather context. **Exclusion:** extreme weather events related with natural disasters rather than changes in weather patterns, or single phrase statements such as "extreme events". Statements mentioning increase world's temperature, changes in global temperature were also excluded.
Pollution (Causes) CCE6	"Air pollution", "pollution", "water pollution", "less quality of air", "atmospheric pollution"	Ticked (1) No ticked (0)	**Inclusion:** statements expressing pollution of air, water, rivers, soil, etc. Statements mentioning poor air quality were also included. **Exclusion:** statements expressing poor water quality.

Natural Disasters CCE7	"Floods", "drought", "alteration of El Niño and la Niña", "hurricans", "earthquakes", "increased natural disasters", "desertification", "more landslides" "increased severity of natural hazards", "heatwaves", "Disappearance of cities in the beach" , "flooded coastal regions".	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning natural disasters. Statements mentioning extreme weather events were included when they were followed by explanations resulting in natural disasters. **Exclusion:** statements expressing extreme weather events, as well as disasters coming from sea level rise. Phrases such as climate change were excluded and categorized as "climate". Apocalyptic rhetoric were also excluded.
Ozone layer depletion CCE8	"Depletion of the ozone layer".	Ticked (1) No ticked (0)	**Inclusion:** statements naming the depletion of the ozone layer as a consequence of climate change. No exclusion was made given that the answers were straightforward at mentioning "depletion of ozone layer".
Temperature CCE9	"Global warming", "Rising global mean temperature", "average temperature increase", "affect the temperature of our planet", " changes in global temperature"	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning global warming, or addressing temperature rising in a global context. **Exclusion:** statements expressing changes in local temperature, or one phrase statements like "changes in temperature".
Water CCE10	"Water shortage", "less potable water", "less fresh water", "water scarcity".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing disruptions in water demand and availability. **Exclusion:** statements expressing water problems derived from social conflicts and apocalyptic rhetoric.
Ice Melting CCE11	"Melting glaciers", "melting polar ice", "melting ice caps", "melting ice sheets".	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning glaciers, ice caps, ice, sea ice and permafrost melting and its consequences, as well statements mentioning loss of albedo processes. No exclusion was made given that the statements were straightforward at mentioning ice melting.
Social Effects CCE12	"Poverty", "famine", "wars", "people migration", "human conflicts", "human suffering", "social crisis", "social problems", "human mobilization".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing any kind of social issues and conflicts, as well as political issues. I also included all types of human migration including the ones derived from floods or drought. One word answers using "famine" or" hungry" were also included. **Exclusion:** apocalyptic rhetoric, and social issues resulting from: sea level rise, agricultural disruptions or health & economic issues.
Apocalypses CCE13	"Death", "human extinction", "Shorter human and animal life", "The end of the human race", "Destruction of human life".	Ticked (1) No ticked (0)	**Inclusion:** statements describing apocalyptic scenarios of death, human extinction and destruction, or statements mentioning no human activity possible in the Earth. **Exclusion:** statements were devastated scenarios derived from health and economic issues, natural disasters, and social conflicts. Non-human extinction statements were also excluded.
Sea Level Rise CCE14	"Increasing sea level", "Raising sea level is going to affect the most populated areas of the planet", "changes in ocean levels."	Ticked (1) No ticked (0)	**Inclusion:** statements explaining sea level rise process and its effects. **Exclusion:** statements where likely consequences of sea level rise was described but did not mention sea level rise as part of the statement.

Effects on Ocean Systems CCE15	"Changes in ocean's salinity", "ocean's temperature rise", "changes in global patterns of sea currents circulation", "changes in the jet stream".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing any type of change in oceans system such as current circulation and temperature. Exclusion: changes in fresh water cycle statements, and ocean's level rise.
Effects on Climate System CCE16	"Climate change", "Climatic issues", "climatic phenomena", "changes in climate all over the world", "climate become more extreme", changing global climate system".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing disruption in climate and air system. Statements mentioning "climate change" were also included in this category. **Exclusion:** statements expressing local weather changes or events.
Undefined CCE17	"Greenhouse gases", "water waste", "misuse of technologies", "toxic gases", "planting trees", "care for green areas", "misuse of minerals", I don't know."	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning "I don't know", blank answers, as well as answers denoting a misunderstanding of the question.

