

**Exploring the Relationship between Climatic
Variability, Inequality and Migration from a Class
Perspective: Evidence from Minqin County,
Western China**

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DEDICATION

*I dedicate this work to my supervisor, Professor Graeme Hugo,
who passed away four months before the submission*

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ABSTRACT

Climate change is an unequal process in which vulnerable groups are always disproportionately affected and easily further impoverished and marginalized. Inequality has been identified as an important factor shaping people's vulnerability to climate change, which determines their experience of climate change impacts and the subsequent adaptation strategies. Human migration, as an important adaptation to climate change, is significantly influenced by inequality. Unequal distribution of resources allows decisions and consequences of migration to vary greatly between nations, communities, and even households and individuals. Despite acknowledging the significant role that inequality plays in the climate change-migration nexus, to date there has been few empirical studies that model the relationship between climate change, inequality and migration, especially in a non-disaster scenario at a sub-national level.

This study aims to close the research gap by providing a nuanced understanding of how different tiers and dimensions of inequality influence households' experience of impacts of climatic variability, a fundamental aspect of climate change, and consequently shape their migration behaviours and intentions. This is achieved by focusing on a slow onset environmental degradation scenario in a sub-national community, Minqin county in western China. To systematically and comprehensively understand inequality, class, a major organising concept to describe inequality and explain human behaviour, is used to conceptualise inequality in two tiers (class structure of the community and class position of the household) and five dimensions (economic, social, cultural, reputational and political status).

Underpinned by a mixed methods approach, qualitative and quantitative data were collected from primary and secondary sources, such as a household survey, in-depth interviews with key informants, census, yearbooks and policy documents. These data enabled this study to carry out descriptive, regression and thematic analysis. A two-stage decision making process of migration has been conceptualised in the framework based upon the Theory of Planned Behaviour. Accordingly, a two-stage econometric regression approach is employed to test two major hypotheses: (1) In what ways and to what extent multiple inequalities shape households' experience of climatic variability impacts? (2) How multiple inequalities combine with the climatic variability impacts to differentiate households' migration patterns

in the past and likely to in the future? The regression model is based on primary data collected from 445 households in Minqin county of western China in 2012.

The results show that the groups that were particularly vulnerable to climatic variability impacts include those living in a community with an unequal distribution of income and having low economic, social and political status in the community. The influence of climatic variability impacts and class on migration is mixed. The negative impact of climatic variability on crops and land drives migration, while the negative impact on water tends to constrain migration, which suggests that it is the specific impacts experienced by a household, rather than climatic variability *per se*, that determines the migration decision. Households with higher economic, social and cultural status show a stronger propensity to engage in, or plan for, migration, especially that which requires substantial resources (e.g., long-distance and entire household migration), whereas those with higher reputational and political status are more likely to stay. Although multiple inequalities shaped by class are found to be significant in influencing climatic variability impacts and migration, results of policy analysis suggest that current migration and adaptation policies largely concentrate on economic inequality and do not provide sufficient institutional and financial support to address inequality.

The study recommends that local government identify the characteristics and needs of the groups that are particularly vulnerable to climate change. The needs of these groups should be integrated into cohesive development programs which promote both local development and human migration. Specific arrangements of instruments, institutions and finance should be made in these programs to ensure that multi-faceted inequality is addressed, allowing vulnerable groups in the community to access more diverse and proactive adaptive strategies.

DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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ABBREVAITONS AND ACRONYMS

APMRC	Australian Population and Migration Research Centre (the University of Adelaide)
ARC	Australian Research Council
BBC	British Broadcasting Corporation
CASMIN	Comparative Analysis of Social Mobility in Industrial Societies
CCPCC	Central Committee of Communist Party of China
CNKI	China National Knowledge Infrastructure
CPAD	The State Council Leading Group Office of Poverty Alleviation and Development (China)
CPC	Communist Party of China
CPG	the Central People's Government (China)
DOEGP	Department of Education, Gansu Province
ECCNARCC	Editorial Commission of China's National Assessment Report on Climate Change
EDPs	Environmentally Displaced Persons
EFZs	Ecological Fragile Zones
GDP	Gross Domestic Product
GOMCG	General Office of Minqin County Government
GOPGGP	General Office of People's Government of Gansu Province
GOSC	General Office of State Council (China)
HH	Household
HRS	Household Responsibility System
IMARG	Inner Mongolia Autonomous Region Government
IMO	International Organisation for Migration
IPCC	the International Panel on Climate Change
ISDR	International Strategy for Disaster Reduction (the United Nations)
MARC	Model of Migration Adaptation to Rainfall Change
MCG	Minqin County Government
MCPC	Minqin County Party Committee
MEP	Ministry of Environmental Protection (China)
MLogit	Multinomial Logit
MLR	Ministry of Land and Resources (China)
MOE	Ministry of Education (China)

MWR	Ministry of Water Resources (China)
NBS	National Bureau of Statistics (China)
NDRC	National Development and Reform Commission
NGO	Non-Governmental Organisation
OLS	Ordinary Least Squares
PGGP	People's Government of Gansu Province
PPS	Probability Proportionate to Size
SC	State Council (China)
SCGPC	Standing Committee of Gansu People's Congress
SCOLGWRD	the State Council Office of the Leading Group for Western Region Development
SEAC	State Ethnic Affairs Commission (China)
SPG	Shaanxi Province Government
SUR	Seemingly Unrelated Regression
TPA	the Theory of Planned Behaviour
UNEP	United Nations Environment Programme
UNESCAP	the United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	the United Nations Framework Convention on Climate Change
UNFPA	the United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
WCDLO	West China Development Leadership Office of the State Council of China
WCG	Wuwei City Government
WCPC	Wuwei City Party Committee

CHAPTER 1: Introduction

1.1 Research context

The scope and scale of human mobility induced by climate change could substantially increase in a way that has never happened before (Hugo 2008b; Warner et al. 2009), because it is argued that human are entering ‘a period of unprecedented climate change’ (McLeman and Smit 2006:31). Hugo et al. (2009) claim that human migration, as a traditional way of responding to environmental disruption, is likely to become one of the principal responses to climate change impacts, though the exact number of climate change-induced migrants remains uncertain and unpredictable.

Climate change-induced migration is considered to be a form of environmental migration (Hugo 2008b). An environmental migrant is defined by the International Organisation of Migration as:

‘persons, or groups of persons, who for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad.’ (IOM 2007 :1)

Migration in response to climate change can take many forms, involve different degrees of voluntariness, and bring about diverse outcomes (Hugo et al. 2009; Piguat et al. 2011). Climate change-related migration, like other forms of adaptation, is a unequal process, with certain groups always experiencing more severe impacts of climate change, having fewer options with respect to migration, and ending up with greater poverty and powerlessness (Dulal et al. 2009; Hugo et al. 2009; Warner et al. 2009; Black et al. 2011b). Inequality has been identified as an important factor influencing populations’ vulnerability and consequently shaping their adaptation (including migration) to climate change from a global to an individual level (Adger and Kelly 1999; Burton et al. 2002; Paavola and Adger 2006).

Inequality is a highly complex social phenomenon. It refers to social relations where people have different positions in a given context, as well as the unequal distribution of various ‘valuable goods’ among the population (Hradil 2001; Goldthorpe 2010). Based on this theoretical understanding, a substantial body of empirical studies have examined how

migration and adaptation to environmental change (including climate change) are affected by inequality in terms of the unequal distribution of income (Smith et al. 2006; Stark et al. 2009); land (Crenshaw and Jenkins 1996; Li et al. 1998); social connection (Isham 2002; Deressa et al. 2009); educational attainment (Henry et al. 2004; Maddison 2007); occupational prestige (Meze-Hausken 2000; Heltberg et al. 2009); and access to policy-making processes (Thomas and Twyman 2005; Paavola and Adger 2006). Yet there is scant theoretical or empirical research that simultaneously and systematically investigates multiple aspects of inequality and its relationship to the climate change-migration nexus.

Class theory provides an appropriate approach to understand the complexity of inequality, particularly within a specific community, because it is ‘a major organising concept in the exploration of contemporary social stratification which describes the systematic structures of social inequality’ (Crompton 1993:4). Although there is no single accurate definition of class, Bourdieusism has gained wide acceptance since the 1990s. According to Bourdieu (1984), class position is comprised of economic, social, cultural and symbolic forms of capital; these provide a theoretical basis to systematically conceptualise various dimensions of inequality in climate change-migration studies.

It is also important to recognise that climate change, except for sudden disasters, mostly does not directly lead to migration; rather, it is the impacts of climate change on other drivers of migration that shape people’s migration strategies (McLeman and Smit 2006; Black et al. 2011a). This thesis has this in mind and assumes that multiple inequalities, shaped by class, can directly and indirectly influence people’s migration and adaptation, by shaping their experience of climate change impacts.

Adaptations, including migration, to climate change have taken place at scales ranging from international to individual levels. Relatively less research attention is focused on spontaneous adaptation in private sectors at the sub-national level (Adger et al. 2003; Adger et al. 2005), especially when issues of inequality issues are involved (Thomas and Twyman 2005). There is no uniformly effective intervention that addresses inequality and promotes adaptation to climate change throughout the world. For efficient and effective adaptation to climate change for communities at the sub-national level, it is in the best interests of those communities to obtain a nuanced understanding of cultural and place-specific inequalities and their relative weights in shaping migration decisions and patterns in face of climate change. They should

then implement appropriate policies for achieving the balance between environment, population, economic development and social equity.

This thesis, taking the above factors into consideration, focuses on establishing a conceptual understanding of the relationship between climate change, inequality and migration from a class perspective. Climatic variability is a fundamental aspect of climate and understanding climate change demands attention to climatic variability (Karl et al. 1995). This study thus empirically examines the influence of multiple inequalities, shaped by class, on households' experience of climatic variability impacts and their migration behaviour, and their intentions in response to those impacts. The analysis is based on primary and second data collected from a rural setting of Minqin county in western China. This region provides an ideal setting to study the climatic variability-migration nexus and its relationship to inequality, because it is an area simultaneously experiencing climatic variability, severe environmental degradation, massive migration and widened inequality.

1.2 Purpose, objectives and research questions

The overarching purpose of this study is to provide an insight into the complex relationship between climate change, inequality, and migration at the household level in a rural setting that is a climate change hotspot. In pursuit of this purpose, the study has a number of specific objectives:

- To examine the heterogeneity of climatic variability and its environmental impacts-induced migration among households within a local community;
- To understand the multiple tiers and dimensions of inequality in this community by examining its class structure and the class positions of its households;
- To establish the extent to which class influences the experience of climatic variability and its environmental impacts at the household level;
- To establish the extent to which class influences human responses, especially migration decisions, to climatic variability and its environmental impacts at the household level;
- To examine the risks and vulnerabilities of the social groups that are most affected by the interaction of climatic variability and its environmental impacts, class and migration;

- To examine the extent to which current migration and adaptation policies consider and address inequality issues; and
- To make policy recommendations relating to migration, development, and social equity.

To achieve these objectives the following research questions will be addressed:

- What impacts of climatic variability and its environmental impacts have households experienced?
- What is the degree of income and land inequality in the townships and how is the class status (economic, social, cultural, symbolic and political) distributed among households?
- What public and private means of adaptation have been undertaken in order to effectively respond to climatic variability and environmental change?
- What are the migration patterns adopted by households? And what are the socio-economic and demographic characteristics of migrants and non-migrants?
- In what ways and to what extent, do the class structure of townships and the class status of households differentiate households' experience of climatic variability impacts and shape their migration decisions?
- To what extent do current migration and adaptation policies consider and address inequality issues?
- What types of policies and programs are needed to facilitate the adaptation of each class sub-group to climatic variability and environmental change and, consequently, to promote local development and social equity?

1.3 Environmental migration in western China

In recent decades, China has been experiencing unprecedented climate change, exacerbating the already serious adverse impacts of environmental problems on its economy and society (Tan and Guo 2008). Western China includes five of the country's seven ecologically fragile zones (EFZs), and houses more than 60 percent of Chinese people who live in absolute poverty (Hugo et al. 2009). The natural environment and people's livelihoods in this region are thus especially vulnerable to climate change and it has been identified as one of the hotspots suffering the greatest impacts of climate change. Hugo et al. (2009) summarise the risks of climate change in western China as: increased risks of drought, desertification, land

degradation, water shortages and decreased agriculture production. In the future, these are certain to accelerate the already significant environmental migration in this region.

Migration has been used for a long time in western China as a way of relieving pressure on the environment and rehabilitating the deteriorating ecosystem, as well as eradicating poverty in this region (Shi et al. 2007). A fragile ecology is considered to be the major factor causing rural poverty in this region because it constrains agricultural production and limits people's incomes. Moving to an area, which provides a better environment for agricultural production and the access to diverse livelihoods, is regarded as an ultimate solution to rural poverty in ecologically fragile areas. Although environmental migration in China is largely organised by the government (Shi et al. 2007), people have also spontaneously migrated away from these ecological fragile areas in western China (Li and Wei 2005).

1.3.1 Government-organised migration

Government-organised environmental migrants in this region comprise three groups of people: firstly, people who live in an area where a deteriorating environment and poverty co-exist; secondly, people living in water conservation districts, natural reserves and ecologically fragile zones; and thirdly, people who live in an area that is subject to frequent and severe geologic hazards (Tan and Guo 2008).

In 1983, a policy of environment-related migration was initiated to reduce environment-related poverty in some of the poorest areas of western China, such as the Dingxi prefecture and the Hexi district of Gansu, and the Xi-Hai-Gu district of Ningxia. In 2001, four western provinces/autonomous regions (Ningxia, Yunnan, Guizhou and Inner Mongolia) were selected by the State Council as the first pilots of environment-related displacement and resettlement programs. Since 2003, environmental displacement and resettlement have been carried out in 13 Chinese provinces (Hugo et al. 2009). Between 1983 and 2006, around two million poverty-stricken people in western China were displaced (WCDLO 2005); in addition, between 2006 and 2010, it was estimated that another 1.5 million poor people would be displaced from western China (NDRC 2007a). Shi et al. (2007) estimated that ten million people, who reside mainly in ecologically fragile regions of western China, would need to be displaced by 2050 to solve poverty and environmental problems. Table 1.1 provides details of government-organised environment-related migration programs implemented or planned in

five provinces and autonomous regions of western China, which have witnessed the most massive environmental migration in the country.

Table 1.1: Environment-related migration in five provinces and autonomous regions of western China

Province	Time	Program	Migrants
Ningxia	1983-2000	Diaozhuang migration	345,000
	2001-2006	off-site environmental migration	194,000
	2007-2011	environmental migration in the dry zone of central Ningxia	207,000
	2011-2015	environmental migration in the dry zone of central and southern Ningxia	346,000
Gansu	1983-2006	anti-poverty migration in the 53 impoverished counties in ecologically fragile zones	649,000
	2001-2005	off-site environmental migration	65,000
	2006-2010	anti-poverty and environmental migration	353,000
	2013-2018	anti-poverty and environmental migration	1,120,000
Shaanxi	2010-2020	anti-poverty and environmental migration	2,400,000
Qinghai	2000-2010	Three River Sources ecological migration	103,000
	2011-2015	anti-poverty and environmental migration	100,000
Inner Mongolia	1998-2000	the first round of environmental migration	6,000
	2001-2005	environmental migration	650,000
	2006-2010	anti-poverty and environmental migration	304,000
	2011-2017	anti-poverty and environmental migration	367,000

Source: Xinhuanet (2011); SPG (2011);CPG (2012); IMARG (2012); GPC (2014)

In 2002, ‘environmental migration’ was regarded as a part of central government policy. The State Council issued a document, titled ‘*Some Suggestions about Further Improving Reforestation Policy and Its Implementations*’ (SC 2002), stating that ‘environmental migration’ would be incorporated into national environment schemes, aiming to promote the rehabilitation of natural environment; moreover, ‘environmental migrants’ would be provided with financial subsidies for the purpose of re-establishing their livelihoods and alleviating poverty. Hugo et al. (2009:105) indicate that there are three major financial sources to assist environmental migration in China: (1) the nation’s ‘aid-the-poor’ and ‘work-relief’ funds; (2) the nations’ environmental protection funding; and (3) the government’s ‘National Bond for West China Development’ (3-5 billion Yuan per annum). With the institutional and financial support, western China has carried out many large scaled environmental migration programs since then.

1.3.2 Spontaneous migration

Despite the fact that large scale environmental migration is usually carried out on a government-arranged basis and is largely involuntary, many people spontaneously out-migrated from ecologically fragile areas in western China prior to, and after, the implementation of governmental migration programs (Li and Wei 2005). This spontaneous migration flow is largely due to the uneven distribution of economic development between the western and eastern parts of China. The underdeveloped economic conditions in western China is partly caused by its fragile natural environment that poverty in the region can be considered ‘ecological poverty’ in many circumstances (Chen 2003). From this perspective, spontaneous migration that aims to eradicate poverty cannot be completely separated from the phenomenon of migration associated with environmental problems. Table 1.2 summarises some distinctions between spontaneous migration and government-arranged migration. Although both aim to protect the environment and achieve economic development, spontaneous migrants receive little assistance from the government but rely heavily upon their private social networks, while government-arranged migrants are provided with comprehensive support in housing, agricultural production, off-farm employment and entitlements to social welfare.

Table 1.2: Spontaneous migration and government-arranged migration

	spontaneous migration	government-arranged migration
reason	Environmental change(including climate change) poverty	Environmental change(including climate change) poverty ecological rehabilitation and environment protection construction projects
main migration channel	relatives and friends	government and government-authorised companies
resettlement	dispersed	centralised
support	one-off subsidy no support at all in some places	subsidy housing production and employment household registration

1.4 Inequality in western China

1.4.1 Inequality between regions and within a region

In China, a widening disparity in development exists between regions (i.e. eastern, central and western), between urban and rural areas, and even within rural and urban areas (Chaudhuri and Ravallion 2007; Chotikapanich et al. 2007; Ravallion and Chen 2007; Young 2007). Inequality, especially income disparity, is usually examined at the regional level (Wan and Zhou 2005). Western China is underdeveloped in comparison to other parts of the country in terms of a low level of GDP and per capita net income and the high prevalence of poverty. The development disparity between western and eastern China is considered to be one of the most important factors driving inter-regional migration in recent decades. Not only is there significant inequality between regions, this also exists within regions, provinces, cities/counties, and even between households within a village (Wan and Zhou 2005). Wan and Zhou (2005) Gansu Development Yearbook (GDYEB 2014) provides an example of income-based inequality within the province. Table 1.3 shows that in 2013, more than half of the districts/counties had a rural annual per capita income between 3000 to 4999 Yuan. Three districts/counties had a very low rural annual per capita income (less than 3000 Yuan), while 15 districts/counties had a high annual per capita income in rural areas (more than 10000 Yuan). The district that had the highest annual rural per capita income, Chengguan district, possessed per capita income that was nearly 7 times greater than that of the poorest Dongxiang county, though they are located in the same province.

Table 1.3: Distribution of rural households' annual per capita income among districts/counties in Gansu province in 2013

Per capita income of rural households (Yuan)	Number of district/county
2000-2999	3
3000-3999	19
4000-4999	31
5000-5999	8
6000-6999	2
7000-7999	3
8000-8999	6
9000-9999	1
10000 and more	15

Source: Gansu Development Yearbook (GDYEB 2014)

1.4.2 Urban-rural inequality

Urban-rural inequality in China is another type of inequality being heatedly discussed by both academics and policy makers. Despite the overall improvement in economic development and living standards in the country, the income disparity between rural and urban residents in China has widened (Li 2005). There is an increasing consensus attributing the widening urban-rural inequality to the government's heavy-industry-oriented development strategy, which has set up a set of urban-biased economic and social policies (Cai and Yang 2000; Lu and Chen 2004; Kanbur and Zhang 2005). The specific factors identified as contributing to the enlargement of China's urban-rural inequality include the urban-bias of the government's education budget, depressed agricultural product prices, a tax system biased toward urban settings, a social welfare and social security system biased toward urban residents, and labour market segregation between rural and urban areas (Yang 1999; Li 2005).

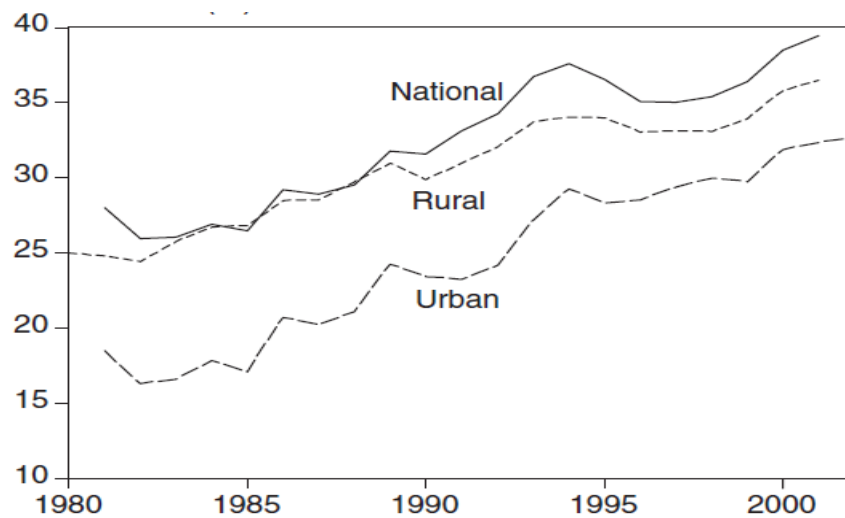
It is important to understand that the degree of urban-rural inequality varies between the regions. Sicular et al. (2007) point out that, since the mid-1990s, the income gap between rural and urban areas widened in western China while it decreased in eastern China. As a result, the level of urban-rural inequality in western China is two to three times greater than in other regions. Sicular et al. (2007) therefore assert that western China is suffering the most serious inequality and that governmental intervention regarding social equity should focus on this region. Zhang and Fan (2004) suggest that social inequality in western China can be effectively targeted by public investment in rural education and in agricultural research and development.

1.4.3 Inequality in rural areas

Inequality, especially income disparity, has increased rapidly within rural areas in recent decades (Gustafsson and Shi 2002). Ravallion and Chen (2007) suggest that, in marked contrast to most developing countries, relative inequality is higher in China's rural areas than in urban areas. Figure 1.1 shows that the Gini coefficients of urban and rural areas of China have both increased significantly since the 1980s, with the rural Gini coefficient always higher than the urban one. This indicates that the degree of income inequality within rural areas is always higher than that within urban areas. Greater inequality in rural areas since the

1980s is resulted from the country's substantial socio-economic reforms, which caused massive migration from rural areas to urban areas and the development of nonfarm opportunities in rural areas that provide uneven rewards to rural households (Morduch and Sicular 2001; Gustafsson and Shi 2002; Meng 2004; Ravallion and Chen 2007). However, Zhu and Luo (2010) claim that poorer households are more likely to migrate and benefit more from migration than rich households, leading to more equal distribution of income in the rural areas.

Figure 1.1: Gini coefficients of China (1980s – 2000s)



Source: Ravallion and Chen (2007:21)

1.4.4 Dimensions of inequality

It is essential to understand that the definition of widened social inequality in China is no longer limited to the uneven distribution of income and other material resources. It has been extended to a much wider range of factors that include, unequal access to policy-making processes and public services (e.g., social security, health, and education), differing lifestyles, and being held disproportionately responsible for social and environment problems (Young 2007).

Inequality is on the top of the Chinese government's agenda. In 1995, the People's Congress listed regional inequality as one of the most pressing problems to be targeted during the ninth five-year plan (1996-2000). In its address at the 18th National Congress, the Chinese government stated that social inequality will impede its efforts to promote socio-economic

reformation and to achieve sustainable development. Combating social inequality is thus one of the policy reform imperatives and achieving social equity is one of the prerequisites for China’s further development (BBC 2012).

1.5 Organisation of the thesis

This thesis consists of nine chapters, as shown in Table 1.4. Chapter 1 has outlined the research context, introduced the key concepts that inform the rest of the study (e.g., environmental migration, inequality, and class), identified the research questions, and has provided the background to environmental migration and inequality in western China.

Table 1.4: Chapter outline of the thesis

Background	Chapter 1	Introduction
	Chapter 2	The Complex Relationship between Climate Change, Inequality, Class, and Migration
Conceptual framework	Chapter 3	The Conceptual Framework of the Relationship between Climate Change, Class and Migration
Methodology	Chapter 4	Methodology
Findings	Chapter 5	Climate Change, Class and Migration in Western China
	Chapter 6	The Influence of Class on the Impacts of Climatic Variability Experienced by Households
	Chapter 7	The Influence of Class and Climatic Variability Impact on Migration
	Chapter 8	Addressing Inequality by Migration and Adaptation Policies
Conclusion	Chapter 9	Conclusion

Chapter 2 is an overview of current literature on the climate change-migration nexus and its relationship to inequality and class. This chapter contributes to identifying research gaps that exist in current studies regarding the relationship between climate change, class and migration. Chapter 3 establishes the conceptual framework of the study by integrating class theory (Bourdieu 1984) and the Theory of Planned Behaviour (Ajzen 1991) into current climate change-migration theory. This chapter outlines two stages involved in the decision-making process of climate change-induced migration, and identifies two tiers and five dimensions of class that influence the decision-making process. Chapter 4 outlines the epistemological assumptions and methodological approaches used in formulating the research

design, collecting primary and secondary data, and analysing the data. The selection of the study areas is also explicitly discussed in this chapter.

Chapter 5, 6, 7 and 8 present the results of the research. Chapter 5 presents an overall examination of western China's ecological environment, climate change and its impact, as well as its demographic characteristics, migration patterns, economic development, and class structure. Chapter 6 examines the experience of climatic variability impacts on households, the class structure of communities, the class position of households, public preparedness for and adaptation to climate change, and the demographic characteristics of households. This information is then used to investigate the influence of multi-level and multi-dimensional class on households' experience of climatic variability impacts. Chapter 7 presents households' private means of adaptation, migration patterns, the characteristics of non-migrants and migrants, and the distinctions between their different migration patterns. This chapter also empirically examines the influence of class on migration behaviour and intentions at the household level. Chapter 8 overviews the public policies relating to adaptation and migration responses to environmental change within the study area. It then examines in what ways and to what extent these policies establish goals and arrange relevant instruments, institutions and budgets to address inequality in adaptation and migration processes. Chapter 9 concludes with a discussion of the major findings, policy recommendations, implications for theory and methodology, limitations of the study, and areas for further research.

The understanding of *climatic variability* and its linkage to class and migration should be embedded in a general discussion on the interrelationship between *climate change*, inequality and migration, because climatic variability is a fundamental aspect of climate change (Karl et al. 1995). Moreover, climate change, as an important form of *environmental change*, clearly fits in a discussion of the linkage between environment and migration (Hugo 2008b; Stojanov 2008). Therefore, the terms 'climate change' and 'environmental change' are used interchangeably in relation to the literature review and for theoretical and policy discussions. The term 'climatic variability' is used to describe the empirical work and in the discussion of the empirical findings of this study.

CHAPTER 2: The Complex Relationship between Climate Change, Inequality, Class, and Migration

2.1 Introduction

This study seeks to explore the complex interrelationship between climate change, inequality, and migration from a class perspective. The interrelationships comprise at least three sub-linkages, namely between climate change and migration, between inequality and climate change-induced migration, and between inequality and class. The three sub-linkages will be examined separately and jointly in order to establish a logical conceptual framework for the study.

This chapter firstly examines the linkages between environmental change and migration in the context of development. This is followed by an examination of the inequality involved in the climate change-migration nexus. This is examined from two perspectives: how inequality influences the climate change impacts borne by different populations, and how inequality shapes people's responses to climate change, including human mobility. Theories and measures of class are then discussed and class analysis is identified as an appropriate approach to study inequality. Finally, examples of class analysis used in contemporary environment-migration studies are examined.

2.2 The complex relationship between climate change and human migration

2.2.1 Introduction

In recent decades, climate change has been identified by higher average temperatures, widespread changes in precipitation patterns, rising sea levels, increases in the frequency and intensity of extreme weather events, and shifts in disease patterns (Warrick and Ahmad 1996; Watson et al. 1998; IPCC 2007:18; IPCC 2013). The report of the International Panel on Climate Change (IPCC) in 2007 systematically examined the impacts of climate change on natural and human environments, and specifically demonstrated the scientific reality of the impacts of climate change on freshwater resources, ecosystem, food security, coastal systems, low-lying areas, industry, society and human health. It is evident that climate change is and will continue impacting human societies in a profound way and the impacts are likely to

increase over time (Stern 2006; Parry 2007). Therefore there is an increasing urgency to develop policies to cope with climate change.

Human migration is one of the many potential impacts of climate change (McLeman and Smit 2006; Stern 2006; Warner et al. 2009), and one of the strategies for adapting to climate change (Renaud et al. 2007; Hugo 2008b; Bardsley and Hugo 2010; Black et al. 2011b). Discussion of the relationship between climate change and migration, as one of the pressing issues raised by unprecedented climate change, has attracted the interest of both academics and policy makers since the 1980s (Perch-Nielsen et al. 2008; Gemenne 2011). Although the linkage between climate change and migration can be identified by evidence in each time-stage and in each part of the world, researchers do not share the same understandings of the linkage. Much of this fuzziness arises from the lack of multi-disciplinary research. Environmental scientists and researchers from humanities and social sciences are investigating the issue through their own lens of expertise and concern, which hardly leads to a holistic view of the linkage between environment and migration (Bardsley and Hugo 2010). In the past 30 years, discussion of the relationship was intense but understanding is still inadequate. Firstly, the linkage between climate change and migration remains disputed (Castles 2002). Moreover, the ways in which climate change, migration and other drivers of migration interact multi-directionally and dynamically are little understood (Hugo 2008b).

This section reviews the existing knowledge regarding the relationship between climate change and migration. It begins with a brief history of the linkage, then examines the debates on the linkage. Lastly, the multi-directional interaction of climate change, migration and development are discussed.

Climate change, as an important form of environmental change, clearly fits in a discussion of the linkage between environment and migration (Hugo 2008b; Stojanov 2008). Most effects of climate change, except rising sea levels, are difficult to absolutely disassemble from other types of environmental change. Given the closely interwoven nature of climate change and other environmental change in producing human mobility, literature focusing on climate change and migration usually begins with a more general discussion of linkages between environment and human mobility (Meze-Hausken 2000; McLeman and Smit 2006; Perch-Nielsen et al. 2008). This study also reviews the interrelationships between climate change, migration and development in a larger environmental context.

2.2.2 History of the linkage between environmental change and migration

The relationship between environment and migration is not new but is a ‘long-standing phenomenon’ (Piguet et al. 2011:2). In the late 1880s, the first systematic theories of migration already acknowledged the significance of climatic factors. Ravenstein (1889:286) pointed out that an ‘unattractive climate’, combined with socio-economic and institutional factors, had driven migration. Semple (1911:143) also indicated that ‘the search for better land, milder climate and easier conditions’ is one of the motivations for people to move.

However, the role of the environment in migration studies then largely disappeared until the late 1980s (Piguet et al. 2011). Piguet et al. (2011:3) attribute the decreasing interest in environmental factors in migration studies to the following trends: (1) technological developments which were believed to decrease the influence of environment on the population and to strengthen human control of the environment; (2) the rising influence of economic, social, cultural paradigm on migration diverting attention away from the influence of environment on migration; and (3) the involvement of a strong political premise of ‘refugee’ in environmentally induced displacements.

By the 1980s, climate change was very prominent and its impact on human society, including human mobility, became a major concern for the international community (Gemenne 2011). As a result, the term ‘environmental migrant’ returned to academic and policy discussions. Later, a significant body of literature emerged to provide evidence of the strong linkages between climate change and human migration. Scientists had managed to identify the linkages existing in prehistoric time (Van Geel et al. 1996; Huntley 1999; Yesner 2001; Tyson et al. 2002). Documented evidence of the relationship between climate change and human movements in ancient times can be found in ancient China (Smit and Cai 1996), and in North America prior to European settlement (Fixico 2003). Recent evidence from all over the world has proved that environmental change has long been closely associated with human mobility. Research in Africa has shown that rural populations have adopted migration as one of the strategies to cope with recurring drought in recent decades (Afolayan and Adelekan 1999; Meze-Hausken 2000; Ezra 2001). North and Central America have experienced wide scale migration within, and beyond, the regions afflicted by environmental disasters, especially severe hurricanes (Girard and Peacock 1997; Morris et al. 2002). The Asia-Pacific

region has witnessed large-scale environmental migration, because it is a region that has experienced enormous population and environment pressures. Evidence from China, Southeast Asia, Bangladesh and the Pacific (Reuveny 2007; Hugo et al. 2009) provides important insights into the linkages between environmental change and migration.

In the 1980s and 1990s, the early landmark publications of the environment-migration nexus emerged (e.g., Jacobsen 1988, Suhrke 1994; Hugo 1996). They attempted to embed the linkage in a broader developmental context and to identify the multiple characteristics and implications of migration induced by environmental pressures. Some early work regarding the relationship between climate change and migration shows interest in making estimates of the number of climate change-induced migrants. One of the earliest estimates was made by Jacobson (1988), indicating that 10 million people would be displaced by environmental change in the mid-1980s. Other estimates were that the number of environmental refugees would increase to 50 million by 2010 (Myers et al. 1993), and to 150 million by 2050 (Myers 2002). The first Intergovernmental Panel on Climate Change (IPCC) report (1990:20) stated that ‘The gravest effects of climate change may be those on human migration as millions are uprooted by shoreline erosion, coastal flooding and agricultural disruption’, though its later reports in 2001 and 2007 were more conservative about the direct effects of climate change on human migration. These early studies raised the awareness of governments and the public of the relationship between environmental change and migration, and brought the concept of ‘environmental migrants’ back into academic and policy discussion. However, the alarmist predictions lacked empirical evidence.

Recent studies realise that environmental migration is a highly selective and heterogeneous process influenced by multi-level and multi-dimensional factors. No uniform solution is available to promote ‘positive migration’ or avoid ‘negative migration’ in response to climate change. Some studies thus divert the focus from estimating the overall trend of migration to detailing the dynamic and complex decision-making process of migrants in the face of environmental change (including climate change). For example, McLeman and Smit (2006) conceptualise the climate change-migration nexus by exploring the mechanism of ‘vulnerability’. They state that sudden climatic events or slow changes, interacting with vulnerabilities determined by economic, social, and cultural capital endowments, will differentiate human migration behaviours. Perch-Nielsen et al. (2008) outline a conceptual framework of climate change-induced migration by studying migration due to sea-level rise

and river and coastal floods. Their study emphasises that a range of adaptation options can be adopted by affected people. More recently, Black et al. (2011a) conceptualised a model that specifies the effects of environmental change on migration. This model incorporates both contextual factors and behaviour controls to explain different migration decisions. A detailed discussion of the conceptual frameworks on environmental change (including climate change) and migration can be found in Chapter 3.

The discussion above has indicated that the effects of environmental change will almost certainly alter patterns of human migration (Black et al. 2011b). The debate on the linkage, however, is still very tense. According to Castles (2002), the major elements in the debate on environmentally-induced migration include the definition of ‘environmental migrants’ (Bates 2002; Castles 2002; McNamara 2007; Piguet 2008), and the weight of environmental factors among all the drivers of migration (Myers et al. 1993; Meze-Hausken 2000; Black 2001; Bates 2002; Castles 2002; Gibbons and Nicholls 2006).

2.2.3 Definitions of ‘environmental migrants’

Since much of the dispute on the relationship between environment and migration focuses on defining the term ‘environmental migration’, it is necessary to discuss the definition of the issue (Hugo 2008b).

To categorise people who have been forced to leave their place of origin due to environmental pressures, the term ‘environmental refugees’ was first introduced by Lester Brown in the 1970s and later defined by El-Hinnawi (1985:4) as:

‘...those people who have been forced to leave their traditional habitat, temporarily or permanently, because of marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life [sic]. By ‘environmental disruption’ in this definition is meant any physical, chemical, and/or biological changes in the ecosystem (or resource base) that render it, temporarily or permanently, unsuitable to support human life’

This definition led to a great deal of subsequent debate about whether environmentally induced migration should be incorporated into the regime of refugee (Hugo et al. 2009). The greatest concern is that modifying the concept of refugee may jeopardise the integrity and

weaken the effectiveness of the existing refugee regime (Black 2001; Castles 2002). Hugo et al. (2009:30) identified other factors which have intensified the debate:

- Environmental factors are only one reason for forced migration, indeed of all migration;
- Most environmentally induced migration occurs within nations, which does not fit into the refugee regime;
- Environmentally induced migrants are not always forced to move in the same way refugees are.

Therefore, instead of the term ‘environmental refugee’, the concept of ‘environmentally displaced persons’ (EDPs) was proposed to describe people who are forced to leave their original residence by environmental events. UNHCR and IMO (1996:4) define EDPs as:

‘Persons who are displaced within their country of habitual residence or who have crossed an international border and for whom environmental degradation, deterioration or destruction is a major cause of their displacement, although not the sole one’

This definition improves the understanding of the relationship between environment and migration by recognising three important characteristics of environmental migration: (1) the migration can be both within and beyond a country; (2) the migration can be induced by both rapid onset environmental disasters and by slow onset environmental degradation; and (3) the migration is not solely influenced by environmental factors. However, environmentally induced migration is not limited to the forced displacement described in the definition, but can also function as a proactive adaptive strategy. Hugo (1996) suggests considering environmentally induced migration as a spectrum, with extremely forced displacement at one end and absolutely voluntary migration at the other. Hence it is necessary to develop a definition which goes beyond the notion of migration only as displacement.

A definition of ‘environmental migration’ is proposed by the International Organisation of Migration (IOM 2007 :1):

‘Environmental migrants are persons, or groups of persons, who for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad.’

This definition has gained wide acceptance mainly because it goes beyond displacement to encompass all forms of mobility initiated by environmental change, though it increases the complexity when attributing the causes of migration to environmental factors (Hugo et al. 2009).

2.2.4 Environmental change as a cause of migration

An important issue hindering people's understanding of the relationship between environment and migration is that environmental conditions are but one factor that influence human migration patterns (Castles 2002; Adamo and Crews-Meyer 2006; McLeman and Smit 2006; Warner et al. 2009; Foresight 2011). There are a range of complex factors, including environmental, demographic, economic, social, cultural, political, institutional and technological conditions that combine to shape human migration behaviour (Suhrke 1994; Hugo 1996; Castles 2002; McLeman and Smit 2006; Black et al. 2011a). These factors interconnect so closely that their mutual influence cannot be sorted out in quantitative accounts (Massey et al. 2010). This undoubtedly increases the difficulty of identifying the relative significance of environmental factors in initiating migration and in categorising environmentally induced migration as a separate type of migration. Richmond (1993:11) suggests researchers go beyond 'descriptive typologies of environmentally induced migration' and focus on 'dynamic interaction of the multiple causal factors' driving migration in the face of environmental pressures.

Hugo (1996) provides a better solution for considering the extent of the effects of environmental conditions on migration as indicated in Figure 2.1. The effects of environment on migration are considered as existing on a continuum ranging from not being significant at all to being the overwhelming cause of migration. It is actually difficult to distinguish 'environmental migrants' from other migrants unless the extreme significant end of the continuum is reached, such as when an area is inundated permanently and people are forced to move. In most cases, environmental factors are a proximate cause of migration, while some other factors, such as demography, socio-economic development, and political conflicts are regarded as the root causes (Richmond 1993; Suhrke and Hazarika 1993; Barnett and Adger 2007; Hugo 2008b). Richmond (1993:8) explicitly argues:

‘...when environmental degradation leads to migration it is generally as a proximate cause linked to questions of economic growth, poverty, population pressure, and political conflict.’

Figure 2.1: Environment as a cause of migration



Source: Bardsley and Hugo (2010:242)

These arguments are supported by Hugo (2008b), who points out that social factors can play a very important role in the process of migration that is obviously induced by environmental disasters. Furthermore, some natural disasters may have their root causes in long-term political, social, economic or agricultural policies which have disturbed the environmental balance (Bilsborrow and DeLargy 1990; Hugo 2008b). Therefore it is best to conceptualise the impacts of climate change on migration as adding an additional driver to existing causes of migration, rather than generating an absolutely separate type of migration (Hugo et al. 2009; Barnett and Webber 2010)

Another issue hindering migration being linked to environmental change is that, in many situations, environmental disasters or degradation do not directly induce migration. Foresight (2011) argues that climate change often influences migration though its impact on other causal factors of migration. Evidence of this can be dated back to the early 1990s when, the study of Bilsborrow (1991) in Indonesia, Guatemala, and Sudan showed that environmental change induces migration indirectly by reducing income and causing deterioration in living conditions. This indirect relationship is modelled in some recent studies (Barbieri et al. 2010; Feng et al. 2010; Massey et al. 2010) focusing on how migration is influenced by changes in agricultural production and economic conditions due to climate change. The ‘indirect’ feature of the linkage adds complexity to conceptualising the relationship between climate change and migration. This is a possible reason for the situation described by McLeman (2013:3):

‘...even where a climate-related “signal” has clearly been a proximate influence on the migration decision of the household, the reasons given for migration...having been economically or socially motivated’

Despite the difficulties in separating the effects of environmental change factors on human mobility from a complex range of causes, and in identifying a direct linkage between environmental change and migration, from both academic and policy perspectives, it is meaningful to identify environmental migrants as a category (Castles 2002). This is because the fact that environmental factors significantly impact on human migration cannot be questioned and the most vulnerable people are in urgent need of support (Hugo 2008b).

2.2.5 Migration as a response to environmental change

Another issue challenging the linkage between environment and migration is that environmental change does not necessarily lead to migration (McLeman and Smit 2006; McGranahan et al. 2007), though migration has always been one important response to environmental pressures (Hugo 1996). McLeman and Smit (2006) explicitly argue that migration occurs out of some communities and households but not others, under seemingly similar environmental conditions. McGranahan et al. (2007) indicate that people respond to climate change impacts by taking three measures: mitigation, migration and modification. Adaptation studies suggest that adaptation can be generally grouped into three categories: in-situ adaptation, migration and no response (Tompkins and Adger 2004; Reuveny 2007). It is essential then to regard environmentally induced population mobility as only one of the responses available among an array of potential mitigation and adaptation strategies (Hugo 2008b; Bardsley and Hugo 2010).

2.2.6 Different types of environmental change-induced migration

Migration, as a response to environmental change, can and does take many forms. To thoroughly understand the specific relationship between environment and migration, it is necessary to disentangle the different forms of mobility that may be connected to environmental factors. Researchers have identified the following important distinctions for each group of mobility forms (Hugo et al. 2009; Piguet et al. 2011:14).

- Forced migration versus voluntary migration
- Migration as a result of sudden, dramatic impacts versus migration as a result of the impacts of slow onset change.

- Migration as a result of perceived environmental impacts versus migration as a result of actual threats of environmental deterioration.
- Short-term migration versus long-term migration
- Short-distance migration versus long-distance migration

Forced and proactive migration: One of the key distinctions identified is between migration as forced displacement or as a proactive strategy for adapting to the impacts of environmental change. Migration was overwhelmingly regarded as the result of failing to adapt effectively to environmental change (Heine and Petersen 2008; Adamo 2013). Among all possible adaptations, migration was considered as the unfavourable ‘last resort’ after in-situ adjustments had been implemented and had failed (Penning-Rowsell et al. 2013). Too often it is assumed that environmentally-induced migration equals displacement. This may be the case for some Pacific countries which are atolls, where the focus of response to potential sea level rises associated with climate change is on resettlement, whilst other forms of mitigation and adaptation are neglected (Connell 2003). However, some researchers argue, with more sophistication and persuasiveness, that the picture of environmentally-induced migration is not one-sided. Richmond (1993) suggests that environmentally induced migration should be divided into *proactive* and *reactive* movements. This means that environmental migration can be both a strategic adaptation to climate change in an anticipatory manner or a forced displacement when environmental pressures become extreme (Renaud et al. 2007; Bardsley and Hugo 2010; Black et al. 2011a). According to the degree of urgency in the movements, Renaud et al. (2007:29-30) categorise environmentally-induced migrants into three sub-groups: ‘environmentally motivated migrants’ who choose to move in face of environmental problems; ‘environmentally forced migrants’ who are forced to move but retain some choice in the timing, and ‘environmental refugees’ who have no choice about any aspect of the move. Hugo (1996:106) further points out that ‘the distinction between voluntary and involuntary migration is not as clear cut as it would appear at first glance’. He suggests that environmentally-induced migration is better considered a continuum; at one end is voluntary movement and forced movement is at the other end. Only under extreme situations, such as sudden climatic disasters, will people be unwillingly displaced. In reality, however, most climate change-induced migration sits between the two extremes. Thus in many circumstances, people retain some power to make decisions and to use certain degrees of initiative in using migration as proactive and strategic adaptation to climate change.

Therefore, Bardsley and Hugo (2010) argue that it is essential to see environmentally-induced population mobility as a wide array of mobility types beyond only displacement.

Rapid onset and slow onset environmental pressures: Another key distinction is made between movement associated with the rapid onset of environmental disasters and that caused by the slow onset of environmental deterioration and degradation. Table 2.1 provides a general comparison of the two types of environmental migration as summarised by Hugo et al. (2009).

Table 2.1: Types of Environmentally Induced Migration according to environmental causes

Environmental Change	Examples	Mobility Response
Sudden, extreme events	-Tsunami	-Large scale displacement
	-Flooding	-Largely temporary displacement
	-Cyclone	-Largely internal migration
	-Earthquake	-May pull in-migrants
Gradual deterioration of environment	-Desertification	-Temporary, circular migration of family members to supplement local income generation
	-Dam construction	
	-Water scarcity	
	-Loss of water and soil	-Gradual permanent outmigration of household
	-Deforestation	

Source: adapted from Hugo et al. (2009:37)

Many studies have indicated that rapid onset disasters (e.g., tropical cyclones, floods, torrential rains) can cause a major displacement of population but that displacement is usually temporary and internal movement rather than long-term or long-distance migration (See Burton et al. 1993; Lonergan 1998; Kliot 2004; Paul 2005; Pais and Elliott 2008). Paradoxically, sudden disasters may even act as pull rather than push factors for migrants. For example, the Indian Ocean tsunami in 2004 attracted an inflow of migrants, who aimed to support their affected relatives or seek employment opportunities from post-disaster reconstruction projects (Paul 2005; Naik et al. 2007).

Slow onset environmental degradation (e.g. water scarcity and drought, desertification, deforestation, loss of water and soil) tends to cause diverse patterns of mobility. Empirical evidence is mixed. On the one hand, many examples are provided to demonstrate the

significant correlation between outmigration and water scarcity or drought in Africa, South America, the Middle East and Central and Southern Asia (Munshi 2003; Barrios et al. 2006; Leighton 2006; Afifi and Warner 2008; Van der Geest et al. 2010). On the other hand, many researchers question the linkage between water scarcity and emigration (Findley 1994; de Haan et al. 2002; Henry et al. 2003; Naudé 2008). They assert that only a very limited impact of drought on increased out-migration can be identified in their empirical studies. Kniveton et al. (2008:34) indicate that drought might decrease long-distance migration while increasing short-term migration.

Perceived and actual environmental pressures: Moving associated with perceived or actual impacts of environmental change could be considered an important determinant of the effectiveness of adaptation to that change. Migration as a result of perceived or potential threats of environmental change, usually taking place prior to climatic events, could be regarded as proactive and effective adaptation. A choice of migration is made at this early stage, possibly because migration is an early optimal option among all adaptive strategies. Migration associated with the actual impacts of environmental change is more likely to be forced, particularly when all other in-situ options have been employed (Hugo et al. 2009).

Long-term and short-term migration, and long-distance and short-distance migration: Some empirical studies show contrasting migration patterns depending on the circumstances of environmental change (long-term versus short-term and long-distance versus short-distance). Henry et al. (2004) studied the relationship between individual migration and community environment in Burkina Faso and indicated that people who move from the drier regions are more likely to undertake both temporary and permanent migration; moreover, a decrease in rainfall increases long-term migration within rural areas but decreases short-term migration to distant destinations. Many researchers demonstrate that water scarcity-induced migration usually involves short-distance movement (see Meze-Hausken 2004; Warner et al. 2010)

Positive and negative outcomes of environmental change induced migration: Migration can offer opportunities as well as challenges in the context of climate change (Black et al. 2011b). On the one hand, outmigration can impact areas sending and receiving migrants in a negative way. It is argued that a preoccupation with migration as a response diverts attention from in-situ adaptation responses and will reduce the adaptive capacity of those left behind to

cope with climate change, and will jeopardise local potential to maintain a viable community (Connell 2003). Climate change induced migration can cause ‘brain drain’ as the loss of labour diminishes human capital and affects local development at the site of migration loss (Naik et al. 2007; Hugo et al. 2009). Environmental change-induced migration, especially the unplanned kind, is argued to have negative impacts on the area of destination by intensifying competition and conflicts (Diehl and Gleditsch 2001; Mitchell 2006; Reuveny 2007).

On the other hand, in many cases, migration acts as the most effective way to diversify income and sustain livelihoods in the face of environmental change (McLeman and Smit 2006; Brown 2008; Laczko and Aghazarm 2009; Tacoli 2009; Black et al. 2011b). If migrants send money and goods back to their home families and communities, the communities’ resilience to climate change may be expected to be enhanced in the long run. For example, in Africa, such remittances to home communities sharply increased to nearly US\$40 billion between 1990 to 2010, even surpassing the Government's development assistance (Black et al. 2011b). Recognising the potential of migration in promoting adaptation to climate change, many researchers argue that effective adaptation requires removing barriers to and making channels for voluntary migration (Hugo et al. 2009; Black et al. 2011b). Black et al. (2011b) even warn that the greatest risks will be borne by the people who are unable to move, a situation that may be exacerbated by maladaptive policies designed to prevent migration.

2.2.7 The interrelationship between environmental change, migration and development

A complex range of factors, reflecting the development level of the society, community and people, combine to shape human migration (Castles 2002; Black et al. 2011a). Environmental change induced migration has multi-faceted implications for the environment and for development in areas sending and receiving migrant, and for development among migrants and their households (Reuveny 2007; Hugo et al. 2009). In this context, many assessments of the linkage between environment and migration are embedded in the more complex context of development.

There are a number of points that can be made about the complex interrelationship of environmental change, migration and development.

- Environmental change will impede the ability of humans to achieve sustainable development and which can reduce vulnerabilities to that change (IPCC 2007; Adamo 2009).
- Environmental change can both drive and inhibit migration (Black et al. 2011b).
- Environmental change-induced migration has the potential to impact the environment and development in areas sending and receiving migrants in both positive and negative ways (Hugo et al. 2009). Furthermore, the level of development can differentiate migration behaviours in the context of environmental change (Naik et al. 2007).
- Environmental problems can be ultimately solved when a sustainable approach is adopted to overcome the poverty and powerlessness of people exposed to environmental challenges and which can promote their development (Hugo 1996). Meanwhile sustainable development can be achieved through environmental change migration (Yan and Qian 2004).

Knowledge of the interrelationship between environment, migration and development is not only essential in appropriately understanding the environment-migration nexus, but also of considerable significance in understanding social, economic and environmental change and for developing effective interventions to reduce poverty and achieve sustainable development (Hugo 2008b). However, the interrelationship is not adequately studied as indicated by Hugo (2008b:19):

‘...the nexus between migration, development and natural disasters remains uncharted territory among policy makers and researchers’

Hugo (2008a) explained that the lack of understanding of the interrelationship is partly due to the fact that the linkages between environment, migration and development evolved separately in both research and policy. Therefore, interdisciplinary research efforts are must explore the complex multi-directional relationship involving environment as both a cause and consequence of migration.

There is a need for policy intervention at all levels to address issues raised by climate change-induced migration. These interventions will only be appropriate and effective where they are based on a thorough and accurate understanding of the relationship between climate change, migration and development. For example, the fact that climate change is only one of

the causes of migration should encourage societies and governments to avoid displacement due to climate change through addressing other causes of migration, such as eradicating poverty, reducing inequality, reducing population growth, solving conflicts, and adopting sustainable usage of natural resources (Hugo 1996). By recognising that migration is only one of the means of adaptation to climate change, policies need to ensure people's ability to migrate and their capacity to stay and adapt in-situ are both enhanced (Renaud et al. 2007; Bardsley and Hugo 2010). Moreover, since migration has both positive and negative implications for the environment and for development, policies should focus on facilitating 'positive migration' and avoiding 'negative migration' rather than simply inhibiting migration (Black et al. 2011b). To inform more targeted policies, it is essential to collect considerably more empirical information about how and why different people make different decisions in relation to future climate risk (Kniveton et al. 2008; Black et al. 2011a).

2.3 Inequality, class and environmental change-migration nexus

2.3.1 Introduction

Previous discussion on the interrelationship of environmental change, migration and development has suggested that environmental change is an unequal process with people being affected to different degrees in different ways, as well as being left with different adaptation means and migration options (IPCC 2007; Black et al. 2011b). The climate change impacts experienced, and adaptation means adopted, by populations is greatly differentiated by inequality (Wisner et al. 2004). Class, as a major organising concept to describe inequality and to explain human behaviour (Crompton 1993), however, has limited use in studies of the climate change-migration nexus for the purpose of examining the influence of inequality on adaptation and migration, especially in non-disaster scenarios.

This section aims to examine whether class analysis is an appropriate and applicable approach to investigate inequality in the climate change-migration relationship, and therefore, whether it is able to explain different migration behaviours in the context of climate change. Firstly the varying scope and different types of inequality existing in the climate change-migration nexus that shape adaptation and migration options are overviewed. Then the relationship between inequality and class is discussed, in order to demonstrate that class represents inequality and that the class framework can effectively analyse inequality. This is

followed by an introduction to theories of class, including the development of concepts and measurements. Finally, previous studies that investigate how class shapes migration in general, and environmental migration in particular, are reviewed.

2.3.2 Inequality in climate change-migration nexus

Inequality exists when some people receive more of a society's 'valuable goods' than others, owing to their position in the social network of relationships (Hradil 2001:30). Inequality can be considered an unequal distribution among individuals in relation to: income; wealth; standards of consumption; the desirability of their occupations; their educational attainments, and the extent of their social and cultural participation. It can also be thought of as the social relations providing the context of which individuals are in some sense advantaged or disadvantaged (Goldthorpe 2010).

It is essential to understand that climate change is a very unequal phenomenon in that, in both international and intra-national settings, vulnerable groups always are disproportionately affected and further impoverished and marginalized. This is mainly because their capacity, determined by their degree of socio-economic development, is insufficient to adapt to changes (Adger et al. 2003; O'Brien et al. 2004; Stern 2006:487; IPCC 2007; ISDR 2009; Warner et al. 2009). Inequality is considered one of the root causes of vulnerability to environmental stressors (Wisner et al. 2004), and vulnerability, in turn, 'is central for climate justice because it helps to tie the primary concerns of adaptation scholarship to those of moral philosophy' (Paavola and Adger 2006:604). Reducing vulnerability to climate change and promoting equitable development in the process of climate change remains an important issue for the 21st century (McCarthy 2001:8; Beg et al. 2002).

Dilemmas of equity exist in both mitigation and adaptation to climate change (Paavola and Adger 2006). In the past decade, debates on climate change-related inequality have focused on mitigation of greenhouse gas emissions (Paavola and Adger 2006). This is what underpins the Kyoto Protocol's guiding doctrine of 'common but differentiated responsibility'. According to the guideline, preferential support should be given to the nations which are most vulnerable to the impacts of climate change and have contributed the least to its causes (Mearns and Norton 2010). In recent years, the equity dimension of adaptation to climate change has attracted scholars' research interest. Equity and justice can be considered to have

distributive and *procedural* forms in ‘fair adaptation’ to climate change (Paavola and Adger 2006). Distributive equity relates to the distribution of benefits and costs of climate change (Young 1994; Kolm 1996), and procedural equity relates to the way in which parties plan and make decisions (see Fraser, 2001; Tyler et al. 1997; Young 2000). Principles of ‘putting the most vulnerable first’ and ‘equal participation of all’ are proposed by Paavola and Adger (2006) to address distributive and procedural inequality, respectively.

Issues of equity rank high on international agendas dealing with global climate change (Mearns and Norton 2010). It is widely acknowledged that developing countries are more vulnerable to the impacts of climate change than developed ones (Burton 1996; Smit et al. 2001; Adger et al. 2003). In this respect, enhancing equity in adaptation to climate change relates to:

‘assuring that vulnerable people in the remotest outposts of the world do not become imprisoned in perennial cycles of destitution and impoverishment at the mercy of climate events’ (Sokona and Denton 2001:120).

Equity issues in the context of climate change at local or sub-national levels, however, have received scant attention (Thomas and Twyman 2005), though Adger et al. (2003) observe that local level climate change is likely to affect sectors of society differentially, especially in developing countries.

In a specific community, people face very similar contextual factors, such as environmental, demographic, economic, social, political and institutional conditions. People living in the same community experience different climate change impacts and adopt diverse means of adaptation, largely because they have unequal access to various resources that determine resilience and their adaptive capacity (Adger and Kelly 1999; Burton et al. 2002). Failure to eliminate, or minimise, inequality can result in increased vulnerability and thus exacerbate the adverse effects of environmental stress on societies (Kelly and Adger 2000; Burton et al. 2002). As well as this, inequality also can be intensified due to climate change (Burton et al. 2002; Dulal et al. 2009). Climate change is most likely to affect disadvantaged groups (Dulal et al. 2009), and some mitigation and adaptation measures are even increasing, rather than reducing, vulnerability amongst vulnerable groups (Thomas and Twyman 2005; Mearns and Norton 2010). Vulnerable groups therefore are suffering further deepening and widening poverty and marginalisation. Based on the work of Sevoyan et al. (2013:15), it is argued that

the vulnerable groups disproportionately affected by environmental problems associated with climate change, include the elderly and people with chronic diseases (Abrahamson et al. 2009; White-Newsome et al. 2009); aboriginal communities (Furgal and Seguin 2006); migrants and ethnic minorities (Cheng and Newbold 2010; Yardley et al. 2011); low income groups (Adger 1999; Brooks et al. 2005; Kovats et al. 2010); homeless people (Ramin and Svoboda 2009); people having low educational attainment (Barnett 2001; Paavola and Adger 2006; Deressa et al. 2009); politically powerless groups (Thomas and Twyman 2005; Paavola and Adger 2006), and so on.

Human migration, as an important response to environmental change, is also an unequal process (Wisner et al. 2004; Bolin 2007). Inequality shapes vulnerability to climate change, leading ‘differently positioned social actors to make very different choices with respect to migration’ (Mearns and Norton 2010:26). Migration is often expensive and requires resources such as means of transportation, social linkages, information, etc. Disadvantaged groups are more likely to be displaced when suffering environmental problems but they have few means and resources to enable them to migrate and resettle successfully (Girard and Peacock 1997; Morrow 1997). For example, evacuation from Hurricane Katrina in New Orleans highly relied upon transportation and people having no access to a car were excluded from the evacuation plan (Cutter 2011). In Uganda and Mali, poverty was identified as an important barrier to migration (Findley 1994). Black et al. (2011b) suggest that the greatest risks of climate change will be borne by vulnerable groups who are unable to relocate.

The motives, patterns and consequences of environmental change-induced migration are highly heterogeneous among geographic localities and social groups over time. This is because the frequency and severity of environmental change stressors, and a population exposure to them and their adaptive capacities are not uniformly distributed in a static way across the globe, regions, nations, communities, or even households and individuals (Warner et al. 2009; Hugo et al. 2009; Massey et al. 2010; Black et al. 2011a). Inequality and its impacts on various aspects of human life have been identified as an important factor influencing people’s choice of adaptive strategies (Bardsley and Hugo 2010; McLeman 2013). However, there is a lack of sufficient empirical evidence regarding the linkage between inequality, the effects of climate change, and adaptive strategies involving both in-situ adaptation and migration. Exploring the linkages is thus a pressing need. It is also important to understand that there is no uniform intervention that is effective in addressing issues

associated with climate change and inequality for the world, because these issues are highly sensitive to local contexts. Therefore specific factors that differentiate people's capacities and responses to environmental change should be identified through empirical studies in climate change hotspots for the purpose of developing appropriate and effective adaptation strategies (Warner and Laczko 2008; Warner et al. 2009).

2.3.3 Inequality and class analysis

There is heated discussion upon whether 'class' is an appropriate approach to analyse inequality in this changing world (e.g., Beck 2013; Goldthorpe 2012). Some (Curran 2013) argue that class is insufficient to represent the comprehensive concept of inequality. They correctly point out that inequality will be affected not only by class, but also by other forms of social structure, such as gender and race. Moreover, along with the process of globalization, international inequality has gained prominence. Some researchers (Beck 2013) believe the understanding of class that focuses on conceptualising inequality in a particular society is insufficient to explain the inequality between nations. Beck (2013:65) argues that it is the 'social evolution of global risk', rather than the 'social reproduction of class', that acts as the key concept for understanding social inequality and transformations. Some others (Therborn 2011:3), by contrast, observe that our societies are experiencing a 'historical turn of inequality', involving decline in international inequality and increase in intra-national inequality. Class is still a powerful determinant of inequality and an analytical tool for its examination.

Researchers from different disciplines tend to adopt different measurements in investigating inequality. Economists mainly focus on *material gaps* (e.g., income and wealth), and may also refer to different *educational attainment* which is regarded as a major determinant of income based on human capital theory. Sociological approaches have been neglected in understanding inequality in many societies (Goldthorpe 2012). Sociologists prefer to discuss inequality in terms of *social class* or *social status* because they believe these concepts can explore multi-dimensions of inequality (economic, social, cultural, symbolic inequalities) (Bourdieu 1984), and they treat inequality in both *distributional* and *relational* senses (Goldthorpe 2012).

Crompton (1993:4) asserts that class is ‘a major organising concept in the exploration of contemporary social stratification which describes the systematic structures of social inequality’. She even put it more straight forward by arguing that ‘when there exists inequality could class be hired as an important analytical tool’ (Crompton 2008:8). Class analysis is considered as an appropriate approach to investigate inequality for this study for the following reasons: (1) this study focuses on a specific community within a nation; (2) this study aims to examine inequality in a comprehensive manner going beyond the notion of material gaps; and (3) class has been identified as one of the most important determinants of vulnerability or adaptive capacity to climate change (Wisner et al. 2004; IPCC 2007; Mearns and Norton 2010).

2.3.4 Class theories and measures

The two seminal figures in the area of class were Karl Marx and Max Weber. Marx categorised class on the basis of a group's ‘access to the ownership and control of the means of production and what was produced’ (Crompton 1993:23). Classes are defined in relation to the mode of production as an objective structure. By comparison, in Weberian theory, classes are an outcome of the subjective behaviour of human actors rather than the objective structure. Weber differentiated societal positions based on three dimensions: economic, political and prestige status (Wright 1979). Some sociologists view Weberian theory as a refutation to Marx’s materialism whereas some others think it can easily fit into the Marxian scheme (Lichtheim 1964; Giddens 1970). Burris (1987:68) outlines four important distinctions between classical Marxist and Weberian theories of class: (1) Marx conceptualises class as an objective structure of social positions, whereas Weber perceives class being constructed in the form of subjective social action. (2) Marx holds to a uni-dimensional conception of social stratification, whereas Weber holds a multi-dimensional view. (3) In Marx’s theory, exploitation, rather than political and ideological domination, is the essential logic of class relations and class conflict, whereas for Weber domination is conceived as an end in itself, with its own independent force and logic. (4) Marx considers classes are an expression of the social relations of production, whereas Weber conceptualises classes as common positions within the market.

In the 1970s and 1980s the study of Wright and Goldthorpe, who are seen as leading neo-Marxist and neo-Weberian respectively, significantly influenced class analysis. Both of the

researchers conducted large scale quantitative studies to strengthen the scientific rigour of class studies (Crompton 2008). Wright and Goldthorpe both try to explain and investigate class from the perspective of employment structures, despite the theoretical distinctions existing between their two schemas (Crompton 2010). Wright's class schema, known as the Comparative Project on Class Structure and Class Consciousness (Comparative Class Project), comprises twelve classes and is developed based on the relations to production (Wright 1979). Goldthorpe et al. (1980) develop a class scheme based on the relations to market instead of production. The scheme, namely Comparative Analysis of Social Mobility in Industrial Societies (CASMIN), involves eleven classes that are grouped into three categories – the service, intermediate and working classes. Goldthorpe's class schema gained prominence in the UK, being incorporated into the 'official' class scheme in Britain's, the National Statistic Socio-Economic Classification (Crompton 2008). The 'employment-aggregate' approach presented by the two schemes loomed large in class analysis community from the 1970s to the 1990s (Savage et al. 2005).

Incorporating the employment structure significantly improves the concept of class, but is far from capturing the full spectrum of class's complexity (Crompton 2010). Crompton (2008) outlines a number of difficulties in using occupation as a measure of class. Firstly, classes based on employment structure cannot classify those without a job. Secondly, besides occupation, other factors (e.g., gender, race and age) are also very important in determining one's position in the social hierarchy. Thirdly, occupational title does not give any indication of capital or wealth holdings. Finally, employment-based classes only focus on the economic dimension and fail to encompass cultural dimensions that also shape classes.

Along with social change in terms of the transformation of occupational structure and the growth of feminism in the late twentieth century, this occupationally-based approach is of declining significance in investigating people's attitudes towards class (Clark and Lipset 1991). In the 1980s, traditional industries were transformed, and as a result, there emerged many new occupations, such as managerial, professional, service and self-employment (du Gay 1996). The structure of occupations has dramatically changed, and went beyond the notion of the traditional structure which the class schemas were based. The traditional 'employment-aggregate' approach is insufficient in class analysis to represent the restructured employment system. The argument about the decreasing significance of 'employment-aggregate' class schemas in understanding inequality also focused on gender

issues. Since the 1980s, the participation of women in paid employment significantly increased as a result of 'second wave' feminism. However, the 'employment-aggregate' approach is based on an occupational hierarchy that only took male's occupation as an indicator of class (Crompton 2008). The approach is consequently criticised for failing to address gender issues within class analysis. Crompton (2008:78-79) maintains that:

'gender relations are constitutive of employment relations and conditions, and this means that attempts to develop a "theoretical" account of employment relations that exclude gender will inevitably be partial'.

Rapid changes in employment led to a debate on the 'end of class' (Beck 1992) meaning that class 'loses its impact as a base for identities and interests' (Svallfors 1995:54). However, Crompton (2010) argues that employment transformation only proves an ending to specific class identities, rather than to the end of class-related inequalities. This does not suggest abandoning class analysis, but developing new measures and approaches that are better able to encompass the various dimensions of inequality (Crompton 2008:50).

A number of attempts have been made to broaden the scope of class by incorporating 'the varying dimensions of inequality' and by giving 'due regard to cultural factors' (Crompton, 2008:89). This 'culture turn', which explores the subjective understanding of people's material lives, gained more attention in the social stratification field (Cloke 1997; Crompton 2008). Kumar (1995:115-116) argues that:

'In the late capitalist stage, culture itself becomes the prime determinant of social, economic, political and even psychological reality...Culture has become "a product in its own right"; the process of cultural consumption is no longer merely an adjunct but the very essence of capitalist functioning'.

Lash and Urry (1994) also point out that it is culture, rather than economic position, that gives meaning to social practices, and it is consciousness or reflexivity that determines class structure.

It has been argued that economic and cultural concepts are not mutually exclusive in relation to class, thus they 'should be used in combination with each other' (Sayer 2005:72). Being able to balance the importance of economic and cultural factors in class analysis, Bourdieusism gained prominence in the 1990s. Although Bourdieu recognises that occupation

is generally a 'good' indicator of position in social space and encompasses 'cultural and organisational specificities', he nevertheless argues that the 'employment-aggregated' classes are not 'real, objectively constituted groups' (Bourdieu 1987:4). Bourdieu (1984) suggested that class should be comprised of the multiple dimensions of capital, including economic (e.g. material resources, property, income.), social (e.g. connections, networks), cultural (e.g. cultural knowledge, credentials) and symbolic (e.g. respect and reputation). Levels of these capital combine to constitute a *habitus*, which is a set of acquired patterns of thought, behaviour and taste shared by all individuals from the same economic, cultural, social and symbolic conditions (Fakier 2009:6). Measures of class are therefore extended from economic factors to a far more complex range of capital. Bourdieu's approach is considered 'the most fruitful way ahead' in class analysis (Crompton 2008:114).

Most social scientists agree that there is no single accurate definition of class, or any universally correct measure of it. Wright (2005:180) argues that specific and particular elaborations of the class concept are shaped by 'the diverse kinds of questions class is thought to answer'. Concepts of class may vary according to the analytical task being undertaken:

'a concept whose task is to help answer a question about broad historical variations in the social organisation of inequality is likely to be defined quite differently from a concept used to answer a relatively narrow question about the subjective identity of individuals in contemporary society'.

Moreover, definitions of 'class' will also vary depending on differences in the theoretical frameworks adopted by different authors (Crompton 1998). Crompton (2008:8) thus asserts that:

'... the most fruitful way ahead in "class analysis" within sociology lies in the recognition of plurality and difference (i.e., between different approaches to 'class'), rather than forcing a choice from amongst competing positions, or attempting to devise a completely new or revised theoretical approach'.

She further suggests that class could consist of three sub-concepts: *class structure*, which describes the unequal distribution of resources, *class locations* of persons within the class structure, and *class actions*, which produce or change social inequality. Despite her support for 'plurality' in the definition and measurement of class, Crompton (2008:8-9) believes that some particular concepts and measures are more appropriate for the analysis of particular

problems and topics than others. She suggests that an eclectic combination of the ‘cultural’ with the ‘economic’ (known as ‘positive pluralism’) is most suitable for an ethnography of class structure on a family level (Crompton 2006: 658).

2.3.5 Class analysis in climate change-migration studies

Class and migration: Changes in social class (social mobility) have significant impacts on human migration (spatial mobility) and vice versa (Rye 2006). On the one hand, people’s migration behaviours are strongly differentiated by their class positions (Rye 2006). For example, Rye and Blekesaune (2007) provide empirical evidence that rural people from upper social classes are more likely to migrate than their lower class counterparts. Migration destination similarly varies with class background; those from upper classes are more likely to migrate to urban regions, whereas those from lower classes show stronger intentions to move to other rural or semi-urban areas (Rye 2011). Moreover, the outcomes of migration practices are also proved to have a strong correlation with classes. Generally, people from upper classes are more likely to gain higher wages and achieve higher educational attainment as a result of migration than their lower class counterparts (Rye 2006; Rye 2011). On the other hand, migration may cause changes in the class position of individuals and families (Rye 2006), as well as leading to changes in the class composition of a community (Girard and Peacock 1997).

However, there are relatively few studies that discuss the linkage between class and migration (Fielding 1992), despite the fact that migration and class both have received much attention within the social sciences. Ringdal (1993) and Urry (2000) correctly point out that social mobility research has ignored the spatial dimension of class status attainment, and migration studies have neglected the influence of class background. This is especially the case in rural societies, which have often been considered homogeneous societies with less inequality and class conflict by comparison to their urban counterparts (Cloke 1997; Rye and Blekesaune 2007). Cloke and Thrift (1990) warn that the understanding of rural society has been impeded by a neglect of class-based analysis. Among the limited studies of the relationship between class and migration, most adopt in-depth qualitative analyses, whilst a quantitative approach is rarely utilised (Rye and Blekesaune 2007). This is partly due to the fact that there is a lack of appropriate longitudinal sources which allow for quantitative analyses of the relationship (see Boyle et al. 1998).

The studies on the relationship between class and migration usually adopt simple indicators of class (e.g., income and education), in spite of the complexity of the concept. There are two possible reasons explaining the simplified use of class in migration studies (Rye 2006). Firstly, the theoretical complexities of class make it difficult to identify appropriate measures of class at the empirical level. Secondly, there is always a lack of comprehensive data allowing for sophisticated measurement strategies. Rye (2011) defines class, in a Bourdieusian way, as possession of economic capital (income) and cultural capital (education). His selection is based on the argument of Skogen (1999), who believes that simple measures can represent the concept of class, and generate the convincing results that more sophisticated measures can. Nevertheless, more sophisticated measures of class drawn from more comprehensive data will improve the understanding of the relationship between class and migration (Bolin 2007).

Jenkins (2002) and Rye (2006) point out that the significance and relevance of different measures of social class vary greatly across nations and communities. For example, the measure of social class in rural Norway includes a father's income and education level (Rye 2006), while in rural Ethiopia it is the number of oxen owned by a family (Ezra and Kiros 2001). Even within a nation, the measure of class in rural areas is not the same as it is in urban areas (Rye 2006). For example, the economic capital of class is often defined as income in urban areas, whereas ownership of physical and natural resources, in particular land, may be important for one's position in the rural class structure (Rye and Blekesaune 2007). The inconsistent selection of class indicators is due to two major factors. First, class is a complex concept comprising multiple dimensions that can be measured by different indicators. Second, the selection of class indicators is very sensitive to the geographical and cultural context, which means that class indicators in a community can be very different from those in other communities.

Class analysis in environment-migration studies: The IPCC (2007:729) claims that much new research has indicated that class, among other socio-demographic factors, could differentiate human adaptive capacity to climate change. This is not new, as disaster scholars have long argued that class is central in understanding social processes during environmental events and one of the factors that determine vulnerability and responses to, and the consequences of, disasters (Wisner et al. 2004; Elliott and Pais 2006; Bolin 2007). In the

1950s, blacks and Mexican Americans, who held low status in American society, disproportionately suffered losses and injuries from tornados and consequently needed greater assistance for recovery, compared to their white counterparts (Moore 1958). Bates et al. (1963) also found that lower class blacks had a much higher mortality rate than whites when facing Hurricane Audrey. In the 1970s, disaster studies began to examine the role that class and demographic characteristics played in accessing assistance, in differentiating victim experiences, and in varying recovery processes (Haas et al. 1977; Bolin and Trainer 1978). Bolin and Bolton (1986) found that people from lower classes were more likely to depend upon external assistance, but were less likely to obtain adequate aid from both insurance and the government. In the 1990s, researchers demonstrated that class inequalities can shape people's experience of environmental events. People from lower classes have disproportionate losses and less access to assistance and insurance (Dash et al. 1997; Girard and Peacock 1997). However, compared with other social-demographic factors, such as gender, age and ethnicity, the role of class in differentiating human vulnerability and response to climatic variability and environment change has been much less empirically studied.

Human migration, as a response to environmental change, has been demonstrated to have a relationship to class in the circumstance of environmental disasters and hazards. An early study of evacuation due to flooding in Texas-Mexico border towns, conducted by Drabek and Boggs (1968), indicated that households from lower classes showed a stronger propensity to leave home for their relatives' than those from upper classes. Conversely, Perry and Mushkatel (1986) found that low class groups were less likely to migrate in the face of disaster warnings than their high class counterpart groups. Morrow (1997) clearly claims that, when facing disaster, the lower the social class of the family, the greater tendency of leaving it shows. Girard and Peacock (1997) found that higher class Anglo households were much more likely to leave their homes than their lower class counterparts blacks when being hit by Hurricane Andrew. Elliott and Pais (2006) similarly indicate that low income blacks were most likely to remain in New Orleans through Hurricane Katrina than high income whites, and lower-income homeowners showed stronger intentions to move back to the original hurricane-stricken communities compared with high income groups.

The linkages between social class and environmental migration can also be found in the environmental deterioration scenario (Izazola et al. 1997). Izazola et al. (1997) point out that households with higher social class status have a stronger propensity to migrate than their

counterparts with lower class status, faced with environmental degradation. However, the relationship of social class and migration is much less studied in environmental deterioration scenarios than in disaster scenarios.

Some studies have recognised that environmental migration has an influence on class in the long-run, through reshaping the socio-demographic composition of the community (e.g., Girard and Peacock 1997). However, little research systematically examines the two-way relationship between class and environmental migration, especially the influence of environmental migration on the class position of households and the class structure of communities. It is assumed that environmental migration can influence class and local development in both a positive and negative manner. For example, environmental change-induced migration, as a means to diversify livelihoods, helps to close the economic gap between different classes and thus alleviates inequality in the community. From another perspective, environmental change can accelerate the relocation of better-off classes and, consequently, worsen poverty in the community. Research regarding the impact of environmental migration on class is scarce, mainly because longitudinal data are usually unavailable to examine the long and complex process of class change.

Most quantitative studies on the relationship between class and adaptation to environmental change have not gone beyond measuring class in terms of income, neglecting other important components of class, such as political, cultural and social dimensions (Peacock et al. 1997; Bolin 2007). Bolin (2007) thus asserts that the measures of class in environmental change studies should be extended from the current relative income measure to a more comprehensive set of indicators.

2.3.6 Summary

The concepts and measures of class are very well-established but their implications in empirical studies of environment and migration are still limited. Firstly, the majority of the studies concentrate on disaster scenarios, while the relationship between environment, class and migration is largely neglected in the context of gradual environmental change, which is occurring more frequently than disasters. Secondly, the indicators of class are mainly limited to race in the United States and income (or other forms of wealth) elsewhere, whereas the social, cultural, reputational and political domains are not sufficiently studied. Lastly,

measures of class are not sensitive to the local context, despite the fact that class measures are culturally determined. A comprehensive measurement of class, which is informed by local cultural and socio-economic conditions, is needed in empirical studies, because the climate change-migration nexus is embedded in the complex context of socio-economic development rather than only being influenced by economic factor.

2.4 Conclusion

The relationship between climate change, an important component of environmental change, and migration is evident, yet complex. It should be imbedded in the comprehensive context of development that is shaped by a range of environmental, demographic, socio-economic, political and technological factors (Black et al. 2011a; Foresight 2011). Being influenced by so many factors, climate change-induced migration is highly heterogeneous in terms of causes, degrees of voluntariness, migration patterns, destinations and post-migration development, whether assessed globally or individually (Hugo et al. 2009; Warner et al. 2009). Vulnerable groups always disproportionately bear the cost of climate change and its-induced migration and, consequently, suffer further impoverishment and marginalisation (Adger et al. 2003; IPCC 2007; ISDR 2009). Thus, climate change-induced migration is considered as a process closely entangled with inequality. To facilitate effective adaptation to climate change and sustainable development of vulnerable populations, it is essential to understand the specific dimensions of inequality that shape their vulnerabilities and differentiate their adaptation and migration behaviours. Class analysis has been identified as an appropriate approach to examine inequality in the climate change-migration nexus (Crompton 1993; Bolin 2007; IPCC 2007).

The current literature regarding climate change, social inequality and migration suggests the following major research gaps:

- The empirical evidence of how climate change, migration and development interact multi-directionally and dynamically is still inadequate for developing effective and appropriate policy responses (Hugo 2008b; Warner and Laczko 2008; Hugo et al. 2009).
- Although inequality is considered significant in shaping adaptation to climate change and in influencing development, empirical studies are rarely carried out to explicitly

explain in what ways and to what extent inequality could interact with climate change to influence adaptation and migration, as well as socio-economic development.

- The relationship between climate change, adaptation and social inequality receives much less attention at sub-national levels than at the global level (Thomas and Twyman 2005).
- Class, as a major organising concept to describe inequality and explain human behaviours and as an important factor influencing people's adaptive capacity to climate change, is employed in only limited ways to investigate inequality in the climate change-migration nexus, especially in non-disaster scenarios.
- The analysis of class in environment and migration studies focuses on income inequality while ignoring the social, cultural, symbolic and political dimensions of class (Bolin 2007).

This study seeks to fill these research gaps by exploring the complex interrelationship between climate change, inequality and migration from a comprehensive class perspective that goes beyond economic inequality, and by focusing on environmental degradation scenarios in a specific community in western China.

CHAPTER 3: Conceptual Framework of the Relationship between Climate Change, Class and Migration

3.1 Introduction

Despite the argument that the concepts of climate change, migration, inequality and class are theoretically linked in a context of development (please refer to detailed discussion in Section 2.3), a coherent framework conceptualising the interrelationship between them is absent. This chapter presents an original framework in which the interrelationship can be theoretically and empirically examined. The framework is based on the newly emerging theoretical and empirical case-based literature regarding climate change and migration (McLeman and Smit 2006; Perch-Nielsen et al. 2008; Black et al. 2011a; Foresight 2011), as well as the theory of planned behaviour (TPB) (Ajzen 1991) and class theory (Bourdieu 1984; Crompton 2008). This framework assumes that the relationship between climate change and migration is a non-linear one. It is believed that climate change *per se* does not directly lead to decision making related to adaptation and migration. Rather, it is the experience of the specific impacts of climate change on households and/or individual members that motivate households to choose between in-situ adaptations, migration and doing nothing. The framework demonstrates that there are two main stages when making an adaptation/migration decision: the *experience* stage and the *behaviour* stage.

The chapter is structured as follows. Firstly, it presents an overview of current frameworks of the environmental change-migration nexus. Secondly, the planned behaviour theory and its application to the two-stage decision making process of environmental/climate change-induced migration are analysed. Thirdly, class theories are incorporated into the framework, and specific measurements of class employed in empirical studies are proposed. Then, a new framework of climate change, class and migration is built and discussed.

3.2 An overview of current frameworks of environmental change-induced migration

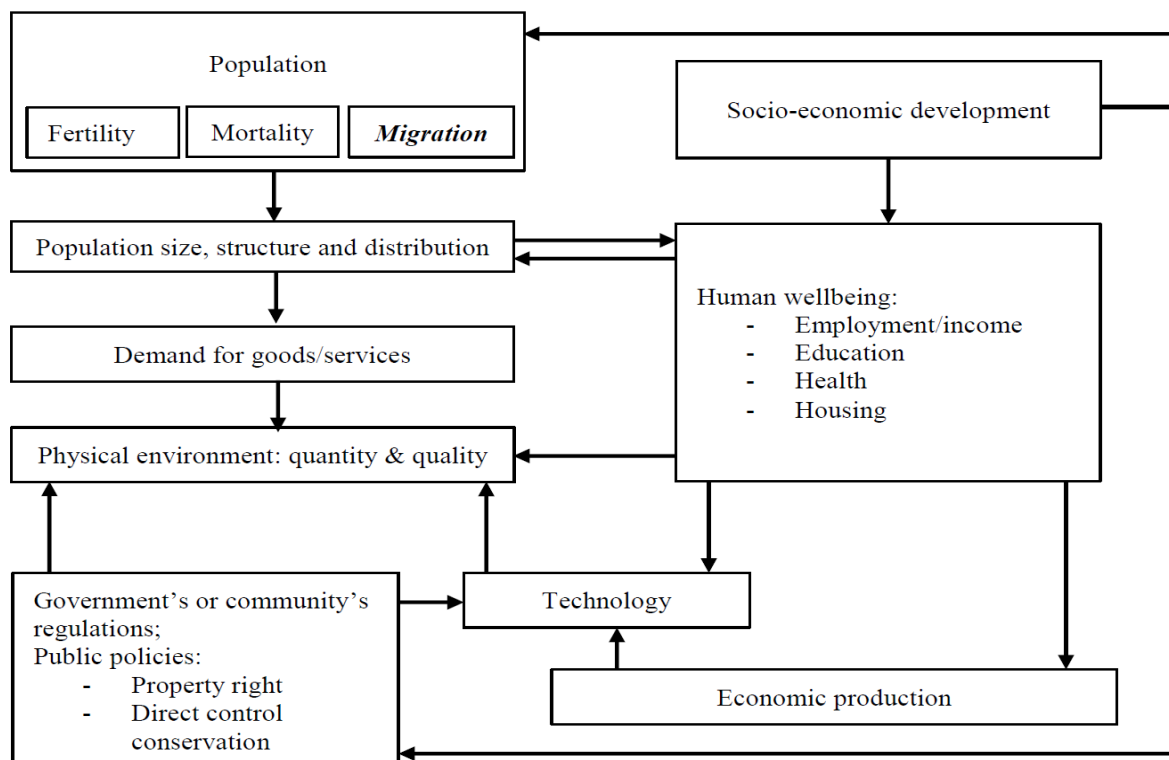
Environment-migration studies tend to focus on migration as a result of environmental problems, rather than viewing migration as ‘a social phenomenon and well established system of social and demographic interaction and change’ (Black et al. 2011a:S5). In recent

decades, more and more researchers have acknowledged that migration in response to environmental change is usually modified by multiple causes (UNESCAP 1989; UNFPA 1991; Hugo 1996; McLeman and Smit 2006; Naik et al. 2007; Perch-Nielsen et al. 2008; Black et al. 2011a). Castles (2010:1566) explicitly argues that migration needs to be understood as ‘one part of a broader set of processes of social transformation arising from major changes in global, political, economic and social relationships’. This implies that research into the linkage between environment and adaptation needs to be placed in the broader context of development.

In 1989, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) introduced a framework to describe the interrelationship between population, environment and development. As presented in Figure 3.1, this framework seeks to:

‘identify or speculate on how population variables affect and are affected by the environment and how intervening factors or policies and measures could be introduced to cope with environmental as well as population problems’ (Hugo 2008b:4).

Figure 3.1: A conceptual framework of the interrelationships between population and the environment



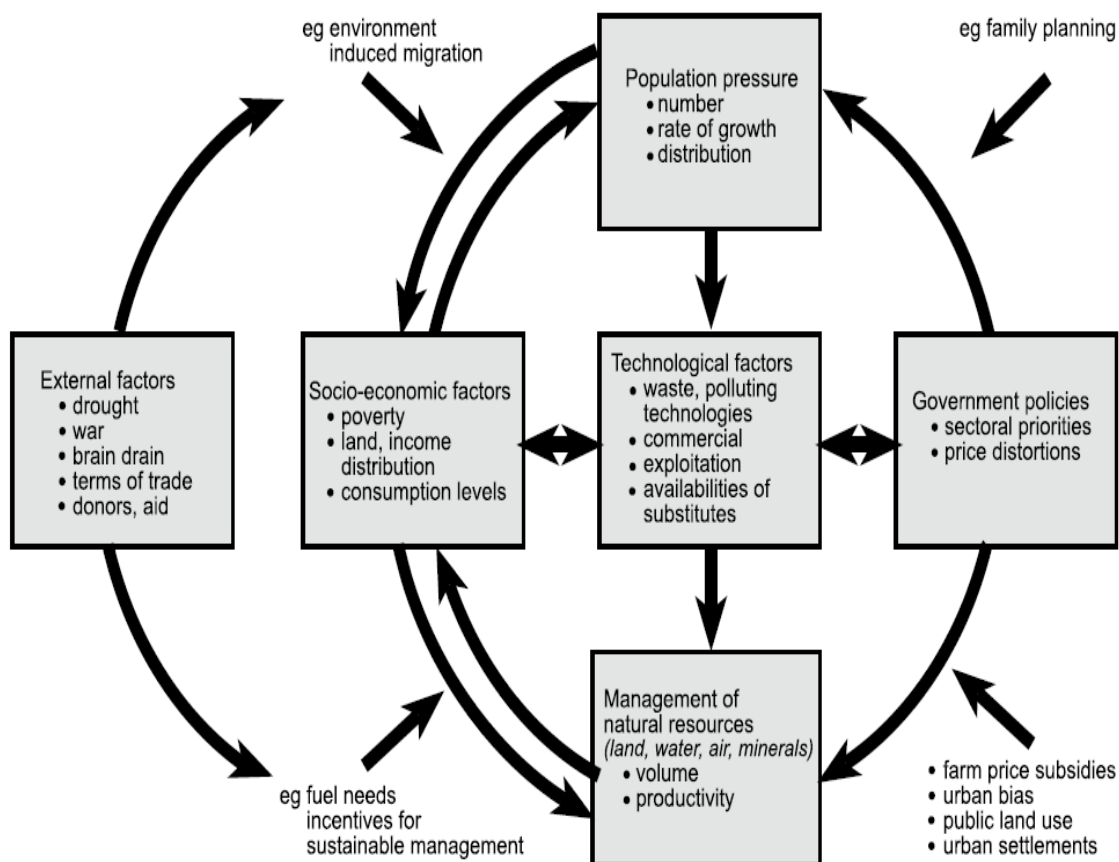
Source: adapted from UNESCAP (1989)

This framework links demographic changes and environmental processes to socio-economic development, human wellbeing, public policies and technology, as well as identifying the linkage between environment and population. This framework innovatively includes migration in population processes that interact with environment processes and socio-economic development at various levels. However this framework does not present the complexity of socio-economic development involved in the environment-population relationship, neither does it examine the influence of the environment and population processes on development. Nevertheless the framework proposes three basic concepts: environment, population (including migration) and development, providing a basic framework of the linkages between environment, migration and development.

Another framework explicitly exploring the role of migration in the interrelationship of population, environment and development developed by the United Nations Population Fund (UNFPA) in 1991 is shown in Figure 3.2. This framework explicitly uses the term ‘environment induced migration’, and links it directly to both population pressures and socio-economic development and indirectly to political, environmental, and technological factors. In this framework, migration is considered as both a cause and a consequence of environmental pressures and it occurs in the process of the interaction of population pressures and socio-economic factors. This framework details the multiple dimensions and specific indicators of development that may influence the environment and migration, though multi-levels of development (e.g., development at national, community and household level) are not identified.

The report of UNFPA (1991) did not demonstrate the details of the multi-directional relationship between the environment, migration and development; though it believed migration was both cause and consequence of environmental pressures and development. Naik et al. (2007) explore the multi-directional feature of the relationship by focusing on a disaster scenario. Their findings suggest that: (1) development may either promote or inhibit migration in the context of disaster; (2) disaster can draw in-migration as well as driving out-migration through its impacts on socio-economic conditions; and (3) migration can influence the development and environment in both positive and negative ways (Naik et al. 2007:14-15). Although focusing on natural disasters, this study provides an insightful reference for examining other forms of environmental change and its relationship to development and migration.

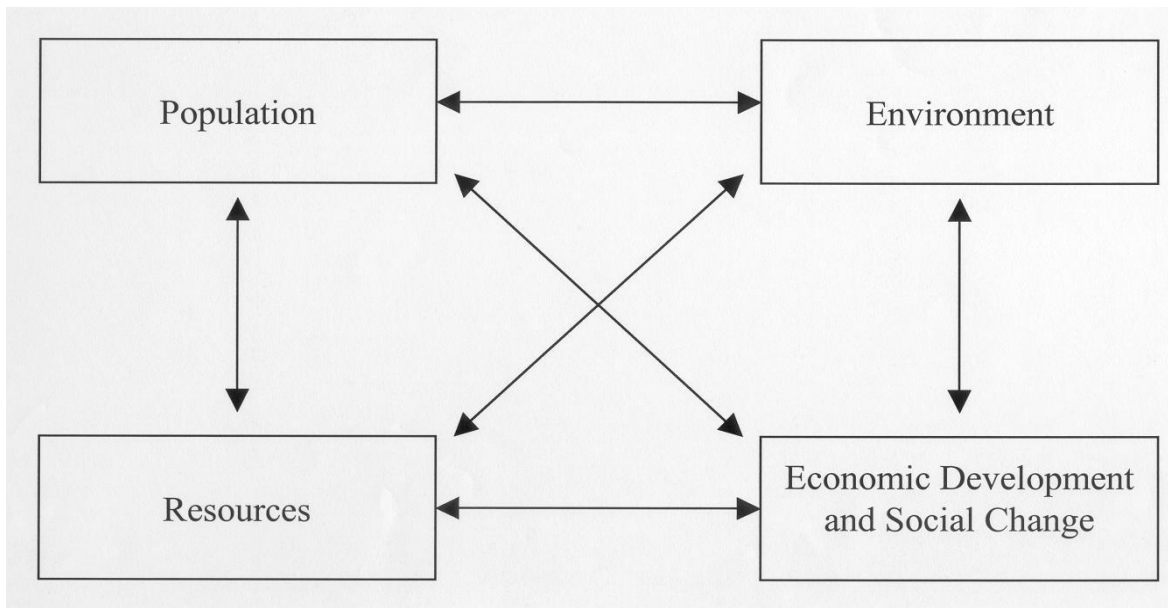
Figure 3.2: The links between demographic and natural resource issues



Source: Hugo (2008a:11)

A clearer and more general framework of the interrelationship between the environment, migration and development (Hugo 2008a) is depicted in Figure 3.3. The term ‘environment’ could represent any kind of environmental change, including those associated with climate change. Migration, as an important population process, clearly fits in the ‘population’ part of the diagram because it can change the population size and distribution. An advantage of the framework is that the relationships between the environment, population and socio-economic development are all viewed as being bi-lateral, with each factor being both a cause and consequence of the other one. This can inform a sophisticated understanding of the relationship between climate change, migration and development: climate change and migration can influence, and be influenced by, each other in a context of development.

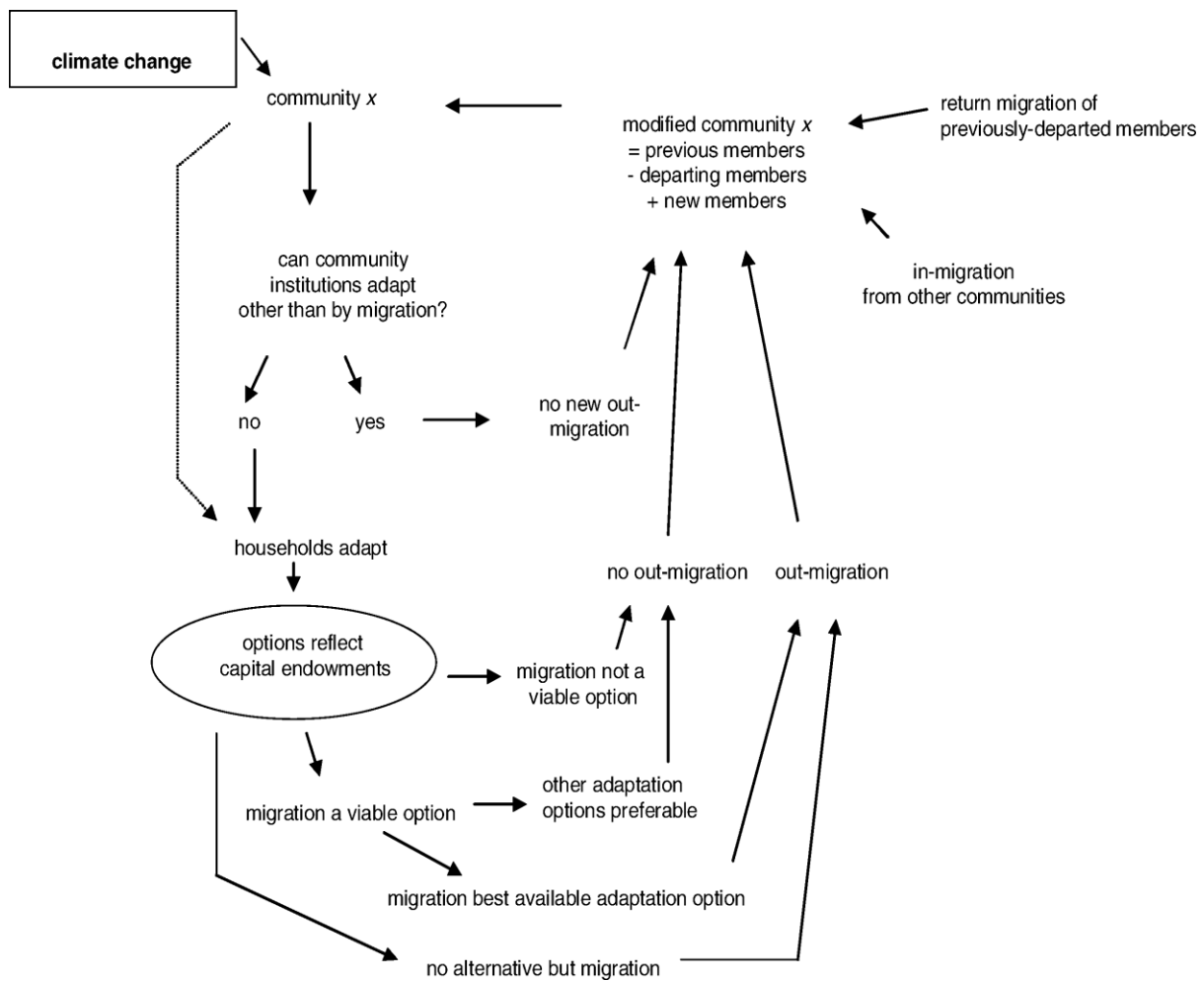
Figure 3.3: A complex interrelationship: Migration, environment, resources and development



Source: Hugo (2008a:9)

One of the earliest works conceptualising climate change particularly, rather than general environmental change, and migration is that of McLeman and Smit (2006). As shown in Figure 3.4, this framework demonstrates that climatic change, interacting with vulnerabilities determined by the institutions of community and the economic, social and cultural capital endowments of households, will differentiate household migration patterns, which, in turn, will reshape the demography and development of the community. This framework convincingly points out that climate change-related migration is a very selective process, with some people migrating, while others staying, even when they face very similar pressures associated with climate change. This framework has gained wide acceptance, possibly because it simultaneously presents the following notions: (1) there are multi-levels (e.g., community and household levels) and multi-dimensions (e.g., economic, social and cultural capital) of development that may determine people's vulnerability and their subsequent adaptation options; (2) migration is a deciding factor of population and development of community as well as being a response to climate change; and (3) migration is seen as only one of the adaptive options that vary between displacement and proactive strategies. This framework can be further strengthened by detailing the factors that influence community institutions and the ways through which population changes influence development of community.

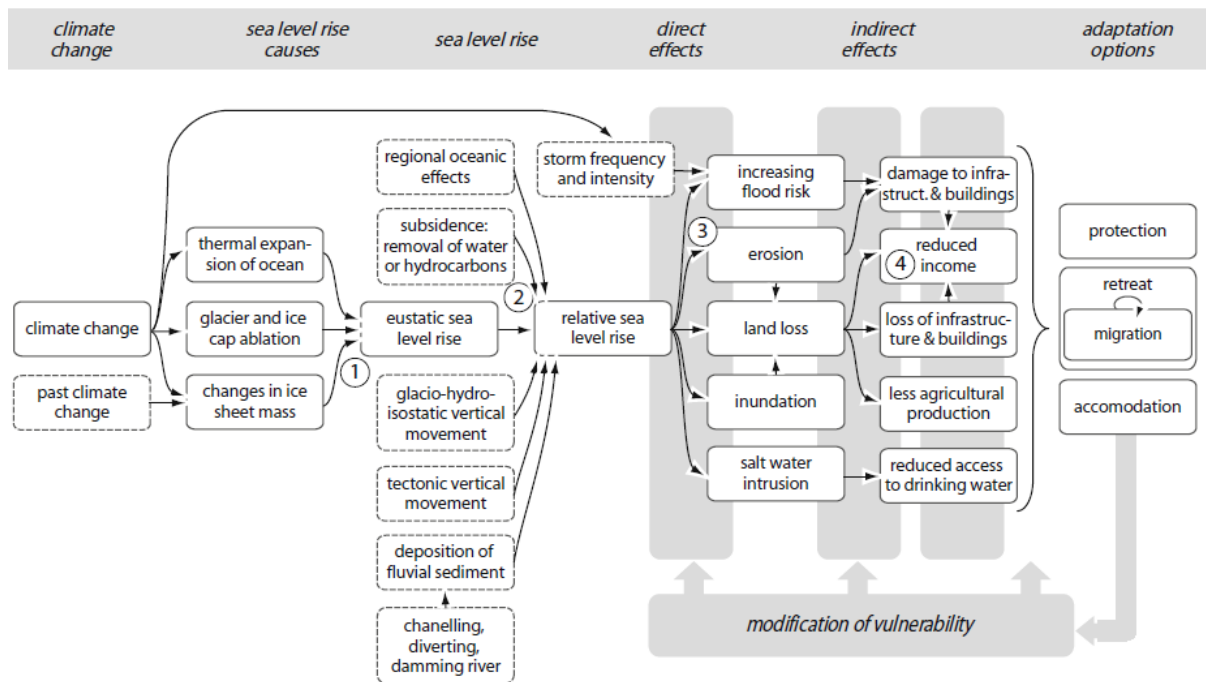
Figure 3.4: Migration as an adaptation to climate change



Source: McLeman and Smit (2006:47)

In their study of migration associated with sea-level rise and river and coastal floods, Perch-Nielsen et al. (2008) propose a theoretical framework of migration decision-making in the event of hazards as shown in Figure 3.5. They correctly point out that there are a range of adaptation strategies that are alternative options to migration when people are affected by climate change. An important contribution made by this framework is that it identifies two phases of climate change effects – direct effects and indirect effects – through which sea level rises/floods associated climate change can initiate migration or other forms of adaptation. This framework clearly indicates that it is not climate change *per se*, but the effects of climate change (both direct and indirect) that determine people’s adaptive behaviour. However, this framework does not take into consideration some important contextual, household, and individual factors that can also influence the effects experienced by people and the forms of adaptation adopted.

Figure 3.5: Conceptual model of the influence of climate change on migration through sea level rise



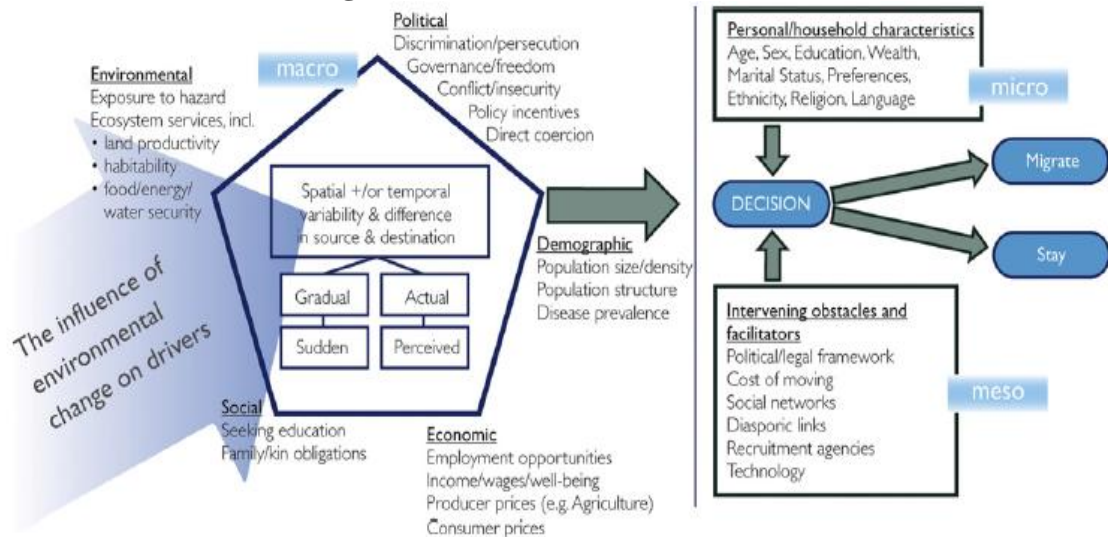
Source: Perch-Nielsen et al. (2008:385)

Recently, a model conceptualising the effects of environmental change on migration developed by Black et al. (2011a) as shown in Figure 3.6, has drawn wide academic attention. One advantage of this framework is that it summarises three specific levels of factors influencing decision making on migration: Firstly, ‘macro’ factors, including demographic, economic, social, environmental and political drivers; secondly, ‘meso’ factors, referring to intervening obstacles to, and factors facilitating, migration; and thirdly, ‘micro’ factors, involving household and individual demographic characteristic. In a similar way to the work of Perch-Nielsen et al. (2008), this framework also acknowledges that climate change influences migration decisions indirectly, not directly.

These conceptual frameworks show that climate change, migration and development can multi-directionally influence each other, both positively and negatively. Environmentally-induced migration is not limited to displacement that occurs without planning by people. Rather, the decision-making processes of migration are marked by complexity and are simultaneously, and progressively, informed by influencing factors that have multiple levels and dimensions. In most circumstances except for sudden disasters, people will go through a

decision-making process before they actually adopt migration or in-situ adaptation, or not adapting at all.

Figure 3.6: The drivers of migration



Source: Black et al. (2011a:S5)

Many recent frameworks have acknowledged that adaptive decision-making is a multi-staged process (e.g., McLeman and Smit 2006; Perch-Nielsen et al. 2008; Black et al. 2011). For example, Perch-Nielsen et al. (2008) demonstrate that there is an ‘effects’ stage that exists prior to the ‘adaptation’ stage. Specifically, people experience the specific impacts of climate change, such as reduced income, loss of buildings, reduction in agricultural production, and reduced access to drinking water, then decide to move or stay. An understanding of the ‘effect stage’ is crucial for linking climate change to the ‘adaptation’ stage. However, the factors shaping each stage are not explicitly developed in these conceptual frameworks, nor are the multiple stages carefully empirically investigated (Tan et al. 2014). An understanding of the decision making process of climate change-induced migration should be heavily based upon behaviour theory, as well as environment and migration theory and practice.

3.3 Incorporation of the planned behaviour theory

According to Hugo (1996), environmental migration should be seen as existing on a continuum incorporating two extreme ends: totally forced and completely voluntary. There are surely migrants who are affected by extreme events (e.g., tsunami, hurricane, flood, and sea water inundation) and who are left with no choice but to migrate. Nevertheless, in reality,

most climate change-induced migration is located between the two extremes (Hugo 1996). This implies that in most circumstances, particularly slow-onset climate change processes, people are left with capacities, to a more or less extent, to make decisions regarding migration and other adaptive strategies. Climate change-induced migration is largely a planned behaviour rather than being a forced or unplanned one in most circumstances except for sudden disasters. This thesis aims to investigate the relationship between the impacts of climate change and migration in non-disaster scenarios, and thus the theory of planned behaviour (TPB) (Ajzen 1991) could provide an appropriate and effective approach to model the relationship between climate change and migration in this study.

The theory of planned behaviour, originating from the theory of reasoned action first introduced by Ajzen in 1985, has become one of the most influential theories in the prediction of human social behaviour (Ajzen 2011). The TPB suggests that a person's 'intention' to engage in a certain behaviour is the most important determinant of that behaviour; and the factors shaping people's intention include 'attitudes', 'subjective norms' and 'perceived behavioural control' (Hale et al. 2002; Ajzen and Fishbein 2005; Fishbein and Ajzen 2011). In this theory, people's attitudes signify an overall positive or negative evaluation of an intended behaviour and perceived behavioural control is described as 'a general sense of personal competence or perceived ability to influence events' (Fishbein and Ajzen 2011:153). Planned behaviour is assumed to be the immediate antecedent of actual behaviour. However, planned behaviour can only perfectly influence actual behaviour if an individual has complete control over performing or not performing the action (Wheeler et al. 2014). Ajzen (2011) therefore claims that the intention-behaviour relationship also depends, in part, on factors that are beyond the individual's control and the strength of the relation is moderated by 'actual control' over the behaviour. The processes of translating planned behaviour to actual behaviour are mediated by actual behavioural controlling factors, which include people's socio-economic characteristics, and their skills, resources, and abilities (Fishbein and Ajzen 2011).

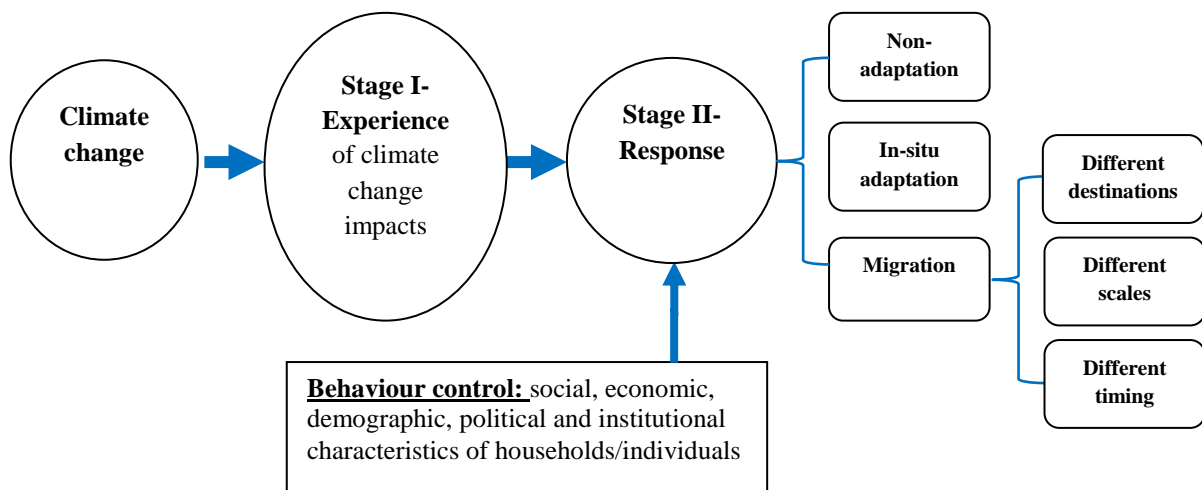
Some reject or question the theory as an adequate explanation of human social behaviour. For example, Wegner and Wheatley (1999) and Wegner (2002) tend to deny the importance of consciousness as a causal factor. Some believe human social behaviour is driven by implicit attitudes (Greenwald and Banaji 1995) and other unconscious processes (Aarts and Dijksterhuis 2000; Uhlmann and Swanson 2004) instead of by conscious intentions. Some

studies empirically illustrate that intentions are sometimes not sufficient predictors of behaviour (Kor and Mullan 2011). Despite these criticisms, the intention-behaviour correlation is usually found to be quite substantial and the theory of planned behaviour does in fact predict human social behaviours quite well (Ajzen 2011).

The theory of planned behaviour has provided a theoretical basis for a number of studies of environmental behaviour in general (Bamberg and Möser 2007), and for adaptation to environmental change in agricultural sector in particular (Sinden and King 1990; Fielding et al. 2008). These studies confirm the importance of attitudes in driving behaviour. Some studies provide evidence that people's intention to take adaptive action in response to environmental problems is rooted in their experience of being impacted by that problem (Sinden and King 1990; Vedwan and Rhoades 2001; Thomas et al. 2007). Sinden and King (1990) outline a three-stage process in farmers' behaviour to protect soil: (1) experiencing soil deterioration; (2) recognising that the problem needs resolving; and (3) intending to resolve the problem. Weinstein (1989) indicates that experience of serious environmental impacts can increase farmer's adaptive preparedness; whereas some others argue that increased adaptation is not always the result of experiencing worse impacts (Wong and Zhao 2001; Whitmarsh 2008). The mixed evidence reminds us that the linkage between climate change, experience of climate change impacts, and adaptation/migration should be studied in context-specific settings. Theoretically, recognition of the experience of environmental impacts can shape people's intention to adapt to these impacts, thus leading to planned adaptation behaviour and, ultimately, resulting in actual adaptation behaviour, taking into account behaviour controls (e.g., socio-economic characteristics, resources and capacities). Actual experience of climate change is one of the most important factors shaping adaptation behaviour at the individual, household and societal level (Vedwan and Rhoades 2001; Thomas et al. 2007).

Applying the TPB to the current conceptual frameworks of climate change and migration can verify and specify the multi-stages of the migration decision-making process. Based on the TPB, it is assumed that the stages linking climate change to actual migration behaviour will include: (1) the impacts of climate change experienced by people; (2) and intentions to avoid or change the adverse impacts of climate change; (3) planning behaviour in relation to migration or other means of adaptation. Figure 3.7 illustrates the framework incorporating the theory of planned behaviour into the climate change-migration nexus.

Figure 3.7: Conceptual framework: A two-stage decision making process of adaptation to climate change



Source: Based partly on Ajzen (1991) and Black et al. (2011a)

This general framework demonstrates that climate change, together with other macro contextual domains (e.g., social, economic, political, environmental and demographic factors) and being moderated by micro behaviour control factors (e.g., socio-economic, demographic and political resources processed by an individual), could lead to different adaptation strategies. The frequency and intensity of climate change and the macro contextual factors are more likely to influence the impacts of climate change experienced by people. However, the micro factors controlling behaviour can significantly predict adaptation behaviour. This framework assumes people living in climate change-affected areas will plan to migrate when climate change impacts are affecting various aspects of their lives, and they view migration as a better means than other adaptation strategies to avoid, eliminate or alleviate the adverse impacts. The plan to migrate becomes actual behaviour when people have sufficient resources and abilities to migrate. Migration patterns are also differentiated by the combination of climate change and its impacts experienced by people, together with macro contextual factors and micro factors that control behaviour.

The initial conceptual framework shown in Figure 3.7 establishes two stages of the migration decision-making process that bridge climate change and migration: the *experience stage* and *response stage*. It is always assumed that recognition of a problem and the intention to solve the problem are highly correlated (Wheeler et al. 2014). This framework therefore proposes the term ‘experience stage’ to represent the combination of the recognition stage of climate

change impacts and the intention stage to solve the problem. The framework also combines the stages of planned behaviour and actual behaviour into the term ‘response stage’, because people’s sense of self-competence and their actual ability to undertake migration are both shaped by same behavioural control factors, including demographic background, experience, possession of and access to various socio-economic resources, and outside supports.

3.4 Incorporation of class theory into the framework of climate change and migration

Class analysis, as discussed in section 2.3, is identified as an appropriate and effective approach to examine inequality issues in the climate change-migration process (Crompton 1993; Goldthorpe 2012). One prerequisite for incorporating class theory into the framework of the climate change-migration nexus is to identify the domains of class and the specific indicators of each domain. As discussed earlier, there is no single correct definition, or uniformly correct indicator, of the concept of class. Instead, the concept varies because it is shaped by different class-related questions for which answers are sought and because it is culturally specific (Wright 2005; Crompton 2008). In this study, the concept of class is adopted to investigate the inequality existing in the climate change-migration nexus. In the existing literature regarding mitigation and adaptation to climate change, inequality issues are widely observed in the international community (Paavola and Adger 2006), but receive less attention at local levels (Thomas and Twyman 2005). This study focuses on the relationship of climate change, inequality and adaptation (rather than mitigation) in a specific community at a sub-national level, where the macro contextual domains (e.g., environmental conditions, economic, social, political, and cultural factors, and institutional situations of the community) are almost the same for all people living in this community. In this respect, inequality in this study refers to the uneven distribution of various ‘micro’ resources, or capital, processed or accessed by each household.

When the class concept is employed to investigate inequality at the *household level*, an eclectic combination of economic, social and cultural capital is considered most suitable for understanding this dimension of class (Crompton 1998). Bourdieu’s theory of class, being able to balance the roles played by the different types of capital, is regarded as the most fruitful ‘way ahead’ in class analysis (Crompton 2008:114). One of Bourdieu’s key conceptual innovations was the classification of four types of capital: economic (wealth,

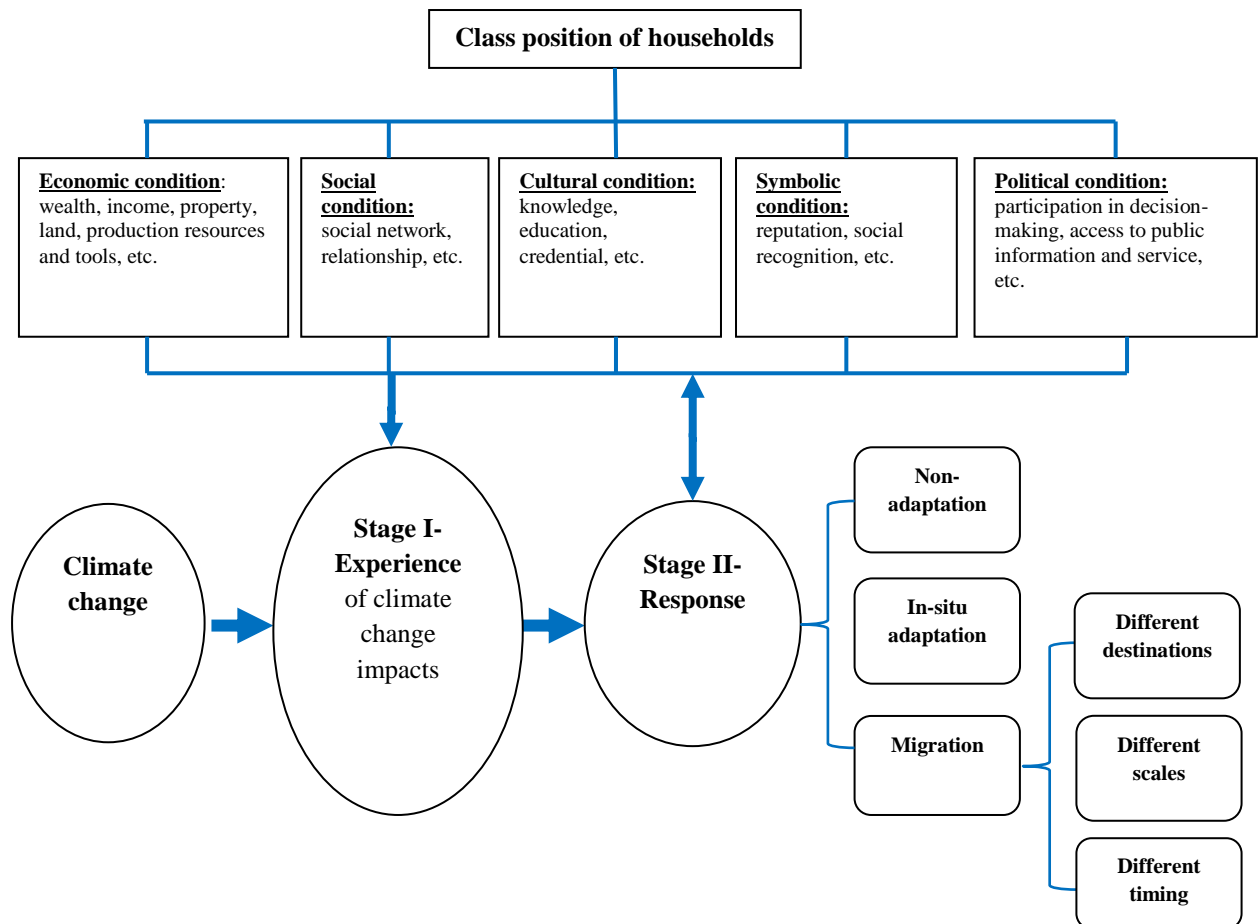
income, property and other types of material resources); social (social connections and networks); cultural (cultural knowledge, education and credentials); and symbolic (respect, social recognition and reputation) (Bourdieu 1986; see also Savage et al. 2005; Crompton 2008). The capitals, and their measures, developed in Bourdieu's class theory provide a comprehensive and eclectic approach for empirically investigating inequality at the household level. However, one important factor that reflects people's status and significantly influences people's adaptation to climate change – access to decision-making processes – is not included in Bourdieu's theory. Adaptation research has proven that unequal participation in decision making is as important as the uneven distribution of resources in shaping people's adaptive capacity to climate change (Young 2000; Fraser 2001; Paavola and Adger 2006). The degree of participation in decision-making process can differentiate people's access to public resources and assistance and ultimately influence their adaptation to environmental stressors (Thomas and Twyman 2005). This is particularly the case in Chinese societies (Bian 2002) (This is discussed in Subsection 5.4.4). Therefore, in addition to economic, social, cultural and symbolic capital, a domain of political capital, which relates to people's participation in adaptation decision-making process and access to public support, should be considered as an important indicator of class in a study of climate change, inequality, adaptation and migration in western China.

Compared to the theoretical sophistication of Bourdieu's theory of class, empirical measures of class in existing studies of the environment and migration are overly simplified. The commonly-used indicators of class in migration studies are usually limited to income, land, and education level (Rye 2006; Rye and Blekesaune 2007), and income, property and race/ethnicity in studies of the environment, adaptation and migration (Moore 1958; Bates et al. 1963; Girard and Peacock 1997; Elliott and Pais 2006). Simplistic empirical measures cannot thoroughly reflect the complexity of Bourdieu's class theory and this may compromise the empirical results of class analysis of the climate change-migration nexus. Better economic, social, cultural, symbolic and political/institutional data will enable a more thorough class analysis and promote consistency between class theory and empirical study.

Based on Bourdieu's theory of class (1984) and the concept of 'fair adaptation' to climate change (Paavola and Adger 2006), a framework (Figure 3.8) is developed to illustrate that class can influence a household's adaptation and migration behaviour, in the circumstances of

climate change, through shaping the economic, social, cultural, symbolic and political conditions of that household.

Figure 3.8: A two-stage decision making process of adaptation to climate change, moderated by class



Source: Partly based on Bourdieu (1984); Paavola and Adger (2006); Black et al. (2011a)

Households are hypothesised to bear more of the costs of climate change impacts and benefit less from adaptations when they have worse economic, social, cultural, symbolic and political conditions. Figure 3.8 shows how the class position of a household can influence both the impacts experienced, and the adaptation strategies, chosen by different households. Specifically, class factors are firstly employed to analyse how climate change interacts with inequality to differentiate people’s experience of climate change impacts, then to investigate how these different experiences combine with inequality to produce varying adaptation and migration behaviours. This suggests that class analysis, employed to analyse the climate change-migration nexus at the household level, can contain the multi-domains suggested by Crompton (2008). That is, the *class position* of a household, based on a *class structure* which

describes inequality in the distribution of resources, and *class actions* which produce social change. The class position of a household and its associated possession of, and access to, various capital will influence its migration decisions; while migration behaviour, in turn, has the potential to reshape the household's class status and even, therefore, restructure the class composition of the local community. Theoretically, class can be an action to change the structure of local society by producing different migration behaviours. Therefore, the interrelationship between climate change, class and migration should be seen as a multi-directional one.

The intention here is not to inquire in depth into the theoretical details of class but to assess which existing theories and measures of class are appropriate and applicable for developing a conceptual framework, as well as informing empirical case studies, of the interrelationship between climate change, class and migration.

3.5 A new framework of the interrelationship between climate change, class and migration

When both the Theory of Planned Behaviour (TPB) and class theory are integrated into the current climate change-migration models, a new framework is developed, as shown in Figure 3.9. The new framework is able to inform empirical work that examines how climate change interacts with multiple inequalities shaped by class to differentiate adaptation and migration behaviour.

Five components are included in the new framework as presented in Figure 3.9:

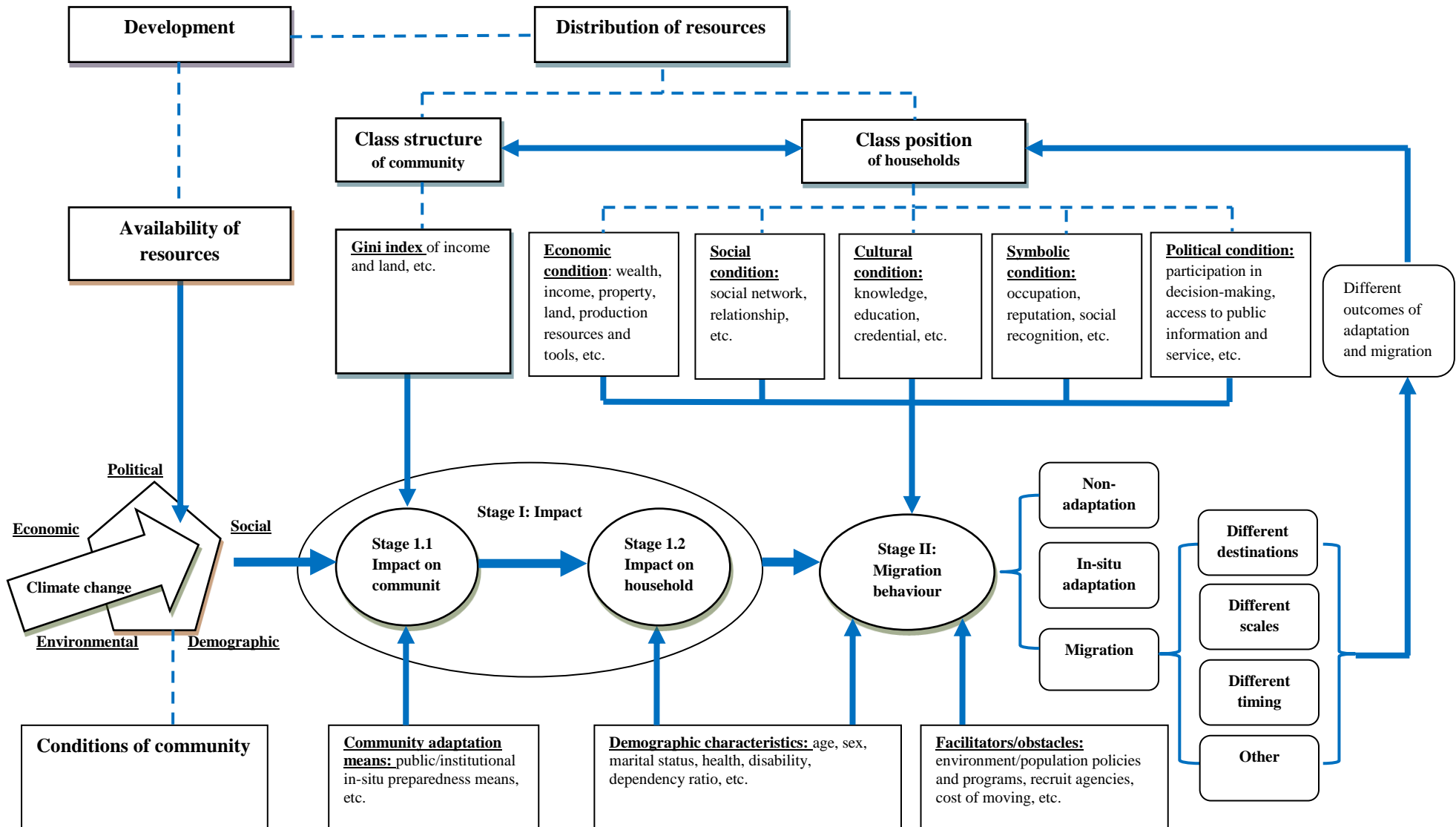
- (i) The identification of two sub-concepts of development: *availability of resources* which refers to the level of development and *distribution of resources* which relates to the social equity dimension of development.
- (ii) The incorporation of the TPB and the identification of the two stages of decision-making processes in climate change-induced migration: the *experience stage* and the *response stage*.
- (iii) The incorporation of class theory as *micro determinants* influencing impacts of climate change recognised by people and *behavioural control* factors shaping people's final migration decisions.

- (iv) The identification of two dimensions of class analysis: *class structure* indicating the community's inequality, and *class position* that specifies a household's economic, social, cultural, symbolic and political conditions.
- (v) The distinction within migration (or non-migration) decisions, as well as between different migration patterns.

This framework focuses on migration decisions made as *private adaptation* at the *household level*, though migration can occur at multiple levels in both the public and private sectors (Adger et al. 2003). Many households, or even communities, have been, or will be, organised by government to migrate, either permanently or temporarily, as a public adaptation measure. The evidence for this can be found in ecologically fragile areas in China (Shi et al. 2007; Tan et al. 2013), disaster-stricken areas in North America (Elliott and Pais 2006), areas in Africa subject to environmental problems (Adugna 1989), and climate change threatened low-lying small island states in the Asia Pacific (Hay and Beniston 2001). Government-led migration in China is largely compulsory and is overwhelmingly decided by public plans. Other drivers/inhibitors of migration, including the class positions of households, do not play significant roles in the decision-making process. Compulsory resettlement, organised by government, is thus not discussed in this framework. However, other public policies or programs regarding the environment, climate change, in-situ adaptation, migration, and socio-economic development are considered important in this framework because they can act as determinants of climate change impacts and as facilitators or barriers to migration.

It is argued repeatedly that the climate change-migration nexus should be embedded in the complex context of development (Castles 2002; Hugo et al. 2009; Castles 2010; Black et al. 2011a). It is argued that social equality, as an important indicator of development (Robinson and Herbert 2001; Munasinghe et al. 2003; Kates et al. 2005), is as important as the availability of social, economic, and technological resources, in shaping the climate change-migration nexus. In a specific local community, where macro contextual factors, determined by the development level and the climatic situation, are very similar for all the residents of the community, the role of inequality determining micro resources obtained by people will loom large in differentiating the impacts experienced, and the adaptation adopted, at the household level. This framework focuses on the equity dimension of development in a community, while still acknowledging that the availability of resources can influence the macro contextual drivers of migration.

Figure 3.9: Conceptual framework of the interrelationship between climate change, class and migration



This framework assumes that climate change can stimulate some kinds of contextual change in a given community. These changes challenge the community's institutions (McLeman and Smit 2006). The pentagon in the lower left-hand corner presents the five dimensions of a community's condition (environmental, economic, social, political and demographic) that can be challenged or influenced by climate change. The degree of efficiency and effectiveness of the community's adaptation to climate change (and its associated socio, economic, political and other stressors) can directly influence its residents' experience of climate change impacts. If community institutions can adapt effectively to climate change, its residents are likely to experience fewer negative impacts. Thus, the *experience* stage of the framework is divided into two sub-stages: the *impact on community* and the *impact on households*. Both of these two sub-stages are influenced by class. The *class structure* of the community, indicating the degree of unequal distribution of social, economic and political resources, can influence the impacts borne by a community. The *class position* of households in the community, based on their possession of, and access to, economic, social, cultural, symbolic and political resources can shape their own experience of climate change impacts.

The specific impacts of climate change vary across communities and over time. As summarised by Tan et al. (2014), the important generalised aspects of climate change impacts may include: (1) increased mortality and declining health status (Peng et al. 2010; Shuman 2010); (2) deterioration in the economic situation (e.g., declines in livelihoods, employment and income, and increases in living costs) (Tol 2009; Oral et al. 2012); and (3) worsening living environment (e.g., deteriorated housing and transportation conditions) (Morton 2007; Lwasa et al. 2009). Some case studies identify more specific impacts. For example, in the study of Massey et al. (2010), focusing on environmental change and migration in Nepal, three out of the five basic measures used to assess local environmental change refer to the specific impacts of environmental change at the household/individual level: individual's perception of changing agricultural productivity, the time required to collect firewood, and the time required to gather animal fodder. Perch-Nielsen et al. (2008) identify the following specific impacts of sea level rise on people: loss and damage to infrastructure and buildings, reduced income, decreased agricultural production and reduced access to drinking water. It is critical to note that the specific impacts of climate change on a community and its residents are often location and time specific, and are affected by local social, economic, political and institutional conditions.

Households will enter the *response* stage after they experience the negative impacts of climate change. The TPB, adopted in my framework, suggests that the factors controlling behaviour will significantly influence the final decision regarding migration. Behavioural control factors include the socio-economic, political and demographic characteristics of a household, which largely overlap with the indicators of class. Therefore, combining the TPB and class, the framework employs five indicators of class that act as behavioural controls. The demographic characteristics of households and their family members, which are not indicators of class, are listed separately as indicators of another set of behavioural control factors.

In this framework, neither migration nor non-migration is simply considered as a completely proactive adaptation to, or passive acceptance of, climate change. The framework acknowledges the existence of multiple characteristics of migration or non-migration. Migration can be a completely proactive adaptation strategy, or it can be a forced displacement; in other cases, means of adaptation can lay somewhere between these two extremes. Nevertheless, non-migration (staying) is not necessarily an optimal response to climate change. The ideal situation is that people do not need to move if facing negligible impacts, or they can successfully adapt in-situ. However, non-migration may also suggest that some people are trapped because they lack necessary resources needed for migration even if they intend to do so (Black et al. 2011b). The different nature of migration (or non-migration) and the various patterns of migration will lead to different outcomes for households. These may facilitate a change in the class status of the family and, consequently, influence the class structure and equality of a community.

3.6 Conclusion

This chapter established a two-stage framework conceptualising the linkages between climate change, class and migration at the household level in a specific community. This framework has been built on three groups of theories and models: environmental/climate change-migration models, the theory of planned behaviour, and class theory. At Stage I, the class structure of a community and the class position held by households influence the specific impacts of climate change experienced by different households. The varying experience of impacts will arouse differential recognition of climate change as a problem and stimulate different intentions to solve these problems. At Stage II, the adaptation and migration

behaviour of households in response to climate change is rooted in the specific impacts they have experienced, and is also influenced by their class status and other behavioural controls. The two-stage framework informs a two-stage analysis, incorporating the results of the first *experience stage* into the analysis of the second *response stage*. The conceptual framework and analytical approach can be applied to empirical case studies in different communities.