G.1. ANSWERS PROVIDED ONLY IN ONLINE QUESTIONNAIRES			
CAUSES	**EXAMPLES OF ANSWERS**	**CODE**	**INCLUSION/EXCLUSION CRITERIA**
Unpredictable CCE18	"The state of our future world will be difficult to predict", "it could be anything, we don't really know", "unpredictable consequences", "no one really knows", " unpredictable due to natural Earth cycles and its feedback capabilities", "Probably effects will be slow and incremental, but they will have many unpredictable interacting effects as well.".	Ticked (1) No ticked (0)	**Inclusion:** statements were uncertainty and don't know answers were mentioned. **Exclusion:** statements expressing unpredictable weather or climate.
Social & Species adaptation CCE19	"The planet and its regions will be unsuitable for some species to thrive but more suitable for others", "innovation and social change", "possibly genesis of new species", "Reduce biodiversity at big scale and increase at small scale, "positive impact far from the Equateur (eg. Russia), negative impact nearer the Equateur (eg, south Europe, South Asia, North an middle Africa", "local isostatic adjustments have to be taken into account", "in general ecosystems and species are adapting to the changing environmental conditions", "evolution will keep going on", "new adaptations", "new species", "more production in certain areas", natural selection", "Re-organization of biomes", "Use of renewable energies", "positive	Ticked (1) No ticked (0)	**Inclusion:** statements explaining social and species adaptation processes as well as social development to face changes. Statements mentioning positive impacts were also included. **Exclusion:** statements mentioning processes of shifts in species distribution and migration, and invasive species. Statements simply mentioning changes in any human process like "changes in agriculture production" were also excluded.

	effects for species living in cold zones", "more job opportunities to sell "green stuff"".		

H. PERSONAL RISK PERCEPTION: Do you think climate change is something that is affecting or is going to affect you personally?	
Responses	**CODE**
Yes	1
No	0
I don't know	3

H.1. PERSONAL RISK PERCEPTION OF CLIMATE CHANGE: In what ways is climate change affecting you, or is it going to affect you?			
CAUSES	**EXAMPLES OF ANSWERS**	**CODE**	**INCLUSION/EXCLUSION CRITERIA**
Health RPCC1	"Diseases", "skin cancer", "pneumonia", "fever", "cold", "allergies", "lung diseases", "blood pressure", "exhaustion", "short life expectancy ", "new diseases", "health issues", alteration in the immune system".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing concern about health. I excluded statements using only the phrase "life quality" as well as statements that did not specify human health effects such as "epidemics" or "pests" and when the context was related with agriculture and food. **Exclusion:** statements mentioning famine, wellbeing, and human psychic states such as "stress"
Food RPCC2	"No agricultural yield", "dried crops", "production decrease", "crop diseases", "crop damages", "we will have to use more chemicals to produce our food", "the animals we massively raise", "feeding issues", "food scarcity", "food would no longer be good".	Ticked (1) No ticked (0)	**Inclusion:** statements regarding diet, food availability, production and agricultural processes including pests and crop diseases. Food security and famine statements were also included. **Exclusion:** statements related with food prices and markets, as well as "lack of resources" statements, and those derived from social conflicts.
Future generations RPCC3	"Sons", "grandsons", "future generations"	Ticked (1) No ticked (0))	**Inclusion:** statements expressing concern for the family and future generations. **Exclusion:** statements expressing concern about families in the context of lack of resources or water availability.
Economy RPCC4	"Rising prices", "familiar economy", "people do not shop when is raining", "higher living costs", "because of floods products do not make it to the markets", "increased public expenditure", "damages to buildings and	Ticked (1) No ticked (0)	**Inclusion:** statements describing effects on economy derived from increase in food and travel prices, material damages, and other type of economic effects like more taxes and levies. Changes in consumerism patterns (increase-decrease) were also included unless mentioned in a behavior context.

	properties", "clothing", "higher medical expenses", "agricultural economy".		**Exclusion:** statements regarding travelling when they were expressed in recreational context rather than economic. Statements expressing lack of resources without any further explanation and food security.
Place of living RPCC5	"More rain", "intense sunlight", "higher temperatures", "seasons changing", "more frequent frost and wind", "It's either too cold or too warm", "the place where we live is changing", "indirectly it affects the environment where we live".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing changes in the surrounding environment and those mentioning changes in local weather in a context of disruption to the place where respondents live. **Exclusion:** statements when only general phrases about weather change were mentioned out of the context of personal disruption with the place where respondents live. One word statements of "environment" were excluded. Statements related to wellbeing and health was also excluded.
Positive effects RPCC6	"I like temperature changes", "Right now Loja is warm!", "More species of flora and fauna", "better income source", "the demand of my job increases", "social awareness", "there will be job opportunities where agronomists will have to invent new ways to produce crops resistant to droughts and floods".	Ticked (1) No ticked (0)	**Inclusion:** statements mentioning any positive effect. No exclusion was made as long as a positive effect was mentioned.
Wellbeing RPCC7	"It affects everyday aspects of life", "humanity deals with the effects in a daily basis", "life quality", "bad mood", "because I live in this world", " fresh water scarcity", "It affects me because it disrupts my wellbeing", "beauty components of landscape will be gone", "my clothing" , "my mood", "the sun radiation is too strong and I have to wear hats", "frustration with climate deniers".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing disruption in people's enjoyment of landscape, biodiversity, environment, water availability as well as disruptions in human's psyche reveling strong feelings such as fear, concern, stress or sadness. One word answers of "recreation" were accepted when not mentioned in a context of holidays, vacation, sports, travelling, or economy. Statements mentioning "life quality" and "is going to affect to all of us" were also included, as well as statements mentioning "lack of resources" when not mentioned in the context of social conflicts or food availability. **Exclusions:** statements emphasizing health, economic, or physiological problems. Disruptions in travelling, sports activities, or place of living or behavior were also excluded. Emotional feelings about species loss.
Empathy RPCC8	"Los of species of flora and fauna", "biodiversity loss", "plants and animals death", "loss of wild areas and wildlife", "extinction of species that I could study".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing emotional feelings about loss of nature and biodiversity. I also included statements expressing emotional feelings about other people hardships. **Exclusion:** statements related to wellbeing and ecosystem services loss.
May activities RPCC9	"Disruption of outdoor labors", "the environment gets unbearable interrupting our daily activities", "seasons are not defined and that interrupts our labor", "one can't work in a rainy day specially if one works outdoors", "I	Ticked (1) No ticked (0)	**Inclusion:** statements expressing disruption in personal activities either in short or large term including daily activities and sports. Disruption in agricultural activities was included when mentioned in the context of agriculture as a mean of living.