CHAPTER 4: Methodology

4.1 Introduction

Methodology is the ‘strategy or plan of action that links methods to outcomes’ and which ‘governs our choice and use of methods’ (Creswell 2003:5). This chapter details the research methodology and the underlying epistemology and theoretical perspectives that are used in this study to examine the interrelationship between climatic variability, class and migration in western China. A mixed methods approach, involving both quantitative and qualitative analysis (Creswell 2003), is employed to collect and analyse both primary and secondary data in the study area. This study is deductive in nature because it first formulates research questions and then answers them with detailed empirical evidence (Bryman 2004; Neuman 2006).

This chapter begins with a brief discussion of the epistemological and philosophical bases of the study, followed by the justification for choosing a mixed methods approach. The research design is then detailed. Specific quantitative and qualitative methods used to collect and analyse data are explicitly discussed in the subsequent sections. A discussion of experience gained and lessons learnt from the fieldwork then follows. The chapter concludes with a reflection on the innovations and the limitations of this study’s research methods.

4.2 Pragmatism and mixed methods approach

Three essential elements of research methodology combine to inform research approaches. They are, firstly, the epistemological and philosophical assumptions that lie behind the methodology. Secondly, the methodology strategy that governs the choice and the use of methods, and, lastly, the specific techniques and procedures called methods that are employed to collect and analyse data (Crotty 1998). Epistemological and philosophical assumptions are defined as a researcher’s ‘certain assumptions about how they will learn and what they will learn during their inquiry’ (Creswell 2003:6). Creswell (2003) specifically summarises four major schools of thought within these assumptions: post-positivism, constructivism, participatory approaches and pragmatism; He also points out that these different assumptions underpin different research strategies.

Among the four schools, pragmatism is the one that pays most attention on the research problem itself, rather than on research methods (Rossman and Wilson 1985). Pragmatists do not commit to any single philosophy and insist that the core principle for method selection should be the one best meeting the research needs (Creswell 2003; Johnson and Onwuegbuzie 2004; Tashakkori and Teddlie 2010). Therefore any techniques and processes can be simultaneously adopted in a single research project. Pragmatism therefore is regarded as the most fitting epistemological underpinning for a mixed methods approach, using qualitative and quantitative methods to answer research questions (Bryman 2006; Feilzer 2010).

The concept of mixed methods approaches is defined by (Johnson et al. 2007:123) as:

‘...the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration’.

Researchers seek to achieve convergence of qualitative and quantitative approaches in a particular study because they have realised that one method has the potential to decrease the limitations and bias of other methods and to inform the development of other methods (Jick 1979; Greene et al. 1989). The central premise of the mixed methods approach is that the combination of qualitative and quantitative methods can provide a better understanding of research questions than a single method (Creswell and Clark 2007:5). More specifically, mixed methods approaches enable the researcher to concurrently answer confirmatory and exploratory questions, which enhances the understanding of research questions in depth and breadth, respectively (Teddlie and Tashakkori 2003:18; Axinn and Pearce 2006:2). Migration is a complex phenomenon and needs to be studied in a sophisticated way, thus many researchers advocate adopting mixed methods approaches in migration studies (Findlay and Li 1999).

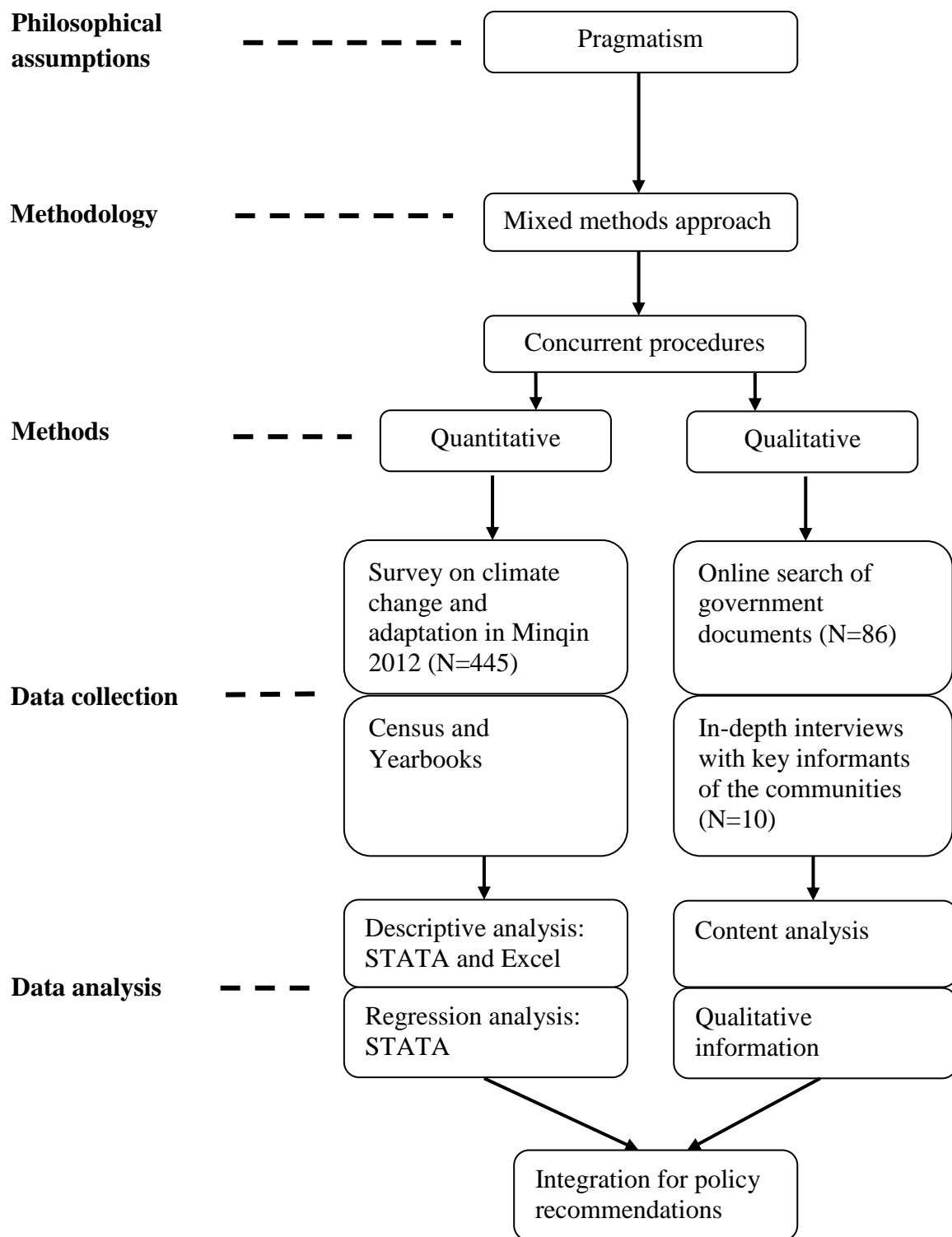
Creswell (2003) advises researchers to identify their rationale for adopting mixed methods in the first place. In other words, why qualitative and quantitative data need to be mixed in a particular project? According to Greene et al. (1989) and Bryman (2006), the rationale underpinning mixed methods approaches consists of two major parts. First, qualitative and quantitative data complete each other. Researchers can use qualitative findings to elaborate,

expand and clarify quantitative findings, and *vice versa* (Creswell 2003). The second reason is that a project tends to answer different research questions which require different research methods (Bryman 2006). This study seeks to provide policy recommendations to local government about improving migration and adaptation to climatic variability and environmental change through addressing social inequality. This requires a solid understanding of, in what ways and to what extent, inequality influences environmentally-induced migration and adaptation and how current migration and adaptation policies address inequality. To better answer the first question, it is necessary to collect a comprehensive set of quantitative data including information on climatic variability and its impacts on environment, the characteristics of households and communities, and data about migration and adaptations; whereas the second question mainly relies upon qualitative data collected from the contents of policy documents. This study intends to achieve the research goal by answering two types of research questions, which require different methodological approaches. Moreover, mixed methods approaches are considered the most suitable approach for studies interested in policy outcomes (Hinsliff 2006:75), making it more justifiable that a mixed methods approach is adopted in this study, since it seeks to provide policy recommendations.

4.3 The research design

This study employs the Concurrent Procedures of mixed methods approaches to design the research procedures. Concurrent design collects qualitative and quantitative data simultaneously to answer different questions and integrates all the information to interpret the overall findings (Creswell 2003:16). As shown in Figure 4.1, this study collects primary quantitative data from the survey and secondary quantitative data from census and year books. Meanwhile, qualitative data regarding the community situation is gathered through in-depth interviews with key informants in the community (primary data) and qualitative data from relevant policy is collected by online searches of governments' official websites (secondary data). Quantitative survey data are used to model the influence of class on migration induced by climatic variability and environmental change. While census and year book data and qualitative in-depth interview data are combined to describe the community situation. Qualitative analysis of the content of policy information is used to analyse the integration of inequality into current migration and adaptation policies.

Figure 4.1: Concurrent procedures of research design in the study



4.4 Data collection approaches

4.4.1 Levels and dimensions of data

This study employs a multilevel model to design the data collection. The determinants of migration are commonly explored either at an individual level (e.g. traditional micro-economic model), household level (e.g. neo-economic theory) or contextual level (e. g. life-course approach) (Ezra and Kiros 2001). It is increasingly recognised that a multilevel model is more appropriate to explore the determinants of migration, because it simultaneously takes into consideration individual, household and community-level factors (Bilsborrow et al. 1987; Zhu 1998; Ezra and Kiros 2001). This study will collect different levels of information through household surveys, key-informant interviews and secondary sources.

To explore the interrelationship between climatic variability, migration and class on the household level, the following information was collected:

- Climatic variability and its impact on community and households;
- Migration and other adaptation means adopted by community and households;
- The socio-economic conditions of the community;
- Social inequality conditions within the community;
- Class position of households in terms of economic, social, cultural, reputational and political status;
- Demographic characteristics of households and individuals, and
- Migration and adaptation policies.

Definitions of the key concepts (e.g., climatic variability and its environmental impacts, migration, adaptation, and class) used in survey questions and secondary data collection are specifically described in Chapter 6 and 7. Table 4.1 shows that this study used multi-level and multi-dimensional data collected from various sources. Both primary and secondary data were used in this study, and focused on class positions and migration patterns at the *household* level. This requires comprehensive and specific household information that is unavailable in current secondary data, which usually provide only community information. Therefore information on individuals and households by means of a survey using structured questionnaires in face-to-face interviews was adopted here as the most appropriate method.

Table 4.1: Multi-level and multi-sourced data collected in this study

Sources of the data	Dimensions of the data	Contents of the data by different levels		
		Individual level	Household level	Community level
Survey	Climatic variability and its environmental impacts	/	frequency and severity of climatic variability; degree of climatic variability impact on livelihoods, economic situation, health, etc.	/
	Migration and Adaptation	migration history and intention	migration history and intentions; in-situ adaptation	/
	Class	educational attainment, occupation, etc.	household income, political affiliation, participation in public decision-making process, social relationship, reputation, etc.	Gini index of income and land derived from household data
	Demographic characteristics of individuals and households	individual demographic characteristics (e.g., age, gender, health)	household demographic characteristics (e.g., sex ratio, dependency ratio)	/
	Institutional arrangements		participation in government organised programs, social security system and medical insurance system.	/
In-depth interview	Climatic variability and its environmental impacts	/	/	frequency and severity of climatic variability; degree of climatic variability impact on villages
	Public preparation and intervention for climatic variability	/	/	public adaptation programs; local socio-economic development programs; social security and medical insurance systems
Census and Year Books	Demographic characteristics of community	/	/	household size, aged population, dependency ratio, ethnicity, age and sex structure, etc.
	Environmental conditions	/	/	Temperature, precipitation, desertification, natural disasters, etc.

Table 4.1: Multi-levelled and multi-sourced data collected in this study (continued)

Sources of the data	Dimensions of the data	Contents of the data by different levels		
		<i>Individual level</i>	<i>Household level</i>	<i>Community level</i>
Census and Year Books	Socio-economic condition	/	/	GDP, income per capita, education, infrastructure, agricultural structure, water, etc.
Policy documents	Integration of addressing inequality into migration and adaptation policies	/	/	policies regarding climate change, ecology and environment, water and land, agricultural development and adjustment, migration, education, disaster preparation and alarm, and new energy

4.4.2 Survey

Surveys are regarded as the main data collection method when quantitative data is needed in research (Bryman 1984). This method allows the researcher to be in close contact with a large number of respondents at a particular point in time (Babbie 2004; Creswell and Clark 2007). Neuman (2004) emphasises the significance of surveys in collecting data from *individuals*. Surveys provide *facts* observed, *behaviours* carried out, and *attitudes* held, by the respondents (Dane 1990:121). This study needs to collect all the facts (e.g., economic, social, demographic characteristics of the individuals and households), behaviours (e.g., migration and adaptation behaviours), and attitudes (e.g., households' perceptions of climatic variability impacts and public support for adaption). The household surveys are therefore considered the most appropriate method to collect quantitative data for this study.

4.4.2.1 Collaboration with an ARC project

In designing and conducting the survey, there was collaboration with an ARC discovery project of the Australian Population and Migration Research Centre (APMRC) titled '*Climate change and migration in China: Theoretical, empirical and policy dimensions*' (DP110105522). This project aimed to explore the relationship between climate change and migration in both urban and rural settings, therefore two surveys were carried out, one in the urban Yangtze River delta region and the other in rural western China. The western China survey covered six counties/districts across three provinces/autonomous regions: Minqin county of Gansu province; Huanxian county of Gansu province; Zhangxian county of Gansu

province; Xiji county of Ningxia Autonomous Region; Hongsipu district of Ningxia Autonomous Region; Dulan county of Qinghai province. Among the six counties, Minqin county was selected as the study area for collaboration between this doctoral dissertation and the ARC project. Moreover, one of the aims of the ARC project is to investigate the complex determinants of migration decisions and patterns at the *household level*, which is consistent with this study which focuses on the interrelationship between *households'* experience of climatic variability and its environmental impacts, class position, migration and adaptation.

There was collaboration in the questionnaire design by merging the research questions of the ARC project and those of this study. The ARC project collected a comprehensive set of data that basically covers the research needs of this study. There were similar interests in obtaining information on four major topics: climatic variability and its environmental impacts, household conditions, public interventions, and migration and adaptation. This study pays particular attention to 'class', which should be investigated from five perspectives: economic, social, cultural, reputational and political status. The ARC project collected data regarding all these aspects except reputational status. Therefore in the final questionnaire a series of questions were added to obtain information on households' reputation in their local communities. The ARC project cooperated with a local research partner, Lanzhou University, to establish a survey team for the rural western China survey. As one of researchers involved in the questionnaire design, the author provided training to the survey team, and joined the team to carry out face-to-face interviews.

As a doctoral student, the chance to collaborate with the ARC project was greatly appreciated. First, the financial and human resources provided by the ARC project allowed this study to collect a complex and comprehensive data set from a large sample. Second, in designing the questionnaire and conducting the survey with experienced researchers, the author's research skills were improved. Third, the ARC project and Lanzhou University provided logistical support and made arrangements with local governments, which was important for this study to reach rural households and the key informants within the communities.

4.4.2.2 Questionnaire design

A structured questionnaire for rural households in Minqin was designed prior to the fieldwork, which was selected in this survey because it produced quantifiable answers where the same

questions are repeated to different respondents (Patton 2001). This study also used a retrospective survey in migrant sending communities (Massey and Espinosa 1997; Williams 2009). In order to minimise recall error, retrospective data collection is limited to five years before the survey (Som 1973). Information about factors that influence migration intentions and behaviours in the year 2007 was collected and used to explain the migration patterns that occurred during the period 2008-2012 and migration intentions after the time of the survey.

The questionnaire was initially produced in the Chinese version, which was used by the Lanzhou University survey team in a pilot test that tested the feasibility of the questionnaire, and to gain local knowledge of the study area, as well as to practise survey skills. The feedback from the pilot survey was incorporated into the final Chinese version, which later was translated into the English version, as shown in Appendix 1. The questionnaire was divided into three major parts: (1) family background and movement; (2) climatic variability and its environmental impacts and adaptation; and (3) different aspects of household conditions. The details of the questionnaire are summarised in Table 4.2.

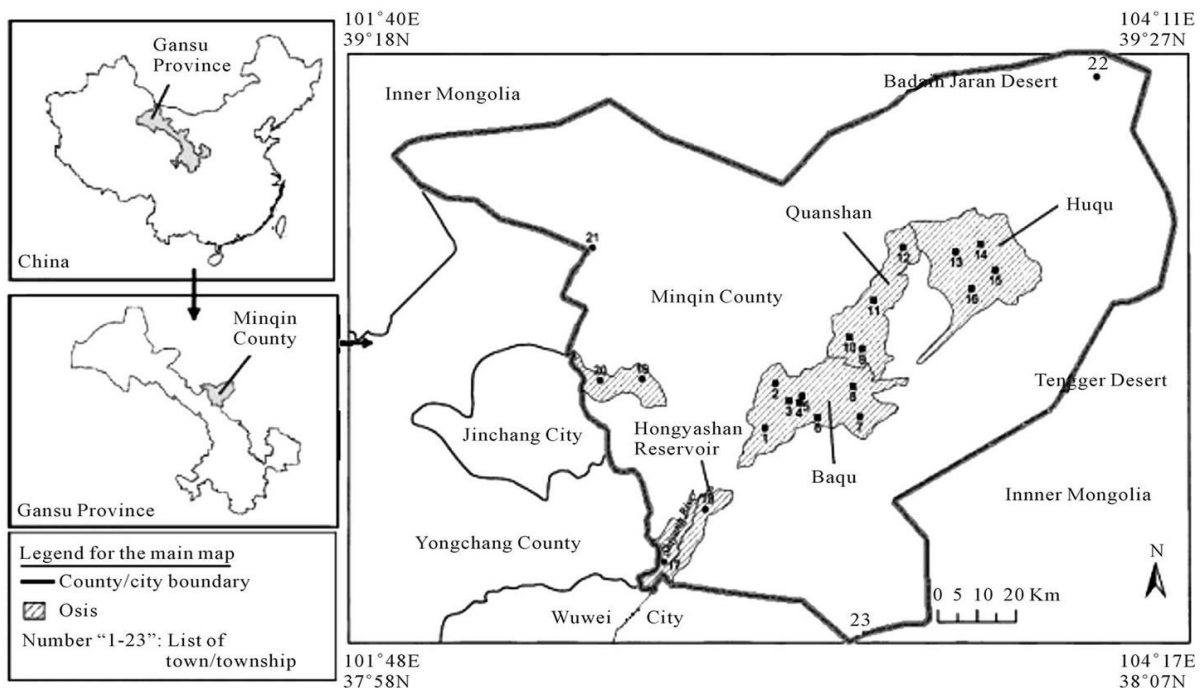
4.4.2.3 Selection of survey areas

Minqin county of Gansu province, western China, as shown in Figure 4.2, was selected as the fieldwork region. Minqin county is a typical ecologically fragile area with low precipitation, scarce water, severe desertification and salinisation (Zhang et al. 2004; Sun et al. 2005). Climate change, coupled with human activities, have accelerated the deterioration of the ecosystem in Minqin county (Zhang et al. 2008). Minqin county is one of the driest regions and is one of the four major sources of sandstorms in China (Gai et al. 2006). The decrease in farmland and grassland and degeneration of vegetation due to ecological deterioration, have severely impacted on local people's livelihoods. The phenomenon of 'ecological poverty' has become prominent in Minqin county since the late 1990s (Ma et al. 2005a). To rehabilitate the ecosystem and alleviate poverty, people in Minqin county have been undertaking environmental migration on both a spontaneous and a government-directed basis within and beyond the county (Li and Wei 2005). Minqin county is an ideal setting for this study, because it is an area where increasing climate change pressures and a fragile ecology overlap with substantial migration, poverty and inequality. Detailed conditions in Minqin county will be further discussed in Chapter 6.

Table 4.2: Summary of the questionnaire content

Part	Section	Information sought
Family Background and Movement	Family members	Individual information: gender, age, marital status, Hukou (household registration) status, ethnicity, education, and political affiliation
	Movements in 2008-2012	Individual movements: time, time frame, type of movement, destination, way of movement, support for movement Household movements: time, origin and destination, method of movement and resettlement, support for movement
	Movement plan in next two years (now-2014)	Individual and household plan: possibility and destination
Climatic variability and its environmental impacts and adaptations	Climatic variability and its environmental impacts	The degree of climatic variability impacts on: production, health, land, water, living costs, employment, income, housing, transportation and communication
	Adaptation to climatic variability and environmental change	Respondents' perception of the outcome of in-situ adaptation and of migration The measures adopted by the household to improve: water and irrigation, water-saving technology, drought and heat resistant crops and cash crops, soil fertility, housing, air-conditioning, energy saving, etc. The degree of benefit from public intervention programs
	Participation in public decision-making and government projects	The degree of willingness to participate in public decision-making The satisfactory degree of social security and medical insurance system The public migration and in-situ adaptation projects conducted in the community and participated in by the household
Conditions of different aspects of households	Employment and social security	Individual conditions: employment, type of work, annual income, job satisfaction, social security
	Production and land use	Type and quantity of land, usage of land, production types, access to public land, etc.
	Economic condition	Household economic conditions: annual income, annual expenditure, savings, debts, loan sources, etc.
	Housing and transportation	Property: source, construction structure, areas, facility, satisfaction, etc. Transportation: the minutes taken to go to some places, such as workplaces, schools, markets, water resources, public transportation, etc.
	Social capital	The people and organisations that provide help to the household, the types of help, social relationship, local reputation, spatial distribution of social networks, communication means, etc.
	Health	Individual health: health ranking, health problems, time spent in caring unhealthy members, etc.

Figure 4.2: Map of Minqin county in Gansu Province, China



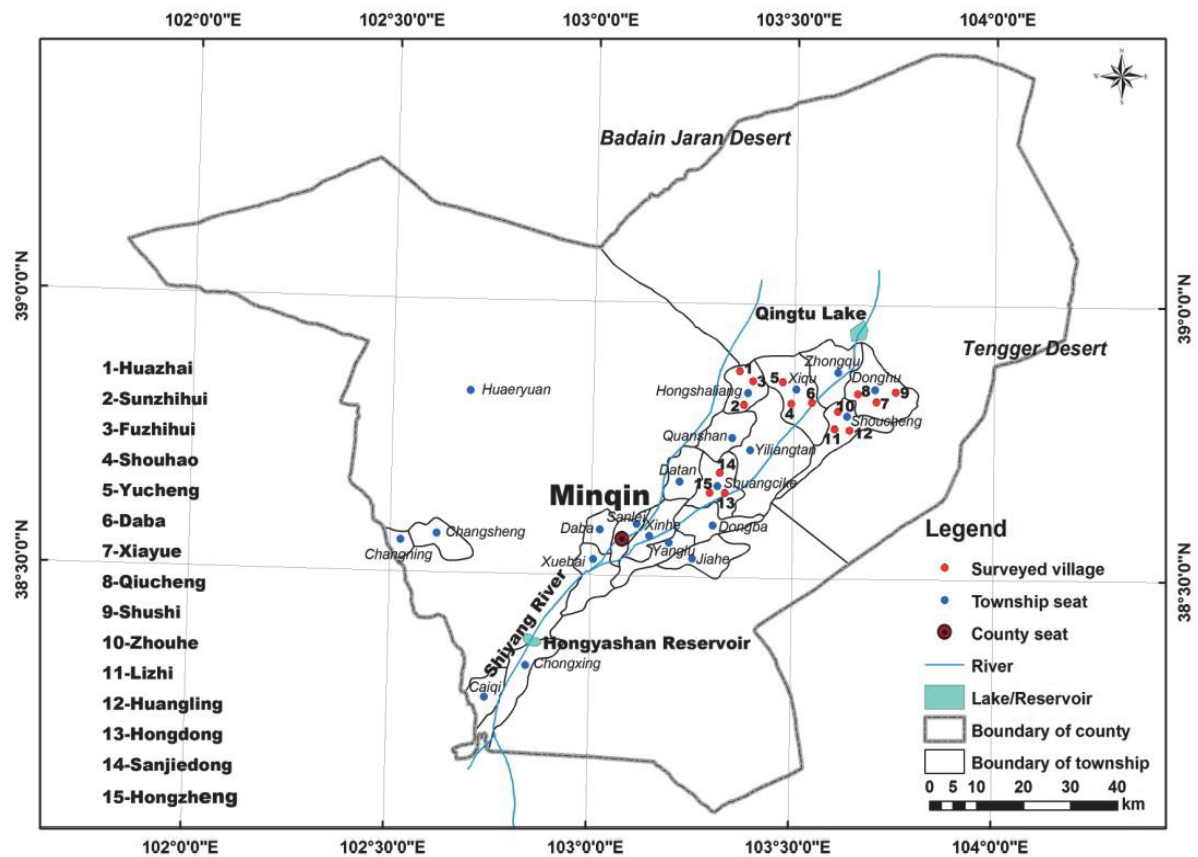
Source: Lee and Zhang (2005)

Five townships of Minqin were selected to survey. They are: Shoucheng; Xiqu; Donghu; Shuangcike, and Hongshaliang, as shown in Figure 4.3. The study adopted the following criteria in selecting the specific survey locations in Minqin:

- Frequency and severity of meteorological events that have occurred in the township in the period 2008-2012;
- Biophysical vulnerability of the townships to climatic variability and environmental change, especially water scarcity, desertification and salinisation; and
- Scale of out-migration on both government-led and spontaneous bases.

Shoucheng, Xiqu, Donghu and Hongshaliang are townships that are located at the lowest end of the catchment of the Shiyang River and they face the greatest threat from water scarcity, soil deterioration and desertification. Migration is one of the major adaptation strategies to climatic variability, environmental change and the deteriorated ecology in these townships. For example, Huanghui village was moved entirely out from Xiqu, and government-organised ecological migration was later carried out in Donghu. These townships are typical locations where obvious climatic variability, severe environmental impacts and migration overlap and so they can provide appropriate data for studying the linkages between climatic variability and migration.

Figure 4.3 The survey locations in Minqin county



Source: Tan and Hugo (2013)

4.4.2.4 Sampling

The representative sample survey consisted of both non-migrant and migrant households. The migrant households can be further divided into two sub-groups: the households which have entirely moved out and those with individual out-migrants. The household survey in the migrant sending community only included those who had never migrated, those with individual migrants and those who had previously moved entire family but had returned. The households which have permanently left can only be reached in the destination communities. However, due to budget and manpower limits, the study could not reach those migrant households not living in Minqin at the time of the survey. One limitation of the study is that the information about the households which have permanently and entirely moved beyond Minqin county was not available.

According to the statistics sample size calculator tool, 384 surveys would have provided valid results, accepting 5 percent margin of error, 95 percent confidence level in Minqin county

with a population of more than 310,000. This study selected 445 households to provide a valid result. The survey used a combination of various sampling methods to select two levels of sampling units which represent villages and households. Firstly, the total sample size (N=445 households) was proportionately distributed to each selected township in terms of population size in 2012. The survey then used a Probability Proportionate to Size (PPS) sampling method¹ to select 3 villages in each township. The PPS method ensures that each household in the sample has the same probability of being chosen regardless of the size of clusters involved in the sampling. As a result, 15 villages were selected as the survey locations in Minqin and the sample size of each township was proportionately distributed to the 3 selected villages in the township based on their population size, as shown in Table 4.3.

Table 4.3: Distribution of sampled households by survey locations

Townships	Villages	Sample No.
Hongshaliang township	1 Huazhai village	26
	2 Sunzhihui village	35
	3 Fuzhihui village	24
Xiqu township	4 Shouhao village	46
	5 Yucheng village	32
	6 Daba village	48
Donghu township	7 Xiayue village	20
	8 Qiucheng village	39
	9 Shushi village	25
Shoucheng township	10 Zhouhe village	26
	11 Lizhi village	24
	12 Huangling village	40
Shuangcike township	13 Hongdong village	23
	14 Sanjiedong village	20
	15 Hongzheng village	17
Total		445

Source: Survey of climatic variability and adaptation in Minqin 2012

¹ Example of PPS sampling method: Suppose there are 6 villages with 100, 200, 400, 600, 700, and 1000 households respectively and totally 3000 households in a township. When 3 villages need to be selected by PPS sample of size method, the first village is allocated numbers 1 to 100, the second village 101 to 300 (= 100 + 200), the third school 301 to 700 (= 300 + 400), and so on to the last village 2001 to 3000 (= 2000 + 1000). Then a random start is generated between 1 and 1000 (= 3000 / 3) and count through the numbers of household by multiples of 1000. If the random start turns to be 10, the villages which have been allocated numbers 10, 1010, and 2010 would be selected. As a result, the first, fourth, and sixth villages are selected.

In each village, a systematic sampling method was used to select sample households. For example, in attempting to sample 20 households in a village with 400 households: (1) obtain the list of house numbers from 1 to 400; (2) then calculate the regular interval which is 20 (= 400 / 20); (3) then randomly select the start number between 1 and 20 by drawing lots, which is 8 for example; (4) then select 20 households whose house numbers are 8, 28, 48 and so on up to the last 388. If a selected household was unavailable at the first visit, it was visited again at another time. If it was still unavailable at the second visit or refused to participate in the survey, the households whose house number is 1 less or 1 more than the number of the originally selected household was chosen as the first and second substitute, respectively. Houses in these villages are all clearly labelled with house numbers on their doors, which made the sampling procedure feasible and efficient.

4.4.2.5 Fieldwork

Research ethics: This study obtained ethical approval in March 2011 from the Human Research Ethics Committee of the University of Adelaide. The study provided the committee with detailed information on the qualifications of the researchers, the rationale for the survey, sampling and interview procedures, confidentiality, safety, etc.

The previous job of the author as a program manager in World Vision China provided experience and numerous opportunities to conduct focus groups, surveys and in-depth interviews with government officials, NGOs, community leaders, rural migrant workers and rural residents in both urban and rural settings in China. In addition, experience of working in the rural areas of Inner Mongolia, Yunnan province, Hebei province and Beijing from 2006 to 2009 equipped the author with a solid understanding of the rural communities in China and skills to engage with the local people.

The survey team provided each respondent with a separate information sheet at the beginning of the interview which detailed important information such as the voluntary nature of the research, general details about the study, what they will be expected to do as part of the research, confidentiality, etc. The feedback from the pilot test suggested that respondents had a low level of literacy and that they could not read or fully understand the information sheet. The contents of the information sheet were then revised to condense them and to use local

language without altering the original meanings. In the fieldwork, the information was read by interviewers to the respondents at the beginning of interview, and the respondents signed their names, or ticked if they were illiterate, when they consented to the interview.

It was assumed that participants might find some questions intrusive, such as ones about their income, their perception of public policies and the government's capacity. To avoid 'no comment' answers, confidentiality of the survey was emphasised and the interview was conducted without the presence of third parties, such as neighbours, village cadres, etc. Most of the respondents were willing to answer such 'sensitive' questions, and while several respondents hesitated they provided the information eventually. At the end of interview, some little gifts, such as towels, soap, toothbrushes, etc., were given to participants to compensate them for the time they spent on the survey.

To protect the confidentiality of the respondents, the names or any information that would reveal the respondents' identities would not appear in any research output without their consent. The audio and written information on the survey was kept at all times in a locked cabinet in a locked office in the Lanzhou University before the data was transferred to an electronic version. All tape/paper copies were destroyed as soon as data were stored electronically on the researcher's password protected computer at the University of Adelaide. This storage will be for a minimum of five years and may continue longer if the information is found to be useful for further analysis.

Organising and training interviewers: Fowler and Mangione (1990) point out that interviewers are more diligent and serious about their survey when they recognise its significance and have a good understanding of their role. The local research partner Lanzhou University recruited 8 postgraduates who were majoring in Geography and Environment and who had some fieldwork experience. In early August 2012 they were provided training for two days. The training focused on introducing the aims and research questions, analysing the survey structure, clarifying ambiguous questions, enhancing interview skills, ensuring ethics and safety, etc. The questionnaire was very complex and comprehensive and it required quite a long time to complete. To promote the efficiency of the interview, two students practised together with one asking questions and the other answering. At the end, each interviewer was expected to finish a questionnaire within 30 minutes.

Contact and cooperation with government institutions: The Lanzhou University established a good relationship with the Minqin government. A member of the survey team, who is also a staff at the Lanzhou University, visited Minqin County Government with an official reference letter issued by the University. It introduced the aims and contents of the survey. The county government consented to the survey and informed the governments of the townships selected in the survey. Meanwhile, the county government referred the researchers to some of the most relevant departments to do in-depth interviews and to collect secondary data, such as the Bureau of Water Resources, Office of Reform and Development, Bureau of Social Welfare and Anti-poverty, etc. The interviewers visited the township governments and village committees before conducting the interviews with households. It was important to obtain consent from different levels of government for the survey in advance; otherwise the survey could be terminated by local authorities at any time.

Face-to-face interviews: Face-to-face interviews in the respondents' community helped the researchers to gain a broader and deeper local knowledge of the study area and to establish a closer connection with respondents. This is especially important for the researchers from outside the area who did not have enough understanding of the community and its people. Although this method is considered less cost-effective than mail and telephone interviews, it is necessary in interviews with people who are illiterate or who have low levels of literacy (Gray 2009). This method is believed to be most fitting in rural areas of Minqin because most people had low levels of literacy. Although Minqin is famous for the quality of its education and it is a major source of college students in Gansu province, this did not ensure the levels of literacy in rural areas because the majority of people with higher educational attainment do not return to rural areas. Face-to-face interviews also can increase the response rate and decrease the 'no answer/comment' responses (Babbie 2004). The face-to-face interview method, of course, entails some risks in the field. For example, some villagers were conservative and suspicious of strangers and acted abusively towards interviewers. To ensure the safety of researchers, it was suggested that all selected respondents should attend the interview in a public place next to their houses rather than inside their homes. If respondents insisted on having the interview in their homes, their choice was respected. Under this situation, two interviewers worked together as a team to conduct the interviews, ensuring that no one was alone in the participants' homes. Most of the villagers were very friendly and

cooperative when they knew the interviewers were college students, because many local families had children studying in high schools and universities.

Interviews: The survey was undertaken in Minqin in August 2012. A structured questionnaire was used for the face-to-face interviews (Appendix 2). The 10 interviewers (2 from the University of Adelaide and 8 from Lanzhou University) were divided into 5 groups and conducted surveys in the 5 selected townships, respectively. The interviewers lived in the homes of villagers during the survey for the following reasons: (1) many selected villages were located far from the township centres; (2) local transportation was inconvenient (private motor tricycle was the only transportation the interviewers could use); (3) August is harvest time in Minqin, and many respondents therefore could only be reached early in the morning or late in the afternoon as they were working in farmlands during the day; and (4) living in villages enabled the interviewers to have a closer connection with the local people and to gain a broader and deeper understanding of the local community. Accommodation was found with the help of members of the village committees who knew which families had extra rooms and were willing to accommodate two interviewers. Having the local authority involved in finding accommodation gained the trust of the local families as well as ensuring the interviewers' safety. Although the village committees were informed about the survey and assisted with accommodation, this did not mean that any respondents from the interviews could be traced.

The household head responded to the questionnaire; where unavailable, their spouse or the household member who had the best understanding of the household's situation answered the questions. People who were 65 years old or older and children younger than 18 years were not invited to undertake the survey. Some respondents gave consent to audio recording, while some refused regardless our explanations about confidentiality. Most respondents finished the questionnaire during the first interview. For several respondents, who did not manage to finish the interview the first time, an appointment was made with them and they were re-visited to complete the interview. Only one respondent terminated the interview halfway. The high response rate proved to be an advantage of face-to-face interviewing.

4.4.3 In-depth interviews

The household survey did not provide comprehensive community-level data, or information on the households that had entirely migrated out of the county. In-depth interviews were then employed to gather information on these topics from key informants, including government officials and community leaders. In-depth interviews also helped discover the respondents' subjective meanings and their interpretations of facts and behaviours (Liamputtong and Ezzy 2005).

As stated above, the important and most relevant government departments participating in the in-depth interviews included General Office of Minqin County Government, the Bureau of Water Resources, the Office of Reform and Development, the Bureau of Social Welfare and the Office of Poverty Alleviation. Community leaders were also interviewed in each selected village, such as the secretaries of village CPC committees, heads and treasurers of village neighbourhood committees, and principals of primary schools. The in-depth interviews with government officials were carried out by an ARC senior researcher, and the ones with community leaders were conducted by the research students in the survey team.

A semi-structured interview, as shown in Appendix 2, was used to collect the following community information from the key informants: (1) the environment, climatic variability and its impacts; (2) government-organised adaptation measures in response to environmental change and climatic variability; (3) population and migration; and (4) development within the community, including economic, natural, physical, human and social capital and institutional capacity.

The in-depth interviews were carried out prior to the household survey, which gave the interviewers overall background knowledge of the survey locations. The information collected from the in-depth interviews proved very valuable in validating the study and improving the interpretation of the results. For example, the information about specific climatic variability impacts on each village, which was not captured by any secondary data, helped the study to validate the selection of survey locations because it proved that all selected villages had experienced significant adverse impacts of climatic variability. Moreover, the information about public preparation and adaptation to climatic variability and environmental change enabled the study to accurately interpret households' participation in

public programs. Answers of ‘*no participation*’ from the household surveys were divided into three categories, based on in-depth interview information. These are ‘*the public adaptation was not carried out in the village*’, ‘*the public adaptation was carried out in the village but the respondents did not know*’, and ‘*the adaptation was carried out in the village but the respondents did not participate despite knowing*’.

4.4.4 Secondary data: census, yearbooks, policy documents

The primary multi-levelled data gathered through fieldwork was supplemented by the secondary contextual information collected from census data, yearbooks and government documents. The Sixth Population Census of Gansu Province 2010 provided the most recent information on the demographic, economic and social characteristics of the study area (Table 4.1). These data provided a good understanding of the context of the study area and enabled the testing of the representativeness of the sample.

The study also sought contextual information on the environment, climatic variability and socio-economic development from yearbooks, such as Gansu Yearbook, Gansu Development Yearbook, Wuwei Yearbook, etc. This information helped to describe the study area systematically and comprehensively, and justified the selection of the study area. Census data and yearbook are all available in the CNKI database subscribed by the University of Adelaide.

The study collected secondary data from government documents identified through online searching, in order to investigate to what extent current migration and adaptation policies consider inequality. As shown in Table 4.1, the study gathered 86 policy documents drawn from 8 policy categories: climate change; ecology and environment; water and land; agricultural development and adjustment; migration; education; disaster preparation and alarm, and new energy. These documents were all collected from the official websites of the three levels of government. First the national government (e.g., the Central People's Government of the People's Republic of China, the State Council of the People's Republic of China, the General Office of the State Council of the People's Republic of China, the National Development and Reform Commission, the Ministry of Environmental Protection, the Ministry of Education, and the Ministry of Water Resources). Second, the regional government (e.g., Gansu Province Government, Gansu Province Government General Office,

Gansu Province Department of Education, Gansu Province Department of Finance, Wuwei City Party Committee, and Wuwei City Government), and, third, local government (e.g., Minqin County Party Committee, Minqin County Government, and Minqin County Government General Office). Data were used to conduct a policy analysis and the results are demonstrated and discussed in Chapter 8.

4.5 Data analysis

4.5.1 Data coding, entry and cleaning

The questionnaire has both pre-coding and post-coding to transform the information to numeric forms. A pre-coded database was set up by the ARC senior researcher when the questionnaire was finalised prior to the fieldwork. After the completion of the survey, post-coding was used to transform the answers to open-end questions into a quantitative form. After finalising the database through both the procedures of pre-coding and post-coding, four interviewers from Lanzhou University were trained to carry out the data entry using Excel. The completed database was thoroughly and carefully checked and cleaned by the author and the ARC senior researcher, in order to ensure the accuracy of data. The quantitative data collected from secondary sources, such as the census and yearbooks, was entered to an alternative Excel database set up for this study.

4.5.2 Quantitative data analysis

The study used two approaches to analyse the quantitative data: descriptive analysis and econometric regression. Descriptive analysis was used to summarise the climatic variability and its environmental impacts, class positions, demographic characteristics, institutional arrangements, means of adaptation, migration patterns, characteristics of migrants and non-migrants, and so forth. Both univariate and bivariate analyses were used to analyse the data and to produce tables and diagrams such as pie charts and column graphs.

Econometric regression models were employed because they can help to understand which among the climatic variability and its environmental impacts and class statuses are related to migration and adaptation behaviours, a result which cannot be achieved by descriptive

analysis. A two-stage regression procedure was adopted based on the two-stage conceptual framework set out in Chapter 4. The main hypothesis underpinning the framework was that, under most situations except for sudden climatic disasters, climate change influences migration and adaptation through affecting various aspects of people's life, rather than in a direct and linear way. The regression procedure was therefore divided into two stages. Stage I models were used to examine the influence of climatic variability and its environmental impacts and class factors on the climate impacts experienced by different households. Stage II sought to investigate how migration patterns are shaped by class factors and the severity of climate impacts. Data on the severity of climate impacts was obtained from Stage I analysis. Multivariate Probit (MProbit) model and Multinomial Logit (MLogit) model (Greene 2008) were used in the Stage I and Stage II analyses, respectively. Choosing the models is discussed and justified in Chapters 6 and 7. The regression analysis was carried out by using statistical software STATA 11.0.

4.5.3 Qualitative data analysis

Qualitative data are less standardised than quantitative data, which means it is difficult to apply strict rules or procedures for its analyses (Neuman 2004). This study employed the *thematic framework* illustrated by (Ritchie et al. 2003:220) to analyse the content of policy documents. Data were collected in Chinese and translated into English. The initial themes of the data were identified and clearly labelled; the raw data were then thoroughly examined and carefully sorted into different themes. Data under each theme were classified into different dimensions/categories and finally summarised. By so doing, patterns within the data were identified and explanations were developed to explain the findings. For example, four initial themes related to the 'integration of inequality into migration and adaptation policies' were identified and labelled as 'aim', 'instrument', 'budget', and 'institution'. Any content related to budget in the policy documents was located in the theme 'budget'. Data were later categorised into three sub-groups; namely, 'no budget mentioned', 'budget mentioned' and 'specific funding described'. Finally, the patterns of budget for multi-levelled and multi-dimensioned policies were identified and discussed, as will be demonstrated in Chapter 8.

4.6 Experiences and lessons

4.6.1 Relationship to the local governments

It was found that the local governments were very cautious about fieldwork conducted by researchers from overseas. This was the main reason most of the researchers needed to find a local research partner (e.g., universities and research institutes) who could communicate with the local governments and obtain local ethical clearance, before going into the field. The ARC project collaborated with Lanzhou University, which is the most reputable university in Gansu province, and which has a good relationship with the different levels of government within the province. The local partner decided whether or not to disclose the true affiliation of the overseas researchers to the government officials. In many circumstances, the overseas researchers were introduced as visiting scholars to Lanzhou University, instead of as researchers from the University of Adelaide, because there was a risk that the government officials would decline the household survey and the in-depth interview. In the study area, some local government officials, such as cadres in township governments, were reluctant to give permission for the survey by saying '*we have not received any notice regarding your survey from government at a higher level*'. It is therefore important to firstly obtain consent from the city or county government and ask them to notify the township governments and village committees in either written or oral form. Although permission was sought from local governments to minimise the risk of survey termination, government officials were not involved in the interviews because this would harm the confidentiality of the respondents and compromise the accuracy of data.

4.6.2 Sensitivity and accuracy

The survey sought some information which was sensitive for some respondents, especially information about relationships to local cadres and the assessment of public programs. In several villages, respondents were generally hesitant to answer these questions, or they gave 'very good' answers, which were obviously not their true opinions. Interviewers coped in different ways. Some interviewers recorded the respondents' answers even if they doubted the truth of the answers; whereas some others traced the true information implied, but not stated, by the respondents. The inconsistency affected the accuracy of this type of

information. This lesson suggests that the training of interviewers should include how to cope with sensitive questions and ambiguous information in a consistent way.

4.6.3 Limitation of the in-depth interviews

The advantages of participating in a large ARC project to conduct the survey have been discussed in earlier section. As an interviewer on the project, the author carried out interviews in 5 counties of the 3 provinces/autonomous regions, rather than only in the study area Minqin county. The time limit did not allow the author to reach key stakeholders with more diverse backgrounds for the in-depth interviews. As a result, this study carried out in-depth interviews with only 10 local cadres in Minqin county. Besides government officials and community leaders, other key informants, such as NGO officers and local researchers, can provide insights into the study from different perspectives. Some government officials tended to cite the stance stated in government documents rather than to express their own opinions. This means the information provided by other key informants could be even more valuable. To increase the reliability of the information provided by local cadres, the interview questions focused on collecting subjective information on climatic variability and environmental change, population and migration, and economic and social development of the community, rather than asking the cadre's own opinions regarding these matters.

4.7 Conclusion

This chapter has detailed the philosophy, strategy, methodology and specific data collection and analysis methods used in the study. Underpinned by a mixed methods approach, comprehensive qualitative and quantitative data were collected from primary and secondary sources, which enabled the study to carry out descriptive, regression and thematic analyses to answer a set of different, but closely related, research questions. The two-staged regression method used in the study has seldom been used in previous empirical migration studies, which added knowledge to the research methods on climate change and migration. The fieldwork allowed the author to consolidate research skills and more importantly, helped in accurately understanding of the purpose of the study and needs of the people in the study area.

CHAPTER 5: Climate Change, Class and Migration in Western China

5.1 Introduction

Western China is an area where climate change, massive migration, absolute poverty and widening inequality overlap. Human migration has become an important adaptation strategy coping with climate change and poverty in western China but its interaction with inequality or class is not adequately understood. This chapter aims to provide an understanding of environment and climate change in this region and its relationship with population (including migration), development, and class. It begins with a brief review of climate change and its impacts, as well as the physical environment in western China. This is followed by an examination of demographic characteristics and human mobility in this region, and the level of development is also discussed. Finally, this chapter details the class structure in rural China.

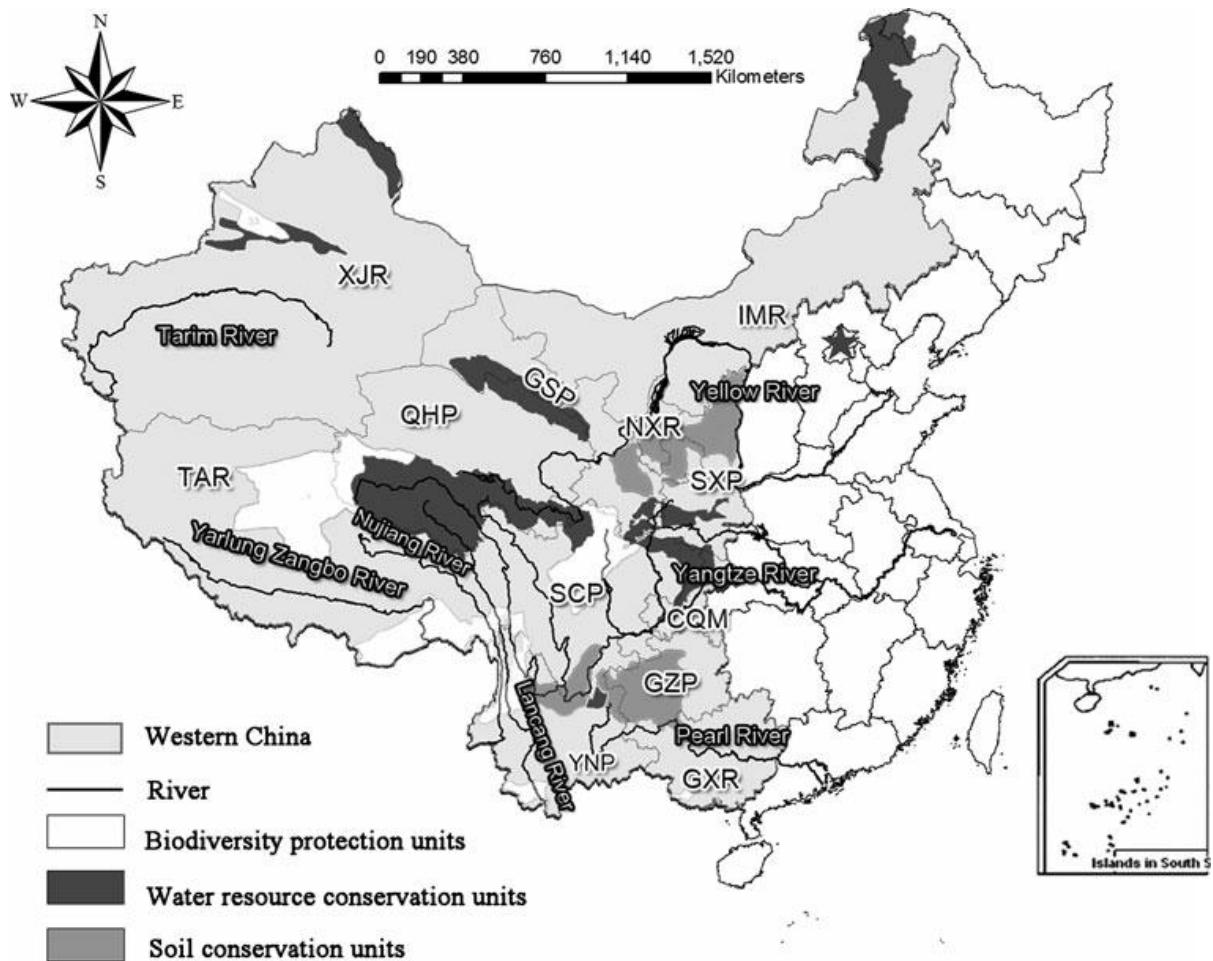
5.2 Environment and climate change in western China

5.2.1 Environment of western China

Western China covers 6.8 million km², accounting for 71.4 percent of the entire territory of China. It consists of twelve provinces and autonomous regions: Shaanxi; Inner Mongolia; Gansu; Ningxia; Qinghai; Xinjiang; Tibet; Yunnan; Chongqing; Sichuan; Guizhou, and Guangxi (Li et al. 2012). As shown in Figure 5.1, Li et al. (2012:484) divide the region into three sub-regions according to geographic conditions, namely ‘the subtropical mountainous south-western sub-region (SW)’, ‘the arid/semi-arid grassland north-western sub-region (NW)’, and ‘the high altitude plateau Qinghai- Tibet sub-region (QT)’.

Western China has abundant natural resources and its ecological condition is extremely significant in safeguarding the security of the country’s ecosystem. The sources of China’s three major rivers, the Yellow River, Yangtze River and Pearl River, are all located in western China. Moreover, western China has 85 percent of the country’s nature reserves, contains 7 out of 17 internationally significant biodiversity hot spots and 28 out 50 nationally significant ecological function units, and 70 percent of the state-level protected species inhabit in the region (MEP 2007; Li et al. 2012).

Figure 5.1: Administrative scope and the typical ecological units of western China



Source: Li et al. (2012:485)

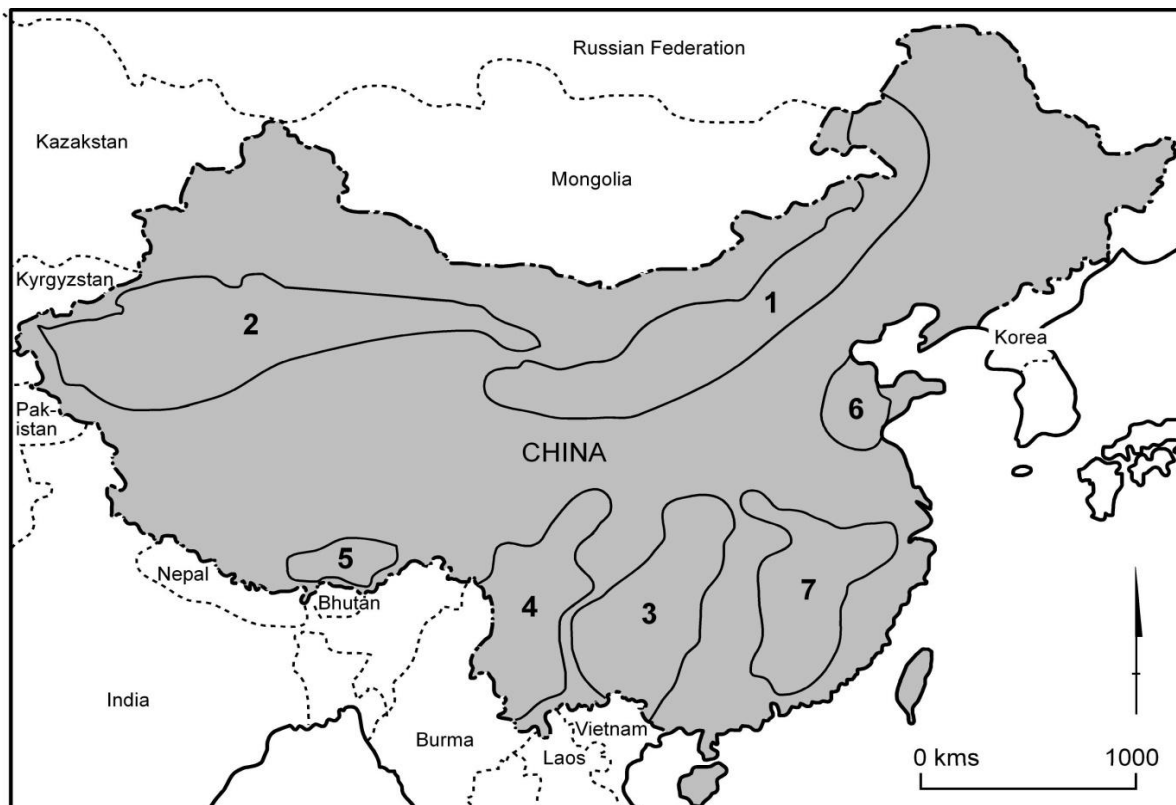
Note:

- SW subregion includes: SCP (Sichuan province); GZP (Guizhou province); YNP (Yunnan province); GXR (Guangxi Zhuang autonomous region); and CQM (Chongqing municipality).
- NW sub-region includes: SXP (Shaanxi province); GSP (Gansu province); XJR (Xinjiang Uygur autonomous region); NXR (Ningxia Hui autonomous region); and IMR (Inner Mongolia autonomous region).
- QT sub-region includes: QHP (Qinghai province); and TAR (Tibet autonomous region)

5.2.2 Ecological Fragile Zones (EFZs)

Tan and Guo (2008) define ecologically fragile environments as one with little resistance to external disturbance and poor stability under external pressure. As illustrated by Figure 5.2, Zhao (1999) identified seven major EFZs in China based on climatic and topographical conditions, five of which are located in western China, with coding from 1 to 5. In addition, all the twelve provinces and autonomous regions of western China fall into EFZs, of these Ningxia, Tibet, Qinghai, Gansu, Guizhou, Shaanxi and Xinjiang have extremely fragile environments (Hugo et al. 2009).

Figure 5.2: Distribution of the Ecologically Fragile Zones in China



Source: Modified from Zhao (1999:24)

Note: 1. Semi-arid and semi-humid areas in north China; 2. Semi-arid areas in north-western China; 3. Lime rock mountains in south-western China; 4. Mountainous areas in south-western China; 5. Qinghai-Tibetan plateau; 6. Plain areas in northern China; 7. Hilly areas in southern China.

5.2.3 Main environment problems in western China

Situated within the EFZs, many areas in western China are sensitive to population pressures and prone to many types of environment degradation, as well as climatic and geological hazards (Li et al. 2012). The most serious environment problems in this region include land degradation, water scarcity and drought, deforestation, desertification, extreme climatic events and secondary meteorological disasters, etc. (Tan and Guo 2008; Hugo et al. 2009). It is commonly argued that the rapid environmental degradation of western China is due to the combined influences of climate and human activities (Jin et al. 2008). For example, in the Shiyang River Basin of western China, where the study area of this study is located, the environmental degradation is considered to be the result of the interacting influence of arid climate, climatic variability in terms of warming temperature and decreased precipitation, population growth, exploration and mal-management of natural resources (Ma et al. 2005b).

Soil erosion: Soil erosion is the most crucial environmental problem faced by China, with 5 billion tonnes of soil lost per year (MLR 2008). Western China is particularly exposed to soil erosion owing to low rainfall, severe water scarcity, over-cultivation, and excessive exploitation of water (Tan and Guo 2008; Hugo et al. 2009). A remote sensing analysis project shows that 60 percent of western China is affected by soil erosion, covering 2.94 million km² and accounting for 82.6 percent of China's total eroded area (Bao 2006). Some of the most serious soil erosion in the world has occurred on the Loess Plateau located in Shaanxi and Gansu in north-western China, with 70 percent of land (about 450,000 km²) being prone to soil erosion (Tan and Guo 2008). Soil erosion has severely jeopardised agricultural production and threatened the ecological life-support system of western China, and it also leads to siltation in rivers and lakes that causes downstream flooding.

Desertification: In China, desertification refers to the process of the degradation of arid or semi-arid land that accompanies changes in sand dunes, sand sheets, and desert steppes (Wang et al. 2009). Wang et al. (2008) divide the process of modern desertification in China into three phases: (1) desertification which has increased since the 1950s; (2) the most rapid desertification, occurring during the 1970s and the early 1980s; (3) rehabilitation, occurring from the mid-1980s to the present. Although some improvements in rehabilitation have been made in some regions, China is still one of the countries that are most seriously affected by desertification (Hugo et al. 2009).

According to the Chinese Ministry of Land and Resources, the deserts and decertified land of China extend over 2.62 million km², accounting for 27.4 percent of the total national territory (MLR 2011). The rate of desertification has accelerated since the 1950s, which has been accompanied by the increased frequency and intensity of sandstorms (Cao 2008). Western China is the region of China which has most deserts and faces the most severe challenge of desertification (Tan and Guo 2008). The provinces that have the largest area of desert land – Xinjiang, Inner Mongolia and Tibet – are all located in western China.

Human activities such as over-grazing, over-cultivation of land, and over-cutting of vegetation have undoubtedly exacerbated desertification in China (Wang et al. 2008). However, the principal determinant of desertification in China has been identified as climate change (Wang et al. 2008; Wang et al. 2009). Wang et al. (2008) provide evidence that

climate change, in terms of variations in spring precipitation and wind regimes, plays a major role in desertification in western China.

To combat desertification and to control sandstorms, Chinese governments have implemented a large-scale forestation program, ‘the Three Norths Forest Shelterbelt’ program, in northern and north-western China since the late 1970s (Cao 2008). By 2050, this program aims to plant 30.6 million ha of trees in an area of 4.1 million km², which account for 42.7 percent of the nation’s total land. Despite the increased area of forestation due to this program, the severity of desertification has been intensified throughout the country (Cao 2008).

Salinisation: Salt affected soils are extensive in China. The total area of salt affected soil is about 36 million hectares, accounting for 4.88 percent of China’s usable land (Yang 2006). Northwest China, having 34,500 km² of affected soils, is particularly affected by salinisation (Li et al. 2012). Some of the most serious examples of salinisation may be found in following areas in northwest China: the Hexi corridor of Gansu; the Tarim Basin and Junggar Basin of Xinjiang; the Qaidam Basin of Qinghai; the Hetao area of Inner Mongolia; the Yinchuan Plain of Ningxia, and the Weinan-Bingdian belt of Shaanxi (Li et al. 2012). To be more specific, 35 percent of irrigation land in Gansu, Xinjiang and Ningxia, and 50 percent in Inner Mongolia is threatened by salinisation (Yang 2006). An important cause of salinisation in northwest China has been identified as irrigation with brackish water. Climate change is also considered a significant factor driving the salinisation processes in this region (Yang 2006).

Deforestation: Forests play a fundamental role in environmental conservation. Continuous deforestation has caused a series of environmental problems and natural disasters in China (Tian and Chao 2010). The frequency and severity of droughts and sandstorms have increased due to deforestation. Yang and Chen (2003) indicate that deforestation in the upstream regions of the Yangtze, Songhua and Nenjiang Rivers is one of the major reasons for the drastic flood of 1998, which killed 3,600 people, left 14 million homeless, and caused an economic loss of USD24 billion.

Western China is especially prone to deforestation. The total area of forests in northwest China (excluding Shaanxi) was 114,126 km², accounting for only 6.5 percent of the total area of the country’s forests. The forest coverage rate of Qinghai, Xinjiang, Ningxia and Gansu is

5.6 percent, 4.2 percent, 11.9 percent and 11.3 percent, respectively, which are all considerably below the national average coverage level of 21.6 percent (MOF 2014).

Degradation of grassland: Grassland plays an important role in controlling carbon emissions (Conant et al. 2001) and preserving biodiversity (Tilman and Downing 1994). Degradation of grassland may lead to severe environmental consequences, such as desertification and sandstorms (Deng et al. 2011). The factors causing and accelerating grassland degradation include climate change, over-grazing and over-harvesting, population pressure, and urbanisation (Zhang et al. 2006; Deng et al. 2011).

Nearly 1.3 billion ha of grasslands have degraded in China in the past two decades, accounting for one third of the usable grassland in the country (MEP 2009). The degradation rate of grassland increased from 15 percent in the 1970s to more than 30 percent in the mid-1980s and increased to 57 percent in 2006 (Wang 2006). Northwest China suffers much more serious degradation of grassland than any other regions in the nation. The degradation rate of grassland in Ningxia, Inner Mongolia, Shaanxi, Gansu and Tibet is as high as 97.4 percent, 60 percent, 58.8 percent, 45.2 percent and 30.4 percent, respectively (Tan and Guo 2008).

Water scarcity: China is increasingly suffering from severe water scarcity. Shortages of both surface water and groundwater have led to a series of environmental problems, such as ground subsidence, salinity intrusion, and ecosystem deterioration (Shalizi 2006; Cai and Ringler 2007), and has consequently threatened food security and economic development in China. It is argued that the factors contributing to China's water scarcity include climate change, population growth, urbanisation and poor water management (Tan and Guo 2008).

Western China has also been facing serious water scarcity. Northwest China, located in the country's arid and semiarid areas, has a bigger shortage of water due to limited precipitation (often less than 400mm per year), and high evaporation rate (normally around 1,200mm per year). The areas in northwest China which face the most serious water stress, include Guanzhong district in Shaanxi, Hexi Corridor district and the Shiyang River watershed in Gansu, and oases in Xinjiang (Yang 2006).

5.2.4 Climate change and its impacts in western China

Hugo et al. (2009:xlviii) define ‘climate change hotspots’ as:

‘... a specific area or region that may be at relatively high risk of adverse impacts from one or more natural hazards which result from climate change’

McCarthy et al. (2001) summarise four typical types of climate change hotspots: low-lying coastal areas, delta regions, low-lying small island states, and semi-arid and low humidity regions. Hugo et al. (2009:146) indicate that western China falls into the category of semi-arid and low humidity regions where water resources are threatened by climate change. The detailed climate data in the study area is presented in Section 6.2.

Water scarcity, as discussed earlier, is one of the most critical environmental problems faced by China. The problem is more serious in western China than in other parts of the country. Drought is mainly distributed in the northwest and north regions of China. Climate change has an important impact on water resources in China (Hugo et al. 2009). Although increased rainfall may tend to reduce the water risk (Nohara et al. 2006), climate change is projected to decrease the areas of glacier and permafrost and, consequently, shrink the sources of water supply for China’s major rivers such as the Yangtze and Yellow Rivers (Wu et al. 2001). It is likely that the average annual runoff of ground water will decrease, leading to severe water shortages in the following decades in western China, especially in Gansu province and in the Ningxia autonomous region (ECCNARCC 2007). Hugo et al. (2009) therefore warn that western China may experience a net drying which could exacerbate the existing water scarcity in that area.

Water scarcity is not an isolated environmental problem but has profound impacts on other problems (e.g., land loss, reduced production, and desertification) and socio-economic problems (e.g., reduced income and impoverishment). Shi (1996) estimated that 40 million ha of agricultural areas are affected by regular droughts annually. Since 2000, annual grain loss due to water scarcity has reached 37.28 billion kg, accounting for 7.9 percent of the total grain production in China, with direct economic losses amounting to 19.3 billion Yuan (Zhao et al. 2008). The reduced production and associated economic loss pose a significant threat to the

nation's food security and increase rural poverty. Moreover, climate change and drought will exacerbate desertification across western China (Shi 1996).

In addition to water problems, climate change in western China also tends to exacerbate the already fragile ecosystems, leading to an increase in various diseases and insects and pests in forest and pastoral areas, as well as in the occurrence of forest fires. Moreover, glacier melting in Tibet and northwest China owing to increased temperatures, could result in a higher risk of local landslides (Hugo et al. 2009).

5.3 Population and migration in western China

5.3.1 Demographic characteristics of western China

As shown in Table 5.1, western China has nearly 336 million people, which accounts for 24.5 percent of China's total population (1.37 billion). The region's population growth rate in the period from 2000 to 2010 was 1.4 percent, much lower than the national rate of around 5.8 percent. Four western China provinces – Chongqing, Sichuan, Guizhou and Gansu – experienced negative population growth, which was largely due to the fact that they were the main migrant-sending regions in China.

In 2010, the urbanisation rate in western China was 41 percent, a lower rate compared to the national one. This indicates that western China has a larger proportion of rural dwelling people than the rest of China does, and thus relies more on agriculture and the natural environment than other parts of the country.

Western China also has a relatively higher dependency rate and a higher illiteracy rate. Diverse ethnicity is another typical demographic characteristic of western China, with 50 out of the country's 55 ethnic minorities living in this region; this accounts for 70 percent of the total ethnic population of China.

Table 5.1: Comparison of demographic characteristics between western China and China in 2010

	Western China	China
Population	336 million	1,370 million
Population increased from 2000 to 2010 (%)	1.4 %	5.8 %
Urban population (% of total population)	41 %	50 %
Dependent population (people aged 14 years or younger and over 65 years/ total population)	27.7 %	25.5 %
Illiteracy (illiterate persons/total population)	7.2 %	4.1 %

Source: Population Census 2010 (NBS 2012c)

In all, the demographic characteristics in western China can be summarised as: less total population, slower population growth, a smaller scale of urbanisation, higher dependency ratio, and lower education level. These characteristics combined reflect that human capital in this natural environment-dependent region is not as advanced as that of other regions of the country to promote development.

5.3.2 Migration in western China

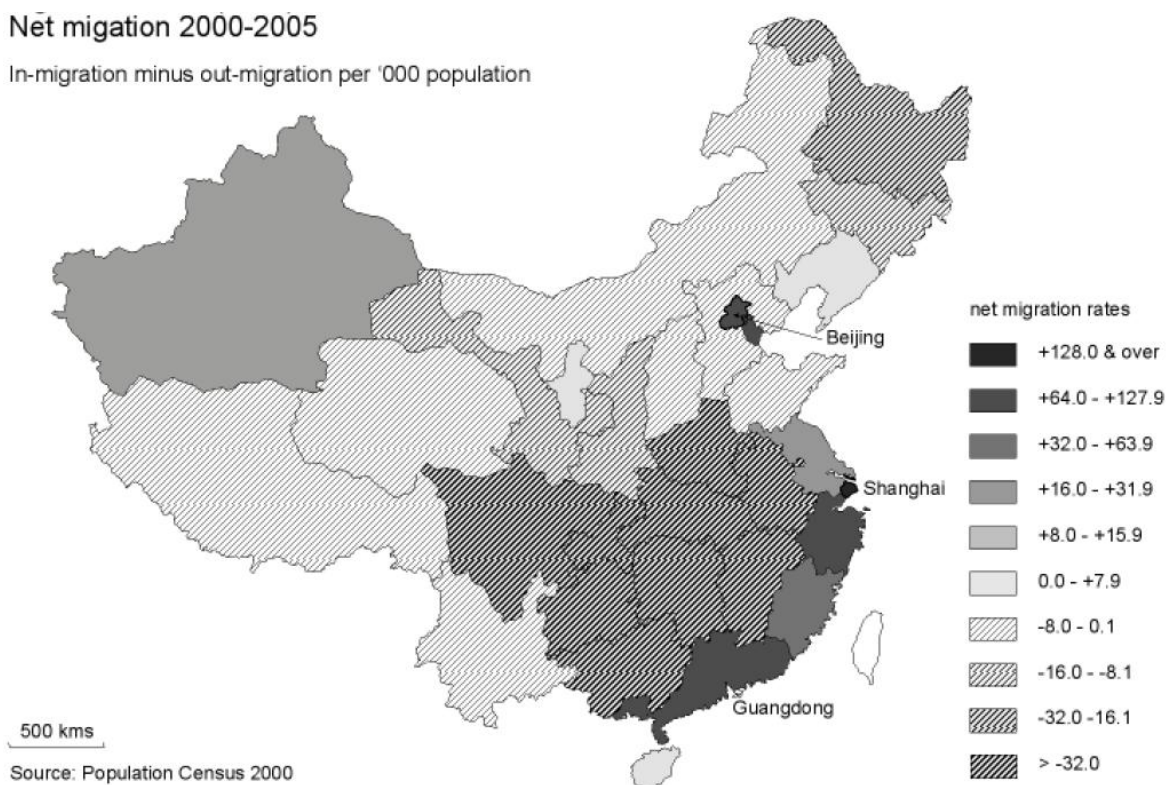
China is, and will continue, experiencing the most extensive internal migration in the world (Hugo et al. 2009). In 2011, there were 252.8 million internal migrants living away from their *Hukou* registered place in China, accounting for more than 18 percent of the total Chinese population. Of these, migrants moving within original provinces and beyond provincial boundaries are 158.6 million and 94.2 million, respectively (NBS 2012c).

Internal migrants in China tend to move from western and central regions to eastern coastal regions, from rural to urban areas, and from undeveloped economic zones to developed zones (Tan and Wang 2004). These features overlap and reflect the fact that a large number of people have moved from rural areas of the underdeveloped central and western regions to urban areas of the developed eastern coastal region.

According to the Population Census 2010 (NBS 2012c), the destinations receiving the largest inter-provincial migrants are Guangdong (21.5 million); Zhejiang (11.8 million); Shanghai (9 million); Jiangsu (7.4 million), and Beijing (7 million). All of these major migrant-receiving regions are located in eastern China. Migrants originated mostly in the inland provinces. The

top places sending inter-provincial migrants are Anhui, Henan and Sichuan; all are located in central or western China. Based upon published data on inter-provincial migration flows from the 2000 Census, supplemented by the unpublished five-year inter-provincial migration flows from the 2005 1 percent Sample Census Survey, Fielding (2010) establishes the inter-provincial net migration trend in China, depicted by Figure 5.3. This confirms the overall Central/Western-to-Eastern trend.

Figure 5.3: Inter-provincial net migration trend, 2000-2005, China



Source: Fielding (2010:18)

Rural-to-urban migrants are usually regarded as rural migrant workers. Migrant workers were defined as people whose household registration was in rural areas but who stayed in an urban area for six months to make a living, without having a higher education degree (Tan 2003). Gui et al. (2012) outline four categories of migrant worker: first, migrant workers who live in the city for a long time, have stable economic foundations and successfully adapt to the city culture; second, individuals who are proprietors of shops; third, migrant workers who are employees; and fourth, migrant workers who are always unemployed due to their limited skills or knowledge.

Before the advent of structural adjustment and economic reform, farmers were strictly tied to the land by the rural collectivisation system and the Hukou system, which limited farmers' access to jobs and consumption goods outside their original area. In the late 1970s, the collective agriculture system was replaced by the Household Responsibility System (HRS), which sharply increased agricultural productivity and gave farmers freedom to choose productive approaches and income strategies (Zhu and Luo 2010). In the meanwhile, the hukou system was loosened in that food and housing in urban areas became marketable, which enabled farmers to live in urban areas without changing their Hukou status (He and Pooler 2002; Zhu and Luo 2010). In addition, economic development led to an increase in the demand for labour in urban areas. The push factors, rooted in rural areas, and the pull factors, located in urban areas, combined to cause a vast internal movement from rural to urban areas (Knight et al. 2011).

Rural-to-urban migration is regarded as an effective means to reduce the demand for land and break the vicious circle of land shortages, extensive cultivation, ecological deterioration, and poverty, especially in ecologically fragile and poverty-stricken rural areas (Zhu and Luo 2010). Moreover, the remittances sent by migrant workers have increased the total incomes of rural households and has enhanced their resilience to negative shocks at home (Bright et al. 2000).

Western China is a major sending area of rural migrant workers. However, migrant workers who aim to seek better living conditions in more developed regions are not the only type of migrants from this region. Western China also has a large number of environmental migrants who have left their hometowns because their lives and/or livelihoods were threatened by a deteriorating environment, or because they lived in a natural protected zone or an environmental engineering project area (Bao 2006; Shi et al. 2007). Western China has more population than its human carrying capacity (Liu and Wang 2001), and this is considered to be an important environmental-related push factor for out-migration from this region. He and Pooler (2002) explicitly indicate that the inter-provincial migration flows in western China in the 1980s and 1990s were partly caused by environmental factors.

In western China, poverty and the fragile ecology overlap to pose challenges for local development and increase the odds of out-migration. 'Development-oriented resettlement' (or 'anti-poverty migration') and 'environmental migration' are two terms which are used

interchangeably in describing human mobility as a result of environmental stressors and their related economic pressures within this region (Xun and Bao 2007; Liang 2011). To relieve pressure on the environment, to rehabilitate the deteriorating ecosystem and to eradicate poverty, people in western China have been experiencing environmental migration due to government-arranged schemes and on a spontaneous basis (Bao 2006).

5.4 Development, inequality and class in western China

5.4.1 Development level of western China

Western China has suffered disproportionate poverty compared to other regions in China (Zhao 2006; Meng 2007). By 2010, the population in western China accounted for about 24.5 percent of the total Chinese population. However, as shown in Table 5.2, the GDP of western China only accounted for about 18 percent of the total national GDP; about only one third of the GDP of eastern China (NBS 2012b). The main factors that are responsible for poverty in western China include its fragile ecology and deteriorating environment, its low level of production, and its poor human capital (Zhao 2006; Tan and Guo 2008).

Table 5.2: Annual GDP of China by regions, 2006-2010 (100 Million Yuan)

	2006	2007	2008	2009	2010
Nation	232815.3	279736.3	333313.9	365303.7	437042
Eastern China	88449.8	105452.8	124093.5	136345.3	162031.4
Western China	40345.7	49182.5	60447.8	66973.5	81408.5
Western China /Nation	17.3 %	17.6 %	18.1 %	18.3 %	18.6 %
Western China /Eastern China	45.6 %	46.6 %	48.7 %	49.1 %	50.2 %

Source: China Statistical Yearbook 2011 (NBS 2012b)

As shown in Table 5.3, annual per capita net income in rural western China has been lower than that of other parts in China. By 2010, the per capita net income of rural residents in western China was 4396 Yuan, which was 74.2 percent of the national level and only half that of eastern China. In 2010, nine out of the ten provinces/autonomous regions with the lowest per capita net income of rural residents were located in western China: Gansu (3424.7 Yuan); Guizhou (3471.9 Yuan); Qinghai (3862.7 Yuan); Yunnan (3952.0 Yuan); Shaanxi (4105.0 Yuan); Tibet (4138.7 Yuan); Guangxi (4543.4 Yuan); Xinjiang (4642.7 Yuan), and Ningxia (4674.9 Yuan) (NBS 2012a).

Table 5.3: Annual per capita net income of rural residents in China by regions, 1990-2010 (Yuan)

	1990	1995	2000	2009	2010
Nation	686.3	1577.7	2253.4	5153.2	5919.0
Eastern China	945.6	2324.7	3343.5	7553.1	8555.7
Western China	564.9	1101.7	1632.3	3788.4	4392.4
Western China/Nation	82.3 %	69.8 %	72.4 %	73.5 %	74.2 %
Western China/Eastern China	59.7 %	47.4 %	48.8 %	50.2 %	51.3 %

Source: China Rural Statistical Yearbook 2011 (NBS 2012a)

In 1994, 592 counties were identified as national poverty-stricken counties by the Seven-Year Priority Poverty Alleviation Program, among which 361 counties were located in western China. By 2012, the number of national poverty-stricken counties in western China had increased to 375, accounting for 63.4 percent of the total number (CPAD 2012). In 1994, the population living in absolute poverty in western China was as high as 65 million, representing 81.3 percent of the total absolutely poor Chinese population. In 2004, western China still had an absolutely poor rural population of 17.5 million, accounting for 65.1 percent of poverty-stricken rural population in the country (NBS 2011). The poverty incidence of rural western China was 6.1 percent in 2010, which was much higher than the level in rural eastern China (0.4 percent) (NBS 2011).

Poverty in western China is highly correlated with ethnic distribution. This region has 50 of the total 55 ethnic groups in China. By 2010, the incidence of poverty in the eight ethnically-concentrated autonomous regions and provinces in western China² was 8.7 percent, much higher than the national level 2.8 percent (SEAC 2011). Table 5.4 shows that nearly 60 percent of national poverty-stricken counties in western China are ethnic counties.

² The eight ethnically-concentrated autonomous regions and provinces in China are: Inner Mongolia; Guangxi; Tibet; Ningxia; Xinjiang; Guizhou; Yunnan, and Qianghai. All of the eight autonomous regions and provinces are located in western China.

Table 5.4: Distribution of the national poverty-stricken counties and the national poverty-stricken ethnic counties in western China, 2000

	Number of counties											
	Inner Mongolia	Guangxi	Chongqing	Sichuan	Guizhou	Yunnan	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang	Western China
(1)National poverty-stricken county	31	28	14	36	50	73	50	43	15	8	27	375
(2)National poverty-stricken ethnic county	31	28	4	20	36	44	0	14	12	8	27	224
(2)/(1)	100 %	100 %	29 %	56 %	72 %	60 %	0 %	33 %	80 %	100 %	100 %	60 %

Source: Wang and Fan (2000)

The distribution of poverty-stricken populations is consistent with the distribution of Ecological Fragile Zones (EFZs) in western China (Lai 2008). The incidence of poverty occurring in the EFZs is extremely high, with 76 percent of the counties located in the areas being poor and with 74 percent of people residing in these areas living in poverty-stricken conditions (Tan and Guo 2008). Since the problems of a fragile ecology, poverty and excessive population overlap in this region, western China is trapped in a vicious circle of deteriorating environment and poverty. It is essential for development campaigns to integrate both concerns about the environment/climate change and poverty.

5.4.2 Grand Development in Western China

In March 2000, China's central government officially initiated the 'Grand Development in Western China'. Its goal was to achieve a satisfactory level of economic development in western China by 2010 and to establish a 'new western China' by the middle of the 21st century (SC 2000). This strategy comprised a series of comprehensive policies involving all dimensions of development, including both socio-economic and ecological/environmental development (Tan and Wang 2004). In 2000, 'The 10th Five-Year Plan on Western Region Development' proposed implementing a range of programs, including infrastructure construction, resource development, ecology rehabilitation and environmental protection,

industrial restructuring, rural development, and improving human capital and social welfare (SCOLGWRD 2002). In 2005, some new programs such as enhancing public services and strengthening open policy were included in ‘The 11th Five-Year Plan on Western Region Development’. Ecology rehabilitation and construction and environment protection still retained its significance in the whole strategy (NDRC and SCOLGWRD 2006). The specific programs relating to ecology and the environment include restoring farmland/pastures to forest/grasslands; protecting natural forests; controlling sandstorms; constructing the forest shelter system; protecting and rehabilitating wetlands; protecting and building natural reserves; conserving water and soil, and controlling desertification.

The ‘Grand Development in Western China’ strategy recognised the important role ecology and the environment played in western China’s economic development. Ecology rehabilitation and construction and environmental protection were given priority in the strategy’s agenda. The development strategy has been trying to break the vicious circle of the deteriorating environment and poverty through integrating all the environmental, economic and population programs. The 10th, 11th and 12th ‘Five-Year Plan on Western Region Development’ (SCOLGWRD 2002; NDRC and SCOLGWRD 2006; NDRC 2012a) all proposed ecology/environmental migration as an important approach to rehabilitate the environment and to eliminate poverty. Environmental migration is a typical multi-purpose action to address issues regarding environment, poverty and population.

5.4.3 Class in rural China

Since the founding of People’s Republic of China, pre-revolution differences between social classes were diminished in a Communist regime by replacing private ownership of productive assets with collectivisation of farming and state consolidation of the urban economy (Kraus 1981). Before China’s extensive reforms, one of the major goals of Chinese policies was equity or ‘balanced growth across regions’ (Wan 2004:362). Inequality, therefore, remained quite limited and stable in the pre-reform period (Tsui 1991). Bian (2002) groups the pre-reform classes according to the following distinctions: (1) residential registration (Hukou) in rural or in urban areas; (2) employment in state owned economic structure or in collective owned economic structure; (3) cadre or worker; and (4) ‘revolution’ versus ‘anti-revolution’ political orientation.

China embarked on structural adjustment and economic reformation in the late 1970s. The reforms de-collectivised both rural and urban institutions and economies, diminishing the pre-reform hierarchy and facilitating the emergence of new class system (Davis 1995). Since then, the Chinese economy has grown spectacularly and overall living standards have been enhanced significantly (Chen and Ravallion 2007). Economic development reduced poverty but increased inequality in China, because one of the initial objectives of economic reforms was to break down the egalitarian system and to let some regions and some people become rich before others (Wan 2004). Chinese society has experienced significantly widening social inequality in the last two decades, which has aroused the increasing concern of scholars and policy makers (Benjamin et al. 2005; Pakulski 2009).

Rural China experiences greater and more profound class transformations, but this receives less attention from researchers than it does in urban settings (Bian 2002). The principle reform in the rural economy is the implementation of the Household Responsibility System (HRS), which recognises rural households, instead of People's Communes, as the basic unit of production, distribution and consumption (Nee 1991). This reform made collective farming history by 1983 and returned property rights to rural families (Lu 2001). Under HRS, farmers gained rights over their production, income and time. These newly autonomous farmers have the chance to diversify their income and have the right to free themselves from the land and seek higher incomes from working in non-agricultural sectors in both rural and urban areas (Nee 1989; Zhu and Luo 2010). The reform splits the originally homogenous peasant group into rich and poor sub-groups (Bian 2002). Leaving the land and leaving the countryside not only brought different economic rewards to individual families; it also diversified farmers' occupations. All these changes have contributed to the differentiation of the once homogeneous 'peasant class' in China.

Another major change in rural class structures associated with the reforms related to the power of rural cadres. During the reforms, rural cadres took advantage of their political and institutional power to obtain market opportunities and to gain economic interests (Nee and Lian 1994). Nee and Su (1998) explicitly indicate that rural cadres can easily gain control over collective industries, arrange salaried positions for their family members and friends, exert a strong influence on private entrepreneurs, and even use 'insider privatisation' to strip

collective assets. From this perspective, rural cadres can translate their occupation-based status into a more powerful and richer class position.

As a result of the rapid and extensive change in rural class structure, a single rural residential status is markedly insufficient to describe the complexity of the class structure in post-reform rural China. Therefore, researchers have adopted various indicators to explore the class structure of rural communities and to measure the class position of rural households or individuals in China (Wan and Yuan 2009). Chinese rural classes are investigated on the basis of occupation, income, consumption, and social resources (Lu 1989; Walder 2002; Wan and Yuan 2009). A widely accepted piece of research on Chinese rural class conducted by Lu (1989) defined eight emerging rural classes based on combined Neo-Marxist, Weberian and Bourdieusm theories. The eight classes and estimated percentages in the registered rural population are listed in Table 5.5.

Table 5.5: Eight classes in rural China

Class	Proportion
<i>rural cadres</i> are the controller of collective economy	7
<i>private entrepreneurs</i> are the new capitalist class	1
<i>managers of township and village enterprises</i> are managerial class	1.5
<i>household business owners</i> and <i>individual industrialists and commercialists</i> are the petty bourgeoisie	6 to 7
<i>professionals</i> are the new middle class	2.5
<i>employees in collective industry</i> and <i>migrant peasant-workers in cities</i> are rural migrant workers	16 to 18
<i>wage labour in local private sector</i> is considered the ‘new working class’	16 to 17
<i>peasants</i> work and live on income from agricultural products	48 to 50

Source: Lu (1989)

These analyses of class structure, however, are criticised for being too rigid to describe the rapidly changing rural society and its occupation structure (Gong 2003). Furthermore, occupation is not considered an appropriate measure for rural classes because it ignores the fact that many of the occupations of rural migrants are part-time and highly mobile (Li 2005).

Lu (2000) points out that any single indicator of rural class could arouse disputes, and multiple indicators of class should be adopted. However, current studies on Chinese rural class structure rarely investigate classes in a comprehensive way and usually ignore the influence of political, reputational, cultural and social differences on the formation of class (Wan and Yuan 2009).

The impact of the rapid class reformation on social equality in rural China is controversial. Some believe that the class reformation that grew out of the market economy will break the original rigid hierarchy and lead to a more equal distribution of development opportunities, while some others argue that class reformation will exacerbate the inequalities in Chinese society by unequally distributing resources across regions and between individuals (Davis 1995; Bian and Logan 1996). Since China is still in the process of class transformation, the class structure is very unstable and highly heterogeneous within the nation. It is difficult to assess class structure of communities and class positions of households by an uniform measure. Class analysis in rural China is therefore particularly sensitive to specific contexts (Lu 2000). This study has no intention to develop a new definition of class or set up a new set of class boundaries in rural China, rather it accepts that there is currently no established definition or structure of class in rural China and tests the influence of *all* potential indicators of Chinese rural class on households' experience of climatic variability impacts and migration patterns. Section 6.4 explicitly discusses the indicators of class employed in this study.

5.5 Conclusion

Rural western China is an area where the fragile ecology, deteriorating environment, intense climate change, massive migration, serious poverty, increased inequality, and rapid class restructure overlap. These factors combine to make this region an ideal setting to explore the interrelationship between climate change, class and migration. There is a large body of literature on environmental migration and poverty-induced migration in western China. Studies that explore the linkage between inequality (e.g., western-eastern, rural-urban inequalities) and human mobility can also be found in this region. These studies principally focus on regional inequality or urban-rural inequality growing out of the ecological poverty of the rural west that drives migration to more developed areas. However, the empirical research linking inequality within the rural communities of this region to environmental

migration patterns is still scarce. Furthermore, class analysis has rarely been adopted to investigate inequality in environmental or migration studies in this region. The newly emerging and rapidly changing class structure in rural China resulting from socio-economic reforms create difficulty in defining and categorising rural classes, which consequently adds to the challenge of using class analysis in this region. This study seeks to respond to these challenges and fill the knowledge gap by investigating the relationship between climate change, inequality and migration from a comprehensive class perspective in a rural community in western China.

CHAPTER 6: The Influence of Class on Household's Experience of the Impacts of Climatic Variability

6.1 Introduction

A two-stage model of climate change-induced migration based on the theory of planned behaviour has been discussed earlier (Chapter 4). Stage I represents people's experience of climate change impacts and their intention to solve the problems associated with that change. The main assumption is that it is the impacts of climate change as experienced by people, rather than climate change itself, that provides a proxy to adaptation. To explore people's migration as a response to climate change, one should understand the climate change impacts borne by people. This chapter aims to examine how these impacts differ by class among households in Minqin county.

The literature on climate change impacts shows that the major types of impact can be divided into: (1) increased mortality and a deterioration in health status (Peng et al. 2010; Shuman 2010); (2) deterioration in economic situations (Tol 2009; Oral et al. 2012); and (3) worsened housing and transportation conditions (Morton 2007; Lwasa et al. 2009). Besides these general impacts, rural families are particularly exposed to the negative impacts of climate change on their livelihoods, agricultural production and access to natural resources (e.g., water resources) (Perch-Nielsen et al. 2008; Massey et al. 2010). The impacts of climate change are context-specific because exposure and adaptive capacity vary greatly across geographic localities and social groups.

Class is used as a set of explanatory variables to explain the different impacts experienced by households, by holding constant other important factors that can influence climatic impact. The explanatory variables are examined at two levels, township and household, enabling the study to investigate how both contextual and individual factors shape human behaviour at the household level. Information about class is grouped into: (1) class structure, relating to Gini index of the townships, and (2) class position, referring to economic, social, cultural, symbolic and political status of households in the community. The study undertook a literature review to identify the indicators of the different dimensions of class that might be significant in influencing people's experience of climate change impacts. The other important factors derived from the review fall into the category of the control variables. The dimensions

and elements of the potential explanatory and control variables are summarised in Table 6.1 and will be examined for the study area in sections 6.3 to 6.6. Finally, a regression model is developed to empirically investigate how the impacts differ by class at the household level.

Table 6.1: Dimensions and elements of class and other factors identified in the literature as significant in shaping climate change impacts

Category	Dimension	Element	Supporting literature	Examined in:
Class structure of town	Gini index	income Gini	Brenkert and Malone (2005); Brooks et al. (2005); Alberini et al. (2006)	section 6.3
		land Gini	Crenshaw and Jenkins (1996); Li et al. (1998)	
Class position of household	economic position	income	McKinley and Wang (1992); Adger (1999); Brooks et al. (2005)	section 6.4
		income diversity		
		housing		
	social position	social connection	Isham (2002); Adger (2003);	
		assistance received	Armitage (2005); Katungi (2007); Pelling et al. (2008); Deressa et al. (2009)	
	cultural position	education	Barnett (2001); Brooks et al. (2005); Paavola and Adger (2006); Deressa et al. (2009)	
symbolic position	occupation	Meze-Hausken (2000); Heltberg et al. (2009)		
political status	access to public service	Thomas and Twyman (2005); Paavola and Adger (2006)		
Control variables	Institutional arrangements	local adaptation	Adger (1999); Adger et al. (2003); Adger et al. (2009)	section 6.5
		aged pension		
		health insurance		
	demographic characteristics	health	Bohle et al. (1994); Meze-Hausken (2000); Croppenstedt et al. (2003); Henry et al. (2003); McLeman and Smit (2006); Deressa et al. (2009); Black et al. (2011a); Afangideh et al. (2012)	section 6.6
		male ratio		
		household size		
		age of household head		
	elderly			
	dependency ratio			

6.2 Climatic variability and its impacts in Minqin county

6.2.1 Climatic variability in Minqin county

This Chapter focuses on an important aspect of climate change – climatic variability – in Minqin county which is an ecologically fragile area, vulnerable to increasing temperature, low precipitation, high evaporation and very low humidity (Zhang et al. 2004; Sun et al. 2005). There have been a number of studies that have focused on climatic variability over the last few decades in this area because of its sensitivity (Song et al. 2006; Han et al. 2008; Liu 2009; Chang et al. 2011; Liu et al. 2011; Ma et al. 2011). The majority of these studies used climate data (e.g., daily mean temperature, mean maximum and minimum temperature, mean rainfall, evaporation and relative humidity, etc.) observed by the Minqin Meteorological Station since the 1960s, and found that the annual mean temperature increased significantly, whilst the annual precipitation only increased slightly.

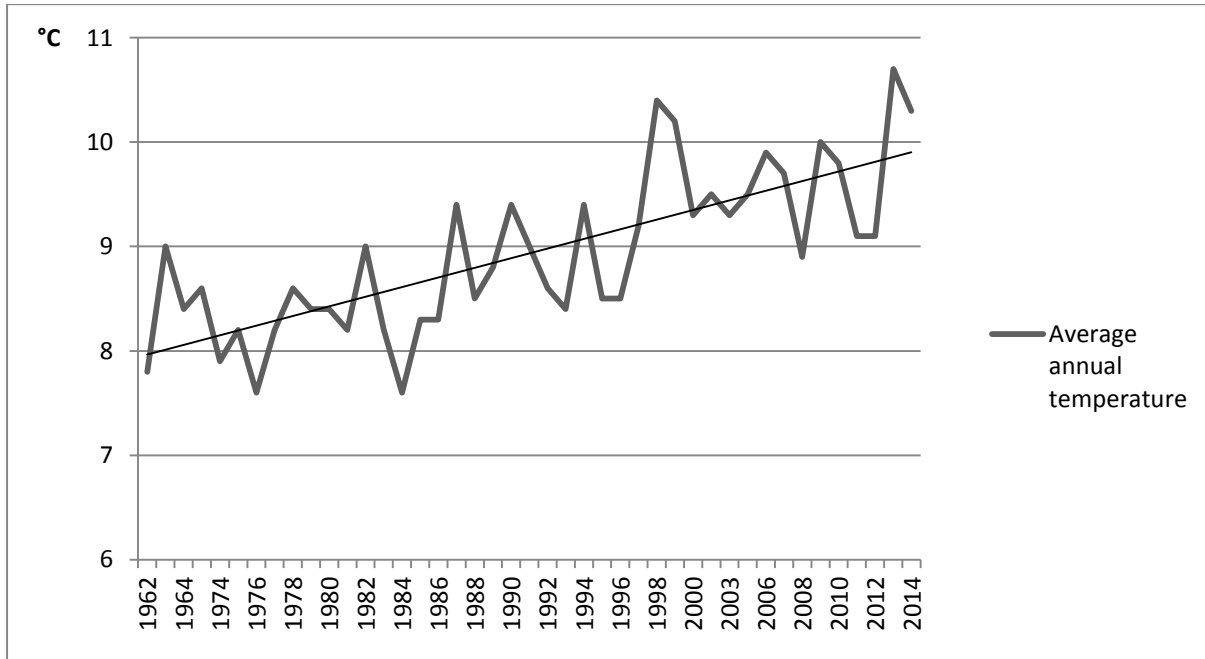
Figure 6.1 shows that the average annual temperature of Minqin has increased dramatically and consistently since the early 1960s. Minqin's average annual temperature in 2014 was 10.3 °C, compared to 7.8 °C fifty years ago. The annual mean temperature increased over the last 50 years at a rate of 0.397 °C/10a³ (Liu et al. 2011), which is higher than the speed of warming at global and national levels and those of north-western China's arid areas over the same period (Liu 2009; Chang et al. 2011). The increase in mean minimum temperature during winter was especially pronounced. Liu (2009) therefore asserts that Minqin is a 'hotspot of globe warming'.

Figure 6.2 shows the changes of total annual precipitation in Minqin from 1963 to 2014. Precipitation in Minqin has fluctuated during the last 50 years, while the annual mean rainfall increased during the 1960s and early-to-mid-1970s, it decreased from the mid-1970s until the mid-1990s and has increased again since the mid-1990s (Chang et al. 2011). Liu et al. (2011) have estimated that the annual mean precipitation has increased over the last 50 years by 2.508 mm/10a, indicating that the annual mean rainfall has increased but not significantly. Despite the slight increase in overall annual rainfall, the seasonal variation in precipitation was not consistent. Han et al. (2008) point out that over the last 50 years precipitation

³ 10a equals to a decade.

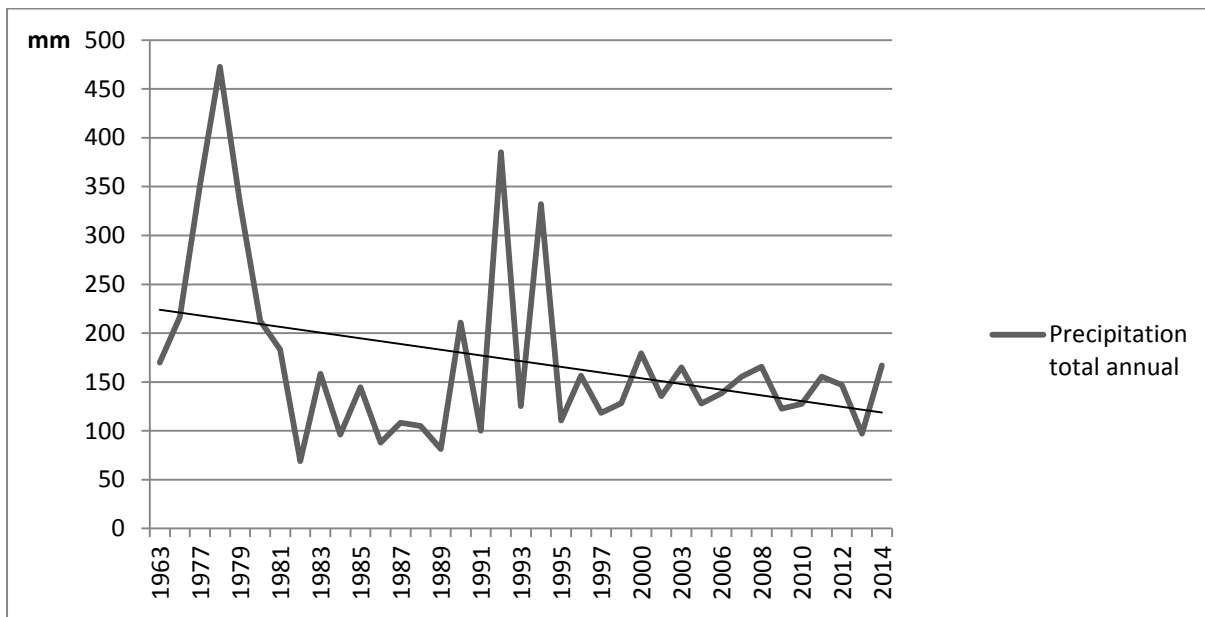
increased in spring and winter, whereas it decreased in summer and autumn. Liu (2009) also indicates that the increased rate of precipitation in Minqin is lower than that of the rest of China's north- dry areas. Minqin is still one of the driest areas in the country.

Figure 6.1 Average annual temperature of Minqin (1962-2014)



Source: Tutiempo.net (2015)

Figure 6.2 Total annual precipitation in Minqin (1963-2014)



Source: Tutiempo.net (2015)

Overall, annual evaporation decreased over the 50 year period in Minqin, but not significantly, with a rate of only -7.233 mm/10a (Liu et al. 2011). Han et al. (2008) demonstrate that the evaporation rate has increased gradually since the 1970s, although it had decreased significantly in the 1980s; the second round of increase occurred in the 1990s, but it has decreased again since the 21st Century. There have been distinctions between seasonal variations in evaporation, with evaporation rates decreasing substantially in spring and summer, slightly in autumn, and remaining the same in winter. Decreased evaporation can be attributed to the increased precipitation that raises the humidity and enhances vegetation density. However, the decreased evaporation in this area is principally due to the fact of the continuing decline of groundwater (Ma et al. 2011). From this perspective, the decreased evaporation is not an improvement of Minqin's climatic conditions; rather it is considered an indicator of a deteriorating environment.

Over the past 50 years, the annual wetness degree increased slightly by a rate of 0.005 /10a in Minqin. The trend in winter was the highest but, with low precipitation and high evaporation, the average rate of Minqin's wetness degree is only 0.154, which is categorised into the arid level (Liu et al. 2011).

Some studies suggest that the climatic variability of the last 50 years has promoted the rehabilitation of the local ecosystem and contributed to decreasing the severity and frequency of environmental hazards, such as sandstorms, in Minqin (Chang et al. 2011; Ma et al. 2011). However, Zhang et al. (2008) suggest that Minqin has experienced significant climate change over the past 7000 years with a long-term trend towards an increase in its aridity, and this is primarily responsible for the present environmental degradation, especially desertification.

6.2.2 The impacts of climatic variability on the environment in Minqin

Climatic variability, coupled with human activities, has accelerated ecosystem deterioration in Minqin (Zhang et al. 2008; Liu et al. 2011). Many studies have concluded that human activities, such as over-grazing, over-planting and mismanaging water resources, are the main causes for environmental degradation, with climatic variability serving only as a 'backdrop' (Lee and Zhang 2005; Sun et al. 2005). However, some other researchers (Zhang et al. 2008) suggest that human activities may have contributed to exacerbating environmental problems since the late 1940s, though they do not appear to be the key factor in initiating these

problems; and they argue that it is the arid climate and associated changes in the water component of the ecosystem that primarily influence environmental degradation in Minqin. Song et al. (2006) summarise four main reasons for environmental deterioration in this area: (1) increasing temperature; (2) decreased rainfall since the 1980s in the mountainous upper catchment of the Shiyang River, which is the only surface water source of the Minqin Oasis; (3) shrinking glaciers in the Qilian Mountains; and (4) over-pumping of groundwater for drinking and irrigation. The first three reasons are directly linked with climatic variability and the last one is also largely associated with the arid climate and a decline in surface water sources in this region.

Desertification, sandstorms and water scarcity are considered three major types of environmental degradation in Minqin, because it is surrounded by the Badain Jaran and the Tengger Desert. The total area of this county covers 16,016 km², of which 91 percent is desert or wasteland (Zhang et al. 2004). Minqin is claimed to be an area experiencing very severe desertification, according to the Chinese government and UNEP (Middleton and Thomas 1997). Arid climate, increased temperature and decreased water resources have accelerated the speed of desertification in this area by causing natural plant losses (Zhang et al. 2004; Song et al. 2006; Liu et al. 2011). In the Minqin Oasis, nearly 70 percent of natural grassland has degraded, and most sand-protection forests on the periphery of the oasis have been destroyed. Sand shrub forestry dropped significantly because of degradation and sandy desertification (Zhang et al. 2008). Sandy desertification has expanded greatly in the Minqin Oasis since the 1950s, with desert encroaching on 6,700 km² of farmland and 39,000 km² of forest lands, 263,000 km² of grasslands being degraded, and 3,300 km² of farmlands being abandoned due to salinisation (Song et al. 2006). Mobile sands cover around 10,000 km² on the periphery of the oasis, and the moving sand dunes encroach on farmland at a rate of 8-10 metres every year. In some zones of severe sand-activities, the rate reaches 15-20 metres per year (Song et al. 2006). Because of its geological location, as shown in Figure 4.2, the ecosystem of Minqin county directly affects the ecological health and weather conditions of northern China (Zhang et al. 2004). Ecological failure in the area would lead to a connection between the Tengger and Badain Jaran deserts, and, consequently, threaten physical environments in northern China. In a report on government work since 2002, former Premier Wen Jiabao repeatedly ranked the environmental issues of Minqin county as the top concern of Gansu province.

Minqin is one of the four major sources of sandstorms in China (Gai et al. 2006). Since the 1970s, in an average year, there have been 28.2 days with strong winds, 23.8 days with sandstorms, 37.8 days with blowing sand, and 30.2 days with floating dust (Chang et al. 2011). Wind carrying sand is a typical pattern in this area. Increased precipitation and the degree of wetness are believed to limit the frequency of sandstorms. However, the days with floating sand and dust have increased considerably since the 1990s. This is mainly because stabilised sand dunes were activated by over-reclamation and sand activities were accelerated by massive vegetation degradation (Ma et al. 2011).

Minqin is an area suffering extreme water shortages, and water sources are around only 500 m³ per capita, which is considered to be extreme water scarcity⁴. According to the carrying capacity of water, Minqin can only support about 170,000 people. However, its population reached 270,000 in 2010. Water discharge into the Minqin Oasis has continually decreased by around 542 million m³ annually. Minqin county is located at the lower reach of the Shiyang River, while Wuwei city is at the upper reach (Figure 4.2). This city has built numerous dams and channels to meet its escalating water consumption since the 1950s, which has directly decreased the water discharge to Minqin county (Lee and Zhang 2005). The water capacity of a unit of farmland has dropped to 220 m³ in Minqin, which is even less than that of Israel, the driest place in the world (Zhang et al. 2004).

Due to the depletion of surface water resources, Minqin has had to exploit groundwater for agricultural production. From 1959 to 1995, the number of pumping wells in the county increased from 0 to 14,200 (Zhao et al. 2004). Wang et al. (2002) estimate that the average annual exploitation quantity of groundwater reaches 370 million m³ in this area, which far exceeds the groundwater replenishment rate and thus leads to a severe groundwater budget deficit (Zhang et al. 2004). It has been reported that some huge ‘groundwater depression cones’ (Shi 2000; Ma et al. 2003), with a total area of 1,000 km² (Li and Chen 2001), have emerged. Such a fall in the groundwater table has caused great damage to the local ecological system in terms of vegetation degeneration and salinisation (Lee and Zhang 2005). Natural vegetation and artificial plantations around Minqin Oasis have withered or disappeared due to

⁴ A place is considered to have sufficient water if the per capita water source reaches 1,700 m³ per capita. There is water stress if the per capita water source is between 1,000 m³ and 1,700 m³. Water scarcity will happen when the per capita water source drops to below 1,000 m³ (Yang and Zehnder 2001).

the decline of groundwater, which, consequently, reactivated fixed sand dunes and increased desertification.

6.2.3 The impacts of climatic variability experienced by households in Minqin

Following the international studies on the impacts of climate change (e.g., on health, income and expenditure, housing and infrastructure, agricultural production), this study included a set of questions to identify the specific impacts of climatic variability upon the people in Minqin county. Before asking them questions regarding climatic variability and its environmental impacts, respondents were given an explanation of climatic variability. In the questionnaire, it was defined as climatic variation (e.g., change in temperature and rainfall) and extreme climatic events (e.g., drought, sand storm, desertification, salinisation).

The respondents were subsequently asked:

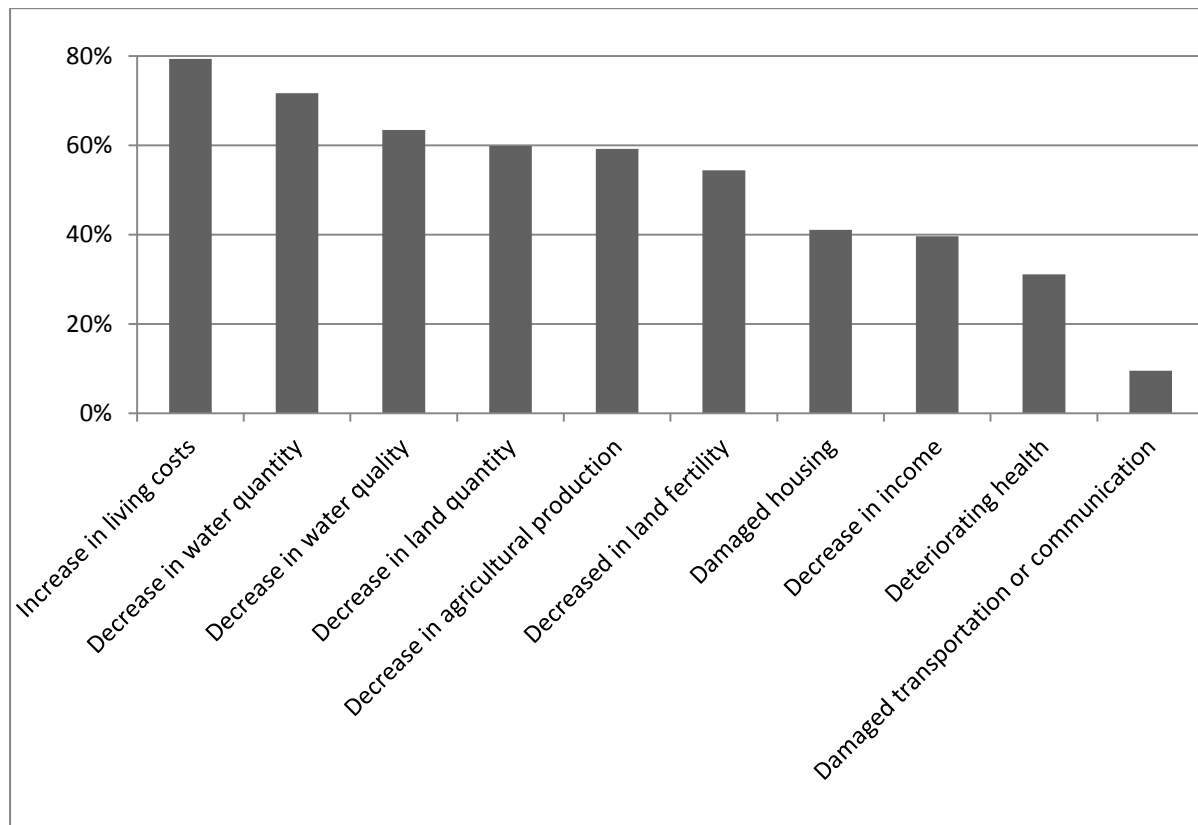
‘Did local climatic variability adversely impact on agricultural production, land quantity, soil fertility, water quantity, water quality, living costs, income, health conditions, housing, transportation and communication, respectively, in your family by the year 2007?’

The meaning of ‘adverse impacts’ was explained to the respondents as: decrease in agricultural production; decrease in land quantity; decrease in soil fertility; decrease in water quantity; decrease in water quality; increase in living costs; decrease in income; deteriorating health conditions; damaged housing, and disconnected or damaged transportation and communication networks.

Climate change is rarely the sole reason causing damage, or loss, to families, and the weight of climatic variability among other determining factors varies in shaping the actual impacts. This understanding urges this study to examine the extent to which climatic variability influences the impacts experienced by different households. The respondents were asked to answer by choosing a number from a scale ranging from 0 (climatic variability has no adverse impact at all) to 10 (climatic variability has the most severe adverse impacts). Firstly, the study examined the most common impacts of climatic variability experienced in this area. The responses are coded as 1 if respondents indicated that climate change had a somewhat negative impact on the above mentioned aspects by choosing a number greater than 0, and 0

otherwise. Figure 6.3 shows the spread of climatic variability impacts experienced by surveyed households in Minqin, which are sorted in descending order from the most reported to the least.

Figure 6.3: Percentage of households reporting climatic variability impacts in Minqin



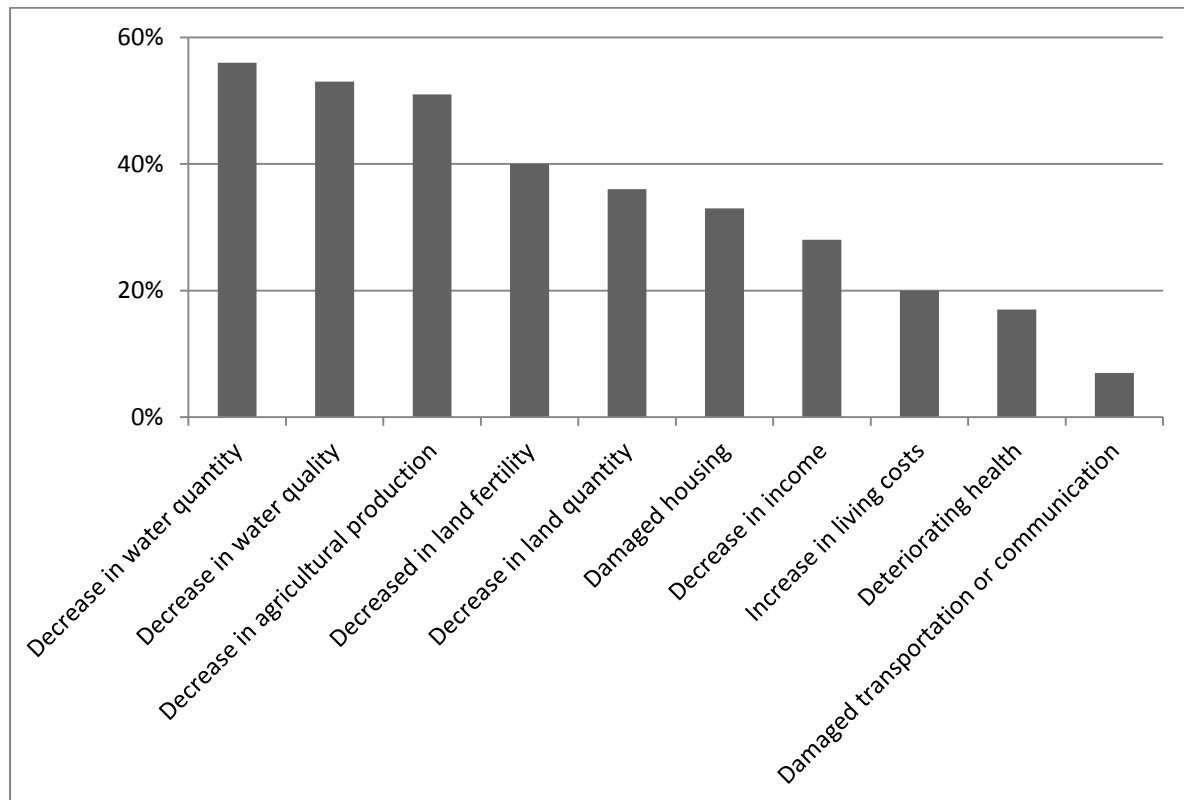
Source: Survey on climatic variability and adaptation in Minqin 2012

The most common impact of climatic variability in Minqin was *increase in living costs*, being reported by almost 80 percent of the surveyed households. This was followed by *decrease in water quantity* (72 percent) and *decrease in water quality* (63 percent). Another set of serious impacts upon Minqin’s rural residents appeared to be land degradation because the 60 percent of respondents reporting *decrease in land quantity* and 54 percent reporting *decrease in land fertility* associated with climatic variability. Being challenged by a reduction in access to quality water and land, it is not surprising that some 60 percent of respondents found their *agricultural production* had decreased in the context of climatic variability. Although they had reported a decline in crops, only about 40 percent of households indicated that they had suffered a *decrease in income* due to climatic variability. It appears that price increases for agricultural products and alternative income sources for the families (e.g., off-farm jobs) have had a positive effect on family incomes. *Damaged housing* (41 percent) and *adverse health*

conditions (31 percent), due to climatic variability, were less frequently reported. The least reported impact of climatic variability is *disconnected or damaged transportation and communication networks* (9 percent), mainly because Minqin is located on a plain that makes transportation relatively easy.

This study also identified the impacts that are closely related to climatic variability. In a scale ranging from 0 (no impact at all) to 10 (most severe impact), the median, number 5, is regarded as a turning point in the significance of climatic variability in shaping adverse impacts. If the respondents chose a number that was smaller than 5 for a specific impact, the influence of climatic variability on that impact was considered to be relatively weak for that family; whereas if a number greater than 5 was chosen, the influence of climatic variability was regarded as strong. The impacts sorted in a descending order are shown in Figure 6.4, from the one that is most significantly influenced by climatic variability to the one being least significantly influenced.

Figure 6.4: Percentage of households reporting that climatic variability is responsible for adverse impacts (scale 6 – 10) in Minqin



Source: Survey on climatic variability and adaptation in Minqin 2012

The adverse changes in agricultural production and natural resources, such as land and water, are most likely to be a result of climatic variability. A *decrease in water resources* were more likely to be related to variability in rainfall, with 55 percent of respondents reporting a significant impact. More than half of the respondents regarded climatic variability as a major reason that had led to a *decrease in agricultural production*. Some 40 percent of respondents indicated that climatic variability was largely responsible for *decreased land fertility* and 36 percent attributed *decrease in land quantity* to climatic variability. Although most respondents reported that climatic variability was one of the reasons causing an *increase in living costs*, only one fifth indicated it was largely responsible for that increase.

The survey found that a decrease in agricultural production and the deterioration of land and water resources are problems most closely associated with climatic variability that affect the majority of population in Minqin. Deteriorating economic conditions, especially increased living costs, are common problems; however, not many people consider climatic variability to be *major* reason for those problems. Three domains of climatic variability impacts – *decreased agricultural production, decreased water resources, and decreased land resources*– were selected to be used as dependent variables in the regression analysis, in order to examine how these impacts are differentiated by class at the household level. Other impacts that appeared to have a weak relationship with climatic variability were not considered further.

6.3 Class structure in the community: Gini coefficients of income and landholding

Class structure should be studied in a specific context and at a specific period of time because it is undergoing rapid change and it is highly heterogeneous between different communities within China (Lu 2000). Fieldwork in Minqin in 2012 provided an opportunity to examine the class structure at the *township level*. Five townships – Shoucheng, Xiqu, Donghu, Shuangcike and Hongshaliang – were selected as the study areas thus five groups of class structure at the township level will be analysed. The information on the class structure of each town will be assigned to each household living in this town as important explanatory variables.

The Gini coefficient of income is the most widely used proxy to assess inequality. Studies into adaptation to climate change have employed this measure as an indicator of vulnerability-

resilience in face of climate variation (Brenkert and Malone 2005; Brooks et al. 2005), and demonstrate that higher inequality in the distribution of income is associated with more negative impacts from climate change (Alberini et al. 2006). In rural communities which are mostly dependent on natural resources and agricultural production, the distribution of land among households is very significant in shaping inequality (Li et al. 1998). Crenshaw and Jenkins (1996) found that severe land inequality, interacting with population growth, exacerbated environmental degradation. The Gini coefficient of land that examines landholding inequality is therefore another important measure of inequality at the township level. Crompton (2008) indicates that ‘class structure’ describes the unequal distribution of resources in a community. This study therefore examines the class structure by using Gini coefficient of income and land to reflect the situation of an unequal distribution of resources.

Deaton (1997) defines the Gini coefficient as the ratio to the mean of half of the average over all pairs of the absolute deviations between people. The Gini coefficient measures the extent to which the distribution of income, or landholding, among individuals or households within an economy deviates from a perfectly equal distribution. It is a summary measure of inequality that can be estimated at different community levels. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line (Deaton 1997). The index can range from zero (perfectly equal distribution of income/landholding) to one (perfect unequal distribution of income/landholding). Thus, higher values of the Gini coefficient indicate higher inequality.

The direct method uses the following formula to calculate Gini coefficient (Deaton 1997).

$$GINI = \frac{1}{\mu N(N-1)} \sum_{i>j} \sum_j |y_i - y_j|$$

Where,

GINI is the Gini index;

μ is the mean of the variable of household income (or the mean of the variable of household land holding per capita);

N is the total number of observations;

and, y_i and y_j are dollar values of household income (or quantities of household landholding)

Table 6.2 presents the results showing the Gini coefficient of income and landholding that was calculated by using the first-hand information. All surveyed households had some income and land holdings. Among the five study areas, Xiqu township had the highest Gini coefficient of income at a value of 0.411, which indicates the greatest income inequality. It is followed by Donghu township with a value of 0.361, while Shuangcike and Hongshaliang townships had similar values around 0.310. Shoucheng township was regarded as the most equal community with the lowest income Gini coefficient of 0.278.

Table 6.2: Gini coefficients of income and landholding at township level in Minqin

Townships	No. of households	Gini coefficient of income	Gini coefficient of landholding
Shoucheng township	90	0.278	0.203
Xiqu township	126	0.411	0.188
Donghu township	84	0.361	0.253
Shuangcike township	60	0.317	0.242
Hongshaliang township	85	0.307	0.227

Source: Survey on climatic variability and adaptation in Minqin 2012

Generally, the Gini coefficients of landholding are lower than those of income in the five townships, indicating that land distribution is more equal than income distribution in the study area. Donghu township has the highest index of 0.253 and thus has the most unequal land distribution, followed by Shuangcike township (0.242), Hongshaliang township (0.227) and Shoucheng township (0.203). Interestingly, Xiqu township, which is identified as the community with the highest income inequality, has the lowest land Gini coefficient (0.203), indicating relatively higher equality in terms of land distribution. The contradictory results of high income inequality and low landholding inequality in Xiqu may reflect the influence of small landholdings on income at the household level is limited in this township. Household income in Xiji might be largely determined by households' off-farm jobs in or beyond the locality.

6.4 Class position of households

In addition to class structure, which sets a macro context of inequality among households, the particular class position of each household in their community is significant in shaping their experience of climatic variability impacts. According to Bourdieu's theory of class (1986), economic, social, cultural and symbolic capital combine to shape people's class positions in a

community. Moreover, the domain of political capital, which refers to the access to political and institutional power and participation in decision making processes, is also important. This is because political capital is regarded as an important measure of class in rural Chinese society (Nee and Lian 1994; Nee and Su 1998), and therefore as one of the factors determining people's adaptation to environmental change (Thomas and Twyman 2005). Thus, five class dimensions including economic, social, cultural, symbolic and political capital can be employed to assess people's class status in their local community. It is hypothesized that the more resources a household has in respect to the five dimensions, the higher its status in the local class structure. This section summarises and defines the specific measures of each dimension of class, and this is followed by a descriptive analysis of the distribution of class status among households.

6.4.1 Economic conditions

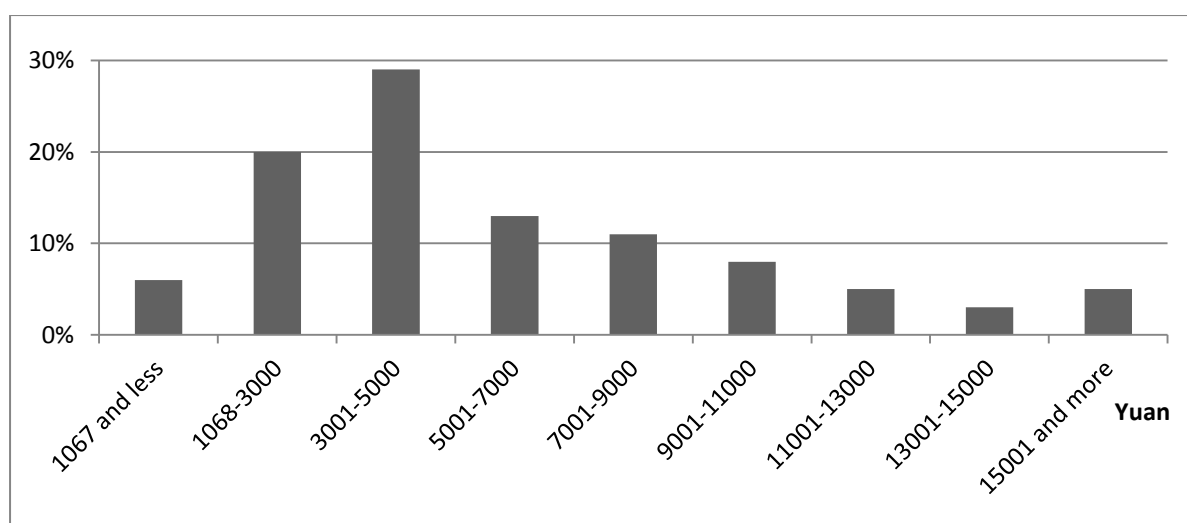
Three dimensions of the economic condition of a household are measured in this study: income, landholding and housing. Income is the most commonly used indicator of poverty and people's economic position in assessing vulnerability to climate change (Adger 1999; Brooks et al. 2005). Adger (1999) also suggests that the diversity of income sources can influence household vulnerability to climate change by changing their dependency on agriculture. The study thus employs household gross annual income and income diversity as measures of income condition.

Land use is regarded as another factor shaping vulnerability to climate change in rural areas (Adger 1999). Land inequality is found to significantly influence environmental degradation (Crenshaw and Jenkins 1996). The quantity of land used by a family can decide the family's on-farm income which is the main source of household income in counties dependent on agriculture. In 1994, the Chinese Central Committee showed support for land reallocation through local land markets when rural land use contracts were extended for another 30 years under the Household Responsibility System (HRS) (Cheng and Tsang 1995). The transfer of land use rights between households or from households to commercial organisations on both temporary and permanent bases has become more and more frequent since the 1990s (Brandt et al. 2002). This has changed the equal distribution of land among rural households and consequently diversified on-farm income of households.

Housing is also important in understanding the distribution of wealth in rural China (McKinley and Wang 1992). When household income increases, one of the first priorities for many rural families is to improve their housing. Inequality in the distribution of housing has increased since the 1980s due to differing household incomes. Housing is a most valuable asset and is considered to be the signal of wealth in rural China. However, home ownership is not an appropriate indicator of family wealth in rural China because almost all rural families own houses. Instead, living area per capita and satisfaction with housing conditions are adopted as proxies for housing in this study. The specific questions and coding used to collect the information on potential measures of the economic status of households in Minqin are listed in Appendix 3.1.

Income per capita: In 2007, the low-income threshold in rural China was 1067 Yuan per capita per annum. It was found in the survey that low-income families account for 6 percent of the total sample (Figure 6.5). Nearly half of the households indicated that their income per capita was between 1068-5000 Yuan. When income per capita is greater than 5000 the percentage of groups in these income brackets decreases, until there is a slight increase in the percentage of households earning 15001 or more. The households having per capita income greater than 15001 accounted for 5 percent of the total sample. Minqin was quite diverse in its distribution of income, with the richest households' income being 15 times that of the poorest ones. It is hypothesised that the per capita lower income a household has, the more negative the impacts of climatic variability will be.

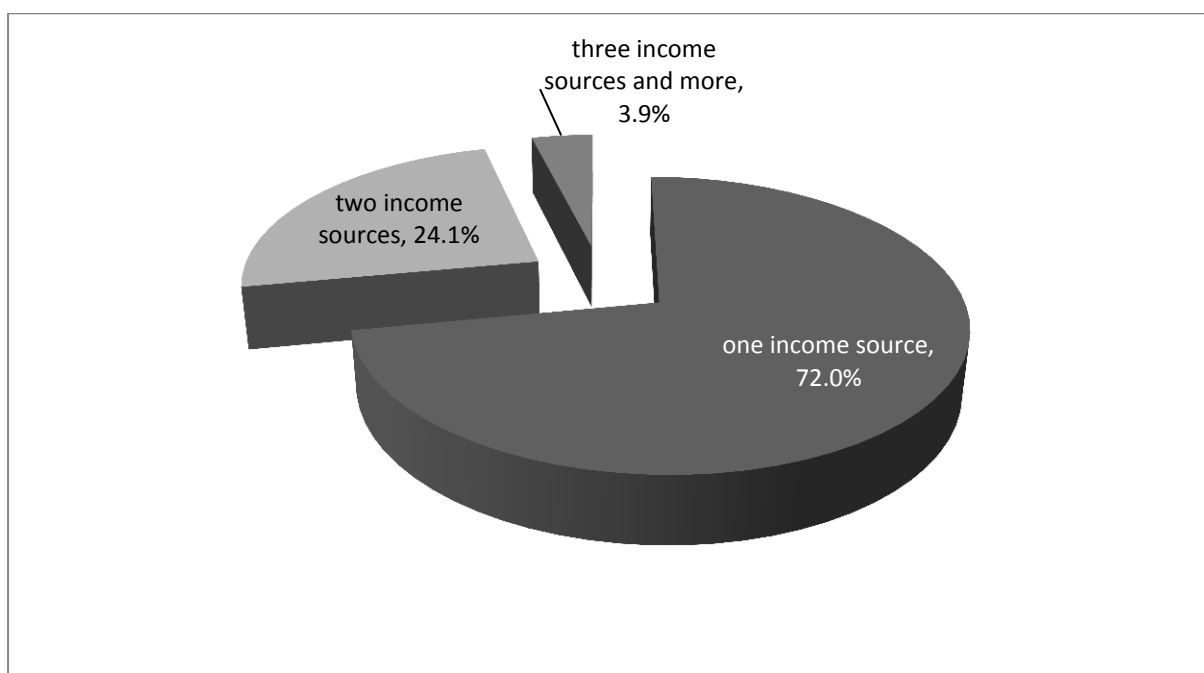
Figure 6.5: Distribution of households by annual income per capita in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Income diversity: As shown in Figure 6.6, the households having only one kind of income source, predominantly agricultural production, accounted for 72 percent of the total sample. Nearly one quarter of households had two income sources and those having three and more income sources accounted for only 4 percent of the total households. This means most households in Minqin lacked the alternative livelihoods and they heavily depended on agriculture production. It is assumed these households were more likely to be exposed to the risks brought about by climatic variability, as a result of their high dependency on the natural environment. Thirty percent of households gain income from off-farm activities, such as being self-employed in a business or undertaking paid-work. The households having diversified income sources, especially off-farm sources, are hypothesised to have stronger resilience to climatic variability because of reduced dependency on natural resources in the agricultural sector.

Figure 6.6: Distribution of households by income diversity in Minqin, 2007

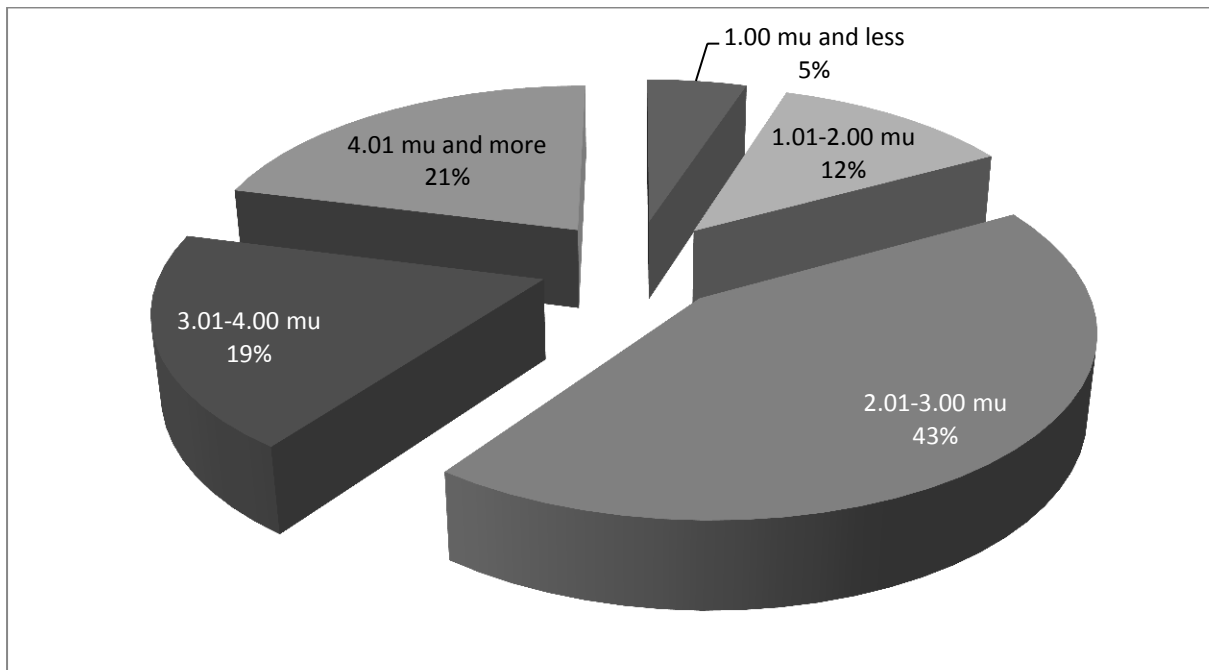


Source: Survey on climatic variability and adaptation in Minqin 2012

Land size: Landholding is crucial for rural residents because it not only provides income but also acts as a safety net in rural areas where a formal social security system is absent or limited. As shown in Figure 6.7, in 2007, the households holding per capita land of 2.01-3.00 mu accounted for 43 percent of the total sample, which was followed by those having per capita land of 3.01-4.00 mu (19 percent). The households whose per capita landholding is

2.00 mu or less accounted for 17 percent and those with more than 4.00 mu accounted some 21 percent. The distribution of land was diverse in Minqin because the survey shows that some households' lands were 7 times that of the others. The high unequal distribution of land is mainly caused for two reasons. First, the transfer of land use rights between households or from households to commercial organisations in Minqin since the 1990s has diversified landholdings of households. Second, even when landholdings remain the same, demographic changes (birth, death and migration) in the past 30 years have led to population increases in some households while population has declined in some others, and changed the *per capita* landholding.