	won't be able to work on my daily activities, it's too hot", "It is more difficult to know the moths we should plant", "I am not able to harvest with these climates"		**Exclusion:** disruptions to wellbeing through ecosystem services loss or emotional feelings such as sadness, as well as statements mentioning travelling in an economy context such as "travel rising prices". Positive effects were also excluded.
Undefined PRCC10	"We don't know what is going to happen with global warming", "Man's hand destroy the environment".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing "I don't know" "no idea" as well as blank answers resulting from either choosing "I don't know" or "yes" in the previous question. Answers mentioning "Don't know the effects in my personal life", "we don't know what is going to happen" were also included, as well as obscured answers like "more extreme events" or "pollution". Any exclusion was made, as long as the respondent did not know a personal effect.

H.2. ANSWERS PROVIDED ONLY IN ONLINE QUESTIONNAIRES			
CAUSES	**EXAMPLES OF ANSWERS**	**CODE**	**INCLUSION/EXCLUSION CRITERIA**
Behaviour RPCC11	"Where we choose to go and when, and how to travel what we consume and where it comes from", "It will necessitate lifestyle changes and largely influence the topics that I decide to study in my career as a scientist", "It will change the way we live now", "changing attitude to nature, it is affecting me as I try most of the time to behave ecologically", "Necessity to adapt my behaviour (energy uses, consumption)", "I am adjusting my lifestyle: No personal car, changes the way I consume and travel", "Changes in behaviour (e.g. less indulgence in activities that use fossil fuels)", "Use more locally produced food", "More recycling", "The place where I live would become hotter and lead to a higher demand of water and high-energy consumption devices such as air conditioners".	Ticked (1) No ticked (0)	**Inclusion:** statements expressing changes in behaviour patterns including daily consumption unless mentioned in an economic context. Statements mentioning changes in the place of living were included only when coupled with behaviour changes. **Exclusion:** statements mentioning changes in food consumption, personal activities, wellbeing and place of living. One word answers like "consumption" were also excluded.
Conflicts & Policy	"People's migration", "Socio-economic crisis which will trickle down and affect me", "Causing global conflict", "worldwide changes regarding security and peace", "increased armed conflicts", "potential wars on water and food", "global problems affecting national politics and at the end also me in terms of migration riots", "climate refugees", "conflicts over land, resources and water", "it entails a massive crisis", "Increase in migration from poorer	Ticked (1) No ticked (0)	**Inclusion:** statements expressing social issues such as security, conflicts, migration, crisis, as well as policies. Conflicts derived from resource access were also included. **Exclusion:** statements related with economic issues and food.

	countries will lead to more attention to borders", "Increasingly right wing govts will prevent freedom of movement around Europe and globally", "political changes", "more parts of society can and will face more terrorism", "social unrest", "poverty and constant crises", "chaos will reign", "social insecurity"		

Appendix 6: Coding book developed for the interviews

a. Types of code used

A. INFORMANT'S PROFILE: ATTRIBUTE CODING		**EXAMPLES OF CODES**
AGE		The age given by informants
GENDER		Male, Female
TYPE OF FARM & FARMER		Commercial, Subsistence
PLACE OF LIVING		South-East side, South-West side
B. FARM PRODUCTION: SUBCODING		
SUBCATEGORIES:	**PARENT SUBCODE**	**SUBCODES**
1. PRODUCTION	PRODUCTION SYSTEMS	Rotary crops, multiple crops varieties, *fincas integrales*, rain fed agriculture.
	ANIMAL BREEDS	Keep traditional farm animals.
	PLOUGHING	Keep traditional ploughing animals.
	IRRIGATION SYSTEMS	Keep traditional irrigation systems.
	FERTILIZERS	Keep traditional fertilizers.
	MORE PRODUCTION	Land access, better economic status, irrigation access, seed access.
	LESS PRODUCTION	Lack of land, diseases, fewer agriculturalists.
	SEASONAL CALENDARS	Keep traditional dates, changing traditional dates.
	WHAT'S DESIRED	More land, government's help, fertilizers, new crops and seeds, more crops, technical training, money, more markets, irrigation systems, more labour force.
	MAIN ISSUES	Money, diseases & pests, lack of labour force, lack of yoke, lack of markets, pastures and food for animals, access to markets, fewer agriculturalists, transportation.
	MAIN CHANGES	New & improved animals breed, new plough practices, new fertilizers, fewer agriculturalists.
2. DISTRIBUTION	PRODUCE EXCHANGE	Keep produce exchange, disruption in produce exchange.
	SELL IN RETAIL MARKETS	Commercial farming.
	SELL FARM ANIMALS	Selling animals.
	WHAT'S LEFT IS GIVEN.	Gifts to community, gifts to relatives.
	BETTER LIVING CONDITIONS	Transport to city markets.
3. ACCESS	MIDDLE MAN	Access to markets.
	WHAT'S NEEDED IS BOUGHT	Running out of food, money to buy, food for animals.
	SUBSISTENCE FARMING	Self-consumption.
	FORGING WILD BERRIES	Forging for self-consumption, forging for selling.

C. ADAPTATION TECNIQUES: SUBCODING			
CATEGORY	**SUBCATEGORIES**	**SUBCODES: IMPACT OF CHANGES**	**SUBCODES: ADAPTATION TECNIQUES**
WEATHER CHANGES	LESS RAIN	NO IRRIGATION-NO PLANTING	STOP RAIN FED AGRICULTURE
			NEW CROPS & ANIMAL BREED
			IRRIGATION SYSTEMS
		DELAYING PLANTING SEASONS	SWITCHING PLANTING MONTHS

			STOP RAIN FED AGRICULTURE
		CROP DAMAGES & DISEASES	GREENHOUSES
			NEW SEEDS
			NEW CROPS
WEATHER CHANGES	MORE OR TOO MUCH RAIN	NO PLOUGHING-NO PLANTING	BUYING FOOD IN MARKETS
		DELAYING PLANTING SEASONS	SWITCHING PLANTING & HARVESTING MONTHS
		CROP DAMAGES	MORE SPRAYING
			SWITCHING PLANTING MONTHS
		POSITIVE EFFECTS	IRRIGATION IS NO LONGER NEEDED
	DELAYING RAINY SEASONS	DELAYING PLANTING SEASONS	SWITCHING PLANTING MONTHS
		CROP DAMAGES	SWITCHING PLANTING MONTHS
	FROST	CROP DAMAGES & DISEASES	NEW SEEDS
			GREENHOUSES
			BUYING FOOD IN MARKETS
			MORE SPRAYING

D. CLIMATE CHANGE PERCEPTION & KNOWLEDGE: CAUSATION CODING		
CATEGORY	**SUBCATEGORY**	**CODES**
UNDERSTANDING	CAUSES	POLLUTION
		OZONE LAYER DEPLETION
		DEFORESTATION
		BURNING
		EARTH'S WARMING
	CONSENQUENCES	STRONGER SUNS
		ANIMALS AND PLANTS' HELATH WORSENING
		HEALTH DETERIORATION
		CHANGES IN WEATHER PATTERNS
		CROP DISEASES
	PERSONAL RISK PERCEIVED	HEALTH
		AGRICULTURE