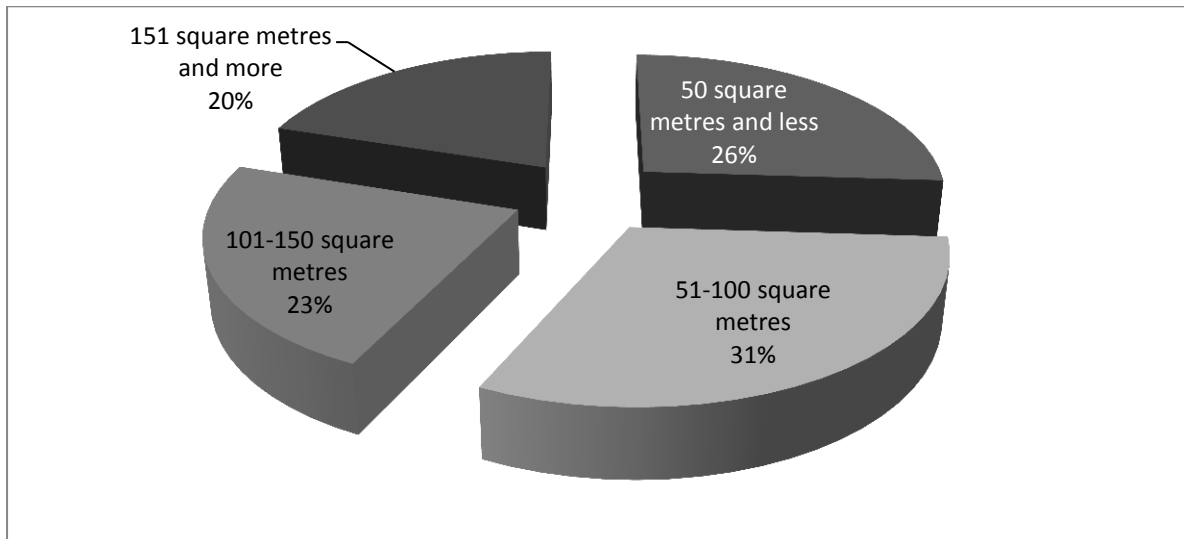
Figure 6.7: Distribution of households by land size per capita in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Housing: More than half of the households fall into the group with per capita living size ranging between 51 and 150 square metres, as depicted by Figure 6.8. Some 26 percent of the households had small living areas (50 square metres or less) and 21 percent had large living areas (more than 150 square metres). Living size here means the size of land, rather than the size of house. Large living size made it possible to build a separate enclosure for livestock the households owned, which could significantly improve the living quality of the households and increase their satisfaction with the houses.

Figure 6.8: Distribution of households by living size per capita in Minqin, 2007



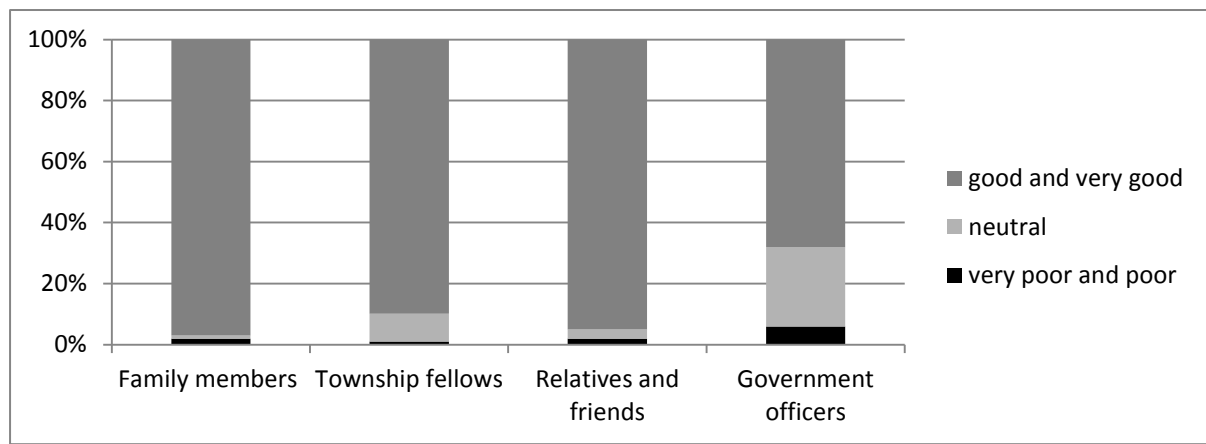
Source: Survey on climatic variability and adaptation in Minqin 2012

6.4.2 Social conditions

The social dimension of class is mainly measured by social relationships and networks (Bourdieu 1984). Social relationships influence the adaptation of the rural population through shaping their financial and technological situation, access to information, cooperation with other stakeholders, and the access to institutional supports (Isham 2002; Adger 2003; Armitage 2005; Katungi 2007; Deressa et al. 2009). In China, social relationships and networks (Guanxi) are considered one of the central issues in the country's social, economic and institutional structure (Gold et al. 2002). Having a good relationship with people, particularly those in power or who control resources (e.g., government officials or successful entrepreneurs), is a symbol of social status in Chinese society. Such relationships facilitate reciprocity between stakeholders, which promotes adaptation to environmental change (Pelling et al. 2008). This study thus uses 'assistance received by the family' as a measure of reciprocity and to exemplify the objective outcomes of a family's social relationships. Social networks are of significance in influencing the social learning processes for managing environmental change (Pahl-Wostl 2009). Whether households are members of formal or informal groups could influence their exposure to environmental problems and their adaptive capacity in response to them. However, that kind of information was not collected in the current survey. The detailed survey questions and coding methods of the potential measures of a household's social status are summarised in Appendix 3.2.

Social relationship: Figure 6.9 shows households' social relationships with township dwellers, relatives and friends, and government officers. Most households had a good or very good relationship within their family and with their township fellows, relatives and friends. It is worth noting that families not having a good relationship with government officers accounted for one third of the total sample. It is hypothesised that this group had less access to public information on climatic variability and public programs in response to that change, because public resources were mainly controlled by government officers.

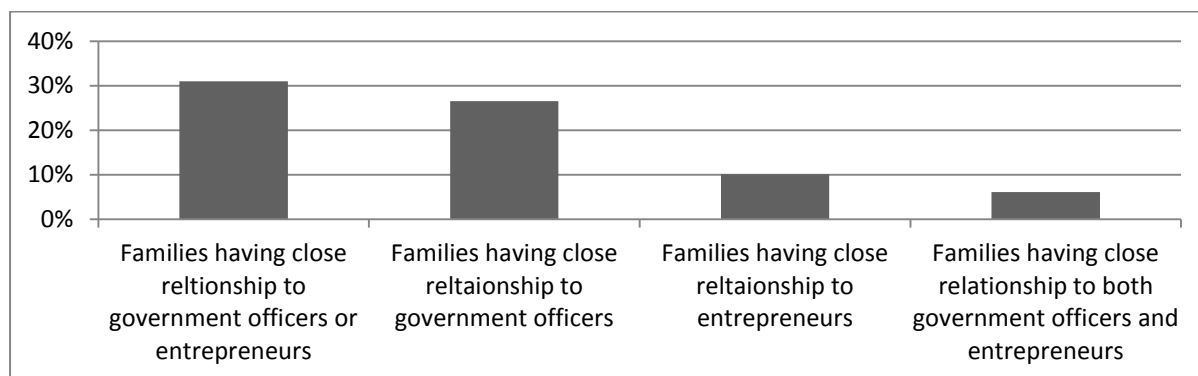
Figure 6.9: Distribution of households by types of social relationships in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Connection to government officers and entrepreneurs: A household was regarded as having close connections to powerful people if any of their relatives was a government officer or an entrepreneur. Figure 6.10 shows that nearly one third of households had a close relationship with powerful people, and 27 percent had a close connection with government officers, whereas the connection to entrepreneurs was 10 percent. Only 6 percent closely connected to both types of powerful people. These households were considered to have the highest social capital in the community because they were more likely to access to economic support, as well as public assistance, compared to those not having any connection to powerful people. It has been discussed in Chapter 4 that the questions regarding relationship with government officers might be sensitive for the participants. To avoid 'no comment' or inaccurate answers, confidentiality of the survey was emphasised and the interview was conducted without the presence of a third party, such as neighbours, friends, village cadres, etc.

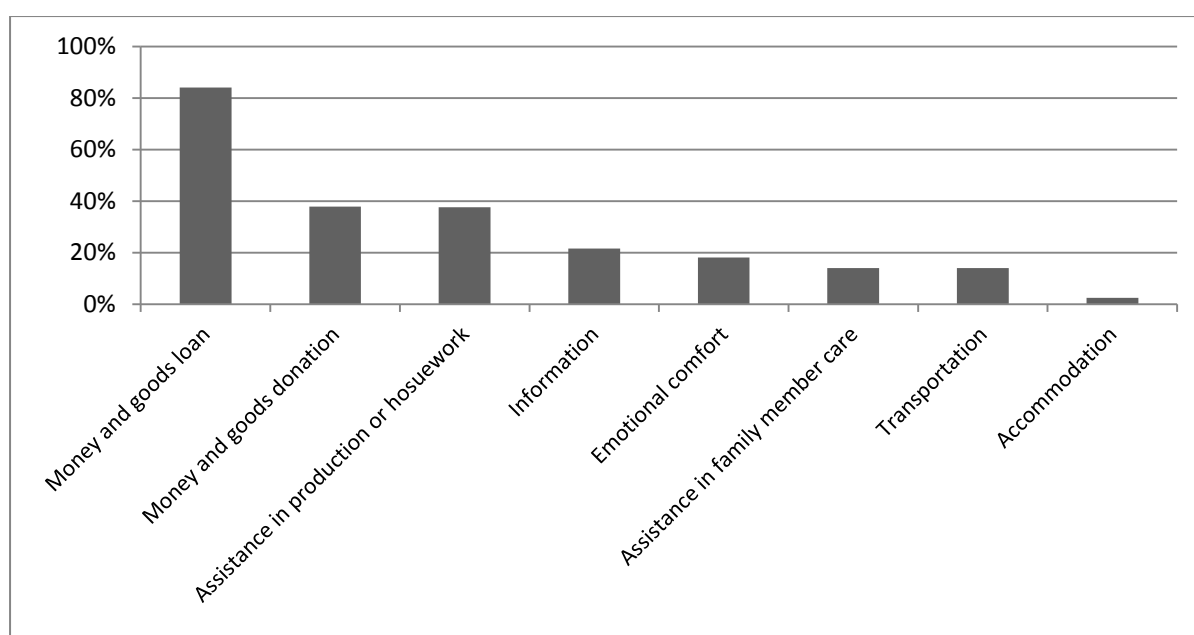
Figure 6.10: Percentage of households with close connections to powerful people in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Assistance received by the families: As shown in Figure 6.11, a money and goods loan was the most common and most important assistance that Minqin people received, with 84% of households receiving this type of assistance. Some 38 percent received money or goods that were donated, suggesting that donations were significant but much less frequent than loans. Another important form of assistance was related to agricultural production and housework, which benefited 38 percent of households. Most of the households did not receive other types of assistance, such as providing information, emotional comfort, family member care, transportation and accommodation.

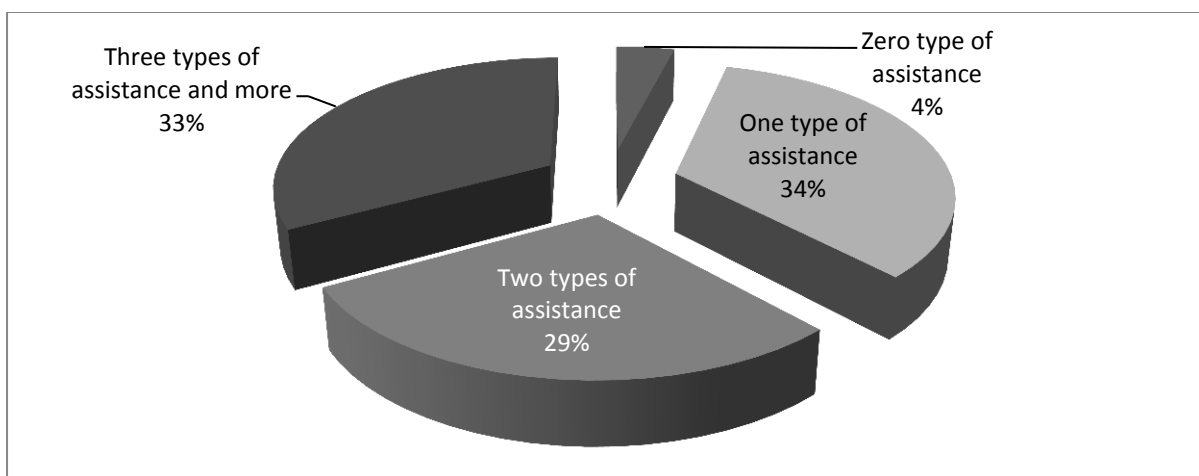
Figure 6.11: Percentage of households receiving different types of assistance in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Types of assistance: Figure 6.12 shows that the households not receiving any kind of help accounted for 4 percent of the total sample. This group was assumed to either have poor social relationships or do not need help because of their strong resilience. Some 63 percent of households had one or two sources that they could seek assistance, and one third of the sample reported access to diversified sources of assistance (3 and more). The latter group either had strong social connections in the community, or were in difficult situations that need many types of assistance.

Figure 6.12: Distribution of households by number of types of assistance in Minqin, 2007



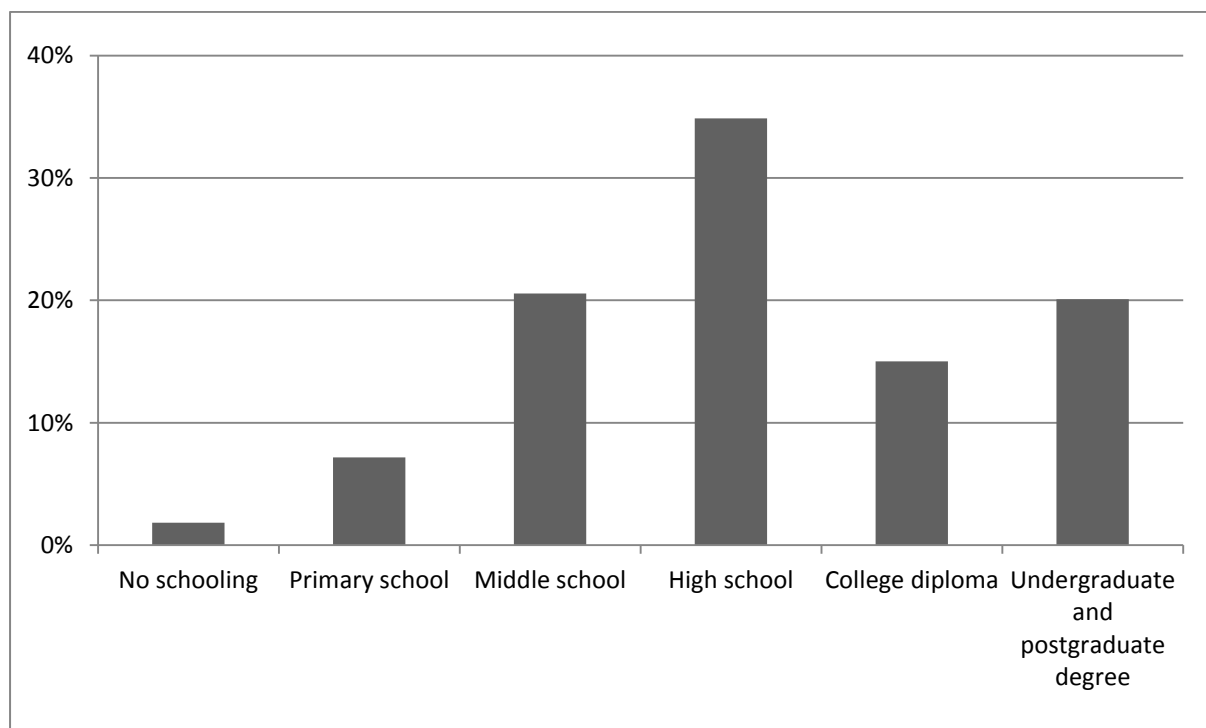
Source: Survey on climatic variability and adaptation in Minqin 2012

6.4.3 Cultural conditions

Cultural capital is principally measured by educational attainment (Jenkins 2002; Rye 2006). According to Bourdieu's class theory, education is a common-knowledge-based indicator of training and skills and even of human capital (Rye 2006). Education is more in measuring people's *acquired cultural capital* rather than their *inherited cultural capital* (Bourdieu 1984). However, Rye (2006) argues that the correlation between the two aspects of cultural capital is significant in empirical studies, so education can usually be used as an indicator of both aspects. Paavola and Adger (2006) indicate that education is a determinant of the adaptive capacity of households and communities. Barnett (2001) and Brooks et al. (2005) claim that education is one of the key indicators of vulnerability to climate variability and advocate improving adaptation to climate change by improving education. Appendix 3.3 summarises the questions and coding related to educational attainment.

Education: The Minqin government claims that the education programs are significant in rehabilitating ecology and protecting the environment because they transfer rural people to urban areas (Li and Wei 2005). Hence, the government proactively encourages people to pursue higher education. Figure 6.13 shows that 36 percent of the households sent their family member(s) to university, which was much higher than the average participation in higher education in China, which was only 8.9 percent in 2012 (NBS 2012c). It is also worth noting that some 8.5 percent of households did not have well-educated family members and their highest educational attainment was only primary schooling. Constrained by their limited education, these households were assumed to be less likely to adopt new agricultural technologies or to secure paid-works, than those that had well-educated family members.

Figure 6.13: The highest educational attainment of family members in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

6.4.4 Symbolic conditions

Symbolic conditions relate to the reputation of a people or a household in the community. However, reputation is probably the class dimension that is most difficult to be quantified in empirical work. Previous studies in China tended to assess one's reputation by focusing on

occupational prestige (Li 2005). This is informed by international studies, during the 1950s to 1980s, on social stratification based on occupation (Hatt 1950; Inkeles and Rossi 1956; Treiman 1976).

There is abundant discussion regarding the impact of off-farm employment on vulnerability and adaptation to climate change in rural areas. Dixon et al. (2001) identify increasing off-farm income and exiting from farming to be effective household strategies for improving livelihoods. Heltberg et al. (2009) indicate that different mixes of employment (on-farm, off-farm and non-farm) are important livelihood strategies that shape households' vulnerability to climate change. Meze-Hausken (2000) indicates that off-farm work is one of the survival strategies assuring livelihood when other income resources fail due to climate change. These studies focus on the economic dimension of occupation, namely diversification of income, for rural households. However, the symbolic dimension of occupation referring to people's reputation has been basically neglected in previous studies. This study seeks to fill the gap.

Some Chinese researchers have indicated that occupational prestige is not a suitable measure of rural people's reputation because there is no occupational system in rural China (Xu 2000). Yet as a result of agricultural and industrial reforms, Chinese rural people now have access to all kinds of jobs that are on-farm, off-farm or non-farm. This has given rural people a better understanding of occupations and occupational prestige, which makes it appropriate to measure reputation by assessing occupational prestige in rural China (Li 2005).

It is important to realise that rural residents have less diversified occupational options and higher occupational mobility, in comparison to their urban counterparts. Thus, occupational prestige alone is insufficient to describe one's reputation in a rural community. This study, therefore, includes some indicators of reputation that are contextually specific to rural China, such as one's influence on village events and other villagers' lives. Accordingly, a set of questions were asked about the household's involvement in four dimensions of community issues: discussing community affairs; organising community activities; providing advice to villagers, and solving conflicts between villagers. The individual or household frequently involved in these issues is considered to have a high reputation in the local community. The potential measures of symbolic status adopted in this study and their related questions and coding are showed in Appendix 3.4.

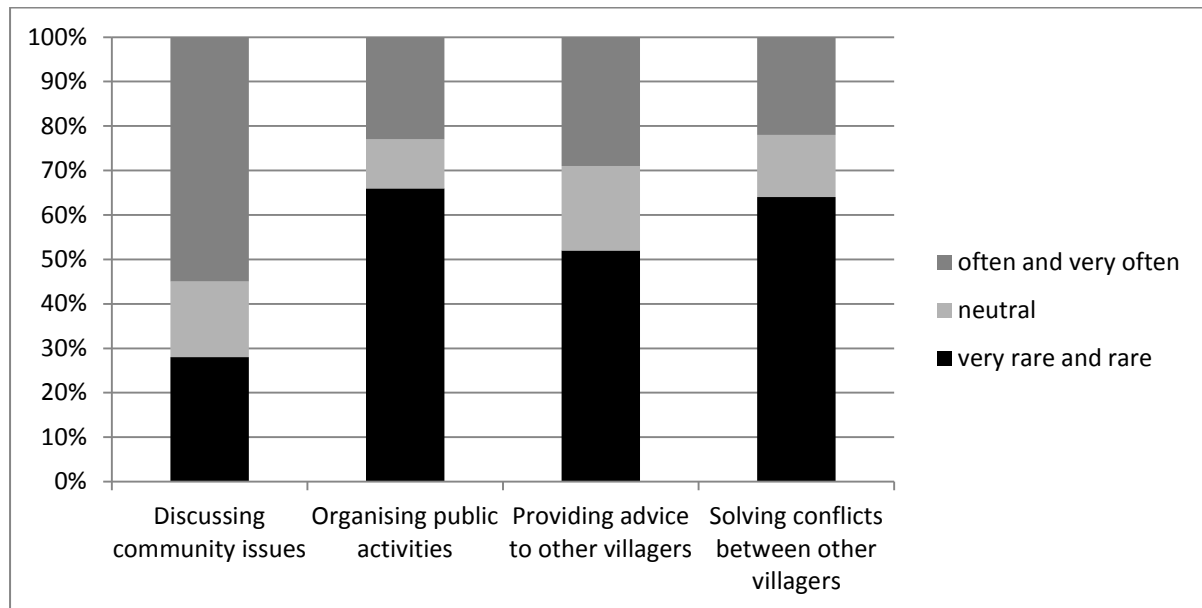
Occupational prestige: Applying Li's (2005) 'occupational prestige ranking system'⁵ to this study, it was found that households were distributed across four prestige groups ranging from a score 2 through to 5. Three quarters of households had the ranking score of 2, which represents farmers, because most households completely depended on agricultural production. It was not surprising to see the higher the ranking score (the higher occupational prestige) the sub-group had, the less households that fell into that sub-group. Some 20 percent of households were ranked score 3 because they had family members who were agricultural technicians and small business owners. The households having primary school teachers as their family members and thus ranking score 4 accounted for 5 percent of the total. Only 1 percent of households ranked score 5 because their family members were government officers in the township governments.

Local reputation: Figure 6.14 shows the level of household involvement in community affairs. Households were regarded to have a respected reputation in the community if they frequently participated in community affairs, such as public discussions, organising community activities, providing advice to other villagers and solving conflicts between other villagers. A high 55 percent of households reported that they frequently participated in discussing community issues, and the rate of their participation decreases dramatically to between 20-30 percent for other types of community issues. More than 30 percent of households often provided advice to other villagers, and some 20 percent of households indicated that they frequently organised public activities and solved conflicts between villagers.

⁵ China's occupational prestige rankings system (Li, 2005):

- Ranking score 1 (the lowest): pedicab driver, porter and house helper;
- Ranking score 2: unskilled labour worker and service provider, farmer, self-employed businessman;
- Ranking score 3: agricultural professional & technician, skilled labour worker and service provider, professional farmer, small business owner, and clerk;
- Ranking score 4: junior professional & technician (e.g., child-carer, primary school teacher, nurse, and junior accountant), junior public servant, senior staff in service and commerce industry, labour contractor;
- Ranking score 5: senior professional & technician (e.g., doctor, pilot, and writer), low-ranking governmental official, private entrepreneur;
- Ranking score 6: middle-ranking governmental official, senior manager, influential professional (e.g., principal, journalist, and lawyer);
- Ranking score 7(the highest): senior governmental official, high-level intellectual.

Figure 6.14: Distribution of households by the frequency of participation in community issues in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

6.4.5 Political conditions

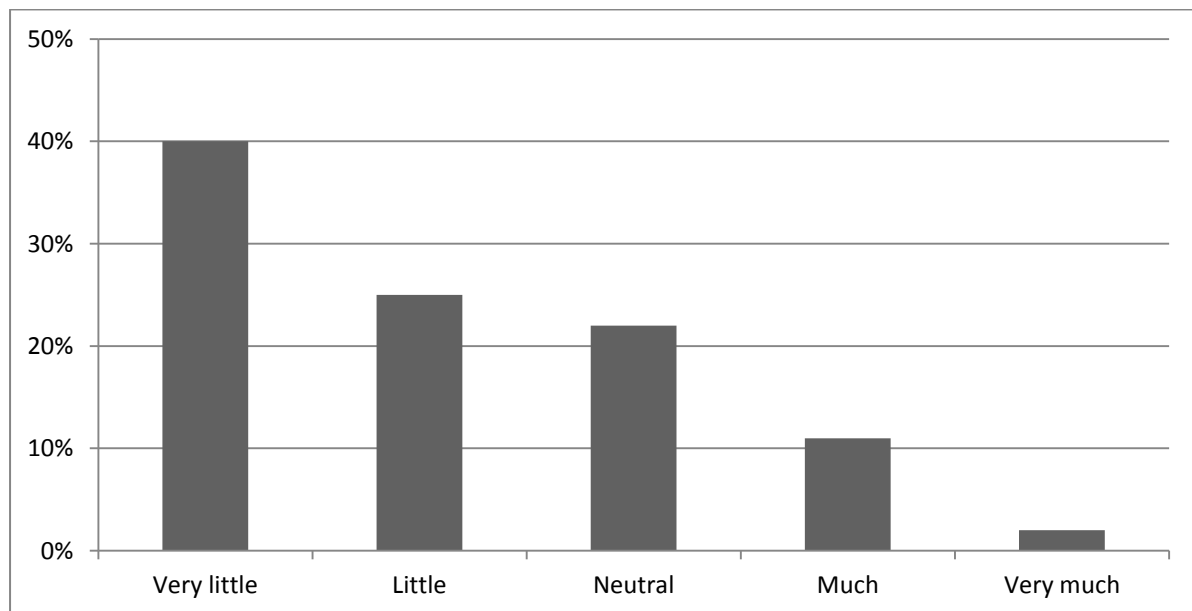
As far as political conditions are concerned, two traditional indicators of people's class position in rural China should not be neglected: (1) whether he/she is a member of the Communist Party of China (CPC); and (2) whether he/she is a government cadre (Nee and Lian 1994; Bian 2002). In rural China, Party members and village cadres can gain access to valuable political and economic information, establish favourable personal connections, and have preferential access to job opportunities or resources (Morduch and Sicular 2001). Another important set of measures of political conditions are people's participation in the decision making process of public policies and services. Unequal participation in decision-making processes has been identified as an important factor jeopardising people's equal access to public resources and assistance and differentiating their adaptive capacity to climate change (Thomas and Twyman 2005; Paavola and Adger 2006). The details of measures of political status are summarised in Appendix 3.5.

Political affiliation and connections to government officers: The households having a CPC member accounted for more than one quarter of the total sample. However, there were only four households that had a government officer as a family member, accounting for less than 1

percent of the total sample. Having a government officer or not is therefore not used as an explanatory variable in the regression models due to the insufficient observations.

Government assistance: Figure 6.15 shows that almost two thirds of households received little or very little assistance from the government when they faced difficulties. Some 11 percent of surveyed households reported that they had received much help, and only 2 percent received a great deal of help, from the government. Twenty-two percent reported that government assistance was not too little or too much (neutral).

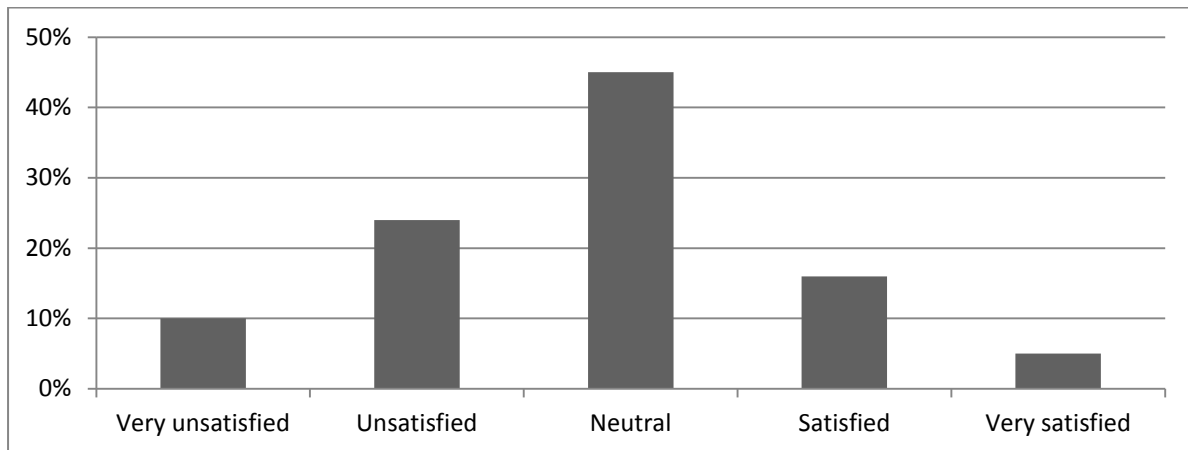
Figure 6.15: Distribution of households by receiving assistance from government in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Satisfaction with participation in public decision-making processes: As shown in Figure 6.16, satisfaction with participation in public decision-making processes was not high, with only a fifth of people showing some degree of satisfaction. One third of households clearly indicated that they were not satisfied with their participation in the decision-making process. The households holding a neutral attitude accounted for a high 45 percent. However, according to the interviewers' observation, many respondents chose 'neutral' in order to avoid commenting on this issue. It can be assumed that the actual number of households that were not satisfied was greater than shown in the figure.

Figure 6.16: Degree of satisfaction with participation in the public decision-making processes in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

6.5 Local preparedness and adaptation to climatic variability

Assessing the impacts of climate change must encompass two scales of vulnerability to climate change – individual and collective vulnerability (Adger 1999; Adger 2001). The collective vulnerability of a community is determined by institutional and market structures and institutional arrangements for preparedness for environmental pressure (Adger 1999). This section discusses the institutional preparedness for climate change from two aspects: (1) the social security system, and (2) local means of institutional adaptation.

Means of adaptation to climate change are not isolated from the decisions about other socio-economic, demographic and cultural development (O'Brien and Leichenko 2000; Adger et al. 2005). It can be very difficult to separate climate change adaptation from the actions of other socio-economic development. Almost all socio-economic development actions can be considered as either a direct or an indirect approach to promote adaptation to climate change by enhancing local resilience or adaptive capacity. Adaptation directly related to climate change in an agricultural community can, and does, take many forms, including diversifying crop production; avoiding investments in high-risk locations; strengthening existing agricultural facilities, such as irrigation systems; promoting insurance, and enhancing weather forecasting (Adger et al. 2003; Adger et al. 2009). Other actions triggered by rural socio-economic development decisions, but related to adaptation to climate change, may include promoting agricultural production by providing subsidies and technical training; developing

renewable energy; enhancing the marketing of agricultural produce, and developing education programs, medical services and infrastructure, etc.

Face-to-face interviews with village cadres were conducted in five selected villages to collect information on institutional means of adaptation. The interviews established that the in-situ institutional means of adaptation in Minqin include:

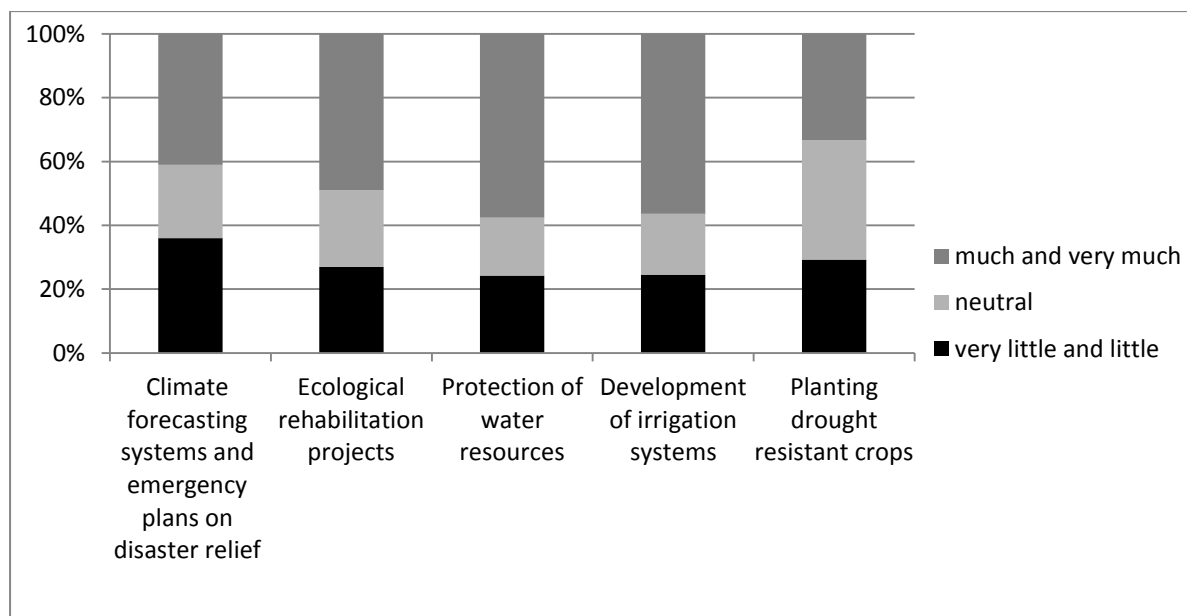
- Improving the weather forecasting system and developing emergency plans for disaster relief;
- Implementing ecological rehabilitation projects (e.g., establishing ecological preservation areas, restoring farmland/grazing land to forest/grassland and desertification control);
- Maintaining and increasing water resources;
- Improving irrigation systems;
- Planting drought-resistant crops;
- Providing training on agricultural production;
- Providing subsidies for agricultural production;
- Implementing campaigns to market agricultural produce;
- Developing renewable energy (e.g., solar energy and biogas);
- Improving local educational and medical services, and
- Improving local infrastructure

To measure the effectiveness of these institutional adaptations to climatic variability, the respondents were asked: *‘To what extent does your family benefit from the local institutional adaptations to climatic variability?’* The respondents answered the question by choosing a number on a scale ranging from 0 (no benefit) to 10 (greatest benefit). Then 0 and 1 are recoded to ‘very little benefit’; 2 and 3 are recoded to ‘little benefit’; 4, 5 and 6 are recoded to ‘neutral’; 7 and 8 are recoded to ‘much benefit’; 9 and 10 are recoded to ‘very much benefit’.

Figure 6.17 shows how people benefited from public preparedness and adaptations that are directly triggered by climatic variability, such as developing climate forecasting systems and emergency plans for disaster relief, rehabilitating the ecological systems, protecting water resources, developing irrigation systems and planting drought resistant crops. Generally, these approaches were effective, with nearly 50 percent of respondents indicating that they

had greatly benefited from each of these means of adaptation. Those considered most useful for people living in Minqin are related to the access to water resources. In the study areas, the irrigation ditches have reached all arable lands, making irrigation available for almost all rural households. Ecological rehabilitation projects are carried out in Minqin to protect ground water through closing down pumping wells and to control desertification through forestation. Many respondents reported that these ecological approaches had reduced the frequency and severity of sand storms in this area. They also showed strong willingness to participate in those ecological rehabilitation projects. However, the percentage of people greatly benefiting from ‘planting drought resistance crops’ was relatively low, possibly because rural households did not intend to make private investment in purchasing seeds of drought resistance crops or in building greenhouses.

Figure 6.17: Degree of benefit from direct public preparedness and adaptations to climatic variability of households in Minqin

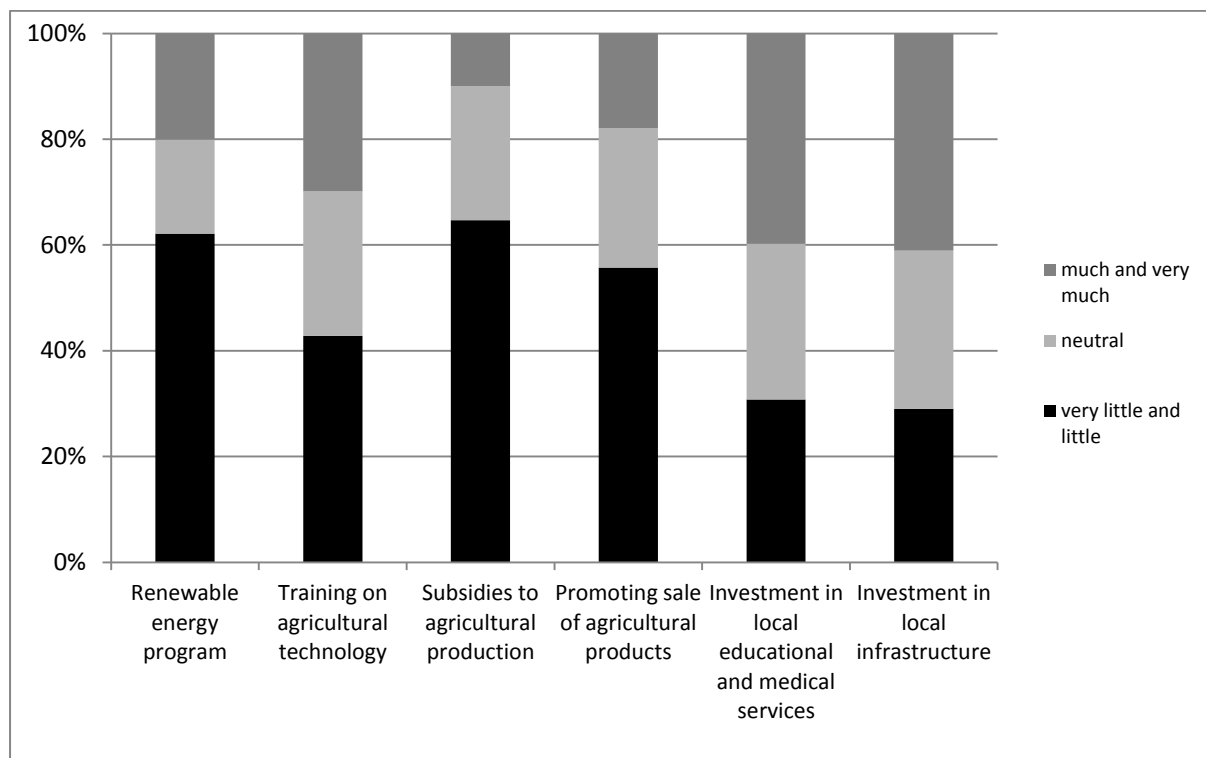


Source: Survey on climatic variability and adaptation in Minqin 2012

Figure 6.18 depicts the extent to which people benefited from means of public preparedness that were induced by local needs of socio-economic development to promote agricultural development, such as developing renewable energy, providing agricultural training, providing agricultural subsidies, promoting sales of agricultural products, improving local medical system, education and infrastructure. In general, these development approaches were not as effective as the direct adaptations to climatic variability; only around one quarter of respondents reported a great benefit. About 40 percent of households were satisfied with

developments in the local medical system, education and infrastructure. However, only 10 percent of households thought that they had greatly benefited from agricultural subsidies, even though most of them received these subsidies from government. One possible reason could be that the subsidies were generally too little to improve the households' agricultural production or to enhance their financial situation.

Figure 6.18: Distribution of households by the degree of benefit from indirect public preparedness and adaptations to climatic variability



Source: Survey on climatic variability and adaptation in Minqin 2012

Social security is measured by two indicators in this study – the aged-pension and health insurance. Respondents were asked: ‘Did your family members aged 16 years or older join the aged-pension scheme and the rural health insurance scheme by 2007?’ The participation ratios of the aged-pension scheme and the health insurance scheme in the study area were calculated. Families were categorised into three subgroups: (1) families with no member joining the pension system/medical insurance systems; (2) families with some members joining the pension system/medical insurance systems; and (3) families with all members joining in the pension system/medical insurance systems. The results indicate that 40 percent of households were not covered by the pension system at all and 25 percent of households were not fully covered. The participation rate in the medical insurance system (mainly the

rural cooperative medical system) was higher in comparison to that of the pension system. Three quarters of families were fully covered by medical insurance and the families not having medical insurance at all only accounted for 12 percent of the total sample.

6.6 Demographic characteristics of the households

Vulnerability and adaptation to climate change is shaped by many factors, among which demographic factors play an important role. Black et al. (2011a) explicitly point out that the demographic factors are one of the five drivers of migration as a response to climate change. Demographic factors can cause migration through placing pressure on the environment. For example, in Java, Indonesia, it was found that rural people undertook outmigration because the environment could not bear the pressure caused by continued population growth (Hugo 1978). However, it is crucial to understand that there is no simple or direct deterministic relationship between demographic factors and the means of adaptation to climate change; instead, demographic characteristics often interact with other factors in influencing the adaptation strategies adopted (Black et al. 2011a; Hugo 2011). It should be noted that there are a variety of adaptation means in response to the interaction of environmental and demographic pressures, such as migration and in-situ adaptations (e.g., agricultural intensification, adoption of new economic activity, reducing fertility) (Hugo 2011).

The macro demographic factors include the size and age-sex structure of populations, local marriage rates, fertility and mortality rates, and population settlement patterns (Henry et al. 2003; Black et al. 2011a). The demographic characteristics of each household that contribute to differentiating families' adaptation and migration behaviour usually include age, sex, health, ethnicity, family size and family structure (Henry et al. 2003; Afangideh et al. 2012).

Black et al. (2011b) believe that younger people have a stronger propensity to migrate in the context of climate change. In Africa, age of the household head represents experience and thus affects adaptation to climate change (Deressa et al. 2009). The sex dimension is usually examined in terms of male ratios (Henry et al. 2003) and the sex of the household head (Deressa et al. 2009). Deressa et al. (2009) indicate that male-headed households adapt more readily to climate change by conserving soil and changing crop varieties. McLeman and Smit (2006) identify the health of family members as an important factor, interacting with crop failure, land use and social connections, to shape vulnerability to climate change among

households in rural Eastern Oklahoman. Ethnicity has been proved to differentiate the effect of environmental change on local mobility with high-caste Hindus being much less likely to be affected and thus to respond to local environmental circumstances than other ethnic groups in Nepal (Massey et al. 2010). Leiserowitz (2006) also indicates that ethnic minorities are more likely to perceive climate change to be a great risk. The influence of household size on selecting adaptation means can be seen from two angles. Meze-Hausken (2000) assumes that large families are more likely to send some of their family members to off-farm occupations in order to ease the consumption pressure imposed by a large family. Whereas Croppenstedt et al. (2003) argue that large households are more likely to adopt agricultural technology and use it more intensively due to their reserves of labour, which turns out to offer a better chance of adapting to climate change. A high dependency ratio is considered as a factor increasing one's vulnerability to food insecurity associated with global climate change (Bohle et al. 1994). Meze-Hausken (2000) also asserts that the greater the number of children in a family, the more likely they are to suffer from starvation and disease resulting from environmental problems. A summary of the demographic factors of households that influence the impacts of climate change on families is presented in Appendix 3.6, which will be utilised as control variables in regression models when assessing the influence of class on the impacts of climatic variability and environmental change on households.

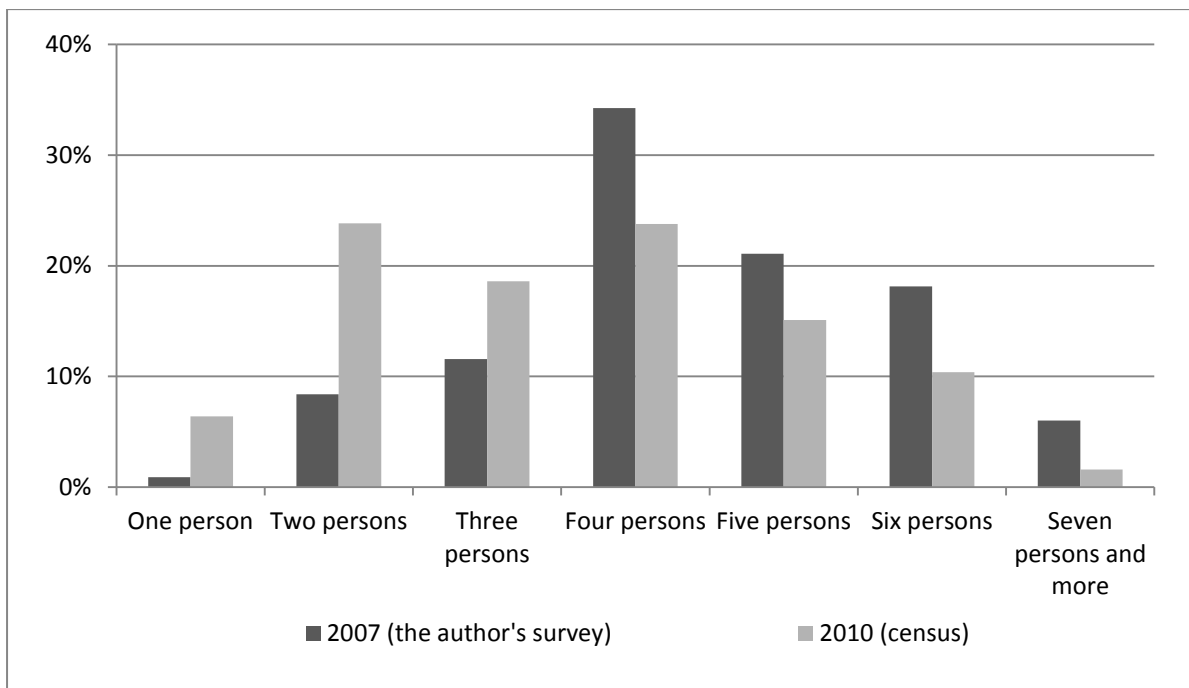
Health: Three quarters of the households reported that their family members did not have any disability, while one quarter suffered from a disability. The most reported disability was a physical disability, which accounted for 15 percent of the total sample. This was followed by sensory impairment accounting for 6 percent, and only 2 percent of households had family members suffering from intellectual disabilities and mental and emotional disorders. The households having one disabled family member accounted for 19 percent of the total sample, and those with two or more were some 33 percent. These households with more than one disabled members were considered to be especially vulnerable because they needed to put a great deal of effort into disability care and they had little manpower for agricultural production and off-farm work.

Male ratio: About half of the households had a balanced sex ratio of 1:1. Some 28 percent of households had more male family members than female members, while 20 percent had fewer males than females in their families. This indicates that, in Minqin, like other parts of

rural China, households having a high men-to-women ratio were more than those having a low men-to-women ratio.

Household size: According to the author’s survey, in 2007, most households (75 percent) were medium size (4-6 persons), as shown in Figure 6.19. Small families (3 persons or less) accounted for 21 percent of the total sample, and only 6 percent were large families (7 persons or more). The census of Minqin (2010), however, indicates that rural families in this county had a relatively small household size. In 2010, some 49 percent of households were small (3 persons or less), and another 49 percent were of medium size (4-6 persons). The large families (7 persons or more) only accounted for 2 percent of the total. This may indicate that rural families living in the study areas (the five townships) had larger family sizes than their counterparts living in the rest of the county.

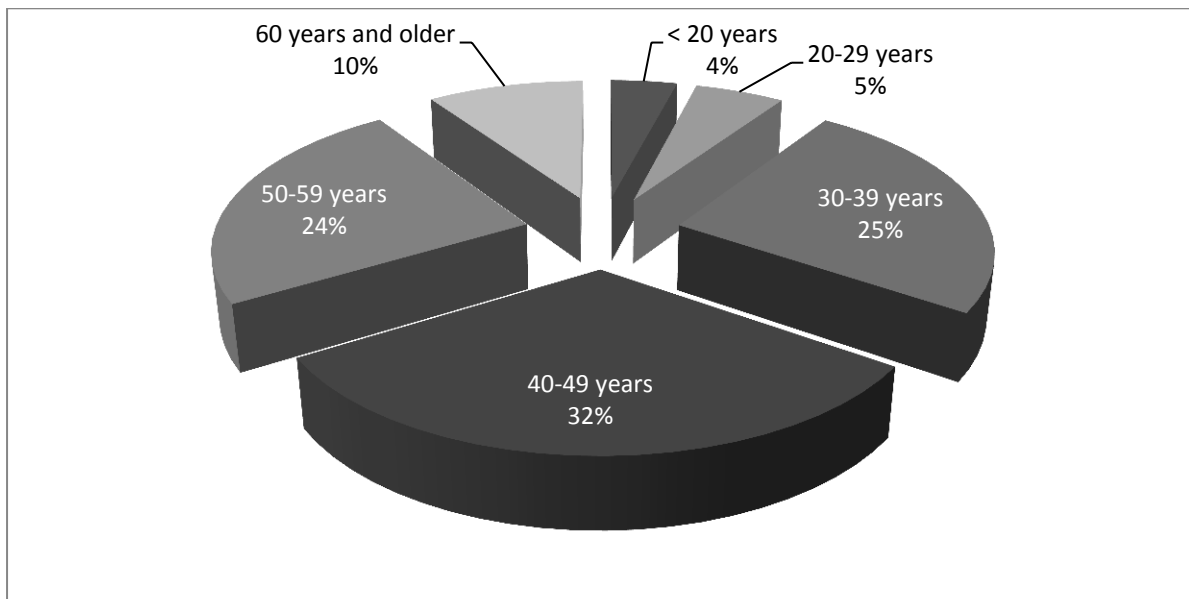
Figure 6.19: Distribution of households by household size in Minqin, 2007 and 2010



Source: the Sixth National Population Census of China 2010; Survey on climatic variability and adaptation in Minqin 2012

Age of household head: As depicted in Figure 6.20, 55 percent of households had middle-aged (40-59 years) household heads, followed by families with young (20-39 years) household heads (30 percent) and old-aged (60 years or older) household heads (10 percent). Only a few household heads were aged younger than 20-years of age.

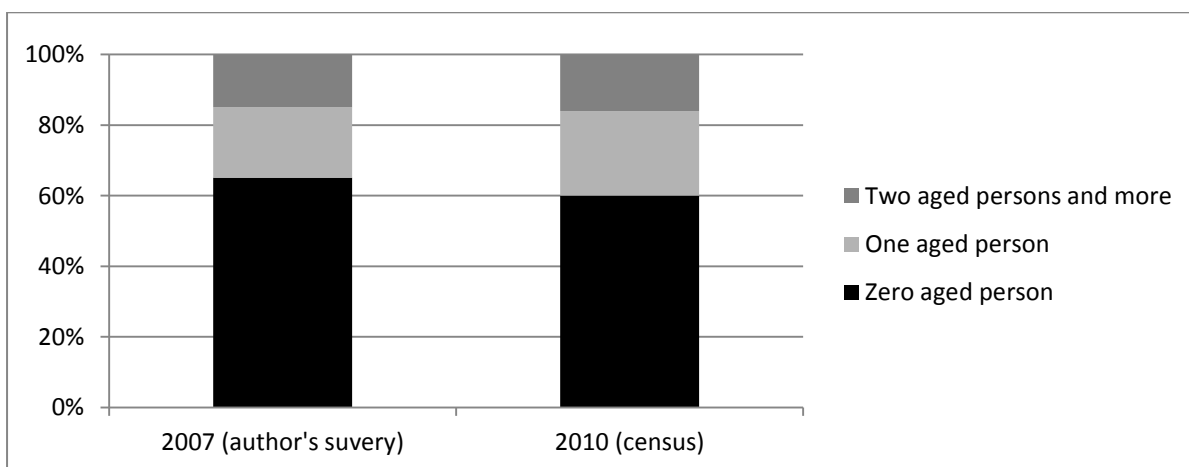
Figure 6.20: Distribution of households by age of household head in Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Households having aged family member(s): Aged persons are defined as people who were 60 years or older; consistent with the latest national population census of China. Figure 6.21 shows that 35 percent of households had at least one aged family member in 2007, which was lower than that shown in the 2010 census (40 percent). The households having one aged person accounted 20 percent of the total sample. Some 15 percent of households had two or more aged people, which was similar to the census.

Figure 6.21: Distribution of households by number of aged family members (60 years or older) in Minqin, 2007 and 2010



Source: The Sixth National Population Census of China 2010; Survey on climatic variability and adaptation in Minqin 2012

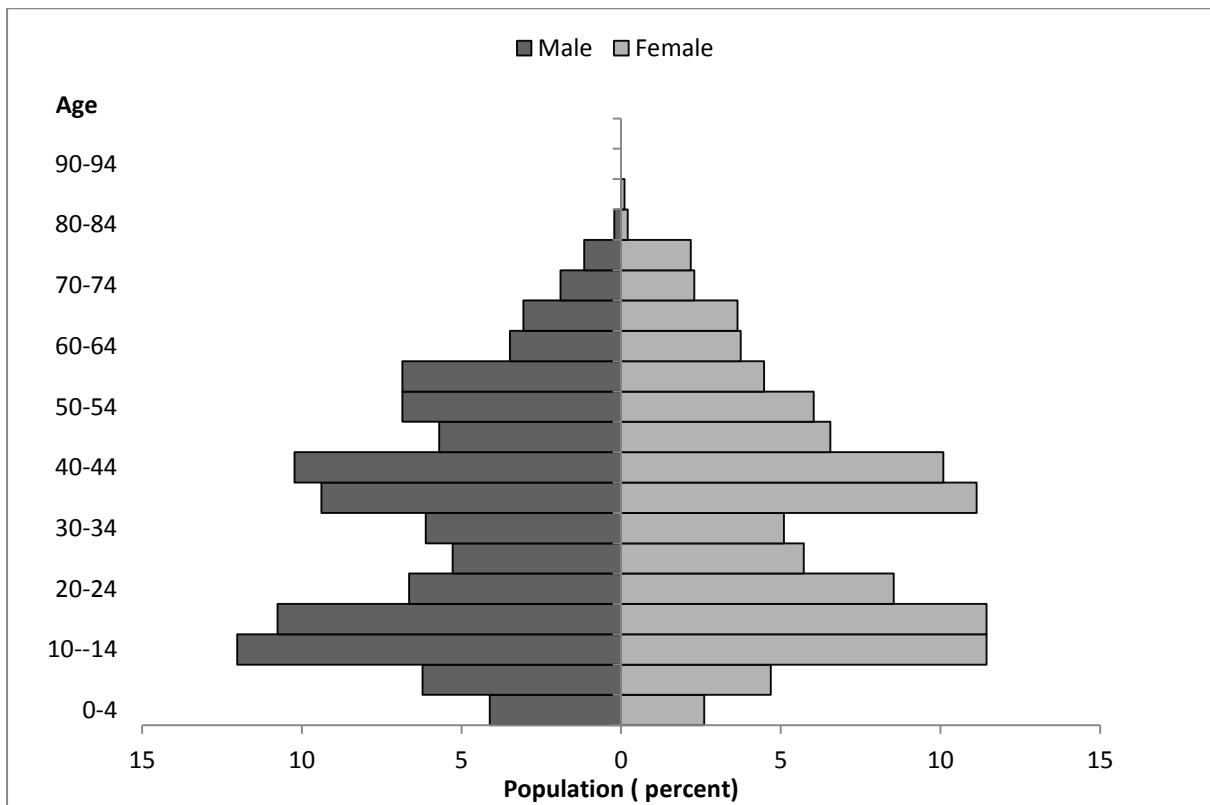
Dependency ratio: The dependency ratio has two components: old-age dependency ratio and youth dependency ratio. The dependency ratio in the study areas in 2007 was much lower than the ratio in the 2010 census. According to the author's survey, the old-age dependency ratio in the study areas in 2007 was 10.7, which was only about a half of the ratio indicated by the 2010 census. This may indicate that the study areas (five townships) did not have as many aged population as the rest of the county does. The author's survey found that the youth dependency ratio was about 20 in 2007, which was slightly lower than the 2010 census ratio 23. These indicate that the study areas might have more working age population than the rest of the county.

Ethnicity: The majority (99.9 percent) of Minqin people are Han-Chinese, while minority ethnic groups (e.g., Hui and Dongxiang) represented only minimal percent (0.1 percent) of the total population, according to the 2010 Census. The author's survey also supported this, and given that there are not enough observations of minor ethnic groups, the ethnicity variable was not included in the regression analysis.

Age-sex structure: The age and sex structure of Minqin in 2007 is generally consistent with that demonstrated in 2010. As shown in Figure 6.22 and Figure 6.23, Minqin experienced rapid population growth until the mid-1970s, when population growth sharply dropped, as shown in the gaps in age structure for the young males and females aged 20 to 34 years. This is largely due to the one-child policy and the increased out-migration of young population due to China's economic reform since the 1970s. The population rose again in the 10 years since the late 1980s, before once again declining significantly in the late 1990s.

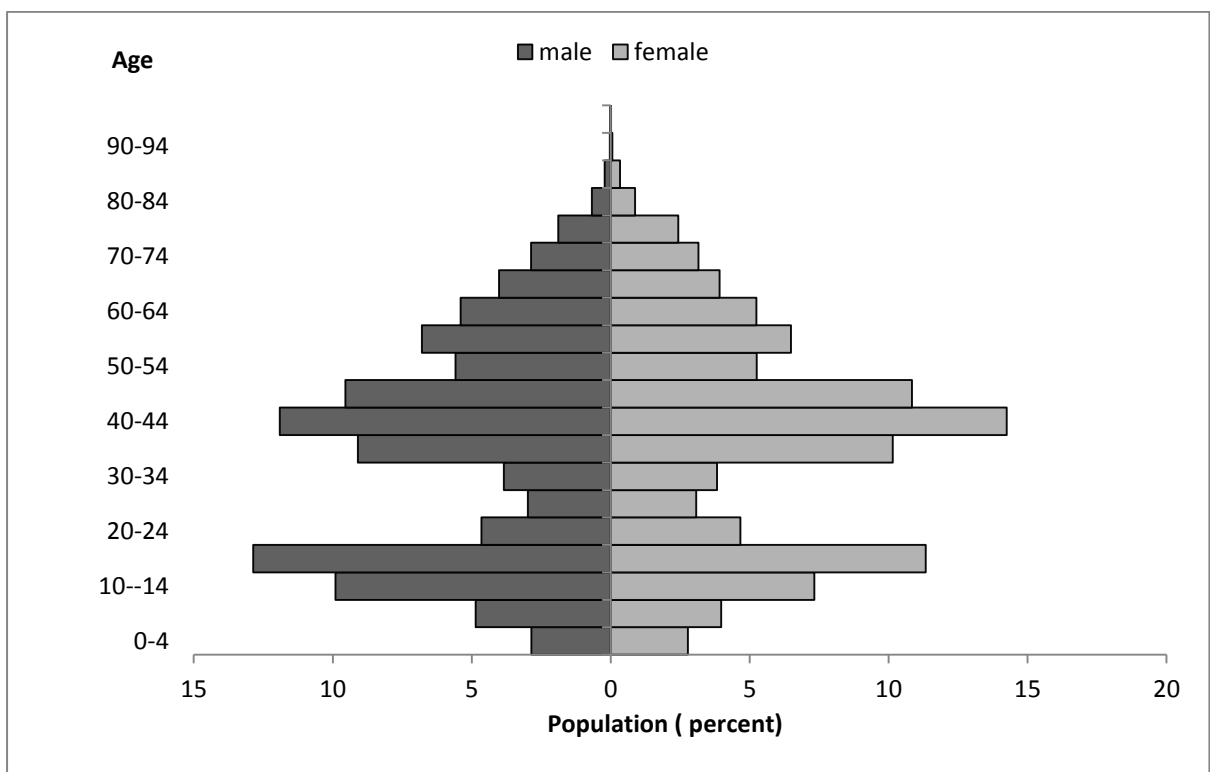
The author's survey shows that around 20 percent of the population were under age 15, and nearly two thirds were in the labour force (15-60 years), while about 10 percent were 60 years or older. The sex ratio of rural population in Minqin in 2007 is quite balanced, with males and females accounting for 50percent, respectively, of the total sample. Despite the overall balance, it must be noted that there are less females than males aged below 15 years and more females than males at older ages.

Figure 6.22: Age and sex structure in rural Minqin, 2007



Source: Survey on climatic variability and adaptation in Minqin 2012

Figure 6.23: Age and sex structure in rural Minqin, 2010



Source: The Sixth National Population Census of China 2010

6.7 The influence of class on the impacts of climatic variability

This section employs regression analyses to investigate how class influences climatic variability-related impacts at the household level. The dependent variables are the major impacts of climatic variability on agricultural development, land and water that experienced by families in rural Minqin. The explanatory variables are class-related factors, which are examined at two scales (the class structure of community and the class position of the family) and on five dimensions (economic, social, cultural, symbolic and political status). Regression is used to quantitatively examine how different scales and dimensions of class influence households' experience of climatic variability-related impacts, by controlling other factors that can also shape the experience (e.g., demographic characteristics and public preparedness for, and adaption to, climatic variability).

6.7.1 Dependent and independent variables

6.7.1.1 Dependent variables (impacts of climatic variability)

Three major impacts of climatic variability in Minqin county were identified: (1) decreased agricultural production, (2) decreased water resources, and (3) decreased land resources. In the household survey, a series of questions were asked about the extent to which climatic variability had impacts on the family's agricultural production, water resources and land resources by 2007. Answers were coded in a scale from 0 (climatic variability has no adverse impact at all) to 10 (climatic variability has the most severe adverse impact) to capture nuanced differences in perceptions among respondents. The higher the score, the greater the impacts of climatic variability experienced by families.

6.7.1.2 Explanatory variables (information about class)

The explanatory variables comprise two sets of information on class. One is the class structure of the local community, represented by Gini coefficients of income and landholding, and the other is the class position of the households, reflected by their economic, social, cultural, symbolic and political status. Table 6.3 presents the names and definitions of the explanatory variables. The rationale of variable selection and the specific questions asked to collect the information about selected variables were discussed earlier.

Table 6.3: Definitions of the explanatory variables

<i>Class structure</i>	
Income Gini	Gini index of income
Land Gini	Gini index of land quantity per capita
<i>Economic status</i>	
household income	the annual income per capita of the household (Yuan)
income diversity	the number of the income sources of the family living in: from 0 to 10
land size	the amount of the farmland per capita (mu)
living size	the living area per capita m ²
satisfaction with housing	the degree of satisfaction with housing condition: from 0 (least satisfied) to 10 (most satisfied)
<i>Social status</i>	
relationship	1=if any of the relationship between family members, neighbours, relatives, colleagues, village cadres is poor or very poor; 0=otherwise
connection with government officers or entrepreneurs	1=if the family has any relative or close friend who is a government officer or entrepreneur; 0=otherwise
assistance received	the number of types of assistance received by the family: from 0 to 9. the assistance includes: money and goods loaned; money and goods donated, assistance in production or housework, providing information, emotion support, assistance in care of family member, providing transportation, providing accommodation and others.
<i>Cultural status</i>	
education	the highest educational attainment in the household: from 1 (no schooling) to 15 (PhD)
<i>Symbolic status</i>	
occupational prestige	the scale of the highest ranked occupation of the family members: from 1 (the lowest ranking score) to 7 (the highest ranking score) based on Li (2005)'s occupational prestige ranking system of China
local reputation	the number of community issues that the household is frequently involved in: from 0 to 4. The community issues include: discussing community affairs, organising public activities, providing advice to other villagers, and solving conflicts between other villagers.
<i>Political status</i>	
political affiliation	1=if any family member is a member of CPC; 0=otherwise
government assistance	the governmental assistance received by the family when facing difficulties: from 0 (very little) to 10 (very much)
satisfaction with participation	the satisfaction with the chance to participate in policy-making process: from 0 (least satisfied) to 10 (most satisfied)
<i>demographic factors</i>	
health	1=if there is any member in the household who is disabled; 0=otherwise
male ratio	the ratio of male to the total number of the household members
household size	the number of people in the household
age	the household head's age
aged household	the number of old-aged people in the household
dependency ratio	the ratio of those not at the working age (aged 14 years or younger, and 60 years or over) to the total number of the household members
<i>institutional arrangement</i>	
local preparedness	the number of governmental interventions on climatic variability that greatly benefit the household: from 0 to 5. These governmental interventions include: climate forecasting systems and emergency plans for disaster relief, ecological rehabilitation projects, protection of water resources, development of irrigation system, and planting climate resistant crops.
aged pension	the ratio of family members who have joined the aged-pension scheme against the total number of persons aged 16 years or older
health insurance	the ratio of family members who have joined the rural health insurance scheme against the total number of family members

It is hypothesised that greater climatic variability impacts are associated with:

- a greater inequality in distribution of income and land in the townships;
- poor economic condition of the family (e.g., lower income, less diversified income sources, less land, smaller house size and lower satisfaction with housing);
- poor social relationships (e.g., poor social relationships, less connection to government officers or entrepreneurs, less connection to people living in other places, and receiving less help or assistance in the face of difficulties);
- lower cultural status due to lower educational attainment; lower symbolic status based on lower occupational prestige and lower local reputation; and
- lower political status (e.g., not having a family member who is CPC member, and having lower levels of satisfaction with participation in the community's decision-making processes).

6.7.1.3 Control variables

Institutional preparedness for climate change and the demographic characteristics of households were identified as important factors shaping people's vulnerability to climate change, and therefore differentiating the experience of the impacts. The study thus includes the *institutional arrangements* and *demographic characteristics* as control variables in the impact model. It is very difficult to separate means of adaptation to climate change from complex development approaches in that setting (Adger et al. 2005). For reasons of feasibility, this study only considers the following means of adaptation that are directly triggered by climatic variability in the study area: climate forecasting systems and emergency plans for disaster relief, ecological rehabilitation projects, protection of water resources, development of irrigation systems, and planting drought resistant crops.

6.7.2 Analytical method

A *seemingly unrelated regression* (SUR) model (Greene 2008:254-257) was estimated to examine how class, institutional arrangements and demographic characteristics influence three major domains of the impacts of climate change in the study area. The purpose of the model was to obtain the predicted severity of each impact. There are three key domains of the

impacts of climatic variability on households in this impact model. Hence a three equation system of SUR is constructed as follows, according to Greene (2008:254-257).

$$y_m = x_m' \beta_m + \varepsilon_m, \quad y_m = [0, 10], \quad m=1, 2 \text{ and } 3$$

where y_m is a Likert scale, which is treated as a continuous variable, from 0 (no impact at all) to 10 (most severe impact), indicating that climatic variability has a varying impact on households' agricultural production ($m=1$), water resources ($m=2$), and land resources ($m=3$); x_m are vectors of explanatory variables that include class structure of the communities, class position of the households and the control variables; ε_m are the error terms.

One advantage of estimating the regressions in a system of equations instead of four separate OLS (Ordinary Least Squares) models is that the former allows correlations between the error term of each equation in the system, which is more closely mirrors the reality since it is likely that the error term of each equation contains the same unobserved variables that affect climatic variability impacts experienced by a household, respectively. The SUR model results confirm this point given the significant correlations between the residuals of each equation in the system. Stata 11.0 is used to estimate the SUR model.