b. Coding process: criteria to code interview data

E. FARM PRODUCTION			
CATEGORY	**SUBCATEGORIES**	**SUBCODES**	
FARM PRODUCTION This category was built upon literature review regarding food security, and participants' testimonies regarding agricultural production including changes observed.	FOOD PRODUCTION It includes evidence of the statements provided by interview participants to explain the systems and strategies used by agriculturalists to ensure food production.	PRODUCTION SYSTEMS	Any evidence mentioning the system used for growing crops, in order to ensure food production, e.g. rotary crops, *fincas integrales*, rain fed agriculture, etc. **When to use:** where mentioning the strategies used to ensure food production. **When not to use:** where talking about changes in planting and harvesting seasons and seasonal calendars. **Example:** "In this land we harvesting maize, then in the same land we will plant potatoes and barley, I mean we use the same land for different crops"
		ANIMAL BREEDS	Any evidence mentioning the farm animals raise to ensure food production. **When to use:** specifically explaining what animals they raise. **When not to use:** where talking about new animals raise. **Example:** "I've guinea-pigs, sheep..."
		PLOUGHING	Any evidence explaining the ploughing practices used. **When to use:** where explaining how informants prepare the land before planting. **When not to use:** where talking about changes in ploughing practices. **Example:** "we plant with the yoke, this's the tradition. If you don't have a yoke you borrowed from your neighbor."
		IRRIGATION SYSTEMS	Any evidence mentioning the irrigation systems used. **When to use:** specifically, where explaining how they irrigate their land **When not to use:** where talking about changes in irrigation systems. **Example:** "Everything here is about irrigating, we have irrigation canals coming from the top of mountain…"
		FERTILIZERS	Any evidence mentioning fertilization practices. **When to use:** specifically, where explaining how informants fertilize their crops. **When not to use:** where talking about changes in the fertilization practices. **Example:** "we only use the Little fertilizers provided by the animals, we put the animals right here to fertilizer the land"
		MORE PRODUCTION	Any evidence mentioning improving in productivity/production, e.g. land access, better economic status, irrigation access, etc. **When to use:** specifically, where explaining that there is more production in comparison to the past derived from any reason. **When not to use:** where simply talking about crops production systems and changes in agricultural practices. **Example: "**My auntie used to tell that they were very poor! There was nothing to eat... Now I have land to grow, now we can produce even if it is only coriander"

CATEGORY	SUBCATEGORIES	SUBCODES	
FARM PRODUCTION This category was built upon literature review regarding food security, and participants' testimonies regarding agricultural production including changes observed.	FOOD PRODUCTION It includes evidence of the statements provided by interview participants to explain the systems and strategies used by agriculturalists to ensure food production.	LESS PRODUCTION	Any evidence where less crop and animal production is happening for any reason, e.g. lack of land, diseases, fewer agriculturalists. **When to use:** specifically, where explaining that there is less production in comparison to the past derived from any. **When not to use:** where simply talking about crops production systems and changes in agricultural practices. **Example:** "Here it's not possible to plant more or have cows because of the lack of land"
		SEASONAL CALENDARS	Any evidence mentioning the crops produced and the changes in planting and harvesting seasons for any reasons. **When to use:** specifically, where explaining the crops planted and changes marked in the seasonal calendars for planting and harvesting **When not to use:** where simply talking about production systems. **Example:** "We plant the same crops our parents and grandparents did, nothing has changed. We plant maize, beans, peas…"
		WHAT'S DESIRED	Any evidence of farmer's desires to improve any aspect of the production system used to ensure food availability, e.g. more land, government's help, fertilizers, new crops, more crops, technical training, money, etc. **When to use:** specifically, where explaining what is needed to improve their production for either self-consumption or commercial purposes. **When not to use:** where talking about main agricultural issues. **Example:** "What I need is more land to produce for both planting and raise animals"
		MAIN CHANGES	Any evidence mentioning changes in overall farm production, e.g. new animals, etc. **When to use:** specifically, where explaining changes in agricultural practices. **When not use:** where talking about changes led by weather changes. **Example:** "we have new guinea-pig races, such races came later…"
		MAIN ISSUES	Any evidence mentioning the main issues claimed by informants to ensure food availability, e.g. money, diseases, lack of labour force, etc. **When to use:** specifically, where explaining the main issues farmers have to ensure food production. **When not to use:** where talking about production systems and seasonal calendars. **Example:** "The problem we have here is the lack of money to buy fertilizers and pesticides, we live far away so everything is expensive and distant"

CATEGORY	SUBCATEGORIES	SUBCODES		
FARM PRODUCTION This category was built upon literature review regarding food security, and participants' testimonies regarding agricultural production including changes observed.	FOOD DISTRIBUTION It includes any evidence of the statements provided by interview participants to explain the strategies used for distributing informant's produce.	PRODUCE EXCHANGE	Any evidence mentioning produce or animals exchange as part of farmer's strategies to ensure food availability, e.g. keep produce exchange, etc. **When to use:** specifically, where explaining the processes of exchanging produce. **When not to use:** where talking about giving away or selling produce to other people but not exchanging or having something in return. **Example:** "We give herbs, maize, barley, anything, so my folks borrow me a yoke in return"	
		SELL IN RETAIL MARKETS	Any evidence where produce is sold in local, regional and global markets, e.g. commercial farming. **When to use:** specifically, where produce selling is mentioned. **When not to use:** where mentioning that what is left is given or exchange, subsistence farming, or selling farm animals. **Example:** "We sell in retail markets … but it's a bit not much"	
		SELL FARM ANIMALS	Any evidence where selling farm animals is mentioned. **When to use:** specifically, where farm animal trade is mentioned. **When not to use:** where mentioning subsistence farming, or only selling produce. **Example:** ¡Yes! We sell sheep and cows, yes I do sell them"	
		WHAT'S LEFT IS GIVEN	Any evidence where the remaining produce are given away to other community members or relatives, e.g. gifts to family or community members. **When to use:** specifically, where produces are given to other people without selling or exchange purposes. **When not to use:** where mentioning selling or produce exchange. **Example:** "I don't sell, I give them away…, because even if I don't get anything in return, for me a "God will reward you" it's much more worthy"	
CATEGORY	**SUBCATEGORIES**	**SUBCODES**		
FARM PRODUCTION This category was built upon literature review regarding food security, and participants' testimonies regarding agricultural	FOOD ACCESSS It includes any evidence of the statements provided by informants to explain the ways used by farmers ensure their access to food.	BETTER LIVING CONDITIONS	Any evidence where better living conditions contribute to afford diverse food. **When to use:** specifically, where better living conditions seem to be one reason for food affordability beyond subsistence farming. **When not to use:** where simply mentioning better living conditions. **Example:** "Nowadays there are more facilities because of the transportation! it came to modern! Before my family did not even have salt, they used to walk to the Coast for salt, they did not have cars"	
		MIDDLE MAN	Any evidence where the middle man is mentioned to ensure food access to markets. **When to use:** specifically, where the middle man transports farmer´s produce to markets. **When not to use:** where mentioning the middle man in negative ways.	

production including changes observed.			**Example:** "There are big cars coming to our *fincas* and they take the produce to the markets, they pay less but we have someone to sell pour produce…"
FARM PRODUCTION This category was built upon literature review regarding food security, and participants' testimonies regarding agricultural production including changes observed.	FOOD ACCESS It includes any evidence of the statements provided by informants to explain the ways used by farmers ensure their access to food.	WHAT IS NEEDED IS BOUGHT	Any evidence where food is bough for any reason to ensure food access, e.g, money to buy, run out of food, food for animals. **When to use:** specifically, where buying food for the family or animals. **When not to use:** where mentioning processes of selling food. **Example:** "Whatever we don't have we buy it in the markets. Potatoes for instance do not last, we have to buy them as well"
		SUBSISTANCE FARMING	Any evidence where subsistence farming ensures food access. **When to use:** specifically, where subsistence farming is the way how farmers access food. **When not to use:** where mentioning produce selling, exchange and given. **Example:** "We don't sell, it is for our consumption"
		FORGING WILD BERRIES	Any evidence where forging ensures extra food access. **When to use:** where forging was an extra but not essential for accessing food. **Example:** "Every week we go up to the mountain to gather blueberries… we gather two buckets and we sell them…"

F. ADAPTATION TECNIQUES			
CATEGORY	**SUBCATEGORIES**	**SUBCODE 1: IMPACT OF CHANGES**	**SUBCODE 2: ADAPTATION TECHNIQUES**
WEATHER CHANGES This category was built upon participants' testimonies regarding weather changes observed. This includes rainfall patterns and frost frequency.	LESS RAIN It includes evidence of the statements provided by interview participants to explain how they have noticed that rainfall is decreasing. It does not include testimonies or delaying rainy seasons.	NO IRRIGATION-NO PLANTING Evidence obtained from informant's statements, and from participant observation (field notes and photos), supporting the effects of less rainfall on rain fed agriculture **Example:** "Lately in these years, it rains less. There is little water to irrigate and plant"	STOP RAIN FED AGRICULTURE Data supporting the facts that people is giving up rain fed agriculture to tackle rainfall decrease
			IRRIGATION SYSTEMS Data supporting the facts that people is implementing irrigation systems to tackle rainfall decrease
			NEW CROPS Data supporting the facts that people is switching to crops that require less water.
		DELAYING PLANTING SEASONS	SWITCH PLANTING MONTHS Data supporting peoples' actions related to switching planting months as a response to less rainfall.