6.7.3 Results and discussion

Table 6.4 presents the results of the Stage I *impact model*; the statistically insignificant independent variables are not reported. The class structure of the community and three out of the five dimensions of the class position of households are found to be significantly associated with the impacts of climatic variability. Education and occupation are not significant in influencing the households' experience of the impacts of climatic variability. Since occupation is not very diversified in rural areas, it could be expected that it does not play an important role in influencing the impact of climate change on households. Education, on the contrary, is hypothesised to be a significant factor in influencing people's experience of climatic variability, because people receiving more education are more aware of the climatic risk and have more knowledge to build their resilience. However, Minqin residents usually undertake post-primary education outside rural areas. After gaining post-primary education, they are more likely to stay in urban areas rather than rural areas. Education does not necessarily enhance families' awareness of, and coping resources of, climatic variability that has occurred in rural areas.

Table 6.4: Regression results: Seemingly unrelated regression

Variables	Impact on agricultural production		Impact on land		Impact on water	
	Coef.	P-value	Coef.	P-value	Coef.	P-value
<i>Class structure</i>						
Income Gini	16.330***	0.002	-16.277***	0.000		
Land Gini					-30.595***	0.001
<i>Class position: Economic status</i>						
household income						
income diversity	-0.519*	0.093				
land size	-0.378**	0.013				
living size			-0.013***	0.000		
satisfaction with housing						
<i>Class position: Social status</i>						
relationship	0.129***	0.009	0.108**	0.011	0.069*	0.069
connection with government officer or entrepreneur			-0.709*	0.094	-0.802**	0.035
assistance received	-0.381**	0.013	-0.250*	0.057		
<i>Class position: Cultural status</i>						
education						
<i>Class position: Symbolic status</i>						
occupational prestige						
local reputation						
<i>Class position: Political status</i>						
political affiliation	-1.444***	0.006				
government assistance	-0.294***	0.001			-0.172***	0.010
satisfaction with participation						
<i>Control variables: demographic factors</i>						
health					0.639*	0.093
male ratio						
household size					-0.357*	0.070
age	-0.039*	0.069				
household with elderly dependency ratio						
<i>Control variables: institutional arrangement</i>						
local preparedness						
aged pension			-0.897*	0.069		
health insurance						
_cons	-3.625	0.404	13.769***	0.000	12.835***	0.000

* p<.10; ** p<.05; *** p<.01.

The class structure of a community, represented by Gini indexes, was found to have a significant influence on all three domains of climatic variability-related impacts. The results are seemingly contradictory, with the income Gini being significantly and positively correlated with decreased agricultural production, but negatively associated with a decline in farmland.

Studies that explore the influence of income inequality (measured by Gini index) on vulnerability and adaptive capacity to climate change largely focus on the national level data (Brenkert and Malone 2005; Brooks et al. 2005; Alberini et al. 2006), except for a study carried out by Brouwer et al. (2007) in floodplain area of Bangladesh, which uses Gini coefficients to measure the income distribution at the local community level. This study finds that the greater the income inequality in a community, the greater the reduction in agricultural production experienced by the households living in that community. This result confirms the empirical findings by Brouwer et al. (2007) that greater income inequality results in higher exposure levels and damage. This is also consistent with the theoretical hypothesis that an unequal distribution of income will contribute to social vulnerability in the context of climate change (Adger 1999; Adger and Kelly 1999).

It was interesting that the households living in a town with higher income inequality are less likely to report damage to land caused by climatic variability. Similarly, greater land inequality is associated with experience of less decrease in water resources. In rural communities in China, income disparity is shaped by two socio-economic reforms: (1) first, socio-economic reform and development since the 1980s has created off-farm job opportunities for rural residents in both urban and rural areas, which has enlarged the income gap between families with diversified income sources and those solely depending on farming (Morduch and Sicular 2001; Ravallion and Chen 2007); (2) second, the transfer of land use rights on both temporary and permanent bases has become more frequent since the 1990s (Brandt et al. 2002), which has changed the equal distribution of land among rural households in the same community. It is assumed that families with more diversified income sources or more land can generate higher income. From this perspective, high income inequality, at a township level, indicates that some families have more income sources or more land than others do in the town. Families living in this town are more likely to attribute declines in land and water either to their own choice of diversifying income sources beyond on-farm activities

or to the process of the transfer of land use rights, rather than to blame them on climatic variability.

The *economic status* of the households is significantly associated with the impact of climatic variability on agricultural production and farm land. The study found that households having more income sources and owning more farm land experience less reduction in agricultural production due to climatic variability, which confirms previous research suggesting that diversified income resources are contributors to strong adaptive capacity (Kelly and Adger 2000; Mendelsohn 2000; Meze-Hausken 2000; Heltberg et al. 2009). The study also found that per capita living area is significantly negatively associated with declines in farm land. Households living in bigger places are less likely to have their farm land impacted.

The *Social status* of households had a very significant influence on all three dimensions of climatic variability-related impacts. Families whose relatives or close friends were government officers or entrepreneurs were less likely to suffer declines in land and water resources. This is probably because these households were likely to have better access to information, financial resources and public services and assistance through their personal connection with the resource-controllers. These households were also more likely to control resources in their own communities (e.g., villages) with support from their ‘powerful backers’. ‘Connection with government officers or entrepreneurs’ becomes an important indicator of social status in China because this relationship brings privileges. Changing the situation is a long-term issue, but a good start might be adjusting the policy communication and implementation systems to a more transparent and informed one, assuring that every family in the community understands the policies and is aware of possible resources. Furthermore, it is expected that the more assistance a family receives, the less impact on agricultural production and land it experiences. The assistance, focusing on cash and goods donation/loan and assistance in production and housework, are mainly provided by families, friends and township fellows. These kinds of assistance are reciprocal. For example, if one family receives help with harvest from other families, it is expected it helps them with harvest once its own work is done. The result suggests that the local government can enhance people’s adaptive capacity by facilitating mutual assistance between households.

One interesting finding is that the families having better relationships with people around them appear to bear more adverse impacts on their land. It is assumed that families having a

better relationship with people around them rank higher in the social status hierarchy that have stronger adaptive capacity. However, vulnerable people who lack access to resources and institutions also can develop strong informal social networks with their extended families, friends and neighbours as a survival strategy in face of environmental and social challenges. This suggests that strong private social relationship does not necessarily contribute to high status in local class structure, especially in China, where social status is shaped by the connection to people that control resources, rather than by the relationships to ordinary people. The result also suggests that ‘having a bad relationship’ does not automatically translate to ‘receiving less assistance’ in the study area. If there are many sources from which families can seek assistance, failing to establish a good relationship with certain people does not necessarily cut off assistance received by them. This informs the local government of the importance of diversifying assistance sources in addition to enhancing the mutual relationship between rural households.

The *Political status* is another factor having a very significant influence on households’ experience of climatic variability-related impacts. Households with CPC members are less likely to experience a reduction in agricultural production, partly confirming the statement of Morduch and Sicular (2001) that the people with higher political status have more information, social connections and resources, contributing to their strong resilience to climatic variability. Moreover, more access to government services and resources is significantly associated with fewer impacts of climatic variability on production and water resources. This finding supports and supplements previous research (Thomas and Twyman 2005; Paavola and Adger 2006) by suggesting that unequal access to public resources and assistance influences people’s adaptive capacity and hence differentiates their experience of climatic variability-related impacts.

Among a series of *demographic factors*, the health status of the family members, household size and age of the household head are found to be significantly associated with the impacts of climatic variability. Households having family members with disabilities or chronic diseases are more likely to experience a reduction in agricultural production and a decline in water resources. This suggests that the local government should provide more support to families having disabled or seriously sick members. Larger families experience less impact on water, which indicates the importance of human capital in reducing vulnerability to climatic variability. If the household heads are older, the families are less likely to suffer

from reduced agricultural production, which suggests that the experience of the household head can help the family alleviate the damage. The aged pension is the only factor among *institutional factors* found to be significant in shaping the impact of climatic variability on land. Higher ratios of people receiving the aged pension in the family are significantly associated with less impact on land. This finding suggests that local people's resilience to climatic variability can be strengthened by enhancing their social security.

6.8 Conclusion

Class is an important factor influencing people's experience of climatic variability. However, different tiers and dimensions of class are rarely theoretically addressed or empirically examined in climatic variability impact and adaptation studies. Aiming to comprehensively represent the full spectrum of inequality in the local community, this chapter examined two tiers of class (class structure at the township level and class position at the household level) and five dimensions of class (economic, social, cultural, symbolic and political status) in Minqin county, by using survey data. Minqin county is a typical ecologically fragile area that suffers severe damage to land, water and agricultural production from climatic variability. Regression analysis was employed to investigate the influence of different levels and dimensions of class on three major aspects of climatic variability-related impacts identified in this county, by controlling for demographic and institutional factors. The results suggest that class structure of the community and three dimensions of class position (economic, social and political status) of the households can significantly influence people's experience of climatic impacts.

The chapter suggests that the following groups disproportionately bear the negative impacts of climatic variability: families highly dependent on natural resources and having limited income sources, owning less farm land, receiving less assistance, not having a direct connection with people who control resources, not having a family member who is CPC member, and having little access to public services. The result supports the hypothesis of this study that the more economic, social, reputational and political resources a household has, the higher its status in the local class structure and the stronger resilience to climatic impacts it has. To enhance the adaptive capacity of the community, the local government needs to recognise the particular needs of the vulnerable groups and address their needs through effective policies and programs.

In conclusion, this chapter offers a detailed understanding of the relationship between class and the experience of climatic variability and its environmental impacts at the household level. Households' experience of climatic variability differs by the class structure of their community and their class positions in that community. Such an understanding could be useful in informing local government about enhancing the community's overall resilience to climate change and other forms of environmental change, through targeting the special needs of families with low economic, social and political statuses.

CHAPTER 7: The Influence of Class and Climatic Variability Impact on Migration

7.1 Introduction

Inequality is an important influence shaping people's choices with respect to migration and non-migration in response to climate change simply because it determines their level of vulnerability (Barnett and Webber 2010). The concept of class theoretically demonstrates the complexity of inequality, but it is used in an over-simplified way in empirical studies to understand the interrelationship between climate change, class and migration (Bolin 2007). This chapter therefore aims to systematically examine how different tiers and dimensions of class interact with three major aspects of climatic variability impact (impact on agricultural production, water resources and land resources) to influence actual and intended migration patterns at the household level in Minqin. This chapter uses two types of key information to explain migration behaviour and intentions: (1) information on class, including the class structure of the community and the class position of households; and (2) the predicted probability of the impacts on the agricultural, water and land conditions of each household. Class factors can *directly* influence migration patterns and intentions in the context of climatic variability, as well as *indirectly* influence them by shaping households' experience of the impacts. The probability of being impacted by climatic variability represents the interaction of climatic variability and class because, many dimensions of class can influence such impacts experienced by households (refer to Chapter 6).

The chapter begins with a brief review of the literature on adaptation to climate change. Then it examines the type of adaptation adopted by rural residents in the study area based on survey information. This is followed by a discussion on actual and intended migration patterns, as well as the socio-economic and demographic characteristics of migrants and non-migrants and their households. Attention is then focused on existing empirical evidence of the determinants of climate change-related migration in order to derive the most appropriate indicators of different dimensions of class and other important factors that are significant in influencing migration in response to climatic variability. Finally a series of regression models are developed to investigate how class and environmental impacts of climatic variability influence actual and intended migration.

7.2 Adaptation to climate change

7.2.1 Adaptation to climate change: A literature review

Human adaptation to climate change is defined as ‘the process of adjustment to actual or expected climate and its effects’ by seeking to ‘moderate harm or exploit beneficial opportunities’ (IPCC 2014:3). Agriculture is among the most vulnerable sectors to the effects of climate change due to its inherent sensitivity to climate (Parry and Carter 1989; Smit and Skinner 2002). Hence, adaptation is significant in facilitating or constraining development in the agricultural sector in the context of global climate change.

Agricultural adaptation takes a number of forms at various social and spatial scales (Bryant et al. 2000). Research on adaptation has employed various typologies to describe its multi-dimensional and multi-scaled nature. One prominent approach is proposed by Park et al. (2012), who developed a theory of Adaptation Action Cycles and introduced two fundamental categories of adaptation: incremental and transformational. Incremental adaptation aims to ‘maintain the essence and integrity of a system or process at a given scale’, whereas transformational adaptation relates to changes in ‘the fundamental attributes of a system’ such as livelihood, location or identity (Park et al. 2012:5). There are sub-categories within both incremental and transformational adaptation. Wheeler et al. (2014) propose to group Australian farmers’ adaptation into three types of incremental adaptation means: (i) expansive (e.g., purchase land, increase irrigation area and purchase permanent water); (ii) accommodating (e.g., improve irrigation efficiency and change crop mix); and (iii) contractive (e.g., sell land, decrease irrigation area and sell permanent water). Transformational adaptation includes actions that are: (i) at a much larger scale of intensity; (ii) new to a region or system; and (iii) in new places and locations (Kates et al. 2012). So far, the agricultural sector has mainly adopted incremental adaptation strategies, and transformational adaptation is far less understood in theory or implemented in practice (Dowd et al. 2014). Some research warns that incremental adaptation is ineffective or insufficient to promote sustainable development in the agricultural sector in the long-term (Howden et al. 2010) and can even lead to ‘maladaptation’ (Barnett and O’Neill 2010).

Adaptation studies suggest that adaptation can also be divided into three categories: in-situ adaptation, migration and no response (Tompkins and Adger 2004; Reuveny 2007). Not

responding to perceived or actual climate change is not always related to lacking adaptive capacity; it can also be considered as a proactive means when people do not consider climate change a significant risk based upon their strong resilience (Brklacich et al. 1997; Mortreux and Barnett 2009). In-situ adaptations in the agricultural sector include practices aiming to adjust or improve: (i) agricultural production (e.g., planting new crops or mixing crops, adopting new agricultural techniques, adjusting time of planting); (ii) natural resources, especially water and land (e.g., water management, soil protection, establishment of natural reserves, returning farmland to forest or grassland, improving irrigation infrastructure and practice); (iii) farm management (e.g., insuring against climate change-related loss); and (iv) personal lifestyle and living habits (Smit and Skinner 2002; Grothmann and Patt 2005; Deressa et al. 2009; Marshall 2010; Osberghaus et al. 2010). Research has shown that climate change-induced migration is not limited to forced displacement and is no longer perceived as a necessarily negative outcome (Bardsley and Hugo 2010; Black et al. 2011a; Black et al. 2011b; Adger and Adams 2013; Baldwin and Gemenne 2013). In most circumstances except for sudden disasters, people use migration as an effective adaptive response to climate change.

Adaptation can also be classified according to the following characteristics: timing of adaptation (e.g., reactive vs. proactive); duration of adaptation (e.g., short-term vs. long-term); motivation of adaptation (e.g., to improve economic development or safety), effect of adaptation (e.g., deteriorated or enhanced resilience), ways of implementation (e.g., through market, social network or individual and collective action), etc. (Smit et al. 2000; Adger 2003; Adger et al. 2005; Bryan et al. 2009). All these adaptations can be implemented at any scale, ranging from international settings, national governments, local governments and organisations through to households and individuals (Adger et al. 2005). This chapter focuses on the adaptation at the household level. Households' adaptation is considered private but not always autonomous, because it is not isolated from collective actions implemented at other social scales. For example, in Minqin, building plastic greenhouse for cash crops seems a private adaptation because it is a household's decision to build it or not. However, almost no household can afford a greenhouse without support from the local government's agricultural development program and the central government's anti-poverty policy and funding. Private adaptation at household level, to some extent, is therefore shaped by collective adaptation at other scales.

7.2.2 Adaptation in Minqin

Minqin people have employed numerous approaches to protect and improve their agricultural production and their lives. The study began by interviewing key informants (e.g., the Village Party Branch Secretary and the head of Village Committee) about what means of adaptation means have been used to promote agricultural development and diversify livelihoods in the context of climatic variability in the study areas. There are two general types of adaptation being adopted in Minqin: in-situ adaptation and out-migration. In-situ adaptation is divided into three sub-categories, which are actions that (1) promote agricultural production; (2) protect natural resources; and (3) protect and improve life. Then the respondents were asked:

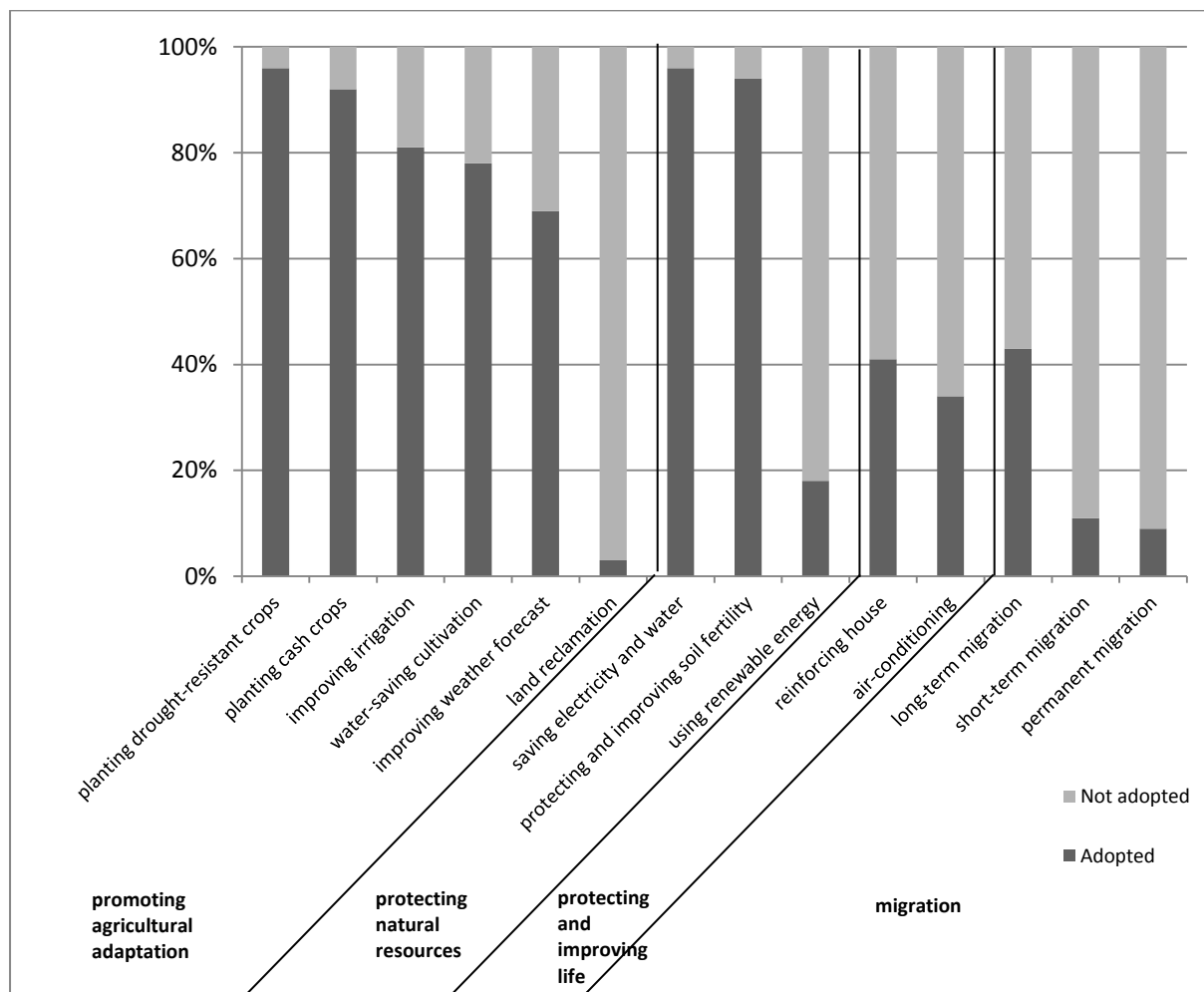
‘Has your household adopted the following means to adapt to adverse impacts of climatic variability? Specifically planting drought-resistant crops, planting cash crops, improving irrigation, adopting water-saving cultivation, improving access to weather information, land reclamation, decreasing usage of electricity and water, protecting and improving soil fertility, using renewable energy, reinforcing house, using air-conditioning facilities, family members taking short-term migration (6 months to 1 year), long-term migration (more than 1 year but less than 5 years) and permanent migration (5 years and more).’

The responses were coded as 1 for each adaptation means if the household has adopted it, and 0 otherwise.

Figure 7.1 illustrates the spread of adaptation means adopted among surveyed households. The results show that most households have adopted some means to promote agricultural production and protect natural resources. More than 90 percent had planted drought-resistant crops (e.g., cotton, potatoes and sunflowers) and cash crops (e.g., fruits, medicinal herbs and forage grass). This exemplifies that household adaptation is shaped by collective adaptation. Aiming to reduce agricultural water consumption and increase farmers’ income, the local government in Minqin has undertaken restructuring of the agricultural industry since 2010 to replace water-intensive grain crops with water-saving cash crops. Farmers in Minqin adopted these changes with support in finance, facilities and technology from local government. Around 80 percent of respondents indicated that they improved irrigation and adopted water-saving cultivation skills. Facing severe water scarcity, Minqin farmers adopted various irrigation and cultivation skills to save water, such as furrow irrigation, drip irrigation, fast irrigation above plastic film, etc. Sixty-nine percent of respondents indicated that access to weather information was improved through purchasing or installing communication facilities,

such as TV sets, radios, land-lines, mobile phone, etc. Only 3 percent of households indicated an increase in farming land. This is not surprising because Minqin government implemented a policy of ‘closing down pumping wells and reducing farm lands’ in order to conserve water resources.

Figure 7.1: Means of adaptation adopted by households in Minqin



Source: Survey on climatic variability and adaptation in Minqin 2012

To protect natural resources, rural households in Minqin have adopted the following means: saving electricity and water, protecting and improving soil fertility and using renewable energy. More than 90 percent of households treated their natural resources, especially water, very carefully. Water scarcity is so severe in the region that local people not only have to adopt water-saving agriculture but also constrain human water consumption. Developing renewable energy, such as solar energy, biogas and wind energy, is also significant in protecting the natural ecosystem. For example, using biogas can decrease dependence on desert plants for firewood and, consequently, reduce the risk of desert vegetation degradation

and desertification. However, less than one fifth of the surveyed households had adopted renewable energy, suggesting that the local government should put more effort into promoting the development of renewable energy. To protect and improve their lives, 41 percent of the households reinforced their houses against strong winds and sandstorms, and 34 percent purchased electronic fans or heaters to adjust the room temperature when it was too hot or too cold.

Migration was an important strategy to adapt to climatic variability in Minqin. More than 40 percent of the households indicated that they had used migration as an adaptation to climatic variability and its environmental impacts over the period 2008-2012. Some 40 percent of households undertook long-term migration (longer than 1 year but shorter than 5 years), while only 9 percent moved permanently (5 years and longer) and 11 percent undertook short-term migration (6 months to 1 year). The results show that farmers in Minqin adopted both in-situ adaptation and migration at the same time. Migration is not a last resort after all in-situ adaptations fail in this area; rather it is considered an adaptive strategy as important as in-situ adaptations.

7.3 Migration as an adaptation to climatic variability

7.3.1 Migration patterns

Migration to adapt to climatic variability, like other adaptation approaches, takes many forms. Patterns of environmentally-induced migration are usually classified according to the following characteristics: (1) degree of voluntariness (e.g., from completely forced migration to completely voluntary migration); (2) motivation (e.g., migration as a result of dramatic sudden impacts versus migration as a result of slow-onset change impacts); (3) timing of migration (e.g., migration before actual impact versus migration after actual impact); (4) duration of migration (e.g., short-term migration versus long-term migration); and (5) distance (e.g., short-distance migration versus long-distance migration) (Hugo et al. 2009; Piguet et al. 2011:14).

In China, there is a special distinction between two migration groups: migration with Hukou transfer and migration without Hukou transfer. The Hukou system was introduced in China in 1958 for the purpose of controlling population mobility through limiting one's access to

state-provided goods, welfare, and entitlements in a specific administrative unit (Chan 2010). Along with the structural adjustment and economic reforms of the late 1970s, the Hukou system was loosened and some essential goods such as food, clothes and housing became marketable (Zhu and Luo 2010). This enabled people to move to and live in some places other than their registered places; however, these migrants still do not have entitlements to social security and services, such as education, medical insurance, pension, etc., in the destination site. Hukou transfer is regarded as formal migration, with migrants being granted full social entitlements at the destination site, whereas migration without Hukou transfer is usually considered an informal and temporary behaviour. Most rural-to-urban migrants do not transfer Hukou to urban areas, and then they do not have equal access to the job opportunities, education and health services urban citizens have.

Although all of these migration patterns are worthy of further investigation, the current dataset only enables an examination of four types of migration patterns in Minqin: (1) actual *Hukou transfer* (migration with Hukou transfer versus migration without Hukou transfer); (2) actual migration *distance* (intra-provincial migration versus inter-provincial migration); (3) intended migration *distance* (intention of intra-provincial migration versus intention of inter-provincial migration); and (4) intended migration *scale* (intention of entire household migration versus intention of individual migration).

7.3.2 Migration patterns in Minqin: descriptive analysis

In the survey, ‘actual migration’ is defined as the movement of a whole household⁶ or part of its membership, beyond the original township for 6 months or longer during the period 2008 to 2012. The survey collected information from 1979 individuals within 445 households.

The respondents were asked to provide migration information on their households and each household member. The questionnaire asked two questions regarding the migration history of the household: (1) ‘*Did your household move since 2008?*’ and (2) ‘*Did your family members migrate since 2008?*’ The responses are coded as 1 if ‘yes’ and 0 otherwise. Few surveyed households moved the entire family, but this does not mean that few households in the study

⁶ This study could not target migrants who moved whole household beyond Minqin county; however, the potential respondents may include those moved whole household beyond Minqin county but returned and those who moved whole household within Minqin county.

area had moved the entire family. The households usually move the entire family out of Minqin, not within it, which makes it difficult to target households moving the entire family within the migrant sending area. This issue makes it impossible to investigate the distinction between household migration and individual migration, which is a limit of this study.

For those having experience of migration, questions about Hukou transfer and migration destination were asked. Specifically, the respondents were firstly asked: ‘*Did your family or family members transfer Hukou to the migration destination?*’ The responses are coded as 1 if ‘yes’ and 0 otherwise. Another question is ‘*Where did your household or your family members migrate to?*’ The respondents were asked to choose from 1 (another township in the same county) to 4 (another province). The responses are coded as 1 (inter-provincial migration) if number 4 was chosen and 0 if number 1 to 3 was chosen.

The distribution of migration patterns among individuals is shown in Table 7.1. The results show that 287 individuals migrated, accounting for 14.5 percent of the total sample. Among the 287 migrants, only 41 transferred Hukou to their destination, accounting for 14 percent of the migrants and only 2 percent of the total sample. As far as the destination is concerned, more than half of the migrants undertook inter-provincial migration, accounting for 7.5 percent of the households. Some 7 percent of households adopted intro-provincial migration.

Table 7.1: Migration patterns at individual level in Minqin

	N (=1979)	percent
Non-migration vs. migration		
non-migrants	1,692	85.5
migrants	287	14.5
Hukou transfer		
non-migrants	1,692	85.5
migrants not transferring Hukou	246	12.4
migrants transferring Hukou	41	2.1
Migration destination		
non-migration	1,692	85.5
another township in the same county	46	2.3
another county/district in the same city	10	0.5
another city in the same province	83	4.2
another province	148	7.5

Source: Survey on climatic variability and adaptation in Minqin 2012

Table 7.2 shows the distribution of migration patterns among households. Around 43 percent of households had experience of migration. Nineteen percent of households only had intra-provincial migrants and 19 percent only had inter-provincial migrants. Only 4 percent of households experienced both intra- and inter-provincial migration. Those households experiencing migration and Hukou transfer accounted for nearly 8 percent of the total sample and 34.8 percent of the households experienced migration but did not transfer Hukou to the destinations.

Table 7.2: Migration patterns at household level in Minqin

	N(=445)	percent
Non-migration vs. migration		
HH not having migrants	255	57.3
HH having migrants	190	42.7
Hukou transfer		
HH not having migrants	255	57.3
HH having migrants not transferring Hukou	155	34.8
HH having migrants transferring Hukou	35	7.9
Migration destination		
HH not having migrants	255	57.3
HH having intra-provincial migrant(s) only	85	19.1
HH having inter-provincial migrant(s) only	86	19.3
HH having both intra- and inter-provincial migrants	19	4.3

Source: Survey on climatic variability and adaptation in Minqin 2012

7.3.3 Characteristics of migrants and their households in Minqin

Table 7.3 shows a comparison of key demographic characteristics for migrants and non-migrants. The significantly different (at $p < 0.1$) characteristics for the migrants (as compared to non-migrants) include: a younger age, better health and a smaller proportion of marriage. The average age of migrants was only 23 years while that of non-migrants was 36 years. Only 4 percent of migrants had health issues while one quarter of non-migrants were unhealthy. Forty-two percent of migrants were married while married persons accounted for 64 percent of non-migrants. Hence migrants were more likely to be young, healthy and single than non-migrants.

Table 7.3: Characteristics of migrants and non-migrants in Minqin

	non-migrants <i>n=1630</i>	migrants <i>n=287</i>	<i>significance</i>
Age (years)	35.50	23.18	0.000
Male (where 1=male;0=otherwise)	0.50	0.52	0.742
Health (where 1=healthy problem; 0=otherwise)	0.25	0.04	0.000
Education (scale from 1 to 12, where 12 is the highest educational attainment)	4.08	6.68	1.000
Marriage (1=married; 0=otherwise)	0.64	0.42	0.000

Source: Survey on climatic variability and adaptation in Minqin 2012

Table 7.4 presents a comparison of class positions, demographic characteristics and institutional arrangements for three groups of households: (i) households not having migrants; (ii) households having intra-provincial migrants only; and (iii) households having inter-provincial migrants.

It was found that the significantly different (at $p < 0.1$) characteristics for the households not having migrants (as compared to those having migrants) were those with fewer income sources, less assistance, lower levels of education, fewer means of communication, lower occupational prestige, fewer CPC members, lower degrees of satisfaction with participation in public affairs. However, the households that did not have migrants were also likely to have more land, larger living areas and higher local reputation than those having migrants. The survey results suggest that some households without migrants had relatively strong resilience shaped by large land and living areas and high local reputation, whereas some households that did not have any experience of migration had limited economic, social and political resources.

In addition, the demographic characteristics of households that did not have any migrants tended to have poorer health conditions, smaller household sizes, a higher male ratio and a higher dependency ratio. For institutional arrangements, those households without migrants were more likely to participate in the pension system and public programs for coping with climatic variability.

Table 7.4: Characteristics of households that have different migration experience in Minqin

	HH not having migrant	HH having intra-provincial migrant(s) only	HH having inter- provincial migrant(s)	<i>significance</i>
	<i>n=255</i>	<i>n=85</i>	<i>n=105</i>	
Income (Yuan)	26468.27	22983.81	29127.89	0.000
Income diversity (from 1 to 8 income resources)	2.68	2.81	3.11	0.000
Land per capita (mu)	3.50	3.30	2.96	0.000
Living size per capita (m ²)	120.02	99.42	102.97	0.002
Relationship (index from 0 to 40, where 40 is the best relationship)	32.52	32.00	33.81	0.080
Connection to powerful people (1=yes; 0=otherwise)	0.27	0.26	0.26	0.942
Assistance (number of assistance types)	2.19	2.52	2.53	0.000
Connection to other county	0.38	0.39	0.43	0.518
Connection to other city	0.40	0.40	0.52	0.206
Connection to other province	0.39	0.31	0.64	0.000
Highest education (scale from 1 to 12, where 12 is the highest educational attainment)	6.13	8.28	8.30	0.000
Communication means (number)	3.84	4.16	4.41	0.000
Highest occupational prestige (scale from 1 to 7, where 7 represents the highest occupational prestige)	2.18	2.48	2.52	0.000
Local reputation (index 0-4, where 4 represents the highest local reputation)	1.55	1.36	1.39	0.005
Party member (1=yes; 0=otherwise)	0.23	0.29	0.30	0.010
Government assistance (scale from 0 to 10, where 10 represents households receiving the greatest assistance from government)	2.87	2.42	2.99	0.022
Satisfaction with participation (scale from 0 to 10, where 10 is the highest satisfaction)	4.42	4.64	4.75	0.020
Health (1=has health problem; 0=otherwise)	0.32	0.31	0.29	0.001
Male ratio	0.52	0.50	0.50	0.013
Household size (number of persons)	4.18	4.76	4.83	0.000
Age of household head (years)	43.33	44.21	44.82	0.922
Elders (1=households having elders; 0=otherwise)	0.35	0.33	0.34	0.526
Dependency ratio	0.36	0.24	0.18	0.000
Local preparedness (number of means of local preparedness)	3.01	2.76	2.93	0.000
Pension ratio	0.55	0.40	0.45	0.000
Medical insurance ratio	0.84	0.77	0.87	0.091

Source: Survey on climatic variability and adaptation in Minqin 2012

Households having inter-provincial migrants, compared to those having intra-provincial migrants, were likely to have more income, more diversified income sources, larger living areas, better social relationships, more connections to other places (especially to other provinces), more communication means, more government assistance and higher degrees of satisfaction with their participation in public affairs. It is evident that the households with long-distance migrants had higher economic, social and political status than those having short-distance migrants. The households undertaking long-distance migration, compared to those adopting short-distance migration, also had the following demographic characteristics: larger household sizes and lower dependency ratios. In addition, they were more likely to participate in government programs, such as the pension system, the medical insurance system and public adaptation programs.

7.3.4 Migration intentions

The questionnaire also collected information about the households' future migration intentions. Respondents were asked: *'Do you intend to move the entire household or send out family member(s) to a place beyond your township in 2013 and 2014 and where the farthest planned destination will be?'* Table 7.5 shows that nearly 60 percent of households did not intend to migrate, while one third intended to undertake individual migration and 7 percent intended to move the entire household.

Table 7.5: Migration intention of Minqin households

Migration intention	N	percent
No migration intention	266	59.8
Intention of individual move only	148	33.2
Intention of household move	31	7.0
Total	445	100.0

Source: Survey on climatic variability and adaptation in Minqin 2012

As shown in Table 7.6, among the 179 households that intended to migrate, 173 indicated their destinations, while 6 did not. Twice as many households intended to undertake inter-provincial migration than those planning intra-provincial migration. This shows that Gansu province is a major source of sending migrants to Xinjiang and other eastern provinces.

Table 7.6: Planned destination of future migration for Minqin households

Destination of intended migration	N	percent
No migration intention	266	59.8
Intention of migration but no destinations specified	6	1.3
Intention of intra-provincial migration	57	12.8
Intention of inter-provincial migration	116	26.1
Total	445	100.0

Source: Survey on climatic variability and adaptation in Minqin 2012

7.3.5 Characteristics of households having different migration intentions

Table 7.7 presents a comparison of class positions, institutional conditions and demographic characteristics for three groups of households: (1) those not intending to migrate; (2) those intending an individual's migration; and (3) those having an intention of a household move.

The significantly different (at $p < 0.1$) characteristics for the households having no intention to migrate (as compared to those intending to migrate) include: lower incomes, less land per capita, smaller living size per capita, weaker connection to powerful people, less assistance, lower degree of education, lower level of occupational prestige, less government assistance, lower degree of satisfaction with participation in public affairs. Households that did not intend to migrate were more likely to have lower economic, social, cultural, reputational and political status in the community. Further, households not having migration plans were more likely to have disabled or sick family members.

These findings suggest that households are unable or unwilling to migrate when they have low class status and household members suffering from unfavourable health conditions. These people are likely to bear the greatest risk of climate change in the future due to a lack of various resources needed for both in-situ adaptation and migration (Black et al. 2011a)

Table 7.7: Characteristics of households that have different migration intentions

	HH having no intention to migrate n=266	HH having intention of individual migration n=148	HH having intention of household migration n=31	<i>signifi cance</i>
Income (Yuan)	24700.38	28927.04	29741.94	0.000
Income diversity (from 1 to 8 income resources)	2.76	2.93	2.74	0.000
Land per capita (mu)	3.13	3.63	3.66	0.000
Living size per capita (m ²)	106.18	121.25	118.88	0.000
Relationship (index from 0 to 40, where 40 is the best relationship)	32.84	32.51	32.71	0.869
Connection to powerful people (1=yes; 0=otherwise)	0.21	0.36	0.29	0.011
Assistance (number of assistance types)	2.10	2.70	2.52	0.000
Connection to other county	0.38	0.41	0.36	0.431
Connection to other city	0.43	0.44	0.36	0.375
Connection to other province	0.40	0.48	0.48	0.202
Highest education (scale from 1 to 12, where 12 is the highest educational attainment)	6.70	7.74	6.84	0.000
Communication means (number)	3.97	4.20	3.87	0.001
Highest occupational prestige (scale from 1 to 7, where 7 represents the highest prestige)	2.30	2.35	2.42	0.008
Local reputation (index 0-4, where 4 represents the highest local reputation)	1.48	1.45	1.58	0.280
Party member (1=yes; 0=otherwise)	0.27	0.23	0.26	0.238
Government assistance (scale from 0 to 10, where 10 represents that the household receives the greatest assistance from government)	2.65	2.88	3.87	0.000
Satisfaction with participation (scale from 0 to 10, where 10 is the highest satisfaction)	4.29	4.81	5.35	0.000
Health (1=has health problem; 0=otherwise)	0.37	0.20	0.26	0.000
Male ratio	0.52	0.50	0.49	0.226
Household size (number of persons)	4.35	4.66	4.29	0.000
Age of household head (years)	44.79	41.43	47.13	0.739
Elders (1=households having elders; 0=otherwise)	0.34	0.38	0.26	0.064
Dependency ratio	0.29	0.31	0.25	0.858
Local preparedness (number of means of local preparedness)	3.03	2.70	3.39	0.000
Pension ratio	0.50	0.42	0.77	0.000
Medical insurance ratio	0.82	0.84	0.95	0.133

Source: Survey on climatic variability and adaptation in Minqin 2012

Households with intentions of individuals to move were likely to have more diversified income sources, larger living areas, stronger connections to powerful people, more assistance, higher levels of education and more communication means. Households intending to move the entire family were likely to have higher income, more land per capita, higher occupational prestige, more government assistance, and higher degree of satisfaction with participation in public affairs. Although the two groups showed the similar high economic and social status in their community, there are significant distinctions between them: households intending to send out family members seemed to have higher cultural status, whereas those intending to move the entire household were more likely to have higher reputational and political status. Households were very likely to send more young members to urban areas for further education if their older members have received more education. Educational migration has been mainstreamed into anti-poverty and ecosystem protection programs in Minqin because it is one of the major channels for out-migration that relieves pressure on the local environment and natural resources (Li and Wei 2005). Moving entire households demands more resources than that educational achievement alone can provide. In Minqin, household relocation is largely influenced and supported by government programs. It is therefore easy to understand why households with high political status, that ensures better access to public resources and government support, are more likely to plan entire household migration. These households also show a higher degree of participation in government programs, such as pension systems and local preparedness for climate change. In addition, households intending to move the entire household, compared with those only intending for individual members to move away, have fewer elders.

Table 7.8 shows the characteristics of households that did not intend to move compared to those that intended to undertake an intra- and inter-provincial move. Similarly, the households having no intentions to move had lower economic, social, cultural and political status than those intending to migrate. Specifically, the households without intentions to migrate were likely to have smaller land per capita, smaller living areas, fewer connections to powerful people, less assistance, lower levels of education, less communication means, lower occupational prestige, and lower satisfaction with participation in public affairs.

Table 7.8: Characteristics of households that plan to move to different destinations

	HH having no intention to migrate <i>n=266</i>	HH having intention of intra- provincial migration <i>n=57</i>	HH having intention of inter- provincial migration <i>n=116</i>	<i>signifi cance</i>
Income (Yuan)	24700.38	24681.07	31608.11	0.000
Income diversity (from 1 to 8 income resources)	2.76	2.70	3.01	0.000
Land per capita (mu)	3.13	3.66	3.62	0.000
Living size per capita (m ²)	106.18	116.64	121.76	0.000
Relationship (index from 0 to 40, where 40 is the best relationship)	32.84	32.39	32.55	0.830
Connection to powerful people (1=yes; 0=otherwise)	0.21	0.42	0.34	0.002
Assistance (number of assistance types)	2.10	2.74	2.62	0.000
Connection to other county	0.38	0.51	0.35	0.279
Connection to other city	0.43	0.51	0.41	0.480
Connection to other province	0.40	0.36	0.55	0.039
Highest education (scale from 1 to 12, where 12 is the highest educational attainment)	6.70	6.96	7.92	0.000
Communication means (number)	3.97	4.19	4.12	0.010
Highest occupational prestige (scale from 1 to 7, where 7 represents the highest occupational prestige)	2.30	2.33	2.39	0.005
Local reputation (index 0-4, where 4 represents the highest local reputation)	1.48	1.46	1.41	0.553
Party member (1=yes; 0=otherwise)	0.27	0.16	0.27	0.002
Government assistances (scale from 0 to 10, where 10 represents that the household receives the greatest assistance from government)	2.65	2.86	3.06	0.222
Satisfaction with participation (scale from 0 to 10, where 10 is the highest satisfaction)	4.29	4.63	5.02	0.000
Health (1=has health problem; 0=otherwise)	0.37	0.18	0.23	0.000
Male ratio	0.52	0.50	0.51	0.234
Household size (number of persons)	4.35	4.18	4.79	0.000
Age of household head (years)	44.79	44.63	41.54	0.014
Elders (1=households having elders; 0=otherwise)	0.34	0.42	0.33	0.050
Dependency ratio	0.29	0.31	0.28	0.147
Local preparedness (number of means of local preparedness)	3.03	3.00	2.68	0.000
Pension ratio	0.50	0.46	0.48	0.622
Medical insurance ratio	0.82	0.84	0.87	0.489

Source: Survey on climatic variability and adaptation in Minqin 2012

As far as demographic characteristics are concerned, the households not intending to migrate, compared to those who do, had more health problems. Furthermore, regarding the institutional arrangements, the households without any intentions of migration were more likely to participate in the local preparedness programs. The households intending to move beyond Gansu province, compared to those intending to migrate within the province, showed higher status in economic rank (e.g., higher income, more diversified income, and larger living area), cultural rank (e.g., higher degree of education), reputational rank (e.g., higher occupational prestige) and political rank (e.g., more CPC member and higher degree of satisfaction with participation in public affairs). It is interesting to find that the households intending to undertake inter-provincial migration had lower social status than those intending to undertake intra-provincial migration because they had fewer connections to powerful people and received less assistance. However, it could be expected that households intending to migrate beyond the province were more closely connected to people in other provinces. As far as the demographic characteristics are concerned, the households with intentions of an inter-provincial move were likely to have some favourable factors, such as larger household size, younger household head and fewer elders. However, they were also likely to have more health problems than those intending to move within the province. It is also expected that the households with intentions of inter-provincial migration were less likely to be involved in local preparedness to climate change than those intending to migration within the province.

7.4 The influence of class and climatic variability impact on migration

7.4.1 Empirical evidence on determinants of climate change-related migration

This section aims to provide some empirical evidence of the linkage between class, climate change impact and migration. The understanding of the influence of class and climate change impact on migration is based on the following literature: (1) research on migration patterns and drivers in the study area; (2) empirical studies into the influence of class on migration in general and environmentally-related migration in particular; and (3) existing empirical evidence on the relationship between climate change and migration that identifies the determinants of climate change-related migration. The first two schools of literature were reviewed previously (subsection 5.4.2 and 2.3.5). This section avoids repetition by only focusing on a review of the determinants of climate change-related migration. Table 7.9

summarises the indicators of different dimensions of class and other important factors that can shape migration as a response to climate change.

Table 7.9: Dimensions and elements of class and other factors significant in shaping climate change-related migration that have been identified in the literature

Category	Dimension	Element	Supporting literature
Class structure of town	Gini index	income Gini	Liebig and Sousa-Poza (2004); Stark (2006)
Class position of household	economic position	income	Smith et al. (2006)
		remittances	Findley (1994); Piracha and Saraogi (2013); Frey and Singer (2006); McLeman and Smit (2006)
	social position	social connection	DaVanzo (1981)
		assistance received	Isham (2002); Pelling and High (2005); Katungi (2007); Dowd et al. (2014)
		spatial connection: relationship to people in other localities	Morton (2002); Ravuvu (2002)
cultural position	education	Henry et al. (2004); Maddison (2007); Deressa et al. (2009)	
	symbolic position	occupation	Meze-Hausken (2000); Heltberg et al. (2009)
	political status	access to public service access to decision making	Thomas and Twyman (2005); Paavola and Adger (2006)
Experience of climate change impact	production	decreased agricultural production, crop failure and food shortage	Ezra and Kiros (2001); Feng et al. (2010); Massey et al. (2010)
	economic condition	income and employment level	Barbieri et al. (2010)
Contextual controls	institutional arrangements	local preparedness governance	Findley (1994); Adger (2000); Beauchemin and Schoumaker (2005); Eakin (2005); Kniveton et al. (2011)
		economic reform	
	community development level	economic development level	Henry et al. (2003); Beauchemin and Schoumaker (2005)
	demographic conditions	population growth male ratio literacy ratio	Hugo (1978); Henry et al. (2003)
Household and individual controls	demographic characteristics	health male ratio household size age	Findley (1994); Massey et al. (2010); Abu et al. (2014)
	experience	experience of migration	Findley (1994); Henry et al. (2004); Abu et al. (2014)

Migration is a highly complex phenomenon because it involves multiple and interwoven motivating factors, diversified migration patterns, heterogeneous characteristics of migrants and varying migration consequences (Tacoli 2010). Climate change-related migration is also very complex, even where a climate change-related event has been clearly identified as a driver of migration (McLeman 2013).

It is repeatedly argued that environmentally-related migration patterns are shaped by multiple factors, including environmental, demographic, economic, social, cultural, political, institutional and technological dimensions, interacting at multiple levels (McLeman and Smit 2006; Perch-Nielsen et al. 2008; Black et al. 2011a). All these factors can equally drive and inhibit migration as a response to climate change (Black et al. 2011a; Foresight 2011). Accordingly, both migration and non-migration can be considered as an indicator of vulnerability in a specific scenario (e.g., involuntary displacement and staying), while it can represent a strong adaptive capacity in another (e.g., voluntary migration and staying) (Smith et al. 2006; Foresight 2011).

7.4.1.1 Contextual factors

Climate change-related migration decisions are informed by multiple causes, including push factors in the site of origin, pull factors at the destination, facilitators or obstacles, and personal circumstances (Mortreux and Barnett 2009). Migration involves causes at multi-levels ranging from personal and household characteristics to social and structural conditions (Martin et al. 2014). There are abundant empirical studies seeking to link contextual factors, such as demographic, social, economic and political characteristics of communities, to migration. The specific contextual factors discussed or examined in previous studies of the climate change-migration nexus include: GDP, employment, wage differentials, poverty, population growth and composition, equity, governance, armed conflict, social connection, and expectations of modernisation (Hugo 1978; Kates 2000; Denton 2002; Castles and Miller 2003; Henry et al. 2003; Hunter 2005; Kniveton et al. 2011).

Henry et al. (2003) examine the relative importance of socio-demographic factors in shaping inter-provincial migration in response to environmental change including climatic variability in Burkina Faso. They found that some socio-demographic variables at the community level, such as male ratios, literacy rate and economic development level, interacted with changes in

rainfall and land degradation, significantly influence the scale of migration. In Burkina Faso, the drought of the 1970s attracted investment from international communities to develop public facilities and to promote economic development in rural areas, which, in turn, slowed down outmigration to urban areas (Beauchemin and Schoumaker 2005). In Mali, local preparedness for drought (e.g., funding of emergency food banks) conducted by government and non-governmental organisations enabled people to stay in the face of production shortfalls, reducing the pressure to migrate (Findley 1994). Kniveton et al. (2011) indicate that diverse and exclusive political governance is significantly correlated to lower future flow of migration in the context of climate change. Hugo (1978) demonstrated that population growth in rural Java in Indonesia significantly challenged the carrying capacity of the local environment, which consequently led to outmigration. Moreover, as for institutional factors, Adger (2000) indicates that institutional change in decentralisation of risk management adversely affects coastal people's adaptation in Vietnam. In Mexico, institutional restructuring of the economic system influenced farmers' livelihood strategies (Eakin 2005).

Empirical studies have also examined the influence of inequality, as measured by income Gini, on migration. For example, Liebig and Sousa-Poza (2004) find that the Gini coefficient always has a significant and positive correlation with migration, which means that higher income inequality in a certain community is likely to drive more migration out of that community. This is supported by the findings of Stark (2006), who proposes a concept of 'relative deprivation' to represent inequality, showing that a higher Gini index (higher income inequality) within a population can cause a stronger propensity for migration by holding constant the population's income. Although the empirical evidence on the relationship between Gini coefficient and climate change-related migration is scarce, it is very likely that the Gini coefficient can interact with climate change to impinge on migration, because climate change-migration is an unequal process with disadvantaged people likely to be more affected by either climate change or migration or both.

7.4.1.2 Individual and household factors

Individual and household characteristics are of particular importance in deciding people's response to the challenges brought about by climate change. Knowledge of these characteristics is crucial to understand why migration is undertaken by some households and individuals but not by others living in a same community. It is empirically proven that, in

some circumstances, household and individual characteristics may play a more important role than community-level factors in influencing migration as a response to climate variability (Henry et al. 2004).

One of the most frequently cited determinants of migration is the economic condition of a household, measured by income, land, property and other forms of wealth owned by that household (Perch-Nielsen et al. 2008). Economic factors can act both as 'driving' and 'constraining' factors of migration. An interesting and insightful example is provided by Smith et al. (2006) who identifies a 'U curve' influence of income on migration. They find that, when Hurricane Andrew hit Florida, people with middle incomes undertook emigration while people of both high income and low income tended to stay in the affected areas due to different reasons. This finding suggests that high income can strengthen people's resilience to climate uncertainty and help avoid involuntary mobility, and, meanwhile, low income can increase the vulnerability of poor populations and thus 'trap' them in the affected areas as involuntary non-migrants. Other indicators of households' economic conditions, such as land and housing have also been examined in climate change-related migration studies. Frey and Singer (2006) find that land and house-owners show a stronger propensity to engage in migration than renters, although majority of studies reveal the opposite effect (Belcher and Bates 1983; McLeman and Smit 2006). For families of migrants, especially those living in rural areas of undeveloped regions, remittances are an important source of income. Remittances are considered as an important factor motivating and enabling the people left behind to migrate (Piracha and Saraogi 2013); However, Findley (1994) argues that remittances can help families and communities at the original site make it through droughts by facilitating development and building their capacity, thus reducing the need for out-migration.

Social relationships, comprising social support and ties of knowledge and information, can influence adaptation strategies through their impact on financial situations, information, and cooperation (Isham 2002; Pelling and High 2005; Katungi 2007; Dowd et al. 2014). Generally, the existence of good relationships with prior migrants at the destination site, can motivate people at the origin site to adopt migration, because prior migrants can provide useful information about employment and life, accommodation and a sense of security (Morton 2002; Ravuvu 2002). However, strong connections to the current locality could

inhibit people's intention to leave (Mortreux and Barnett 2009). Social relationships can therefore both increase and decrease migration.

As an essential indicator of cultural capital, educational attainment is argued by researchers to significantly influence responses to environmental change. Some empirical studies (Maddison 2007; Deressa et al. 2009) have proved that education levels significantly increase in-situ adaptation to climate change in Africa. Henry et al. (2004) find that a higher level of education is significantly associated with high risk of out-migration in response to climatic variation and rainfall decrease in Burkina Faso.

The political status of households, as measured by their participation in the policy-making process and access to public services and resources, is crucial in deciding the effectiveness of adaptation to climate change (Thomas and Twyman 2005; Paavola and Adger 2006). The potential influence of the reputation of a household, represented by ranking its members' occupational prestige and local reputation, was important to establish the adaptive capacity of that household. Although there is not much evidence regarding the specific impact of households' political and symbolic status on migration, *per se*, in face of climate change, it is very likely that these two types of factors can influence migration behaviour too, since migration is one of the major adaptation or livelihood strategies.

There is abundant empirical research (Findley 1994; Massey et al. 2010; Abu et al. 2014) that has investigated the roles of demographic factors in deciding migration decisions in the context of climate change. In a case study by Abu et al. (2014) in Ghana's forest-savannah transition zone, demographic factors such as age and household size have been proved to have a direct and important effect on migration intentions. In addition, other research (Findley 1994; Massey et al. 2010) finds that impacts of climate change and subsequent migration behaviours vary by gender and ethnicity.

7.4.1.3 The role of experience of climate change impacts

Besides the objective determinants discussed above, Mortreux and Barnett (2009) point out that people's perceptions of climate change risk are also central to their migration decisions because migration is a highly subjective process. They outline a range of factors that

contribute to shape people's perception and, consequently, influence adaptation. These include availability of information, trust in authorities, values and culture, assessment of adaptive capacity and adaptation means, and personal experience (e.g., experience of migration and climate change impact). How these factors shape households' experience of climate change impact on major domains of livelihoods has been investigated in Chapter 6. In this chapter, households' experience of climate change is employed as a proxy of their perception of climatic risk, because the experience is informed by most, though not all, factors that shape perception of climatic risk.

Climate change often does not directly impinge upon migration, but through its impacts on other drivers of migration, such as economic, social and political conditions (Foresight 2011; Abu et al. 2014). To conceptualise the non-linear relationship between climate change and migration, Perch-Nielsen et al. (2008) use 'direct effects' and 'indirect effects' to bridge 'climate change' and 'adaptation options' in their models of the influence of climate change on migration. Kniveton et al. (2011) develop a conceptual model of migration adaptation to rainfall change (MARC), which summarises the specific agents through which climate change might influence migration: increased vulnerability of ecosystems, deteriorated natural resources, decreased production and income, differential employment opportunities, changes in policies, and political instability. Studies on the non-linear nature of climate change-migration linkages mainly focus on the agricultural sector and examine how migration is influenced by decreased agricultural production, crop failure and food shortages due to climate change (Ezra and Kiros 2001; Feng et al. 2010; Massey et al. 2010). These studies all indicate that the adverse impact of climate change on agricultural production contributes significantly to out-migration. Barbieri et al. (2010) examine the process of climate change shaping migration through its impacts on income and employment levels, and conclude that the experience of climate change impacts on economic conditions can act as a push factor for future migration.

7.4.1.4 Climate change differentiates migration patterns

When exploring the complexity of climate change-migration linkages, it is essential to understand that climate change and its impacts not only influence the decision to migrate or not, but also differentiate migration patterns in terms of destination, duration and timing (McLeman 2013). For example, Henry et al. (2004) show that, in Burkina Faso, climate

variability, such as short-term rainfall deficits, is correlated with an increase in long-term migration but a decrease in short-term migration. Poverty, in terms of low incomes and low remittance levels, is likely to increase the risk of short-cycle migrations, but not long-cycle ones, in response to drought in Mali (Findley 1994). In their case study in Nepal, Massey et al. (2010) reveal that environmental changes in agricultural production, land cover, population density and times required to collect firewood significantly promote short-distance migration whereas the correlation between those changes and long-distance migration is not as strong. This study bears this in mind and examines the factors that decide migration, as well as shape the heterogeneity of migration patterns.

7.4.1.5 Migration and non-migration

In conclusion, ‘history of migration modeling is replete with contradictory theory and conflicting evidence’ (Fotheringham et al. 2004:1640). As a result, migration, as a response to climate change, can be considered as a continuum, with one end being the indicator of extreme vulnerability (e.g., being forced to leave when others can stay) and the other end representing strong adaptive capacity (e.g., being able to leave when others cannot). In a similar way, non-migration is also a continuum, with great vulnerability on one end (e.g., being ‘trapped’ due to limited resources) and strong resilience on the other (e.g., not being threatened by climate change that has already affected others). It is possible that both involuntary migrants and non-migrants are going to bear the greatest risk of climate change, which requires interventions to avoid forced displacement and ‘trapped’ population as well to promote planned in-situ adaptation and migration (Black et al. 2011b; Foresight 2011).

7.4.2 Dependent and independent variables

7.4.2.1 Dependent variables (migration patterns)

This study explored four types of migration patterns at the household level: (1) the actual migration destination; (2) the actual Hukou transfer; (3) the intended migration destination; (4) the intended scale of migration. Migration, in this study, is defined as a movement of household member(s) or the entire household beyond the original township for six months or

longer. This definition applies to all migration patterns discussed below. The time frame for actual and intended migration was set as 2008-2012 and 2013-2014, respectively.

The actual migration destination: Households were categorised into three groups depending on their actual migration destinations: inter-provincial migration, intra-provincial migration and non-migration. Non-migration is considered an important group here because a better understanding of migration should be based on knowledge of both migrants and non-migrants. Inter-provincial migration refers to movement beyond the original province (Gansu). Households that only moved within Gansu province were grouped as ‘intra-provincial migration’; those that did not migrate were grouped as ‘non-migration’. High school students, who usually live on school campuses located in the county centre, were not considered as migrants, though they live beyond their original township, because they returned home every weekend and totally depended on their families.

The actual Hukou transfer: Households were categorised into three groups according to their Hukou transfer: migration with Hukou transfer, migration without Hukou transfer and non-migration. A household was grouped in ‘migration with Hukou transfer’ if its members transferred the registration of Hukou to the migration destination. Households that had migrants who did not transfer their Hukou were categorised as ‘migration without Hukou transfer’. The rest of the households were grouped in ‘non-migration’.

The intended migration destination: Households were categorised into three groups depending on their intended migration destinations: intention of inter-provincial migration, intention of intra-provincial migration and no intention of migration. Definitions of the inter- and intra-provincial migration are the same as the ones of actual migration destinations.

Intended migration scale: Households were categorised into three groups according to their intended migration scales: intention of household move, intention of individual move and no intention of migration. ‘Intention of household move’ was defined as an intention to move the entire household, and ‘intention of individual move’ was defined as an intention for household members to move, in the next two years.

7.4.2.2 Explanatory variables (information on class)

The explanatory variables comprised two sets of key information: (1) information on class, including community inequality represented by income Gini and the class position of households reflected by their economic, social, cultural, prestige and political status; and (2) predicted degree of climatic variability impact on agricultural production, water and land. The two groups of factors exert *direct* influence on households' migration patterns, while class factors also can *indirectly* affect migration patterns through shaping households' experience of climatic variability impacts.

Table 7.10 shows the names and definitions of the explanatory variables. In addition, other important factors, such as demographic characteristics, experience of migration, institutional preparedness and arrangements, were included as control variables.

Selection of these variables was based on a literature review on the drivers and constraints of migration in the face of climatic variability and environmental change identified (refer to subsection 7.4.1). However, some factors that are significant in shaping environmentally-related migration were not included in the study due to data limitations. For example, information on remittances was missing from the dataset, making it impossible to examine the important role of remittances in shaping adaptation and migration. Instead, this study employed 'income diversity' as a substitute for remittances. Other unavailable information was social, economic and demographic data at the village level. Some contextual factors, such as GDP, income per capita, population density, irrigation rates, medical insurance rates and pension rates, could be collected at the township level. However, township level information had to be omitted by regression models because the study only selected five townships, which did not provide enough variation across townships.

All information was collected in 2007 except the 'migration experience' which was collected between 2008 and 2012. 2007 information was used to predict the actual migration behaviour between 2008 and 2012, and migration intentions in 2013 and 2014.

Table 7.10: Definitions of the independent variables for predicting migration patterns

Variables	Definition	Actual migration	Intended migration
<i>Climate impacts</i>			
Probability of impact on agricultural production	predicted probability [0, 1], calculated from the first stage model.	√	√
Probability of impact on land	predicted probability [0, 1], calculated from the first stage model.	√	√
Probability of impact on water	predicted probability [0, 1], calculated from the first stage model.	√	√
<i>Class structure</i>			
Income Gini	Gini index of income	√	√
<i>Economic status</i>			
Household income	the annual income per capita of the household (Yuan)	√	√
Income diversity	the number of the income sources of the family living in: from 0 to 10	√	√
Land size	the amount of the farmland per capita (mu)	√	√
<i>Social status</i>			
Connection with Government officer or entrepreneur	1=if the family has any relative or close friend who is a government officer or entrepreneur; 0=otherwise	√	√
Assistance received	the number of types of assistance received by the family: from 0 to 9. ⁷	√	√
Spatial connection	The number of places where the relatives and close friends of the family live: from 0-3. ⁸	√	√
<i>Cultural status</i>			
Education	the highest educational attainment in the household: from 1 (no schooling) to 15 (PhD)	√	√
<i>Symbolic status</i>			
Local reputation	the number of community issues that the household frequently involve in: from 0 to 4. ⁹	√	√
<i>Political status</i>			
Political affiliation	1=if any family member is a member of CPC; 0=otherwise	√	√
Government assistance	the governmental assistance received by the family when facing difficulties: from 0 (very little) to 10 (very much)	√	√
Satisfaction with participation	the satisfaction with the chance to participate in policy-making process: from 0 (least satisfied) to 10 (most satisfied)	√	√

Source: Survey on climatic variability and adaptation in Minqin 2012

⁷ the assistance includes: money and goods loan; money and goods donation, assistance in production or housework, providing information, emotion support, assistance in family member care, providing transportation, providing accommodation and others.

⁸ The places include: other counties within the same city, other cities within the same province and other provinces.

⁹ The community issues include: discussing community affairs, organising public activities, providing advice to other villagers, and solving conflicts between other villagers.

**Table 7.10: Definitions of the independent variables for predicting migration patterns
(continued)**

Variables	Definition	Actual migration	Intended migration
<i>Control variables: demographic factors</i>			
Health	1=if there is any member in the household who is disabled; 0=otherwise	√	√
Male ratio	the ratio of male to the total number of the household members	√	√
Household size	the number of people in the household	√	√
Age	the household head's age	√	√
Migration experience	1=if the household experienced migration during 2008 to 2012; 0=otherwise		√
<i>Control variables: institutional arrangement</i>			
Agricultural preparedness	the number of governmental preparedness in agricultural sector that greatly benefit the household: from 0 to 5. ¹⁰	√	√
Socio-economic arrangements	the number of governmental socio-economic arrangements that greatly benefit the household: from 0 to 4. ¹¹	√	√

Source: Survey on climatic variability and adaptation in Minqin 2012

7.4.3 Analytical method

This section uses a Multinomial Logit (MLogit) model to investigate households' actual and intended migration patterns. The MLogit model is one of the most frequently used regression models in situations with multi-choice dependant variables, because it can simultaneously estimate binary logits for all comparisons among the choices (Greene 2008:843-845). The MLogit model can be expressed as follows, according to (Greene 2008:843-844).

¹⁰ The preparedness includes: climate forecast system and emergency plan on disaster relief, ecological rehabilitation projects, protection of water resource, development of irrigation system, and planting climate resistant crops.

¹¹ The arrangements include: to ensure local food security, to establish marketing channel, to improve local educational and medical services, and to improve local infrastructure.

$$\text{Prob}(Y = j | w) = \frac{\exp(w' \alpha_j)}{\sum_{j=1}^3 \exp(w' \alpha_j)}, j = 1, 2, 3$$

where Prob denotes probability, j denotes the dependent variable categories (1, 2 and 3), w is a vector of independent variables. The dependent variables are classified into three categories for each set of migration patterns in four separate MLogit models:

- Non-migration ($Y=1$), migration without moving Hukou ($Y=2$), and migration with moving Hukou ($Y=3$) for actual migration patterns;
- Non-migration ($Y=1$), intra-provincial migration ($Y=2$), and inter-provincial migration ($Y=3$) for actual migration patterns;
- Non-migration ($Y=1$), individual migration ($Y=2$), and household migration ($Y=3$) for intended migration patterns; and
- Non-migration ($Y=1$), intra-provincial migration ($Y=2$), and inter-provincial migration ($Y=3$) for intended migration patterns

Estimation is based on the maximum likelihood method and is carried out by Stata11.0.

7.4.4 Result and discussion

7.4.4.1 Actual migration: Inter-provincial migration, intra-provincial migration and non-migration

Table 7.11 presents the results of the Stage II *response model-actual migration destination*. Climatic variability and its impacts on environmental change were found to have a significant and mixed influence on the actual migration destination. Specifically, those households that experienced a greater impact on land were more likely to undertake either intra-provincial or inter-provincial migration than staying, whilst those that experienced greater deterioration in water due to climatic variability were less likely to migrate.

Table 7.11: Multinomial logit regression results: actual migration destination

	inner-provincial migration Vs. non-migration	inter-provincial migration Vs. non-migration	inter-provincial Vs. inner-provincial migration
	Coef.	Coef.	Coef.
<i>Climate impacts</i>			
probability of impact on agricultural production	-0.109	0.319	0.428**
probability of impact on land	0.443**	0.525***	0.082
probability of impact on water	-0.555**	-0.564***	-0.009
<i>Class structure</i>			
income Gini	-3.108	0.359	3.468
<i>Economic status</i>			
household income	0.000	0.000	0.000**
income diversity	-0.157	0.336	0.493**
land size	-0.029	-0.143	-0.114
<i>Social status</i>			
connection with government officer or entrepreneur	-0.265	-0.567	-0.301
assistance received	0.293**	0.409***	0.116
connection to people living in other areas	-0.073	0.186	0.260*
<i>Cultural status</i>			
education	0.473***	0.475***	0.002
<i>Symbolic status</i>			
local reputation	-0.391***	-0.321**	0.071
<i>Political status</i>			
political affiliation	0.162	0.447	0.285
government assistance	-0.190**	-0.018	0.172**
satisfaction with participation	0.116	0.029	-0.087
<i>demographic factors</i>			
health	0.329	-0.164	-0.493
male ratio	0.304	-0.316	-0.620
household size	0.210	-0.021	-0.230
age	0.018	0.025**	0.007
<i>institutional arrangements</i>			
agricultural preparedness	-0.017	0.014	0.031
socio-economic arrangements	-0.282*	-0.112	0.170
constant	-2.088	-7.179***	-5.091*
Obs.	395		
Wald Chi2 Statistics	143.110***		
Pseudo R2	0.212		
Log likelihood	-311.432		

Source: Survey on climatic variability and adaptation in Minqin 2012

* p<.10; ** p<.05; *** p<.01.