		Evidence obtained from informant's statements and seasonal calendars, supporting the effects of less rainfall on planting seasons. **Example:** "I planted in September, October, November, but it was dry…"	STOP RAIN FED AGRICULTURE Data supporting the facts that people is giving up rain fed agriculture as a response to delaying planting seasons.
		CROP DAMAGES Evidence obtained from informant's statements and from participant observation (field notes and photos), supporting the effects of less rainfall on crop damages. **Example:** "…It was dry! corn did not grow and peas got damaged."	GREENHOUSES Data supporting the facts that people is building up greenhouses as a response to crop damages caused by drought seasons
			NEW SEEDS Data supporting the facts that people is sowing seeds that are more resistant to drought.
			NEW CROPS Data supporting the facts that people is switching to crops that are more resistant to drought.
CATEGORY	**SUBCATEGORIES**	**CODE 1: PROBLEMS**	**CODE 2: SOLUTIONS**
WEATHER CHANGES This category was built upon participants' testimonies regarding weather changes observed.	MORE OR TOO MUCH RAIN It includes evidence of the statements provided by interview participants to explain how they have noticed that it is raining more often or too much.	NO PLOUGHING-NO PLANTING Evidence obtained from informant's statements and from participant observation (field notes and photos), supporting the effects of more or too much rain on ploughing activities. **Example:** "When it rains a lot it is not possible to plough and weed…"	BUYING FOOD IN MARKETS Data supporting the facts that people is unable to plough and therefore planting, because of too much rain. As a result they rather buy their food in local markets.
		DELAYING PLANTING SEASONS Evidence obtained from informant's statements and seasonal calendars, supporting the effects of more or too much rain on planting seasons. **Example:** "…winter don't let us plant, there was too much winter"	SWITCH PLANTING AND HARVESTING MONTHS Data supporting the facts that people is switching months to plant and harvest as a response to more frequent or excessive rainfall.
		CROP DAMAGES Evidence obtained from informant's statements and from participant observation (field notes and photos), supporting the effects of more or too much rainfall on crops. **Example:** "My potatoes got damaged because it was raining a lot"	MORE SPRAYING Data supporting evidence that people is spraying more frequently as a response to excessive rainfall.
			SWITCH PLANTING MONTHS Data supporting evidence that people is switching months to plant as a response to more frequent or excessive rainfall.

		POSITIVE EFFECTS Evidence obtained from informant's statements and from participant observation (field notes and photos), supporting positive effects of more or too much rainfall on crops. **Example:** "There is lots of water right now, so we don't longer need irrigation…"	IRRIGATION IS NO LONGER NEEDED Data supporting evidence that people do not longer need irrigation as an effect of more frequent rainfall.
CATEGORY	**SUBCATEGORIES**	**CODE 1: PROBLEMS**	**CODE 2: SOLUTIONS**
WEATHER CHANGES This category was built upon participants' testimonies regarding weather changes observed..	DELAYING RAINY SEASONS It includes evidence of the statements provided by interview participants to explain how they have noticed that rainy seasons are coming late. It does not include testimonies of drought or less rainfall	DELAYING PLANTING SEASONS Evidence obtained from informant's statements and seasonal calendars, supporting the effects of delaying rainy seasons on planting activities. **Example: "**We used to plant in January, when it's rain time, but nowadays it is delayed, it comes in March…"	SWITCH PLANTING MONTHS Data supporting evidence that people is delaying their planting activities as a response to delayed rainy seasons.
		CROP DAMAGES Evidence obtained from informant's statements, seasonal calendars, and from participant observation (field notes and photos), supporting the effects of delaying rainy seasons on crops. **Example:** "This year has been a dry and my crops have been damaged because of the lack of water"	SWITCH PLANTING MONTHS Data supporting evidence that people is switching their planting months as a response to delayed rainy seasons.
CATEGORY	**SUBCATEGORIES**	**CODE 1: PROBLEMS**	**CODE 2: SOLUTIONS**
WEATHER CHANGES This category was built upon participants' testimonies regarding weather changes observed.	FROST It includes evidence of the statements provided by interview participants to explain how they have noticed that the frost frequency has increased	CROP DAMAGES AND DISEASES Evidence obtained from informant's statements, and from participant observation (field notes and photos), supporting the effects of frost on crops. **Example:** "There is more frost, and it burns potatoes"	NEW SEEDS Data supporting evidence that people is using seeds that are more resistant to frost.
			GREENHOUSES Data supporting evidence that people is building up greenhouse to protect their crops from frost.
			BUYING FOOD IN MARKETS Data supporting evidence that people is buying food when they lost their crops because of frost.
			MORE SPRAYING Data supporting evidence that people spray more often their crops to tackle frost.