Stage I analysis (refer to Chapter 6) showed that households having lower economic, social and political status were more likely to experience greater climatic variability impact on land and water. This means low economic, social and political status, *indirectly*, can either promote migration through influencing climatic variability impact on land or inhibit migration by shaping climatic variability impact on water. As far as the *direct* influence of class on migration decisions is concerned, out-migration was positively associated with more assistance, higher educational level and older household head. It is interesting to find that households having higher local reputations, better access to local public resources and services and greatly benefiting from local socio-economic development were less likely to migrate. The result shows that high social and cultural status can enable households to migrate while high symbolic and political statuses encourage households to stay.

Households that experienced a more severe decrease in agricultural production showed a stronger propensity to move beyond, rather than within the province. The Stage I analysis (refer to Chapter 6) found that low economic, social and political status could significantly decrease agricultural production and then *indirectly* promoted intra-provincial migration over inter-provincial migration, by holding constant of other determinants of migration in Stage II analysis. However, the direct influence of class factors on migration destinations shows that choosing intra-provincial migration over inter-provincial migration was significantly correlated with higher economic, social and political status, such as higher income, more diversified income sources, stronger connection to people living outside of Minqin, and more government assistance. The households of lower class showed a stronger propensity to undertake long-distance moves if they had as many resources as other households, but the reality was that their movement to other provinces was inhibited by their limited economic, social and political resources.

7.4.4.2 Actual migration: Migration with Hukou transfer, migration without Hukou transfer and non-migration

The results of the Stage II *response model-actual Hukou transfer* are presented in Table 7.12. Similar to the results shown in the model of *actual migration destination*, households experiencing more severe impacts of climatic variability on agricultural production and land were more likely to migrate, whilst those bearing a greater impact on water were more likely to stay than to migrate without Hukou transfer.

Table 7.12: Multinomial logit regression results: actual Hukou transfer

	Migration without moving Hukou Vs. Non-migration Coef.	Migration with moving Hukou Vs. Non-migration Coef.	Migration with moving Hukou Vs. Migration without moving Hukou Coef.
<i>Climate impacts</i>			
probability of impact on agricultural production	-0.034	1.040***	1.074***
probability of impact on land	0.483***	0.145	-0.338
probability of impact on water	-0.532***	-0.241	0.291
<i>Class structure</i>			
income Gini	2.071	-22.671**	-24.742***
<i>Economic status</i>			
household income	0.000	0.000	0.000
income diversity	0.109	0.198	0.089
land size	-0.187*	0.358**	0.544***
<i>Social status</i>			
connection with government officer or entrepreneur	-0.527	0.545	1.072*
assistance received	0.328***	0.537***	0.209
connection to people living in other areas	0.087	-0.066	-0.153
<i>Cultural status</i>			
education	0.401***	1.005***	0.604***
<i>Symbolic status</i>			
local reputation	-0.338***	-0.590***	-0.253
<i>Political status</i>			
political affiliation	0.097	1.567**	1.470**
government assistance	-0.142**	0.193	0.334**
satisfaction of participation	0.070	0.119	0.049
<i>demographic factors</i>			
health	0.139	-0.357	-0.497
male ratio	-0.405	1.260	1.664
household size	0.112	-0.170	-0.282
age	0.020	0.023	0.003
<i>institutional arrangements</i>			
agricultural preparedness	-0.039	0.055	0.093
socio-economic arrangements	-0.191	0.029	0.220
constant	-3.569	-11.980***	-8.412*
Obs.	395		
Wald Chi ² Statistics	131.630***		
Pseudo R ²	0.285		
Log likelihood	-256.628		

Source: Survey on climatic variability and adaptation in Minqin 2012

* p<.10; ** p<.05; *** p<.01.

The factors significantly and positively associated with migration included: more assistance, higher educational attainment and having a CPC member. Households were more likely to stay if they had higher local reputations and more access to public resources and services. High local reputation and sufficient access to local public resources and services strengthens the attachment of households to their place of origin, which in turn reduces the risk of out-migration. Moreover, households living in townships with higher income inequality were less likely to migrate with transferring Hukou than to stay.

Households were more likely to undertake migration with Hukou transfer than migration without Hukou transfer when they had experienced greater impacts of climatic variability on agricultural production. Stage I analysis showed that higher income inequality at the township level led to higher decreases in agricultural production. In Stage II, it was thus assumed that higher income inequality could *indirectly* promote migration with Hukou transfer over that without Hukou transfer through its influence on decreased agricultural production. However, the result of Stage II shows that households were less likely to transfer Hukou if they were from a township with higher income inequality. The household class factors significantly and positively associated with choosing migration with transferring Hukou over migration without transferring Hukou included: larger land size, stronger connection with government officer or entrepreneur, higher educational level, having a CPC member and more access to public resources and services. Hence households having higher economic, social, cultural and political status were more capable of transferring their Hukou to other localities.

7.4.4.3 Migration intentions: Non-migration, intra-provincial migration and inter-provincial migration

Table 7.13 presents the results of the Stage II *response model-intended migration destination*. The influence of climatic variability and its environmental impacts on intended migration destination were significant and mixed. A higher probability of impact on agricultural production was significantly correlated with an intention of inter- and intra-provincial migration; however, a greater impact on water was significantly correlated with an intention to stay. Climatic variability-related water issues not only inhibited actual migration but also limited the intention to migrate.

Table 7.13: Multinomial logit regression results: intended migration destination

	Intension: inner-provincial migration Vs. non-migration	Intension: inter-provincial migration Vs. non-migration	Intention: inter-provincial Vs. inner-provincial migration
	Coef.	Coef.	Coef.
<i>Climate impacts</i>			
probability of impact on agricultural production	0.566**	0.525***	-0.041
probability of impact on land	0.204	-0.288	-0.492**
probability of impact on water	-0.879***	-0.746***	0.133
<i>Class structure</i>			
income Gini	-24.197***	-25.317***	-1.120
<i>Economic status</i>			
household income	0.000	0.000	0.000
income diversity	0.176	0.271	0.096
land size	0.407***	0.351***	-0.056
<i>Social status</i>			
connection with government officer or entrepreneur	0.368	-0.205	-0.573
assistance received	0.439**	0.318**	-0.120
connection to people living in other areas	0.106	-0.119	-0.224
<i>Cultural status</i>			
education	0.096	0.237***	0.141
<i>Symbolic status</i>			
local reputation	-0.190	-0.206	-0.015
<i>Political status</i>			
political affiliation	0.369	0.701*	0.332
government assistance	0.045	0.097	0.051
satisfaction with participation	-0.073	0.080	0.153
<i>demographic factors</i>			
health	-0.682	0.220	0.902
male ratio	-0.834	-0.465	0.369
household size	-0.032	0.179	0.211
age	0.034*	-0.005	-0.038*
migration experience	-0.926**	0.031	0.957**
<i>institutional arrangements</i>			
agricultural preparedness	0.249*	-0.064	-0.313**
socio-economic arrangements	0.044	-0.094	-0.138
constant	4.015	6.368**	2.353
Obs.	389		
Wald Chi2 Statistics	216.560***		
Pseudo R2	0.276		
Log likelihood	-254.992		

Source: Survey on climatic variability and adaptation in Minqin 2012

* p<.10; ** p<.05; *** p<.01.

Unlike the contradictory influence of climatic variability impacts, class factors showed a more consistent influence on migration intentions. Specifically, households showed greater intentions to undertake migration than staying when they were from a township with lower income inequality and had higher economic, social, cultural and political status (e.g., having larger land size, more assistance, higher education level and a CPC member).

Intention to migrate within or beyond the province was decided by the probability of climate impact on land, migration experience and local agricultural preparedness. Specifically, households more severely impacted on land had less intention to move beyond the province than within it. Based on the results of the Stage I analysis, households having lower economic and social status (e.g., smaller house, less assistance and no connection to powerful people) experienced a greater impact of climatic variability on land, and had less intentions to undertake long-distance moves. In addition, households that benefited greatly from local agricultural preparedness for climatic variability did not intend to move beyond the province. The only factor significantly and positively associated with the intention of inter-provincial migration was migration experience. Households having migration experience showed stronger intentions to migrate beyond, rather than within, the province.

7.4.4.4 Migration intentions: Household migration, individual migration and non-migration

Table 7.14 shows the results of the Stage II *response model-intended migration scale*. The result shows that the greater impact on agricultural production was significantly correlated with a stronger intention of individual migration, while greater impact on water was correlated with a stronger intention to stay. Generally, households were more likely to have intention of moving the entire household, or to send individual migrants, rather than to stay if they lived in a less unequal community and had higher economic, social and cultural status. Climate impacts and class factors did not directly differentiate households' intentions of the scale of migration. The only two factors that had a significant influence were household size and local socio-economic arrangements. Specifically, larger household were less intended to move the entire household than to send out individual migrants. One possible reason is that moving a large household requires substantial financial and social resources, which most households do not have. In addition, when a household benefits greatly from local socio-economic development, it is expected that it has less intentions of migration.

Table 7.14: Multinomial logit regression results: intended migration scale

	Intension: individual migration Vs. non-migration	Intension: household migration Vs. non-migration	Intention: household migration Vs. individual migration
	Coef.	Coef.	Coef.
<i>Climate impacts</i>			
probability of impact on agricultural production	0.554***	0.396	-0.159
probability of impact on land	-0.125	-0.043	0.082
probability of impact on water	-0.734***	-0.771***	-0.037
<i>Class structure</i>			
income Gini	-25.490***	-20.233***	5.257
<i>Economic status</i>			
household income	0.000	0.000	0.000
income diversity	0.235	0.285	0.050
land size	0.414***	0.213	-0.202
<i>Social status</i>			
connection with government officer or entrepreneur	0.203	-0.405	-0.607
assistance received	0.351***	0.354**	0.003
connection to people living in other areas	-0.032	-0.102	-0.070
<i>Cultural status</i>			
education	0.189***	0.122	-0.067
<i>Symbolic status</i>			
local reputation	-0.138	-0.120	0.017
<i>Political status</i>			
political affiliation	0.551	0.761	0.210
government assistance	0.072	0.096	0.024
satisfaction with participation	0.013	0.114	0.101
<i>demographic factors</i>			
health	-0.194	-0.077	0.117
male ratio	-0.402	-1.316	-0.914
household size	0.191	-0.220	-0.411*
age	0.004	0.036	0.033
migration experience	-0.125	-0.855*	-0.730
<i>institutional arrangements</i>			
agricultural preparedness	-0.045	0.297*	0.341
socio-economic arrangements	0.022	-0.397*	-0.419**
constant	5.583**	4.259	-1.324
Obs.	395		
Wald Chi ² Statistics	195.300***		
Pseudo R ²	0.272		
Log likelihood	-248.546		

Source: Survey on climatic variability and adaptation in Minqin 2012

* p<.10; ** p<.05; *** p<.01.

7.5 Conclusion

This chapter measured the causal effects of climatic variability impacts, class and their interaction on actual and intended migration, while controlling important demographic and institutional factors. In-situ adaptation means and migration patterns were examined and the characteristics of migrants and their households were discussed. A Multinomial Logit (MLogit) model was employed to predict the odds of different patterns of actual migration (2008-2012) and migration intentions (2013-2014), based on survey data set which collected comprehensive information from 1979 individuals in 445 households.

The following key conclusions are derived from the results:

- Climatic variability has been, and will continue, affecting migration through shaping households' experience of environmental impacts on agricultural production, land and water resources.
- Different environmental impacts of climatic variability have different influence on migration. Impacts on land and crops drive migration, whilst impact on water inhibits migration.
- Migration and in-situ adaptation are both important strategies adopted in Minqin to adapt to adverse impacts brought about by climate change.
- Class factors can influence migration patterns in direct and indirect ways. Class indirectly influences migration through its effect on households' experience of climatic variability impacts.
- Income inequality at the community level significantly constrains out-migration behaviour and intention.
- The influence of different dimensions of class on migration is inconsistent. Generally, households with higher economic, social and cultural status are more likely to engage in, or plan, migration, particularly that which requires more resources (e.g., long-distance migration, Hukou transfer and entire household migration); whereas, households with higher symbolic and political status show a stronger propensity and intention to stay.

As a key finding, declines in soil and agricultural production due to climatic variability dramatically increase the probability for a household to undertake and plan for migration.

However, decrease in water supply associated with climatic variability significantly decreases the probability of migration. This is in line with the mixed empirical evidence that climatic impacts can both stimulate and constrain adaptation and migration (Foresight 2011). In Minqin, water scarcity is the leading risk and the fundamental cause of all other types of environmental degradation. Decreased water supply leads to decrease in agricultural production, livestock production, drinking water and ecological water, which brings much greater adverse impacts on human life, livelihoods and living environment than declines in land and crop do. Unlike the impacts of climatic variability on agricultural production and land that stimulate migration, impact on water constrains migration because it more significantly and thoroughly decreases people's adaptive capacity and subsequently traps people in the affected areas. This result suggests that all adaptive and development policies implemented in Minqin should focus on water issues. The *Key Management Planning for Shiyang River Basin*, first proposed by the Gansu provincial government in 2007 (NDRC and MWR 2007), is a typical example of formulating development strategies based on addressing water scarcity in this area. The Plan points out that to combat water scarcity and regenerate the ecosystems in Minqin and the whole Shiyang River Basin, effective policies should consist of policies on water and land, ecosystem rehabilitation, economic development, renewable energy and human resettlement.

Migration cannot be automatically translated into 'effective adaptation' or 'failure of adaptation'. Therefore either encouraging migration or constraining migration is not a 'no risk' option (Smith et al. 2006; Foresight 2011). To facilitate more effective adaptation at the household level, the local government should acknowledge the importance of both in-situ adaptation and migration, and identify the disadvantaged households that migrate or stay involuntarily. In Minqin, disadvantaged households with low economic, social and cultural status are more likely to stay and those with low symbolic and political status are more likely to migrate. It is expected that some households cannot migrate due to the limits of low income, little assistance and low levels of education. It is also possible that some households have to migrate because they are to some extent excluded from local adaptation and development approaches due to their low symbolic and political status. This suggests that local governments should strengthen households' ability to migrate, and even support them to undertake migration that requires substantial resources, by increasing the income of households living in poverty and developing a more available and affordable education system. In addition, governments need to ensure more effective in-situ adaptation for all class

groups, by developing adaptation and development programs that are highly transparent and equitable, thus alleviating the privilege of community and political elites. In conclusion, in areas influenced by climatic variability there is a need for governments to develop and implement policies and programs that enable people to undertake both voluntary and effective in-situ adaptation and migration. These public initiatives should be sensitive to the complexity of the many dimensions of class.

CHAPTER 8: Addressing Inequality by Migration and Adaptation Policies

8.1 Introduction

It has been established earlier (Chapters 6 and 7) that households' experience of climatic variability impacts and migration behaviours are significantly influenced by the multiple dimensions of class, in terms of economic, cultural, social, reputational and political inequalities. It is therefore important to integrate inequality into migration and adaptation policies in order to promote proactive and effective migration or in-situ adaptation, especially for disadvantaged people with lower class status. Appropriate policy advice should be based upon an understanding of the current level of the integration of equity into existing migration and adaptation policies. By identifying the policy gaps, where inequality is not well addressed, this chapter provides specific and practical advice to inform future development of migration and adaptation policies.

This chapter aims to assess the extent to which the policies regarding migration and adaptation to climate change, and those regarding inequality, consider each other by conducting a content analysis of publicly available documents collected from official government websites. This chapter starts with a review of the scope of adaptation policy and how it considers inequality. This is followed by a description of research design related to content analysis, specifying the definition of policy, the tiers and sectors of policies involved in the study, the sources from which the policies are collected, and the analysis grid developed by this study. How poverty reduction policies consider migration and adaptation to climate change, and how migration and adaptation policies consider inequality are discussed respectively. This chapter concludes with a summary of the results and specific policy implications.

8.2 Climate change adaptation policies and inequality

8.2.1 Scope of climate change adaptation policy

Adaptation to climate change is a multi-tiered and multi-faceted practice performed by both public and private actors (Adger et al. 2003). Adaptation practises can be carried out at international, national, regional and local levels (Niang-Diop et al. 2004) and cover various

measures, including agricultural adaptation means, sustainable management of natural resources, education and training, economic development, development of science and technology, enhancement of monitoring , observation and communication systems, etc. (Lim and Burton 2005). Adaptation policy is inadequate or ineffective unless it is embedded in a wide variety of existing environmental, social and economic policy schemes. It is important to develop new policies and measures to directly facilitate adaptation to climate change. However, an equally important and more cost-effective way is to consider adaptation as a component in various policy domains (Apuuli et al. 2000), and to mainstream adaptation into these domains. The Adaptation Policy Framework developed by the United Nations Development Program indicates that integrating adaptation policies between different sectors is the way to support adaptive planning (Lim and Burton 2005; Niang-Diop and Bosch 2005). The European Union also argues in its Sustainable Development Strategy that adaptation to climate change should be integrated into all relevant policies (Urwin and Jordan 2008). To provide an example of this policy integration, Burton et al. (2002) summarise the policies that should consider adaptation to climate change in the agriculture sector, including policies about management of ecosystems and natural resources, public health, infrastructure, human settlements, management of natural hazards and disasters, and national socioeconomic development. The effectiveness of climate change adaptation can be best assessed in the light of all these relevant policies, rather than by climate change and adaptation policy alone.

8.2.2 Discussion of inequality in climate change adaptation policies

Discussion of the inequality issues involved in climate change policies mainly focuses on mitigation at the international level, while the integration of equality into climate change adaptation policy at national, regional and local levels remains understudied (Metz 2000; Thomas and Twyman 2005). International equity principles of mitigation are largely related to equitable sharing of emission and avoiding economic burdens for developing nations (Metz 2000). Article 3.1 of UNFCCC specifies the equity principle in this way:

‘...the parties should protect the climate system ... on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country parties should take the lead in combating climate change and the adverse effects thereof’.

The Kyoto protocol requires developed countries to reduce their carbon emission and creates an adaptation fund to financially support adaptation in developing countries (Metz 2000).

At national and sub-national levels, there are only a few studies attempting to investigate the implications of adaptation policies for social equity. A study in Namibia by Thomas and Twyman (2005) explores the influence of water management policy on people's access to water resources. Although the Directorate of Rural Water Supply of Namibia recognises that all rural water points in communal areas are common resources for the community and hence water access is open to all people, no measures are specified or undertaken to avoid exclusion of already vulnerable people. As a result, some individuals who cannot afford compulsory payments to the water point committees have to offer labour to local 'elites' in exchange for the access to water resources. Thomas and Twyman (2005) provide another example of how adaptation/intervention policy accelerates inequality in Botswana. The Financial Assistance Programme was implemented in Botswana from 1982 to 2001, aiming to support business initiatives. This program required the applicants to provide a 10 percent contribution in order to receive the up to 90 percent grants, which excluded people living in poverty-stricken and remote areas from benefitting from the scheme and further enlarged the gap between better-off and worse-off groups in the community. This is also the case in Minqin county, the study area of the thesis, where an agricultural development scheme was developed to financially support the construction of drip irrigation systems and greenhouses if rural families could provide private contributions. As outlined in Chapter 5, this scheme has the potential to further marginalise the already vulnerable households who cannot afford the contribution. These national and sub-national studies largely concentrate on the influence of adaptation policies on inequality outcomes while fewer studies attempt to explore the extent to which current policies address inequality. This is the area to which this chapter seeks to make a contribution.

8.3 Content analysis of integration of equality into climate change adaptation policies

8.3.1 Definition of 'public policy'

Policy can be defined as a principle to guide legislative or regulatory action taken by governments or non-governmental organisations to achieve intended goals (Anderson 2005).

Public policy is regarded as a system of ‘courses of action, regulatory measures, laws, and funding priorities concerning a given topic promulgated by a governmental entity or its representatives’ (Kilpatrick 2010). This study defines public policy as publicly available written documents issued by a department of the Chinese government to achieve certain goals and objectives through the strategies and measures specified in these documents. The Chinese government has established official websites in recent years, which publicise some public policy documents and provide the public with access to the full text of these documents. Although these public accessible documents are far from comprehensive, because many important documents are still classified as ‘confidential’, they are representative of the government’s beliefs, values, goals and priorities, strategies, measures and resources that it is comfortable about sharing with the public.

8.3.2 Sectors and tiers of policy

As discussed earlier (subsection 7.2.1), effective assessment of climate change adaptation policies should be embedded in a wide variety of environmental, social and economic policy schemes. The guiding policies for climate change adaptation in Gansu Province, *Gansu Province’s Climate Change Program* (PGGP 2009), outlines the comprehensive approaches undertaken to address climate change impacts and promote adaptation, including:

- reducing carbon emissions (e.g., adjustment of industry structure, development of renewable energy, and protection of natural forests);
- enhancing adaptation in the agriculture sector (e.g., adjustment of agricultural structures, development of high-value crops, improvement of agricultural facilities, and improvement of pest control);
- improving water management (e.g., improvement of irrigation systems, protection of water resources, implementation of the Water Diversion Project from Tao River, and establishment of water rights allocation and a transfer scheme);
- protecting the ecology and environment (e.g., protection of forests, sand control, protection of underground water in the Shiyang River Basin and the wetland in Gannan Region); and
- improving disaster monitoring, early warning and response systems.

The *Key Management Planning for Shiyang River Basin* (NDRC and MWR 2007) is the key policy addressing the ecological deterioration and poverty in the study area, Minqin county. This policy explicitly states that migration/relocation is a major approach to reduce the pressure on the natural environment, and to facilitate the vulnerable populations' effective adaptation to unfavourable environmental conditions (including the negative impacts of climate change). Migration policy is considered an important component of adaptation policies in this study. It is worth noting that education is considered to be an important channel through which young labourers are relocated out of Minqin (Li and Wei 2005). Education, especially tertiary education and vocational education, equips young people with knowledge and skills to find and undertake off-farm jobs and enables them to work and live in urban areas. Education is a promising approach to promote permanent migration and ensure successful settlement. Education policy is therefore included in this study to better understand the implications of migration policy for climate change adaptation.

According to general international guidelines on the dimensions of adaptation policy and the specific Chinese descriptions of policies involved in climate change adaptation, this study identifies 8 sectors of policy as essential components of comprehensive adaptation schemes in a rural setting of the study area. They are policies of: climate change; ecology and environment; water and land; agricultural development and adjustment; migration; education; disaster prevention and relief, and new energy.

These policies have been obtained from official websites of the three levels of government, namely national (any department of the Central People's Government), regional (including any department of Gansu Province Government and Wuwei City Government), and local (any department of Minqin County Government and township governments). Chinese policy-making generally follows the top-down model (Lu 1998; Li 2004), which means formulation of local policies are directly informed and influenced by policies developed at higher levels. Therefore it is important here to include policies from all levels here to better understand how policy travels down the policy chain from those made at the top to those at the bottom.

The collection of policy documents started with an internet-based search of the official website of the Minqin government. All relevant and publicly available policy documents were collected and categorised into the eight sectors of local policy. Each local policy document was carefully read in order to identify the relevant policies at the national or

regional level that were considered as guidelines within the local policies. Then these guiding policies at the national and regional level were sought from the official websites of the national and regional governments, such as the Central People's Government of the People's Republic of China, Chinese Government Public Information Online, China Climate Change Info-Net, Gansu Province Government, Gansu Agriculture Information Net, Gansu Education Department, etc. Some national and regional policies referred to within local policies could not be found on the government websites and thus were not included in the analysis. Finally the documents that did not contain any information regarding inequality were excluded from further content analysis.

8.3.3 Dimensions of policy analysed in the study

An analysis grid, containing key aspects of policy analysis, was developed for analysis of the content of policy documents that consider any form or extent of inequality. Hall (1993:279) develops a three-fold division of policy which specifies three key elements of policy; namely *goals*, the *instruments* by which goals are attained, and *calibration*, such as the time frame for the instruments. Besides the three key elements, two other factors are also significant in assessing the effectiveness of a policy: *funding*, which covers the expense of policy implementation and *institutions*, which are responsible for achieving the policy goals and implementing the policy instruments. This study identifies the following 4 dimensions of policy for assessing the integration of inequality issues into migration and adaptation policies:

- Aims: what aims about equality have been proposed in these policy documents?
- Instruments: what measures/techniques have been adopted to achieve equality?
- Finance: Has any budget/funding been specified to support the implementation of the instruments to achieve equality?
- Institutions: which departments/stakeholders are responsible for achieving equality and implementing relevant instruments?

8.4 Integration of social equality policy and climate change adaptation policy

This section examines the extent to which policies about social equality and those about climate change adaptation are integrated. To better understand the integration of these policies, it is necessary to assess the relationship from two perspectives. First, to what extent

do social equality policies consider adaptation means to climate change? And, second, to what extent do climate change adaptation policies integrate efforts to address social inequality issues?

8.4.1 Poverty reduction and development policies

The major policy addressing social inequality in China is a poverty reduction policy which aims to alleviate and eradicate poverty and bridge the gaps between regions, communities and people. From official government websites, three levels of poverty reduction policies were collected. They are: *Outline for Development-oriented Poverty Reduction for China's Rural Areas (2011-2020)* (national policy); *Guidelines for Development-oriented Poverty Reduction for Gansu Province's Rural Areas (2011-2020)* (regional policy), and *Action Plan for '1236' Poverty Alleviation Program for Minqin County* (local policy). These three full-text documents were analysed to assess whether or not, and to what extent, poverty reduction and development policies considered the following 8 sectors of adaptation policy: climate change; ecology and environment; water and land; agricultural development and adjustment; migration; education; disaster preparation and alarm, and renewable energy.

The results of the analysis of the national policy are presented in Table 8.1 and show that almost all dimensions of climate change adaptation are well integrated into national poverty and inequality reduction policy. The national policy plans to bridge the development gap between regions by providing poor areas with political, institutional, financial, and technological support on a range of environmental, economic, social, and technological programs. These include, but are not limited to: ecological rehabilitation and environment protection, improvement of water conservation and irrigation, improvement of farmland, agricultural development and adjustment, anti-poverty relocation, improvement of education and vocational/skill training, improvement of disaster monitoring and early warning, and development and adoption of renewable energy. Apparently implementing these programs contributes to both adapting to climate change and reducing poverty and inequality. This suggests that adaptation to climate change is closely related to poverty and inequality reduction though the term 'climate change' has not been explicitly mentioned in poverty and inequality reduction policy.

Table 8.1: Integration of adaptation means to climate change into national development-oriented poverty reduction policy

<u>National Policy</u>	
Outline for Development-oriented Poverty Reduction for China's Rural Areas (2011-2020)	
Issued by: Standing Committee of National People's Congress	
When: 2011	
Time frame: 2011-2020	
Goals:	
- adequate food and clothing, compulsory education, basic medical care and housing will be available for poor populations;	
- per capita net income growth rate of poor peasants will be higher than national average;	
- widening development gap will be bridged.	
Climate change	N/A
Ecology and environment	Return farmland/grazing land to forest/grassland Water and soil conservation Natural forest protection Shelter-forest system construction Desertification and stony desertification control Biodiversity protection Increase in ecological compensation
Water and land	Improvement of basic farmland Improvement of irrigation and water conservation Security of drinking water Increase in irrigation land
Agricultural development and adjustment	Development of the unique industries Advanced agricultural technology
Migration	Anti-poverty by relocating
Education	Provide pre-job training and living allowance to poor middle and high school graduates Provide living allowance and transportation subsidies to poor students receiving secondary vocational education Provide skill training to poor rural labourers
Disaster preparation and alarm	Strengthen monitoring and early warning Relocate and avoid disaster Control mudslides and landslides
New energy	Development of renewable energy (e.g., hydropower, solar power, wind energy, and biomass energy) Promotion of biogas stove Promotion of straw gasification and gas centralised supply

Source: Outline for Development-oriented Poverty Reduction for China's Rural Areas (2011-2020) (CCCPC and SC 2011)

Table 8.2 presents the analysis of a regional poverty reduction policy for Gansu province. This policy adapts the national poverty reduction policy (Table 8.1) for the specific context of Gansu province.

Table 8.2: Integration of adaptation means to climate change into regional development-oriented poverty reduction policy

<u>Regional Policy</u>	
Guidelines for Development-oriented Poverty Reduction for Gansu Province's Rural Areas (2011-2020)	
Issued by: The 11 th Standing Committee of People's Congress of Gansu Province	
When: 2012	
Time frame: 2011-2020	
Goals:	
<ul style="list-style-type: none"> - Adequate food and clothing - Alleviated poverty and increased prosperity - Improved ecological environment - Enhanced development capacity - Narrowed gap between regions 	
Climate change	N/A
Ecology and environment	Return farmland/grazing land to forest/grassland Water and soil conservation Natural forest protection Prohibit grazing
Water and land	Improvement of irrigation Security of drinking water
Agricultural development and adjustment	Development of unique industries Advanced agricultural technology
Migration	Anti-poverty by relocating
Education	Improve vocational education, skill and business training for poverty-stricken population Provide assistance to students from poverty-stricken families Improve nutrition of rural students enrolled in compulsory education Improve capacity of teaching teams Avoid poverty caused by education expenses
Disaster preparation and alarm	Control geological disasters
New energy	N/A

Source: Guidelines for Development-oriented Poverty Reduction for Gansu Province's Rural Areas (2011-2020) (SCGPC 2012)

The goals of addressing poverty and inequality indicated in the regional policy are consistent with those in the national policy. However, the regional policy proposes a special goal of an improvement in the ecological environment, which is not mentioned by the national policy. This reflects the fact that a fragile ecology and deteriorating environment is one of the root causes of poverty and inequality in Gansu, which cannot be effectively addressed unless the ecological environment is rehabilitated and protected in this region. The condition of the ecological environment is seen to be highly affected by climate change in western China (Hugo et al. 2009), which means mitigating and adapting to climate change is significant in addressing poverty and inequality in this region.

The regional policy follows the guidelines of the national policy and plans similar programs and actions in the fields of ecology and environment, water and land, agricultural development and adjustment, migration, and education. However, for disaster preparation, the regional policy does not mention a monitoring and early warning system, which is emphasised by the national policy. Gansu province is located in an area prone to natural disasters, therefore efforts should be focused on building the disaster monitoring and early warning system. The regional policy does not mention the development and usage of renewable energy, whereas the national policy calls for development of new energies. Developing renewable energy is very important for protecting the natural systems in such an ecologically fragile zone, such as the rural areas of Gansu, and, consequently, helps in addressing poverty caused by the deterioration in ecology. However, it appears that the role renewable energy plays in poverty reduction has not been explicitly acknowledged by Gansu government.

The analysis of the local poverty reduction policy, issued by the Minqin County Party Committee and the Minqin County Government, is presented in Table 8.3. Although the time that this local policy was published (2014) is beyond the time-frame of this study (2008-2012), it is analysed because it is the only formal policy regarding poverty and inequality in Minqin since 2008.

Table 8.3: Integration of adaptation means to climate change into the local development-oriented poverty reduction policy

Local Policy	
Action Plan for ‘1236’ Poverty Alleviation Program For Minqin county	
Issued by: Minqin County Party Committee and Minqin County Government	
When: 2014	
Time frame: 2014-2018	
Goals:	
<ul style="list-style-type: none"> - Increased income - Adequate food and clothing - Ensuring compulsory education, basic medication and housing to all 	
Climate change	N/A
Ecology and environment	<ul style="list-style-type: none"> Close well and reduce farmland Return farmland to forest Sand control and forestation
Water and land	<ul style="list-style-type: none"> Improvement of irrigation system Security of drinking water Increase of irrigation land
Agricultural development and adjustment	<ul style="list-style-type: none"> Development of agricultural infrastructure: sunlight greenhouse High-value plants and fruits: honey melons, fennel, dates, grapes, gouqi berries Storage and processing of agricultural products
Migration	Anti-poverty by relocating
Education	<ul style="list-style-type: none"> Promote labour exporting by training Provide skill training to all poor rural labourers
Disaster preparation and alarm	Control cold spells, sand storms and forest damage
New energy	Install solar street lamp

Source: Action Plan for ‘1236’ Poverty Alleviation Program For Minqin county (MCPC and MCG 2014)

The local policy makes the goal of equality very specific, by making compulsory education, basic medical services and housing available to everyone, regardless of their status in the community. The local policy adapts the national and regional policies in the Minqin context and develops specific programs and action plans. For example, to protect the ecology, the local policy proposes to close wells and reduce farmland. Reducing farmland can potentially reduce farmers’ income if alternative livelihoods are not forthcoming. But the government believes reducing the usage of underground water will improve local ecology, and improving ecology is seen as the basis for alleviating poverty and inequality and promoting long-term development for this community. Responding to the principle of development of unique industry indicated in the national and regional policy, the local policy specifically proposes constructing sunlit greenhouses and planting honey melons, dates, grapes, gouqi berries etc. Like the regional policy, the local policy does not emphasise the importance of disaster

monitoring and an early warning system and renewable energy in influencing a reduction in poverty and inequality.

It is worth noting that all levels of poverty reduction policy consider migration as an important means to address poverty and inequality. Chapter 7 identified migration as an important means of adaptation to climate change in the study area. This finding is consistent with the government's assumption that migration can break the vicious circle between climate change, deterioration in the ecology and poverty, because migration has the potential to simultaneously address all these issues. The poverty reduction policies emphasise the principle of voluntary participation in government-organised migration programs. Poverty-stricken families living in ecologically fragile areas are given priority to relocate to other areas with better living environments and diverse livelihood options. It is hoped that this sort of migration can reduce absolute poverty rooted in fragile ecology, and bridge the gaps between communities and households in income, living conditions, quantities and quality of natural resources (e.g., water and land), infrastructure, production facilities and materials and social services.

In conclusion, the national, regional and local policies regarding poverty and inequality all consider important dimensions of climate change adaptation as a means to achieve prosperity and social equity. Policies made by the three levels of government appear generally consistent, despite the fact that the regional and local policies do not pay attention to disaster monitoring and early warning systems, and development of renewable energy as the national policy does. The next subsection assesses in what ways, and to what extent, addressing inequality is integrated into the policies regarding climate change adaptation.

8.4.2 Policies regarding climate change adaptation that consider equality

Table 8.4 presents a summary of all publicly accessible adaptation policies that were published between 2008 and 2012, and obtained from official websites of national, regional and local governments. In total, the study identified 86 documents¹², of which 39 addressed

¹² The *Key Management Planning for Shiyang River Basin* is a document with cross-cutting themes, focusing on both areas of 'ecology and environment' and 'water and land'. Therefore, this document is considered as two policies, one related to ecology and environment policy and another about water and land policy.

inequality issues. Titles and sources of the policies that address inequality can be found in Appendix 4.

These policy documents for each level of issuing authority are categorised into the 8 sectors of adaptation policies. As Table 8.4 shows, among the 8 sectors, 5 mention inequality issues in all the *national, regional and local* policies while 3 do not. The policies that do not consider inequality issues include the local policy about climate change, the regional policy about ecology and environment, and national and regional policies about disaster preparation and alarm.

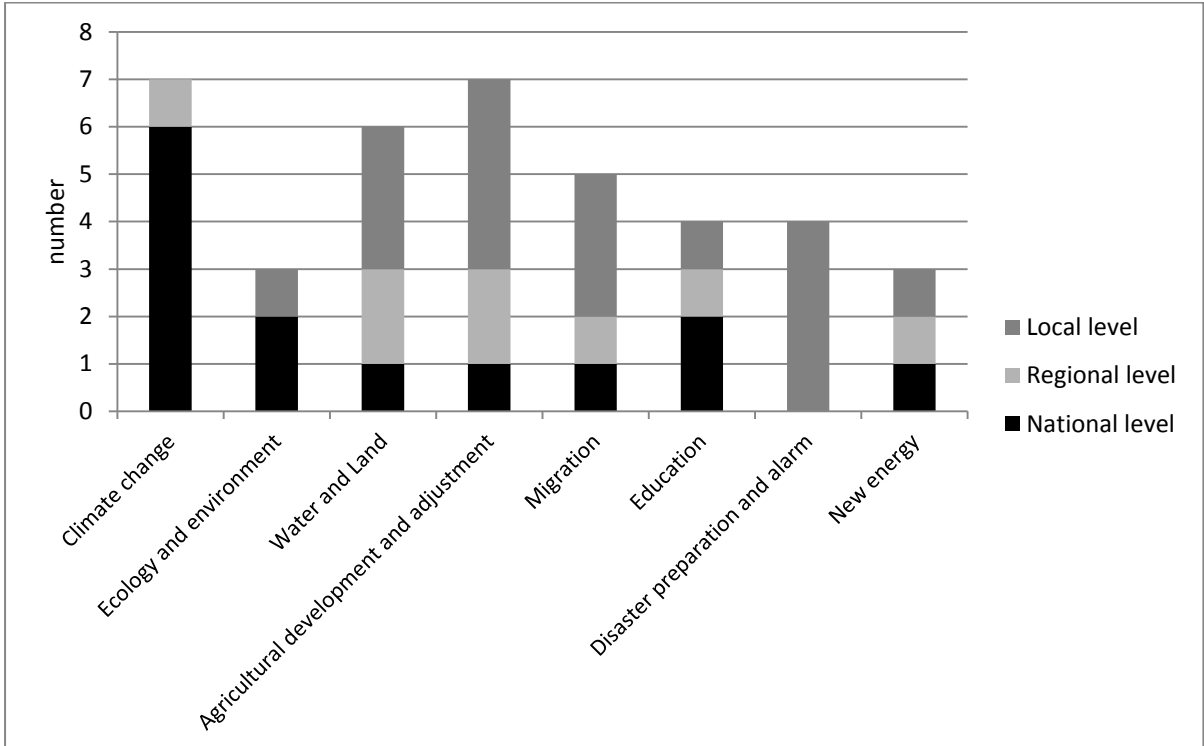
Table 8.4: Overview of the government documents on adaptation to climate change on national, regional and local levels

		Climate change adaptation policies									
		Climate change	Ecology and environment	Water and Land	development and adjustment	Agricultural	Migration	Education	alarm preparation and disaster	New energy	Total
Collected documents	National level	6	3	1	2	2	2	1	1	18	
	Regional level	2	4	4	3	1	1	1	1	17	
	Local level	1	6	10	14	7	1	10	2	51	
	Subtotal	9	13	15	19	10	4	12	4	86	
Collected documents that consider equality	National level	6	2	1	1	1	2	0	1	14	
	Regional level	1	0	2	2	1	1	0	1	8	
	Local level	0	1	3	4	3	1	4	1	17	
	Subtotal	7	3	6	7	5	4	4	3	39	

Source: Various government websites (refer to Appendix 4)

Figure 8.1 shows that all national, regional and local policies of migration considered inequality issues. Inequality also attracted attention from all levels of government in the policies of water and land, agricultural development and adjustment, education and new energy. For the policies of disaster preparation and alarm, only local policies considered inequality while regional and national policies did not mention it.

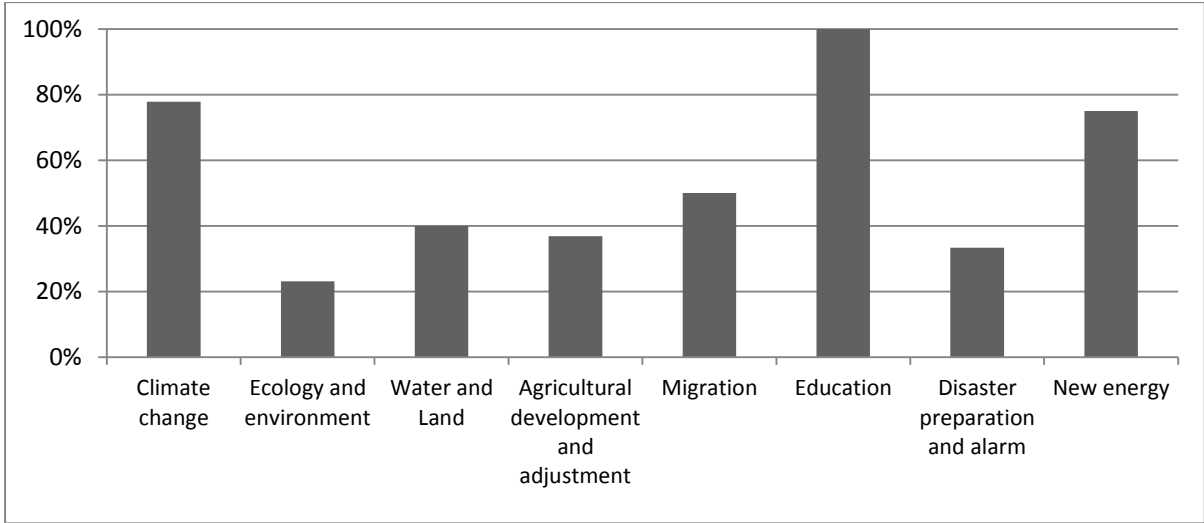
Figure 8.1: Eight categories of policy that consider equality by different levels of government



Source: Various government websites (refer to Appendix 4)

For each sector of adaptation policies, the ratio of policies that consider inequality to all policies collected is summarised in Figure 8.2. Half of the migration policies consider equality, a ratio that is lower than those policies regarding education, climate change and new energy, and higher than the others.

Figure 8.2: Ratios of the policies that consider equality against all the policies collected



Source: Various government websites (refer to Appendix 4)

The policies that consider inequality issues are summarised in Table 8.5 through to Table 8.12. The tables comprise two major parts. The first part provides general information on the policies, including the policy name, year published, issuing authority, time frame, and policy goals. The second part concentrates on assessing the integration of equality into these policies from four respects: aims, instruments, finance, and institutions.

Table 8.5 shows how policies of climate change address inequality. The national policies mainly aim to establish fair international mechanism and reply upon international conventions to achieve the aim. ‘China’s National Climate Change Program’ also aims to improve the transparency of the policy-making processes by strengthening public surveillance. However, national policies do not specify the budget and institution to address inequality. The regional policy aims to address the inequality between regions by increasing fiscal transfer payments to the poverty-stricken areas. It also indicates that the funding is provided by the provincial government. There is no specific policy regarding climate change at the local level.

Table 8.6 shows the integration of equity into the policies of ecology and environment. The national policies aim to promote equal participation of people in ecological rehabilitation programs and support poverty-stricken populations. Improving public surveillance is employed to promote equal participation and environmental programs are developed to reduce poverty. However, these policies do not indicate the fund and institution to achieve the aims. The local policy also aims to promote equal participation of people in water management programs by improving public surveillance. It clearly arranges the township governments and village committees to post notice with respect to the water programs in public.

Table 8.7 shows the integration of equity into the policies of water and land. The national policy aims to build up an equal water use system by establishing a water use association of farmers. Various institutions, including the governments, water management institutions and water use association, are responsible for establishing the equal water use system. The regional policies follow the national policies to establish an equal water use system. In addition, it aims to reduce the negative impact of water price adjustment on poor families. The local policies focus on achieving equal distribution of water and enhancing public acquisition of water-related information.

Table 8.5: Integration of equity into climate change policies

	Policy	Time	Issued by	Time frame	Goals	Integration of equity into climate change policies			
						Aims	Instruments	Budget	Institution
National	China's Policies and Actions for Addressing Climate Change	2008/2009/2010/2011/2012	National Development and Reform Commission	2008/2009/2010/2011/2012	Mitigating climate change Adapting to climate change Enhancing basic capability Participation of the whole society Participation in international negotiations Strengthening international cooperation	Fair and reasonable international mechanism for addressing climate change	UNFCCC Kyoto Protocol Common but differentiated responsibility Developed countries take leads in emission-reduction Fund and technology transfer for developing nations	N/A	N/A
	China's National Climate Change Programme	2007	National Development and Reform Commission	2007-2010	Control greenhouse gas(GHG) emissions Enhance adaptation capacity Advance science and technology Raise public awareness Strengthen institutions and mechanisms	Fair and reasonable international mechanism for addressing climate change Transparent policy-making process	UNFCCC Kyoto Protocol Common but differentiated responsibility Developed countries take leads in emission-reduction Fund and technology transfer for developing nations Improve climate change information release Public surveillance	N/A	N/A
Regional	Gansu Province's Climate Change Programme	2009	Gansu Province Government	2009-2015	Enhance adaptation capacity Control greenhouse gas(GHG) emissions Raise public awareness Strengthen institutions and mechanisms	Support poor areas	Increase fiscal transfer payment	Provincial financial fund	N/A
Local	N/A								

Source: NDRC (2007b); NDRC (2008); NDRC (2009); NDRC (2010); NDRC (2011); NDRC (2012b); PGGP (2009)

Table 8.6: Integration of equity into ecology and environment policies

	Policy	Time	Issued by	Time frame	Goals	Integration of equity into ecology and environment policies			
						Aims	Instruments	Budget	Institution
National	Key Management Planning for Shiyang River Basin	2007	National Development and Reform Commission Ministry of Water Resources	2006-2020	Improve efficiency and effectiveness of water use Increase farmers' income Promote sustainable development	Enhance public acquisition, participation and surveillance	Media post Survey Publicity by posting notice	N/A	N/A
	China's 12 th Five-Year Plan for Ecology Protection	2012	Ministry of Environment Protection	2011-2015	Improve in: Ecology monitoring Biodiversity Ecology rehabilitation zone Reversing ecology deterioration	Reduce poverty	Sustainable use of biodiversity	N/A	N/A
Regional	N/A								
Local	Minqin County's Post-Management Plan for Shiyang River Basin	2012	Minqin County Government	N/A	Improve efficiency and effectiveness of water use Protect under-ground water Promote sustainable development	Enhance public acquisition and equal participation	Media post Publicity by posting notice: township, village and village group Information exchange platform	N/A	Township governments Village committees Village group committees

Source: NDRC and MWR (2007); MEP (2012); MCG (2012)

Table 8.7: Integration of equity into water and land policies

Policy	Time	Issued by	Time frame	Goals	Integration of equity into water and land policies			
					Aims	Instruments	Budget	Institution
National Key Management Planning for Shiyang River Basin	2007	National Development and Reform Commission Ministry of Water Resources	2006-2020	Improve efficiency and effectiveness of water use Increase farmers' income Promote sustainable development	Establish equal and reasonable water use system	Establish farmer water use association Farmers participate in distributing water Water distribution to each well is supervised by water use association Water distribution to each household is carried out by water use association	N/A	Province, city and county governments Shiyang River basin water management department Irrigation district water management branch Representatives of farmer water use associations
Regional Gansu's Pilot Plan to Accelerate Water Reform	2012	Gansu Province Government General Office	2011-2015	Improve management of water conservancy construction Improve management of water use system Establish grass-root water service system Water is fairly and reasonably priced	Reduce negative impact of water price adjustment on poor families	Progressive water pricing	N/A	N/A
Guidance for Water Allocation and Perfection of Water Right System in 2010	2009	Wuwei City Party Committee	2010	Increase surface water Decrease exploitation of underground water Transfer water from other river basins Reserve water for economic and ecological emergency	Equal and transparent distribution and pricing of water	Establish farmer water use association Publicise irrigation areas, water quantity and price	N/A	Farmer water use associations

Source: NDRC and MWR (2007); MCG (2009); WCPC (2009); GOMCG (2011); MCG (2011c); GOPGGP (2012a)

Table 8.7: Integration of equity into water and land policies (continued)

	Policy	Time	Issued by	Time frame	Goals	Integration of equity into water and land policies			
						Aims	Instruments	Budget	Institution
Local	Minqin County's Plan for Water Allocation in 2010	2009	Minqin County Government	2010	Reduce water use	Equal distribution of water	N/A	N/A	N/A
	Minqin County's Plan for Water Allocation in 2012	2011	Minqin County Government	2012	Reduce water use	Equal distribution of water	N/A	N/A	N/A
	Minqin County's Management Plan of Agricultural Water Price	2011	Minqin County Government General Office	N/A	A water-saving society Development of agricultural water-saving technology and facilities Reasonable allocation and management of water resources Pro water-saving pricing system	Enhance public acquisition and equal participation	Publicise water price and water rate	N/A	Farmer water use associations

Source: NDRC and MWR (2007); MCG (2009); WCPC (2009); GOMCG (2011); MCG (2011c); GOPGGP (2012a)

Table 8.8 shows how the policies of agricultural development and adjustment address inequality. The national policy aims to bridge the gap between Gansu province and other western provinces/autonomous regions. Three types of instrument are employed to achieve the aim, including the development of high-value agriculture and industry, the protection of ecology in the river source region, and the implementation of water diversion program. However, the funding and institutions are not specified in this policy. The regional policies aim to reduce the gap between different areas within Gansu province, by supporting the economic development and education in ecologically fragile areas and poverty-stricken areas. In addition to reducing poverty, the local policies also focus on protecting people's equal participation in agricultural development programs and equal access to agricultural subsidies. Specific institutions are appointed to ensure the equal distribution of resources in agricultural programs, though no funding is specified.

Table 8.9 shows the integration of equity into the policies of migration. The national policy aims to reduce poverty by relocating people out of ecologically fragile and poverty-stricken areas. The regional policy aims to reduce the development gap between different regions within the province by relocating population and providing migrants with equal access to living and production resources. It is worth noting that the regional policy, 'Gansu Province's 12th Five-Year Plan for Anti-poverty by Relocating', specifically indicates the amount and source of the funding for relocation, as well as the institutions at different levels and across different sectors. The local policies of migration aim to support the disadvantaged migrants and promote equal access to public support. To achieve the aims, the government plans to include migrants into the basic living allowance system, to provide special funding to disabled and sick migrants, and to ensure migrants' equal access to subsidies on housing and greenhouse. Funding and institutions are also specified in these local policies.

Table 8.10 shows the ways in which the policies of education address inequality. The main aim of all policies of education is to provide equal education to everyone. Education resources, such as teachers, teaching facilities and books, are provided to schools in rural areas and poverty-stricken areas, in order to bridge the gap between schools and areas. Meanwhile, financial support is provided to students from rural areas and poverty-stricken families. However, all these policies do not specify the funding and institutions to achieve these aims. This is probably because the departments of education are automatically responsible for implementing these policies and there is no need to mention the institution and funding in the documents.

Table 8.8: Integration of equity into agriculture development and adjustment policies

Policy	Time	Issued by	Time frame	Goals	Integration of equity into agriculture development and adjustment policies				
					Aims	Instruments	Budget	Institution	
National Several Opinions of the General Office of the State Council of the People's Republic of China, on Further Supporting Economic and Social Development of Gansu Province	2010	General Office of the State Council of the People's Republic of China	/	Bridge the gap between Gansu Province and other Western Provinces Increase income Reduce poverty Improve infrastructure Control ecology deterioration Develop high-value industry	Bridge the gap between Gansu Province and other Western Provinces Reduce poverty in Gansu Province	Development of high-value crops and industry in Dingxi and Longnan Protection of ecology of Wei River source region Water Supply Project of Transferring Water from Taohe River	N/A	N/A	
Regional Gansu Province's 12 th Five-Year Plan for Agricultural Development	2011	Gansu Province Government General Office	2011-2015	Development of modern agriculture Increase farmers' income Increase agricultural production Enhance market competitiveness of agricultural products Sustainable development	Reduce poverty in ethnical areas, old revolutionary base areas, arid regions, and high cool and humid regions, poverty-stricken communities of migrants in Hexi Corridor.	Reduce poverty through: technology development, industry development, and education and training. Development of secondary and tertiary industry	N/A	N/A	
Wuwei City's 12 th Five-Year Plan for Under-Forest Economy	2012	Wuwei City Government	2011-2015	Development of under-forest economy Increase productivity of forest Increase farmers' income Sustainable usage of forest	Integration of poverty reduction into development of under-forest economy	N/A	N/A	All poverty alleviation and development departments	

Source: MCG (2008); GOSC (2010); GOPGGP (2011a); MCG (2011a); GOMCG (2012c); GOMCG (2012b); WCG (2012)

Table 8.8: Integration of equity into agriculture development and adjustment policies (continued)

Policy	Time	Issued by	Time frame	Goals	Integration of equity into agriculture development and adjustment policies			
					Aims	Instruments	Budget	Institution
Local Minqin County's Implementation Plan for Improved Varieties Subsidy Program in 2012	2012	Minqin County Government General Office	2012	Promote improved agricultural varieties Increase agricultural production and quality	Enhance public acquisition, participation and surveillance	Publicity by posting notice for 15 days on: farmers' names, subsidies, and hotline for public supervision and report	N/A	Village group committees
Minqin County's Implementation Plan for Direct subsidies for grain producers and general subsidies for purchasing agricultural supplies in 2012	2012	Minqin County Government General Office	2012	Provide subsidy	Equal and transparent allocation of subsidies	Publicity by posting notices on subsidy allocation in townships, villages and in village groups	N/A	Township governments Village committees Village group committees State-owned farms
Minqin County's Implementation Plan for Direct subsidies for grain producers and general subsidies for purchasing agricultural supplies in 2011	2011	Minqin County Government	2011	Provide subsidy	Equal and transparent allocation of subsidies	Publicity by posting notice for on subsidy allocation in townships, villages and village groups	N/A	Township governments Village committees Village group committees State-owned farms
Minqin County's Development Plan for Grass Planting and Animal Husbandry 2008-2010	2008	Minqin County Government	2008-2010	Sustainable and rapid development of modern husbandry industry Increase husbandry productivity Increase income	Support poverty-stricken rural families	Support poverty-stricken rural families to develop husbandry	Poverty reduction fund	N/A

Source: MCG (2008); GOSC (2010); GOPGGP (2011a); MCG (2011a); GOMCG (2012c); GOMCG (2012b); WCG (2012)

Table 8.9: Integration of equity into migration policies

Policy	Time	Issued by	Time frame	Goals	Integration of equity into migration policies				
					Aims	Instruments	Budget	Institution	
National	Key Management Planning for Shiyang River Basin	2007	National Development and Reform Commission Ministry of Water Resources	2006-2020	Improve efficiency and effectiveness of water use Increase farmers' income Promote sustainable development	Poverty reduction	Relocation of 10500 people living in ecologically fragile and poverty-stricken areas to state-owned farms	N/A	N/A
Regional	Gansu Province's 12th Five-Year Plan for Anti-Poverty by Relocating	2011	Gansu Province Government General Office	2011-2015	Eliminate absolute poverty Alleviate relative poverty	Poverty reduction Increase income Bridge development gap within the province	Relocation of 44 thousands poverty-stricken households (220 thousand people) living in ecologically fragile and disaster prone areas Provide migrants with equal access to energy, infrastructure, social services, education and land	4.9 billion in total 1.8 billion from: the specialised fund for anti-poverty relocation of central government 0.8 billion from: other funds of central government 0.235 billion from: local governments 0.2065 billion from: fund raised by farmers	Gansu Province Government City governments County/district governments Township governments Development and reform departments Poverty reduction departments Financial departments Agricultural and husbandry departments Transportation departments Construction departments Education departments Water departments

Source:NDRC and MWR (2007); GOMCG (2008b); GOMCG (2008a); GOMCG (2009b); GOPGGP (2011b)

Table 8.9: Integration of equity into migration policies (continued)

	Policy	Time	Issued by	Time frame	Goals	Integration of equity into migration policies			
						Aims	Instruments	Budget	Institution
Local	Plan of Post-Migration Management for Migrant Receiving Areas in Minqin	2009	Minqin County Government General Office	N/A	Relocation Stable life Prosperity	Support poverty-stricken migrants	Include migrants from Xing'an Village into basic living allowance system	N/A	Bureau of Civil Affairs Changning Village Committee
	Implementation Plan for Ecological Migration Pilot in Zhengxin Village of Donghu Township	2008	Minqin County Government General Office	2008	Relocation of people to specific industry and area Reduce pressure on ecology Poverty reduction	Support disadvantaged people	Provide specialised ecology protection fund to people with disability or chronic disease	Specialised ecology protection fund	Poverty reduction departments Donghu Township Government
	Implementation Plan for Construction of Migrants Receiving Areas on Farmland of Datan Township	2008	Minqin County Government General Office	2008	Poverty reduction Settlement of new migrants	Equal access to government support	Provide subsidies on housing and greenhouse construction to every household that has migrated	Integrating funds from various sources	Bureau of Construction Bureau of Animal Husbandry Datan Township Government

Source: NDRC and MWR (2007); GOMCG (2008b); GOMCG (2008a); GOMCG (2009b); GOPGGP (2011b)

Table 8.10: Integration of equity into education policies

Policy	Time	Issued by	Time frame	Goals	Integration of equity into education policies			
					Aims	Instruments	Budget	Institution
National Several Opinions of the General Office of the State Council of the People's Republic of China, on Further Supporting Economic and Social Development of Gansu Province	2010	General Office of the State Council of the People's Republic of China	/	Bridge the gap between Gansu Province and other Western Provinces	Provide equal education	Secondary vocational education 'tuition waiver program' for poverty-stricken students	N/A	N/A
	2010	Ministry of Education	2010-2020	Modern education system Learning society Country with strong human capital	Support development of high schools in poverty-stricken areas in Western China	N/A	N/A	N/A
					Avoid dropout due to poverty	Tuition waiver for poverty-stricken students receiving secondary vocational education Provide subsidy to poverty-stricken high school students and postgraduate students	N/A	N/A
					Close the gap between areas and schools	Provide rural areas and poverty-stricken areas with more support on teaching resources, facilities, books, campus construction, etc.	N/A	N/A
					Equal educational opportunity for children of rural migrant workers	N/A	N/A	

Source: GOSC (2010); DOEGP (2010); MOE (2010); MCPC and MCG (2011)

Table 8.10: Integration of equity into education policies (continued)

	Policy	Time	Issued by	Time frame	Goals	Integration of equity into education policies			
						Aims	Instruments	Budget	Institution
Regional	The Outline of Gansu Province's Plan for Medium and Long-Term Education Reform and Development	2010	Gansu Province Department of Education	2010 - 2020	Improve school conditions, especially in rural areas	Avoid dropout due to poverty	Increase living allowance for high school boarders from poverty-stricken families	N/A	N/A
					Improve compulsory education		Provide subsidy to high school students from poverty-stricken families		
					Provide equal opportunity for education		Provide subsidy to poverty-stricken students receiving tertiary education and secondary vocational education		
					Establish life-long education system	Close the gap between areas and schools	Improve facilities for rural schools Improve capacity of teachers in rural schools		
					Provide vocational education to poverty-stricken students	Tuition waiver for poverty-stricken students receiving secondary vocational education Provide living allowance to poverty-stricken students	N/A	N/A	
					Eliminate illiteracy		Develop adult education	N/A	N/A
Local	The Outline of Minqin County's Plan for Medium and Long-Term Education Reform and Development	2011	Minqin County Party Committee, Minqin County Government	2011 - 2020	Improve school conditions	Close the gap between areas and schools	Balanced allocation of teachers, facilities, books and classrooms	N/A	N/A
					Improve compulsory education	Avoid dropout due to poverty	Provide subsidy Improve 'County Head Education Fund' Advocacy on social aid for education		
					Provide equal opportunity for education			N/A	N/A
					Establish life-long education system				

Source: GOSC (2010); DOEGP (2010); MOE (2010); MCPC and MCG (2011)

Table 8.11 shows the integration of equity into the policies of disaster prevention and relief. This kind of policy is not found at the national and regional level. The aims of equity in the local policies include providing particular support to remote areas and supporting disadvantaged people. The policies indicate that the information of early warning should be sent timely to remote areas by increasing and improving the means of communication. Moreover, the governments should provide shelter and special care to people who are poor and in special needs. All the local policies specify the institution to carry out the above programs, but no specific funding is introduced.

The integration of equity into the policies of new energy is shown in Table 8.12. The national policy aims to provide different areas with equal access to energy. It is therefore important to provide particular support to the areas that currently do not have sufficient energy, such as remote areas and rural areas. Development of renewable energy and the upgrade of electricity system in these areas are important instruments to provide sufficient energy. The national policy also specifically lists various institutions that are responsible for these energy programs. The regional policy also seeks to provide sufficient energy for remote areas by developing new energy, while the local policy focuses on promoting equal participation of people in the new energy programs.

8.4.3 Characteristics of policies that consider inequality

To obtain a more nuanced understanding of the integration of inequality issues into adaptation policies, this subsection seeks to provide a detailed description of how different sectors and levels' adaptation policies consider the aim of equity, instruments to address inequality, finance to ensure implementation of the instruments, and institutions to implement the instruments; Moreover, this subsection assesses how the current policies consider the dimensions of inequality (e.g., economic, social, cultural, reputational and political inequality) and levels of inequality (e.g., inequality between nations, regions, households and individuals).

Table 8.11: Integration of equity into disaster prevention and relief policies

	Policy	Time	Issued by	Time frame	Goals	Integration of equity into disaster prevention and relief policies			
						Aims	Instruments	Budget	Institution
National	N/A								
Regional	N/A								
Local	Emergency Notification on Precaution for Temperature Fall, Snowfall and Strong Winds	2012	Minqin County Government General Office	2012	Prevent and cope with temperature fall, snowfall and strong winds	Assist poor people	Arrange shelter for poverty-stricken families	N/A	Township governments Departments of civil affairs
	Plan for Work Distribution of Geological Disaster Prevention	2012	Minqin County Government General Office	N/A	Prevent geological disasters Protect life and property safety	Early warning to remote areas	Early warning through wired broadcasting, loudspeaker, beating gongs, informing house by house	N/A	Bureau of Industry and Information Technology Bureau of Radio and Television Bureau of Land and Resources Bureau of Water Resources Bureau of Metrology
	Minqin county's Plan for Rapid Responding to Sand Storms	2011	Minqin County Government	N/A	Rapid response to sand storms Avoid and reduce casualties and injuries, and economic losses	Early warning to remote areas	Ensure everyone receives meteorological information through either text, television, electronic display or loudspeaker	N/A	Bureau of Metrology Bureau of Radio and Television Township governments
	Emergency Notification on Precaution for Fire Hazards Caused by Strong Wind	2010	Minqin County Government General Office	2010	Control fire hazards	Assist people in special needs	Provide care for people who are aged, sick, disabled and young	N/A	Township governments Village committees Departments of public security and fire fighting

Source: GOMCG (2010); MCG (2011b); GOMCG (2012a); GOMCG (2012d)

Table 8.12: Integration of equity into new energy policies

	Policy	Time	Issued by	Time frame	Goals	Integration of equity into energy policies			
						Aims	Instruments	Budget	Institution
National	China's 12 th Five-Year Plan for Energy Development	2012	The State Council of the People's Republic of China	2011-2015	Control energy consumption	Provide sufficient energy for remote areas	Development of renewable energy	N/A	National Development and Reform Commission
					Improve capacity of energy supply	Optimisation of energy structure	Protection of ecological environment	Equal pricing for electricity	Extend electricity to areas without electricity
Regional	Gansu Province's 12 th Five-Year Plan for New Energy and Renewable Energy Development	2012	Gansu Province Government General Office	2011-2015	Development of new energy and renewable energy	Provide sufficient energy for remote areas	Development of photovoltaic power system Establish small-scale photovoltaic power station	N/A	N/A
Local	Minqin County's Plan for Biogas Construction in Rural Areas	2009	Minqin County Government General Office	2008-2009	Promote biogas Promote crop farming and livestock breeding Increase income	Enhance public acquisition and equal participation	Publicise policies, action plans, subsidies, conditions, name list, purchasing details, prices, and distribution of resources	N/A	Village committees

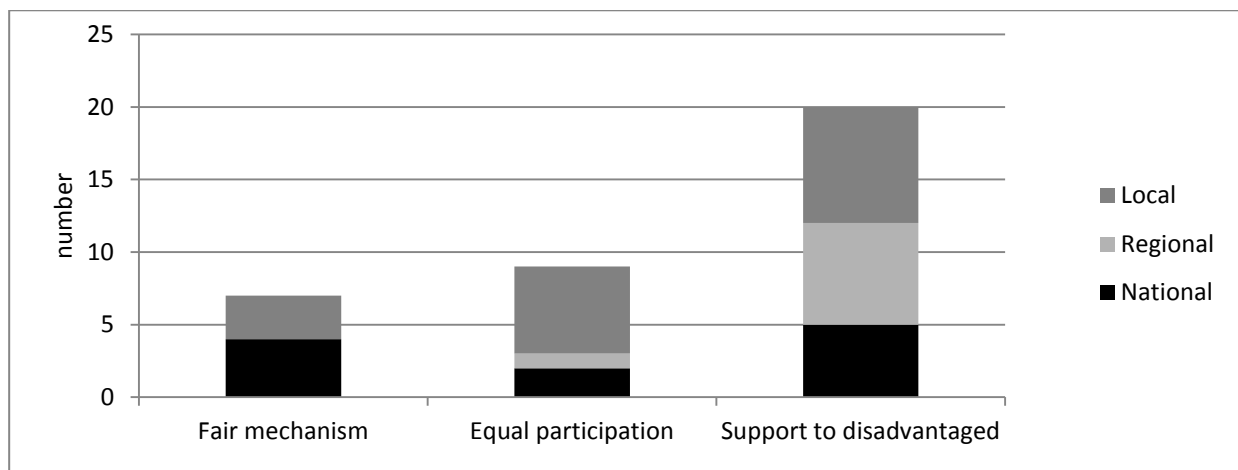
Source: GOMCG (2009a); GOPGGP (2012b); SC (2012)

8.4.3.1 Aims of equity

The aims of equity indicated in these policies can be categorised into three general groups. The first is to establish or participate in *fair mechanisms*, such as fair and reasonable international conventions and fair water use systems, which promote the fair distribution of responsibilities, costs and benefits among nations, areas and populations. The second aim focuses on *equal participation* of people in public affairs by eliminating or reducing privilege (e.g., to ensure a transparent process of policy-making and resource distribution, and to enhance public acquisition and surveillance). The last aim is to provide support to *disadvantaged groups* and thus close the gap between populations. More than half of the policies consider ‘support disadvantaged ones’ as their aim for equity, a quarter describe the aim as promoting ‘equal participation’ of people in public affairs, while the remaining 19 percent consider establishing or joining a ‘fair mechanism’ as their aim.