G. CLIMATE CHANGE PERCEPTION AND KNOWLEDGE			
CATEGORY	**SUBCATEGORIES**	**CODES:** developed from interview participants' statements.	
UNDERSTANDING This category was based on climate change literature. It addressed people's climate change knowledge, perception and understanding of the causes, consequences and personal risks.	CAUSES It includes evidence of the statements provided to explain what is causing climate change according to interview participants.	POLLUTION	Any evidence where the word pollution was mentioned as part of the descriptions given by participants to explain the causes of climate change **When to use:** where specifically mentioning any kind pollution related to climate change. **When not to use:** where talking about pollution in a general context. **Example: "**I heard that because of the pollution that we generate there are these climatic changes that affect all of us, crops and people"
		OZONE LAYER DEPLETION	Any evidence where the ozone layer depletion was mentioned as part of the descriptions given by participants to explain the causes of climate change **When to use:** where specifically mentioning the ozone layer depletion related to climate change. **When not to use:** where talking about t in a general context of the ozone layer depletion. **Example: "** it's been said that climate has changed a lot because of the ozone layer depletion "
		DEFORESTATION	Any evidence where deforestation was mentioned as part of the descriptions given by participants to explain why climate is changing **When to use:** where specifically mentioning deforestation as causative of CC. **When not to use:** where talking about deforestation as a general topic. **Example: "**Global warming is happening because we cut down the forest that keep the humidity"
		BURNING	Any evidence where the burning was mentioned as part of the descriptions given by participants to explain the causes of climate change **When to use:** where specifically mentioning burning as one of the causes of climate change. **When not to use:** where talking about burning in an agricultural context. **Example: "**People sometimes burn, and that smog and pollution and other things… change the weather"
		EARTH'S WARMING	Any evidence where terms such as global warming, Earth's warming and temperature warming was mentioned as part of the descriptions given to explain the causes of climate change **When to use:** where specifically mentioning the terms global, Earth and temperature warming. **When not to use:** do not apply. **Example: "** I heard that because of global warming these climatic changes are happening"

CATEGORY	**SUBCATEGORIES**	**CODES:** DEVELOPED FROM INTERVIEW PARTICIPANTS' STATEMENTS.	
UNDERSTANDING This category was based on climate change literature. It addressed people's climate change knowledge, perception and understanding of the causes, consequences and personal risks.	CONSEQUENCES It includes evidence of the statements provided to explain what the effects of climate change are according to interview participants.	STRONGER SUNS:	Any evidence where mentioning stronger sunlight effects, sun burning and temperature increasing for "stronger suns" as effects of changes in climate. **When to use:** where mentioning any sunlight effect related to climate change. **When not to use:** where talking about sunlight in a health context. **Example: "**There are months when the sun is more intense because of a layer or whatever"
		ANIMALS AND PLANTS HEALTH' WORSENING	Any evidence where mentioning health effects on animals and plants, as part of the descriptions given to explain what these climatic changes are provoking **When to use:** where specifically mentioning animals and plants health worsening related to climate change. **When not to use:** where talking about plants and animals' health during personal risk questions. **Example: "**What is heard is that sunlight is more intense nowadays, and that this is destroying plants and animals"
		HEALTH DETERIORATION	Anyevidence where mentioning human health effects, as part of the descriptions given to explain what these climatic changes are provoking **When to use:** where specifically mentioning health issues related to climate change. **When not use:** where talking about health issues during personal risks questions. **Example: "**The ozone layer is broken and this is why the sun is burning and damages our health "
		CHANGES IN WEATHER PATTERNS	Any evidence where mentioning changes in weather patterns as part of the descriptions given by participants to explain what is changing in their agricultural activities. **When to use:** where mentioning changes in temperature, rain, frost, etc. related or to climate change questions and explanations. **When not to use:** where talking about weather changes in a general context. **Example: "**it can be seen that sometimes the rain is pouring and the day after the sun is intense, and that worries us because cassava gets rot"
		CROP DISEASES	Any evidence where mentioning crop diseases as part of the descriptions given by participants to explain what is changing in their agricultural activities. **When to use:** where mentioning issues with crop diseases related to climate change questions and explanations. **When not to use:** where mentioning crop diseases during personal risk questions. **Example: "**because of these climatic changes, there is more *lancha*, so we have to spray the crops to produce"

CATEGORY	**SUBCATEGORIES**	**CODES:** developed from interview participants' statements.	
UNDERSTANDING This category was based on climate change literature. It addressed people's climate change knowledge, perception and understanding of the causes, consequences and personal risks.	PERSONAL RISKS It includes evidence of the statements provided by interview participants to explain how climate change affects them personally.	HEALTH	Any evidence where mentioning health effects as part of the descriptions given by participants to explain how climate change will affect them or is affecting them. **When to use:** where specifically mentioning health effects related to climate change during personal risk questions. **When not to use:** where talking about health issues in a general context and during climate change questions. **Example: "**Climate change…! that would affect my body. For example too much sunlight affects me "
		AGRICULTURE	Any evidence where mentioning agricultural issues as part of the descriptions given by participants to explain how climate change will affect them or is affecting them. **When to use:** where specifically mentioning agricultural issues related to climate change during personal risk questions **When not to use:** where talking about agricultural issues in a general context and during climate change questions. **Example: "**With the sun in the skin… animals as well, and crops!"

Appendix 7: Photo gallery

a. The researcher conducting interviews with commercial farmers

b. Panorama of the South-West side of the Andes in southern Ecuador

c. Sunday farmer's market

d. The researcher and subsistence farmers during participant observation

e. The researcher conducting interviews with subsistence farmers

f. Panorama South-East side of the Andes in Southern Ecuador

g. Examples of seasonal calendars drawn by informants with assistance of the researcher