Figure 8.3 shows the distribution of the three types of aims by national, regional and local level. Both national and local policies consider all the three types of aims, while regional policies do not indicate any aim of establishing or participating in a ‘fair mechanism’ but largely focus on aiding disadvantaged people. National policies focus on participating in international fair mechanism and providing support to poverty-stricken areas. Local policies not only seek to promote equal participation in public programs and assist disadvantaged people, but also aim to establish local fair mechanism to ensure that people can constantly benefit from public programs in an equal way.

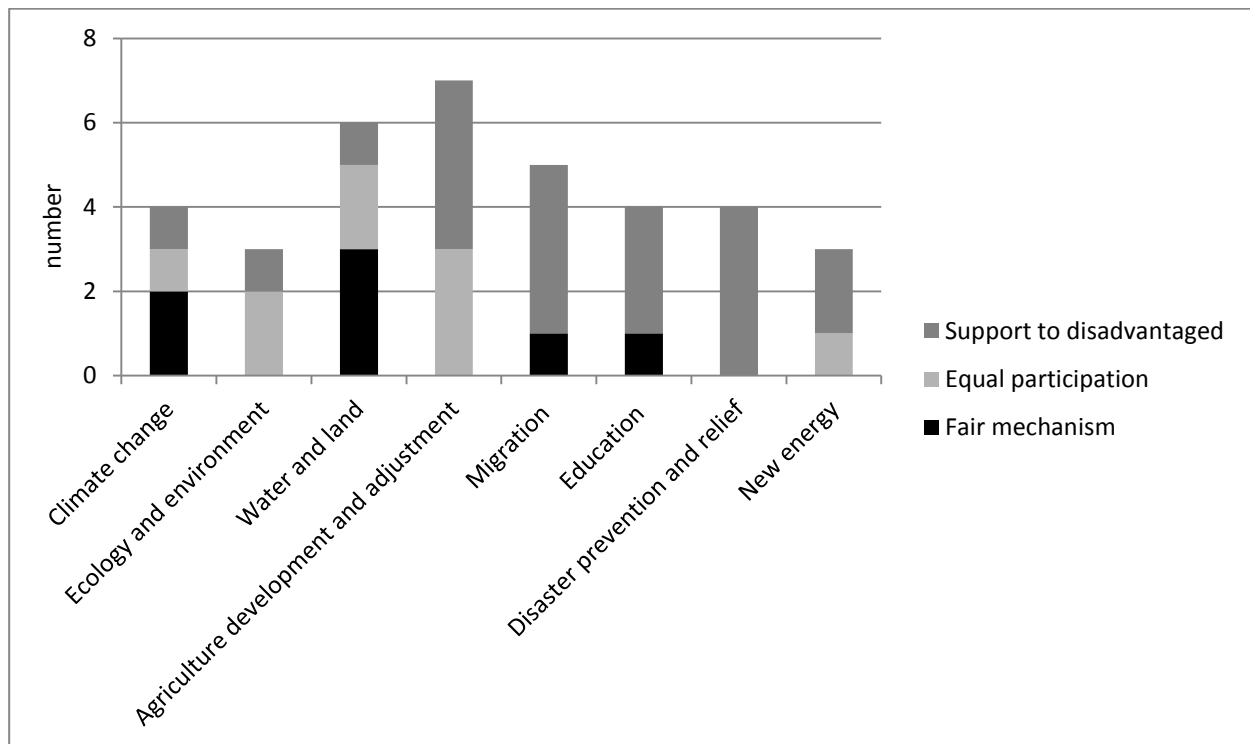
Figure 8.3: Three major types of aims of equity by national, regional and local levels



Source: Various government websites (refer to Appendix 4)

Figure 8.4 indicates that migration policies mainly concentrate on providing support to disadvantaged people who are in poverty, living in poverty-stricken areas, and who are living with disability and chronic diseases (refer to Table 8.9). One of the local migration policies indicates that the aim of equity is to establish a fair government support system so that all migrants can have equal access to public subsidies. There is no aim regarding equal participation in public decision-making mentioned in migration policies. Only two categories of policies, climate change and water and land, propose all three types of aims, while policies of disaster prevention and alarm aim to support disadvantaged people but neglect the other two types of aims.

Figure 8.4: Three major types of aims of equity by 8 sectors of adaptation policies



Source: Various government websites (refer to Appendix 4)

8.4.3.2 Instruments

Almost all policies that propose addressing inequality introduce specific instruments by which the aims are to be attained, except for some policies related to water and land and education. For example, one local policy about water and land, *Minqin County's Plan for Water Allocation*, does not specify the instrument to achieve its aim of 'equal distribution of water' (refer to Table

8.7). The national education policy, the *Outline of the National Plan for Medium and Long-term Education Reform and Development*, does not introduce any instrument by which ‘development of high schools in poverty-stricken areas in western China’ and ‘equal education opportunity for children of rural migrant workers’ can be achieved (refer to Table 8.10).

Table 8.13 summarises the specific instruments employed by each sector of the adaptation policies and categorises them into five types: international conventions; social-economic development schemes, environmental programs; aiding disadvantaged program, and public surveillance. International conventions, such as UNFCCC and the Kyoto Protocol, are adopted as instruments in national climate change policies. They aim to establish fair and reasonable international mechanisms which encourage developed countries to take the lead in emission-reductions and the transfer of funds and technology to developing nations. The instruments regarding the general development of primary, secondary and tertiary industry and the development of technology and education are grouped in socio-economic development schemes. The study area is located in a region which has a long history of suffering from poverty and a deteriorating environment. This explains why most of the instruments for addressing poverty and inequality fall into the categories of environmental programs and aiding the disadvantaged programs. Environmental programs include the management of natural resources (e.g., water and biodiversity); development of renewable energy; improvement of meteorological information systems, and ecological relocation schemes. The instruments that provide particular support to areas and populations suffering from fragile ecologies and poverty are categorised as aiding the disadvantaged programs. Public surveillance is an important and effective instrument for ensuring policy transparency and the equal participation of people in public affairs. Specific public surveillance instruments include media postings, surveys, posting notices to the public, and the establishment of information exchange platforms.

Figure 8.5 shows that nearly half of the instruments indicated in the 35 adaptation policies fall into the category of aiding the disadvantaged programs. This means that providing direct support to under-developed areas and disadvantaged populations is the most common means adopted by governments to bridge the development gap between areas and populations. Environmental programs and public surveillance account for 24 percent and 17 percent, respectively, of the total instruments introduced by the policies. Only 4 percent of instruments are related to international convention, mainly because the policies collected for the study focus on sub-national adaptations.

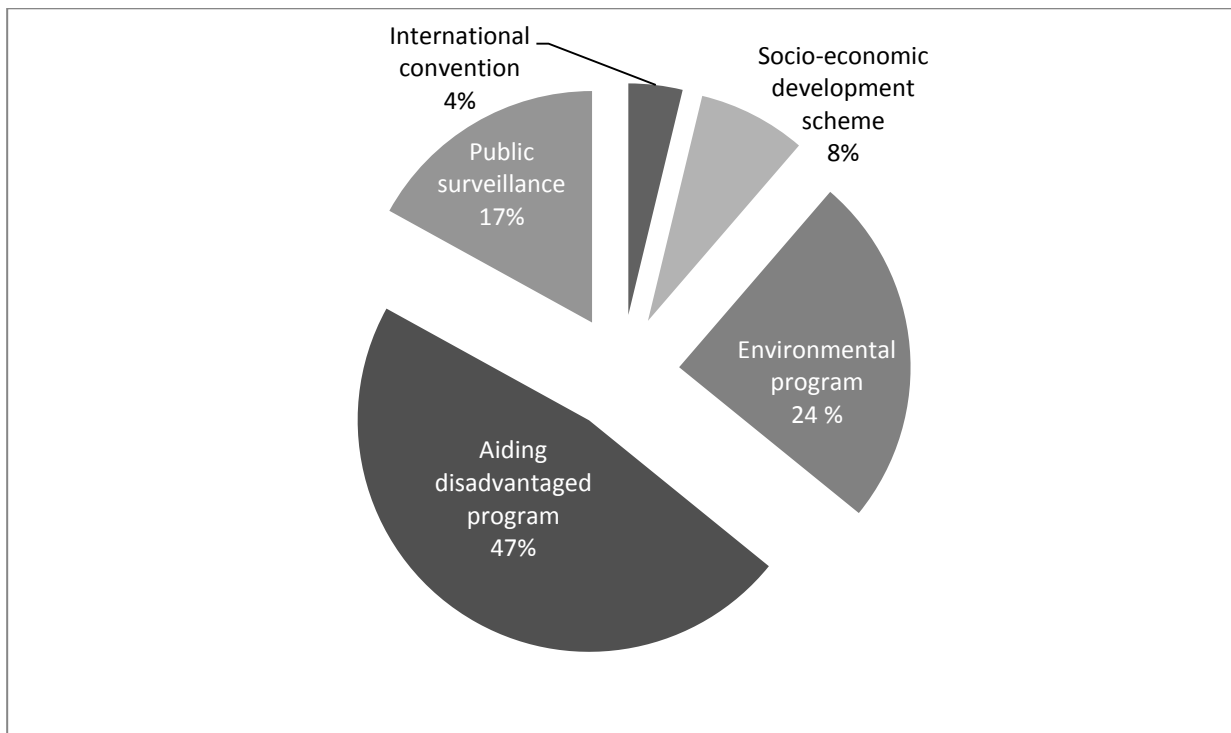
Table 8.13: Overview of instruments adopted to address inequality

	Climate change	Ecology and environment	Water and land	Agriculture development and adjustment	Migration	Education	Disaster prevention and relief	New energy	In Total
International convention	2								2
Socio-economic development schemes				4					4
Development of high-value agriculture and industry									
Development of secondary and tertiary industry									
Development of technology									
Education and training									
Environmental program		1	2	2	2		2	4	13
Farmer water use association									
Sustainable use of biodiversity									
Ecology protection									
Water Supply Project									
Development of renewable energy									
Meteorological information and disaster early warning system									
Relocation of people from ecologically fragile zones									
Aiding disadvantaged program	3		1	1	4	14	2		25
Increase fiscal transfer payment to poor areas									
Improve education in poor areas									
Progressive water pricing									
Particular support for poverty-stricken rural families									
Particular support for migrants									
Particular support for people with disability or chronic disease									
Particular support for poverty-stricken students									
Public surveillance	1	2	2	1				3	9
Media posts									
Survey									
Publicity by posting notices									
Information exchange platforms									
In Total	6	3	5	8	6	14	4	7	53¹³

Source: Various government websites (refer to Appendix 4)

¹³ The number of instruments is larger than that of policies as some policies introduce more than one instrument.

Figure 8.5: Five major types of instruments adopted to address inequality



Source: Various government websites (refer to Appendix 4)

As shown in Table 8.14, the higher the level of the issuing authority, the greater the number of instruments adopted. National policies adopt all five types of instruments, while regional policies adopt four and local policies three. Local policies do not use the general socio-economic development schemes to achieve equality, but focus on using more specific instruments such as aiding the disadvantaged programs, public surveillance, and the environmental programs.

Migration policies employ two types of instruments; ‘aiding the disadvantaged programs’ and ‘environmental programs’. For the disadvantaged migrants who are poverty-stricken and from ecologically fragile areas, migration policies specify some support programs, such as the basic living allowance system for everyone, specialised ecology protection funds that aid people with disabilities or chronic diseases, the housing and greenhouse subsidies, and equal access to public resources and services (Table 8.9). Agricultural development and adjustment policies employ four types of instruments, except international convention, which covers more instruments than other policies. On the other hand, education policies only adopt one instrument, ‘aiding disadvantaged program’.

Table 8.14: Five major types of instruments adopted by national, regional and local policies

	National policy	Regional policy	Local Policy
Public surveillance	2	1	6
Aiding disadvantaged program	5	10	10
Environmental program	7	4	2
Socio-economic development scheme	1	3	0
International convention	2	0	0

Source: Various government websites (refer to Appendix 4)

8.4.3.3 Finance

Some 94 percent of the policies do not mention a budget to financially support the implementation of relevant instruments to address inequality. The policies specifying financial sources account for only 5 percent of the total policies, and only 1 percent specifically describe both the source and the amount of budget. Overall the regional policy about climate change and local policy about agricultural development and adjustment and migration specifically mention financial sources. The only policy that describes the specific funding is a regional policy about migration, namely *Gansu Province's 12th Five-Year Plan for Anti-Poverty by Relocating*, which specifies the amount, sources and composition of its budget (refer to Table 8.9).

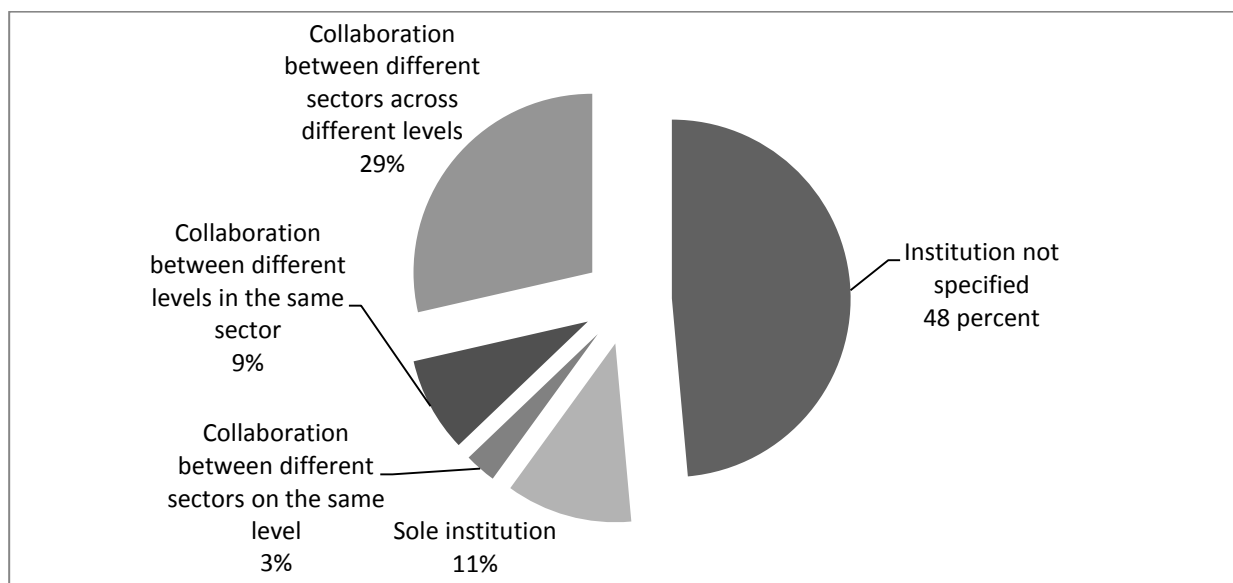
8.4.3.4 Institutions

Some of the policies that were analysed specify the institutions that are responsible for achieving the aims of equity, while some do not. All the analysed policies are categorised into three general groups, namely *institution not specified*, *sole institution*, and *institutional collaboration*. The last group is further divided into three sub-groups: institution collaboration between *different sectors at the same level*, *different levels in the same sector*, and *different sectors across different levels*.

Figure 8.6 shows that nearly half of the policies analysed do not specify the institution to address inequality issues, while the policies that appoint only one institution account for 11 percent. Some 48 percent of policies seek to achieve their aims about equity through collaboration between different institutions, among which collaboration between different sectors at the same level account for 3 percent, collaboration between different levels in the same sector 9 percent, and collaboration between different sectors across different levels 29 percent. The institutional collaboration largely focuses on collaboration between different sectors across different levels.

Taking the regional migration policy, *Gansu Province's 12th Five-Year Plan for Anti-Poverty by Relocating*, as an example, the institutions introduced by the policy include different levels of government (e.g., province, city, county and township governments) and various sectors (e.g., departments of development and reform, poverty reduction, finance, agricultural and husbandry departments, transportation, construction, education and water management) (refer to Table 8.9).

Figure 8.6: Distribution of policies by institutions addressing inequality



Source: Various government websites (refer to Appendix 4)

Table 8.15 shows that the higher level of government specifies institutions less often than the lower levels. Meanwhile, the local policies adopt more institutional collaboration than the national and regional policies. This is not a surprising finding because national policies usually act as guidelines whereas local policies are more closely and directly linked to action plans that need the institutions to be specified.

Table 8.15: Distribution of institutions addressing inequality by national, regional and local policies

	National policy	Regional policy	Local policy
Institution not specified	8	5	4
Sole institution	0	1	3
Institutional collaboration:			
<i>between different sectors on the same level</i>	0	1	0
<i>between different levels in the same sector</i>	0	1	2
<i>between different sectors across different levels</i>	2	1	7

Source: Various government websites (refer to Appendix 4)

As shown in Table 8.16, compared to other policies, migration policies largely rely on inter-sectoral and inter-level institutional collaboration to attain equality. This is also the case for policies of disaster prevention and relief. Education policies do not specify any institution probably because the education departments are assumed to take responsibility for all the aims and actions plans proposed in these education policies.

Table 8.16: Distribution of institutions addressing inequality by 8 sectors of policy

	Climate change	Ecology and environment	Water and land	Agriculture development and adjustment	Migration	Education	Disaster prevention and relief	New energy	In total
Institution not specified	3	2	3	3	1	4	0	1	17
Sole institution			2	1				1	4
Institutional collaboration									
<i>between different sectors on the same level</i>	0	1	0	0	0	0	0	0	1
<i>between different levels in the same sector</i>	0	0	0	3	0	0	0	0	3
<i>between different sectors across different levels</i>	0	0	1	0	4	0	4	1	10
In Total	3	3	6	7	5	4	4	3	35¹⁴

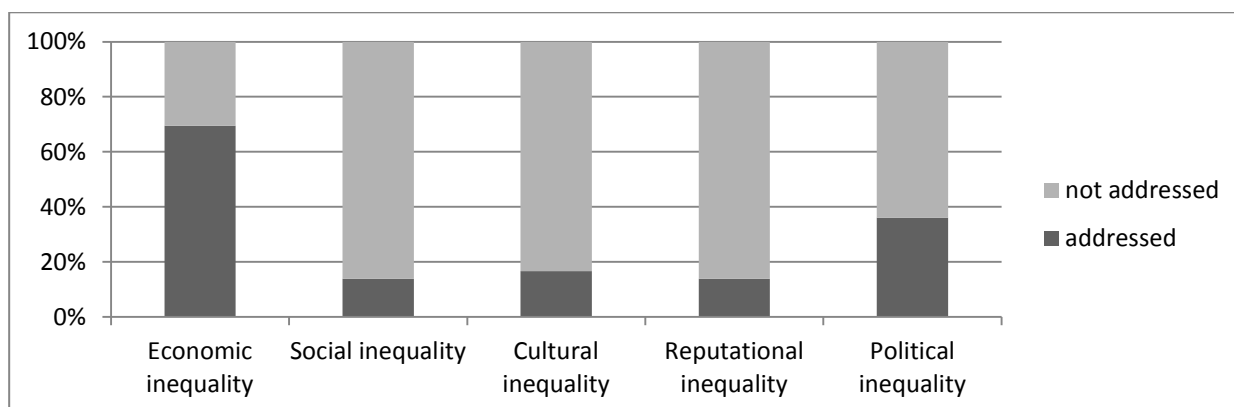
Source: Various government websites (refer to Appendix 4)

8.4.3.5 Dimensions and tiers of inequality discussed in adaptation policies

Previous chapters have proposed five dimensions of class, namely economic, social, cultural, reputational and political inequality. Figure 8.7 shows that 69 percent of policies seek to address economic inequality. This is followed by those addressing political inequality (e.g., promoting policy transparency, increasing public participation and strengthening public surveillance) which account for more than a third of the sampled policies. The policies considering social, cultural and reputational inequality are fewer in number than those focusing on economic and political inequality, only accounting for 14 percent, 17 percent, and 14 percent, respectively.

¹⁴ ‘China’s Policies and Actions for Addressing Climate Change’ was produced every year between 2008 and 2012. The five documents are combined because one policy as they have the same aims, instruments, budgets and institutions regarding equality.

Figure 8.7: Distribution of analysed policies (N=35) by dimensions of inequality



Source: Various government websites (refer to Appendix 4)

Table 8.17 provides a more nuanced picture of how different sectors of policies consider the multiple dimensions of inequality. Migration policies are considered to address all five dimensions of inequality, because the regional migration policy, *Gansu Province's 12th Five-Year Plan for Anti-Poverty by Relocating*, plans to provide migrants with equal access to energy, infrastructure, social services, education and land regardless of their economic, social, cultural, reputational and political statuses (refer to Table 8.9). This is also the case for water and land policies, which seek to ensure equal distribution of water to every farmer regardless of status in a particular domain (refer to Table 8.7). Policies regarding climate change, ecology and environment, agricultural development and adjustment and new energy, basically focus on achieving equity through addressing economic poverty and by increasing public participation in public affairs. Only education policies specifically propose to decrease cultural inequality by eliminating illiteracy. Disaster prevention and relief policies only focus on the economic dimension of inequality.

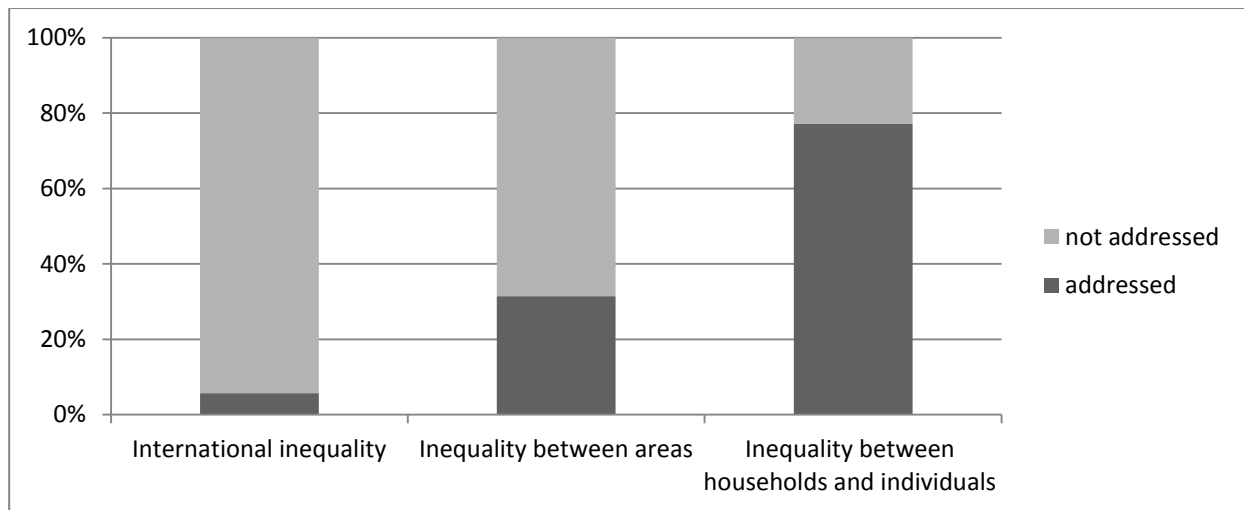
Table 8.17: Distribution of dimensions of inequality by the 8 sectors of adaptation policies

	Climate change	Ecology and environment	Water and land	Agriculture development and adjustment	Migration	Education	Disaster prevention and relief	New energy
Economic inequality	3	1	4	4	4	4	3	2
Social inequality	0	0	3	0	2	0	0	0
Cultural inequality	0	0	3	0	2	1	0	0
Reputational inequality	0	0	3	0	2	0	0	0
Political inequality	1	2	4	3	2	0	0	1
In Total	4	3	17	7	12	5	3	3

Source: Various government websites (refer to Appendix 4)

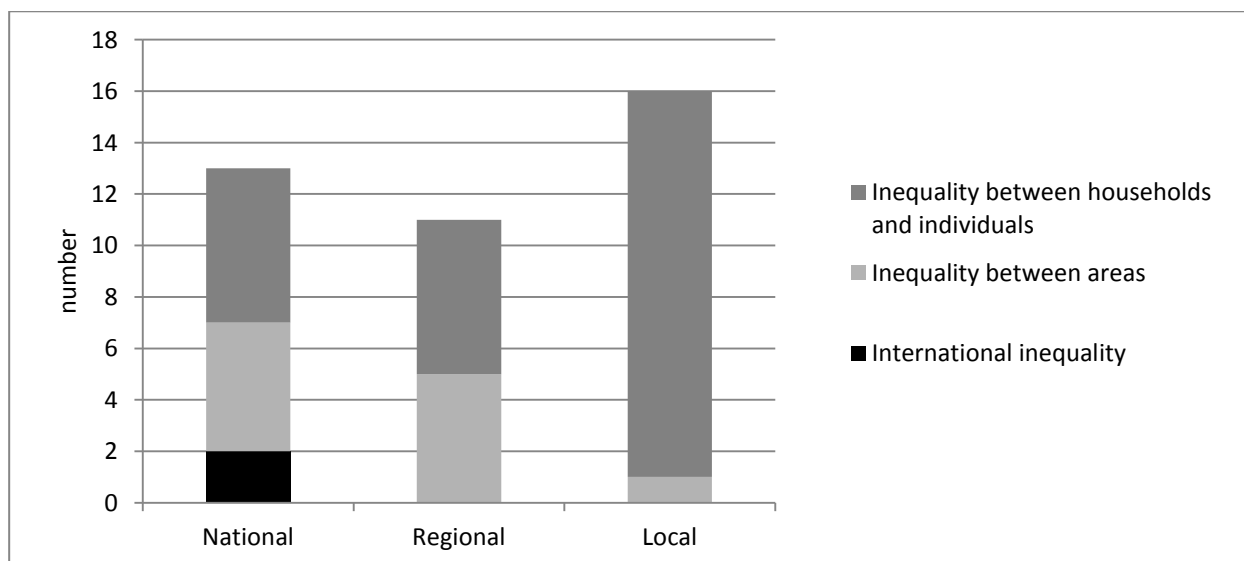
There are three general tiers of inequality discussed in the policies selected for analysis: international inequality, inequality between areas, and inequality between households and individuals. Figure 8.8 shows that inequality between households and individuals is the topic most frequently discussed, accounting for 77 percent of the total sample policies, while nearly one third of the policies discuss inequality between areas, and only 6 percent consider international inequality. As shown in Figure 8.9, it is reasonable that only national policies consider international inequality, while local policies mainly focus on inequality between households and individuals.

Figure 8.8: Distribution of analysed policies (N=35) by tiers of inequality



Source: Various government websites (refer to Appendix 4)

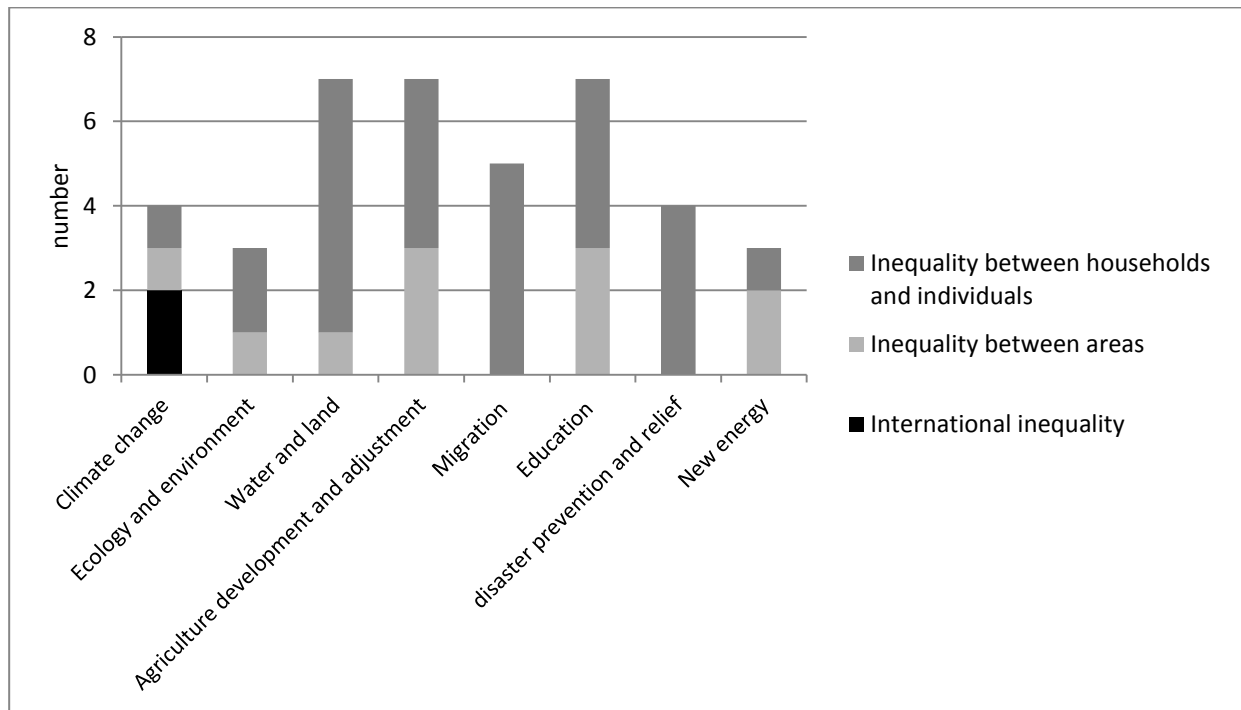
Figure 8.9: Distribution of tiers of inequality by national, regional and local policies



Source: Various government websites (refer to Appendix 4)

Figure 8.10 shows that migration policies only address inequality between households and individuals, as do disaster prevention and relief policies. Climate change policy is the only sector of policy that considers international inequality. The other five categories, policy about ecology and environment, water and land, agricultural development and adjustment, education and new energy, discuss inequality between areas, as well as between households and individuals.

Figure 8.10: Distribution of tiers of inequality by the 8 sectors of adaptation policies



Source: Various government websites (refer to Appendix 4)

8.5 Discussion and conclusion

This chapter has provided a nuanced understanding of the ways, and to what extent, equity has been integrated into existing multi-tiered and multi-dimensional adaptation policies. The aims, instruments, finance and institutions specified to address inequality were examined in these policies. The poverty and inequality reduction policies have acknowledged the importance of a wide variety of climate change adaptation means in addressing inequality. Meanwhile all of the 8 sectors of adaptation policies generally consider inequality an issue that needs to be addressed. However, the resources needed to address inequality are not explicitly incorporated in most of the policies, with nearly half of them not specifying policy implementation measures and 94 percent not mentioning particular funding at all. It is reasonable that some national and regional

policies not specify resources when they only aim to provide a blueprint guiding the formulation of local policies. However, for local policies that act as an immediate antecedent to action plans, the claim of equity alone without specified arrangements of resources may constrain the effectiveness of managing inequality. This analysis concludes that governments, especially those at the local level, fail to specify resources to manage inequality in adaptation policies.

The results also show that the aims and instruments of addressing inequality have largely focused on providing direct assistance to disadvantaged population, which is necessary but far from adequate to close the development gap between regions and populations. Fair mechanisms that are more sophisticated and long-term should be established to ensure reasonable and equal distribution of resources and equal participation in public affairs. Moreover, policies at different levels in the same sector are general congruent because lower level policies tend to follow the guidelines set by the upper level ones in a context of top-down policy.

One important limitation of this study is that the analysis is based on publicly available policy documents only, which are far from comprehensive. Moreover, this study employs a top-down approach to assess how local policies are informed by and follow national and regional policies to address inequality. This study does not examine the ‘bottom-up’ influence (Urwin and Jordan 2008) of the implementing actors and agencies on policy formulation and outcomes regarding inequality. Finally, this study focuses on the analysis of the written content of public policies which represents the governments’ values, attitudes and strategies. However the actual implications of these policies for inequality remain unclear. The study of Thomas and Twyman (2005) in Namibia shows that the decentralisation of water management to promote equal access to water resources turned out to be a barrier, excluding poor people from access to water. Though equity may be well integrated into the text of policies it is not necessarily translated to improved equity outcomes. One needs to be cautious about linking the results of analysis of policy's text to actual policy implementation processes and outcomes.

Previous chapters have concluded that the multiple dimensions of inequality have a significant influence on migration and adaptation to climate change. This motivates adaptation policies to consider inequality and to make practical plans to address existing inequality and to avoid exacerbating inequality. In conclusion, this chapter suggests that managing inequality should be considered and well planned in current and future migration and adaptation policies in order to promote, rather than constrain, effective adaptation to climate change.

CHAPTER 9: Conclusion

9.1 Introduction

This study has examined in what ways, and to what extent, the multiple tiers and multiple dimensions of class determine households' experience of climatic variability impacts, and, subsequently, shape their adaptation strategies and migration patterns. In addition, how inequality is addressed by current migration and adaptation policies was examined. The analysis has drawn upon primary data collected by a survey of 445 households and in-depth interviews with key informants, as well as secondary data gathered from census, yearbooks and government documents. The study focuses on Minqin county in western China, a hotspot of climate change due to extreme water scarcity and desertification, as well as a place witnessing dramatic socio-economic and demographic changes.

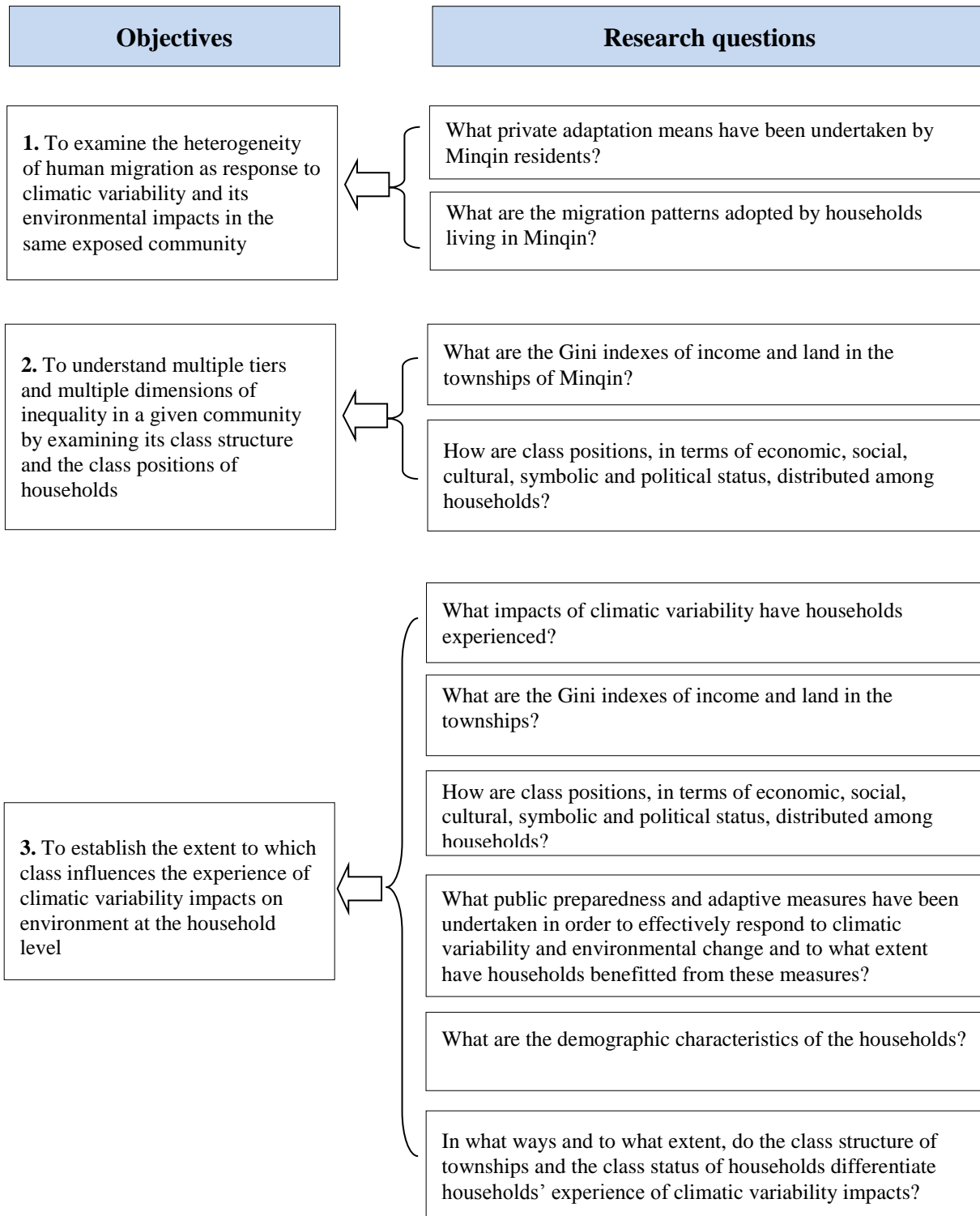
This chapter concludes the thesis by summarising the major findings, discussing the implications for migration and socio-economic development policies, considering the contribution to environment-migration theory, assessing any limitations of this study, and providing some future research directions.

9.2 Major findings

This section brings together the results from previous chapters and assesses the extent to which these results contribute to achieving the research objectives of this study. The overarching aim was to enhance the understanding of the complex interrelationship between climatic variability, class and migration at the household level in a rural setting which is a climate change hotspot. To achieve the aim, it is essential to have a nuanced understanding of climatic variability and its environmental impacts within a specific community. This includes acknowledgement of the multiple tiers and multiple dimensions of inequality shaped by class, adaptation strategies and the migration patterns adopted by households, as well as the important drivers/barriers of migration other than class-related factors (e.g., institutions and demographic characteristics). All the information was then used to empirically examine the influence of climatic variability and its environmental impacts and class on migration. To provide appropriate policy recommendations, a prerequisite is gaining a good understanding of current policies regarding migration, adaptation and social equity. As illustrated in Figure 9.1, to achieve the main aim, this study identifies 6

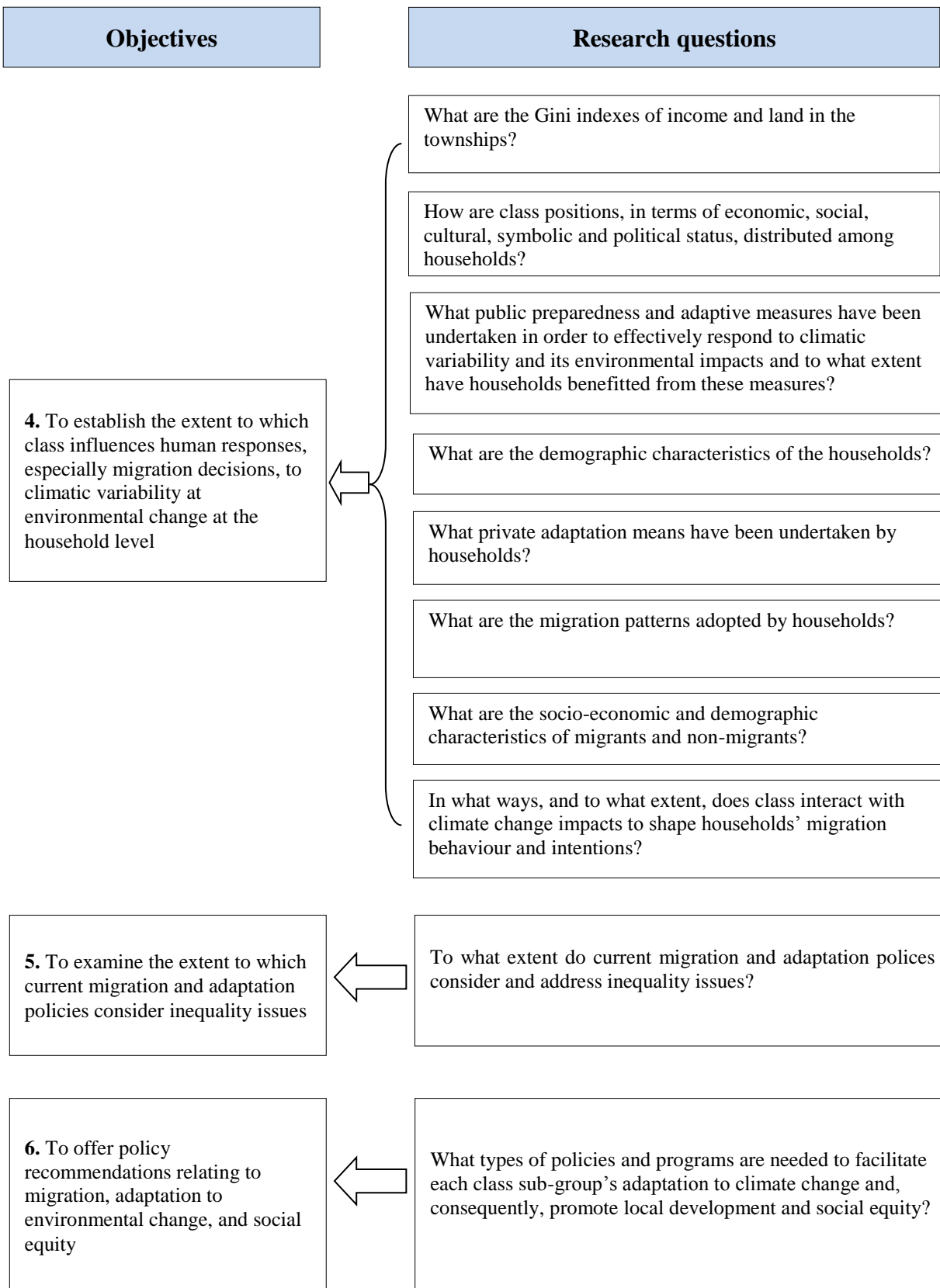
objectives and specifies 12 research questions¹⁵ that sought to achieve each objective. Findings relating to each objective are then summarised.

Figure 9.1: Research questions seeking to achieve objectives of this study



¹⁵ Some research questions seek to achieve more than one objective. For example, answer to the research question ‘What are the migration patterns adopted by households living in Minqin?’ contributes to achieve both objectives 1 and 4.

Figure 9.1: Research questions seeking to achieve objectives of this study (continued)



9.2.1 Objective 1: To examine the heterogeneity of human migration as response to climatic variability in the same exposed community

Households in Minqin adopted four categories of adaptation: (1) promoting agricultural production (e.g., planting drought-resistant crops, planting cash crops, improving irrigation, implementing water-saving cultivation, and improving access to weather forecast); (2) protecting natural resources (e.g., saving electricity and water, protecting soil, and using renewable energy); (3) protecting and improving their living environment (e.g., reinforcing house, and using air-conditioner); and (4) migration. The adaptive means most commonly adopted by households were related to natural resources and agricultural production. In Minqin, migration was a strategy, as important as in-situ adaptations, adopted by nearly half of the households to adapt to climatic variability and its environmental impacts.

This study investigated patterns of both actual migration (2008-2012) and future migration intentions (2013-2014) in Minqin. The two types of actual migration pattern are *the actual Hukou transfer* (migration with Hukou transfer versus migration without Hukou transfer) and *the actual migration distance* (intra-provincial migration versus inter-provincial migration). The types of intended migration patterns include *the intended migration distance* (intention of intra-provincial migration versus intention of inter-provincial migration) and *the intended migration scale* (intention of entire household migration versus intention of individual migration).

Although not being comprehensive about migration patterns in the study area, this study showed that households within a community could have diverse migration histories and intentions. It was found that Minqin was an area that had experienced dramatic population mobility, with more than 40 percent of households migrating during the period 2008-2012. Hukou transfer is strictly controlled by the government and transferring Hukou from poor and rural areas to urban and wealthy ones is extremely difficult. The results showed that only 14 percent of migrants have transferred their Hukou to their destination, mainly as a result of marriage and higher education. Inter-provincial migrants were more common than intra-provincial ones in Minqin, because Gansu province is an important site of origin, sending labourers to Xinjiang, Inner Mongolia and the eastern part of China. Households in Minqin also showed a strong intention to migrate, with about 40 percent of them indicating that they planned to migrate in the coming years (2013 and 2014). It is expected that more households only intended to move individual family members, rather than the entire household. Nevertheless, nearly 7 percent of total households still intended

to move the entire family out of their current township in the near future. Consistent with actual migration behaviours, more households planned to migrate beyond the province than within it.

9.2.2 Objective 2: To understand multiple tiers and multiple dimensions of inequality in a given community

This study has examined inequality in terms of two tiers (the class structure of community and the class position of households) and five dimensions (the economic, social, cultural, symbolic and political status of households). The class structure, referring to patterns of inequality in a community, was commonly assessed by the Gini index. Five townships in Minqin – Shoucheng, Xiqu, Donghu, Shuangcike and Hongshaliang – were selected as the survey sites, which provided five groups of Gini indexes at township level. The results showed that Gini index of income varied between the lowest 0.278 (lowest income inequality) in Shoucheng township and the highest 0.411 (highest income inequality) in Xiqu township. The Gini index of landholding did not show such an obvious gap between the five townships, only varying between 0.203 (lowest land inequality) and 0.253 (highest land inequality). The results indicate that, within the same community (e.g., a county), different sub-communities (e.g., townships) may face different situations of inequality.

The distribution of the five dimensions of class position among households was measured by using primary data collected from household surveys. The results indicate that households have diverse economic, social, cultural, symbolic and political statuses in their community.

- *Economic status*: The income gap between households is very large. The households living in poverty accounted for 6 percent of total sample, while around 13 percent of households had more than 11,000 Yuan annual income per capita, which is ten times the poverty threshold (1,068 Yuan in 2007). Nearly three quarters of households had only one income source, while of the rest, one quarter had three sources and more. The size of land varied between 1 mu and 7 mu and the size of house varied between 50 m² and 400m².
- *Social status*: Nearly one third of households had a connection with government officers and entrepreneurs, whereas the rest did not have such strong social networks. Most of the households indicated that they had good relationships with people surrounding them, but the actual assistance they have received from these people showed big differences. There

were 4 percent of households receiving no assistance, while nearly one third of households received multiple forms of assistance.

- *Cultural status*: The highest educational attainment of households varied from no schooling to postgraduate degrees, suggesting that the cultural status of the households is highly diverse in the communities.
- *Symbolic status*: Occupational prestige among the households did not show big differences, with 94 percent of households working as farmers, labour workers, and self-employed persons. Local reputation showed a greater diversity among households than occupational prestige.
- *Political status*: The households having CPC member(s) accounted for 26 percent of the total sample. Sixty-five percent of households indicated that they received little assistance from the governments, while 13 percent asserted that the government has provided great help to them. Satisfaction with participation in policy-making processes varied greatly too, with 34 percent of household not satisfied, while 21 percent were satisfied.

9.2.3 Objective 3: To establish the extent to which class influences the experience of climatic variability impacts at the household level

Climatic variability, in terms of a significant increase in temperature, was evident in Minqin. As a result, Minqin has long experienced desertification, sandstorms, water scarcity and farmland degradation, which threatened farmers' livelihoods and challenged the economic development of the community. The most common and severe impacts of climatic variability experienced by *households* were a *decrease in agricultural production, in water resources, and in land resources*.

To better understand the influence of class on impacts of climatic variability experienced by households, other important factors determining these impacts (e.g., public preparedness and adaptive measures and household demographic characteristics) were discussed and included as control variables in regression models. Four types of public preparedness and adaptation were carried out in Minqin: (1) improving the forecasting and alarm system; (2) rehabilitating ecosystems; (3) improving agricultural production; and (4) conducting general development schemes. The public projects that most benefited households were related to water – *protection of water resource and development of irrigation systems*. More than half of the households

indicated that they greatly benefited from these two adaptive projects. The study also found that households' adaptive capacity could be enhanced by another two public adaptive means, which are *improving the forecasting and alarm system* and *rehabilitating ecosystems*. Moreover, the findings suggested that households benefited from these public adaptations to a differing extent, which illustrated the fact that the public adaptation and vulnerability of a community can vary across its households. This study collected the following demographic information from households and individuals in the survey: health status, male ratio, household size, age of household head, elderly dependency ratio, ethnicity, and age-sex structure. The age-sex structure of respondents from the survey data was generally consistent with the census population from the 2010 Sixth National Census in Minqin. This shows that the sample closely represents the population in Minqin. The findings indicate that people living in Minqin were, in the main, Han-Chinese, and they had a balanced sex ratio but had unfavourable health status. In addition, compared to the census data, the sample's dependency ratio was lower and the household size was larger.

A regression model was used to investigate the influence of class on climatic variability impacts on the household level by controlling the factors of public adaptation and household demographic characteristics. The results showed that households living in the same local community (e.g., a county) experienced different impacts, though they faced very similar natural climatic conditions. Generally, the households living in a township with greater equality and themselves having higher economic, social and political status were less likely to experience the adverse impacts associated with climatic variability. The following groups were found to be particularly vulnerable to climatic variability impacts: households having no off-farm income; having less farmland, receiving little assistance, having no connection with the CPC and local governments, and having little access to public services. These results explicitly indicate that climatic variability impacts at the household level are not a natural outcome, but are closely related to socio-economic and political factors in a given community.

9.2.4 Objective 4: To establish the extent to which class influences human responses, especially migration decisions, to climatic variability at the household level

Differences in socio-economic characteristics were examined between migrants and non-migrants and also between migrants adopting/planning different migration patterns. Generally,

compared to non-migrants, migrants were more likely to be young, healthy and single, to be from a larger family with fewer dependents, and to possess more economic, social, cultural and political resources. Taking the migration destination into consideration, the study found that households having inter-provincial migrants were likely to have more favourable demographic, economic, social and political characteristics. Households having no intentions of migrating were likely to have health problems and lower economic, social, cultural, reputational and political status in their community. These findings indicate a possibility that some households were 'trapped' at their site of origin due to unfavourable health conditions and limited socio-economic and political resources. These people are very likely to bear the greatest risk of climate change and be unable to adapt to that change (Black et al. 2011a). Household intending to undertake long-distance migration, compared to those intended to undertake short-distance migration, had higher economic, cultural and political ranking in their community.

The regression results showed that the impacts of climatic variability on agricultural production, and on land and water had a mixed influence on the migration of households. Impacts on crop and land tended to drive migration, while impacts on water were more likely to constrain migration. These mixed results suggest that climatic variability *per se* does not automatically drive or inhibit migration; it is the specific impact experienced by a household that influences its migration decisions. The class structure of the community in terms of income inequality was significantly correlated with migration behaviour and intentions. Households living in a more unequal township, with higher income Gini index, were less likely to undertake or to plan migration. The class position of households in the community exerted a mixed influence on migration. Households with higher economic, social and cultural status showed a stronger propensity to engage in, or plan for, migration. These households were also more likely to undertake, or plan for, inter-provincial migration, entire household move and Hukou transfer, which require substantial resources. However, households holding higher symbolic and political status were more likely to stay in their community; this might be because they had strong sense of belonging to that community due to their high-profile local reputation and because they received satisfactory public support as a result of their high political status. This study has shown that multiple inequalities, shaped by class, can both drive and constrain migration. These findings are in line with Smith et al. (2006) and Foresight (2011) who argue that all determinants of migration can both drive and inhibit migration.

9.2.5 Objective 5: To examine the extent to which current migration and adaptation policies consider inequality issues

This study examined four important policy components – the aims of equity and the instruments, finances and institutions arranged to achieve these aims – in each of the following relevant adaptation policies: policies about climate change; ecology and environment; water and land; agricultural development and adjustment; migration; education; disaster prevention and relief; and new energy. Although adaptation policies in the 8 sectors all indicated that inequality is a problem affecting adaptation and development and should be addressed, few policies specified resources (e.g., institutional, human and financial resources) to actually manage inequality and its associated negative impacts. Furthermore, current policies mainly concentrated on addressing economic inequality, while other important dimensions of inequality were largely neglected. Nevertheless, a comprehensive study of these policies suggested that inequality issues could be addressed through: (1) multiple instruments (e.g., socio-economic development schemes, environmental programs, aiding the disadvantaged programs, and enhanced public surveillance); (2) collaboration between institutions from different levels and sectors, and (3) providing specific and sufficient financial support. Objective 6, seeking to provide specific policy recommendations relating to migration, adaptation to environmental change and social equity, is to be discussed in ‘policy implications’.

9.3 Policy implications

According to the major findings, an overarching suggestion of this study is that cohesive development programs should fully take into account environmental sustainability, economic development, and social equity, through integrating approaches to local development and human mobility. Migration is a proactive adaptive strategy to climate change in many situations, but ‘rarely a medium or long-term solution to environmental problems’ (Hugo 1996:124). Hugo (1996) suggests environmental sustainability can only be achieved through using the environment in a sustainable way, and overcoming poverty and powerlessness. Policies should enhance people’s ability to migrate, as well as to undertake in-situ adaptation.

Both absolute and relative poverty and powerlessness should be taken into account in policy interventions. Absolute poverty and powerlessness represent the low level of development level of a community and relative poverty and powerlessness refer to inequality among populations

within a community. In Minqin, policies relating to the environment and to socio-economic development tend to see rural populations in a certain community (e.g., village) as a homogeneous group, and concentrate on addressing absolute poverty and the vulnerability of that community. Anti-poverty measures and ecological relocation of whole Huanghui villages is an example of this ‘homogeneous’ philosophy. This study has shown that vulnerability and adaptation to climate change are heterogeneous among households living in the same community. This suggests that special emphasis should be placed upon *relative* poverty and powerlessness that explains why migration decisions vary among different households within a local community (Stark and Taylor 1991; Stark et al. 2009; Hyll and Schneider 2014).

Minqin has attracted extensive policy attention due to its extremely fragile ecology and its priority as a strategic part of China’s ecosystem. As discussed in Chapter 8, cohesive programs integrating the 8 dimensions of policy intervention have been established in Minqin, but they do not effectively address inequality. This section will provide specific recommendations that relate to improving the already cohesive and comprehensive migration, adaptation and development policies.

9.3.1 Migration policies

China is undergoing a dramatic socio-economic transformation, and urbanisation is an unavoidable part of this trend. China’s urbanisation rate has increased from 18 percent in 1978 to over 50 percent in 2012; a rate that is still very low in comparison to developed countries. According to China’s first strategic plan of healthy urbanisation — New-Style Urbanisation Plan (2014-2020) (SC 2014), by 2020 the urbanisation rate will reach 60 percent, representing the migration of 100 million rural people to become permanent residents of urban areas. The plan also explicitly indicates that urbanisation is an important approach in rural areas to alleviate environmental pressures, increase natural resources per capita, promote large-scale agricultural production, and increase living standards. The role migration plays in the environment and in development is specific to the social context. In the context of China’s rapid urbanisation, migration has the potential to be a solution to environmental and developmental problems by breaking the vicious circle of overpopulation, degraded environments, and a deteriorating economy.

Migration is regarded as one of the most important approaches to eradicate poverty and to protect the ecology and the environment in this county. However, relocation of people within the county does not solve the problems associated with water scarcity (Li and Wei 2005), therefore permanent migration beyond the county is encouraged by the local government. One interesting example is that the tertiary education system has been used to relocate people, mainly young people, permanently out of this county. In many places, a student who is admitted by a university will transfer his or her household registration (Hukou) to the location of the university. Even college students who do not transfer the Hukou out of their households usually will not return to rural areas because tertiary education equips them with knowledge and skills to make a life in urban areas. Minqin is highly regarded for its education quality and has a much higher rate of university admittance than other regions in western China (NBS 2012c). It is very interesting to find that the county's substantial investment in education resulted in exporting population rather than increasing its own human capital. Although the local education policy does not include labour exporting as an aim of education, researchers (Li and Wei 2005) indicate that education is an important channel through which young people are relocated beyond the county. Educational migration can provide numerous opportunities for development in Minqin by reducing the population, facilitating the sending of remittances, enhancing social capital, and so on. However, it carries the risk of 'brain drain', which can create other challenges for local development.

Along with the trend towards urbanisation, the government can facilitate rural residents voluntarily and permanently migrating out of Minqin and successfully resettling in urban areas. This requires policy interventions beyond those of the Minqin government, because migration and resettlement involve governments at both origin and destination of migration, and higher authorities which coordinate these origins and destinations. The New-Style Urbanisation Plan (2014-2020) (SC 2014) should be adapted into regional, municipal and local plans for urbanisation, specifying the scale, ways, timing, assistance, finance and institutions involved in permanent migration out of Minqin. Some key factors fundamentally determining the success of migration and resettlement, such as people's willingness to migrate, resources for migration, skills for non-farm occupations, differences in culture and means of production, information about destinations, and social inclusion within destinations, should be fully taken into account in these urbanisation schemes. Special emphasis should be placed on class groups with low economic, social and cultural status, who are less likely to undertake migration.

On the other hand, the Minqin government should develop a plan for human resources on the basis of its socio-economic development strategy. If former residents' expertise obtained from higher education and on-the-job training is necessary for the county's development, the government should provide job opportunities and financial support to provide incentives for these people to come back, in order to minimise the risk of 'brain drain' associated with out-migration of the young and educated population.

9.3.2 In-situ adaptation and local development policies

In Minqin, water scarcity is the key environmental issue that constrains migration because it traps people in the affected area by its significant negative impact on people's ability to migrate. The in-situ adaptation and local development policies should aim to avoid this type of involuntary stay. To achieve this aim, particular intention should be paid to address water scarcity in Minqin. Current water-related policies in Minqin mainly concentrate on protecting and increasing underground water, which requires farmers to reduce water usage for agricultural production and thus exacerbate water scarcity for farmers. Water policies should be supplemented with economic development schemes that simultaneously reduce farmers' dependence on water resources and generate more income for farmers. For example, the local government is advised to restructure agriculture from water-consuming cropping (e.g. corn and wheat) to drought-tolerant cropping (e.g. cotton, sunflower, fennel, chili, honeydew), horticulture and livestock, to adopt advanced water-saving techniques (e.g. furrow irrigation, drip irrigation, low pressure pipeline and sprinkler irrigation) in farming, and to reduce water-consuming secondary industries.

Policies are needed to facilitate and support financially worse-off families by either diversifying their income sources, through securing off-farm jobs, or by increasing their on-farm income by protecting land and water and helping them adopt new agricultural technologies. In Minqin, compared to the people who participate in the government-organised relocation program, self-initiated migrants have less chance to receive employment information, training and financial support, which inhibits their efforts to secure off-farm jobs. It is more difficult for poor people to move beyond the farm, seeking new job opportunities. An information platform could be established in each village, to provide every family in the community with information about work and life beyond the farm. The Minqin government is dedicated to protecting its water resources by closing down pumping wells and by reducing farm land. To maintain and increase

agricultural production during the process of water and land reduction, the government must introduce new agricultural technologies to farmers, notably drip irrigation and plastic greenhouses. However, these new technologies are not accessed by every family in the community. Financial and technological supports from government are only provided to rural families that first invest. This means that poor families are excluded from these technology programs. The local government should identify these poor families and provide special funding to facilitate their adoption of new technologies. Otherwise, the approaches that aim to strengthen adaptive capacity can further marginalise poor families, enlarge inequality, and thus increase the community's vulnerability to climate change.

For families with low social and political status, the government should particularly ensure their involvement in the community's reciprocal systems and public service programs. Formal reciprocal systems should be established to provide each household with assistance and support despite the condition of its own social relationships. In Minqin, the only 'reciprocal institution' known to the farmers is a water management committee. However, this committee is only responsible for applying water use permits on behalf of the villagers from the township water management station and for turning on the pumping machine should the permits be granted, which does not provide particular support to villagers. The Government should empower and financially support this kind of committee to promote mutual assistance for production among committee members and provide particular help to households receiving very limited resources from outside their families. It is also very important to increase the transparency of policy. This can decrease the chance of translating personal connections with powerful individuals into privileged access to public resources. Various communication means, such as public postings, broadcasts, TV, texts via mobile phones, training workshops and public promotional campaigns, should be used to keep everyone in the community informed about potential resources.

9.3.3 Integration of inequality into migration and adaptation policies

Inequality can both shape and be shaped by adaptation to climate change (Blaikie et al. 2004; Dulal et al. 2009). Previous subsections 9.3.1 and 9.3.2 have discussed how to promote effective adaptation to climatic variation by addressing inequalities and providing particular assistance to vulnerable groups with low economic, social, cultural, reputational and political status in the local class structure. This subsection seeks to provide advice on how to prevent inequality to be widened by adaptation. To avoid inequality being further entrenched by adaptation, it is prudent

to alter the content of existing adaptation policies to provide stronger statutory support for equity. All adaptation-related policies should clearly indicate that achieving equity is one of their aims. More importantly, specific resources (e.g., institutional and financial resources) that ensure achievement of equity should be designed in these adaptation policies, making sure that ‘equity’ is not only an empty slogan. Moreover, a practice of *equity proofing*, which requires all adaptation-related policy-making authorities to take inequality into account in the early phase of policy formulation, needs to be undertaken to ensure that future adaptation policies contribute to equality, or at least do not undermine it. Chinese policy has a history of encouraging unbalanced economic development, which is illustrated by the famous political claim ‘let some ones become rich first’ (Wan 2004). Some policy documents collected for this study have seemingly inherited this development philosophy. For example, many agricultural policies indicate that governments will support those farmers who are taking a leading role in local production by providing them with more subsidies and bonuses. In addition, farmers who cannot afford private contributions are excluded from the agricultural facility development schemes. Development schemes can provide pioneers with certain resources and support in establishing successful pilot projects that attract more people to adopt effective development approaches; however, they also need to make sure that vulnerable groups can also benefit from the advance development schemes. Socio-economic development and improvement in social equity are both important facilitators of effective adaptation to climate change. It is important that the development initiatives can promote equity, or at least do not increase existing inequality.

9.4 Implications for theory and method

Inequality has long been considered by adaptation and migration theories as an important factor influencing human behaviour in response to environmental change (IPCC 2014). The current discussions relating to inequality issues involved in mitigation and adaptation processes tend to concentrate on the differences between nations (Thomas and Twyman 2005). Despite the importance of global collaboration on issues surrounding climate change, sub-national studies focusing on inequality between local communities and households are of fundamental significance in informing culturally and spatially specific policy interventions. When inequality issues are discussed at sub-national levels, a single aspect of inequality, particularly that related to material inequality (e.g., unequal distribution of income and wealth), is often used to predict human response to environmental problems. Inequality and climate change-related migration are both complex social phenomena, thus linking inequality to the climate change-migration nexus

requires a holistic approach, integrating theories and practises relating to environmental change, migration, development, and inequality.

One contribution of this study is incorporating class theory (Bourdieu 1984), which explains the complexity of inequality within a community, into the climate change-migration nexus. Class theory, in combination with the reality of class in China, provides the theoretical foundation for this study to examine the economic, social, cultural, reputational and political dimensions of inequality. A comprehensive understanding of inequality is essential because a singular or simplistic understanding of it increases the risk of inaccurate, or partial, interpretation of the role it plays in climate change-related migration. This might lead to neglecting some disadvantaged groups affected by different forms of inequality, resulting in adaption being undermined. This study has shown that people who are not economically disadvantaged can still be vulnerable to climate change because they are affected by other forms of inequality. Addressing the unequal distribution of income is not the only solution to manage inequality that affects adaptation to environmental problems. All the economic, social, cultural, reputational and political inequality should be taken into account to understand the interrelationship between climate change, inequality and migration.

Theories of environmental migration have indicated that migration takes various forms in the face of climate change (Hugo et al. 2009; Piguet et al. 2011). Disentangling different forms of mobility is vitally important in planning and managing the various streams of human mobility. This study has enhanced the understanding of migration patterns and their underlying causes by investigating various distinctions (e.g., different demographic, economic, social, cultural, reputational, and political characteristics) between: (1) inter-provincial migrants and intra-provincial migrants; (2) households moving the entire family and those sending individual migrants; and (3) migrants transferring Hukou to their destination and those keeping Hukou at their site of origin.

This study also enhances the understanding of the multiple stages involved in the decision-making process with respect to climate change-induced migration. By incorporating the theory of planned behaviour (TPB) (Ajzen 2011) into current conceptual works unravelling the relationship between climate change and migration (McLeman and Smit 2006; Perch-Nielsen et al. 2008; Black et al. 2011a; Tan et al. 2014), this study proposed that there are two main stages when making an adaptation/migration decision in face of climate change: (1) the *experience*

stage where households' experience of climate change impact is influenced by class, and (2) the *behaviour* stage where adaptive behaviour (including migration) is shaped by interaction of climate change impact and class. Accordingly, a two-stage regression procedure was employed to model the influence of class on households' experience of, and adaptation to, climate change. Data on the severity of climate impacts, used as independent variables to predict migration patterns in Stage II, was obtained from the Stage I analysis. The analytical tool and methods are applicable and useful for other sub-national communities.

9.5 Limitations of the study and future research

This study has produced useful information regarding the influence of various domains of climatic variability and its environmental impacts and multiple inequalities shaped by class on different migration patterns. However, there are several limitations that restrict our understanding of some important aspects of the interrelationship between climatic variability and environmental change, inequality, class and migration.

The conceptual framework established in Chapter 3 demonstrated that there is a two way impact between migration and class. Available data only enabled this study to investigate the influence of class on migration in the context of climatic variability. However, how spatial mobility (migration) leads to household social mobility (change in class position) has not been discussed here. The social mobility of households and the subsequent restructure of class composition in the community is a long and gradual process, which requires longitudinal data that is not available.

For various reasons, some important information was not collected or not used in the analysis. First, an important migration group – migrant households moving the entire family out of the site of origin – was not included in this study. It would be ideal to target migrants in both migrant sending and receiving communities (Massey and Espinosa 1997), but limitations of human and finance resources restricted this study to carry out the survey in migrant destinations. As a result, this study only investigated the *intentions* of household and individual moves, while the distinctions between *actual* household and individual moves were not studied. Second, information on remittances is missing from the dataset, which makes it impossible to examine their important role in shaping vulnerability and migration. Third, some important contextual factors about communities, such as social, economic, and demographic information at the

township level, were collected from yearbooks but were omitted from regression models, because the study only selected five townships which did not provide enough variation within the data contained in the models. Village level information would provide more variation, but the relevant data were not available from secondary sources, or were not sufficiently or consistently collected in the in-depth interviews with key informants in each village. Another limitation is that data are relatively dated because the survey was conducted in 2012 to collect the information of migration during the five year period 2008-2014 and other information in 2007. Data in 2007 were used to predict migration behaviour during 2008-2012 and migration intentions during 2013-2014.

The direction for future research needs to centre on the *multi-directional* relationship between climatic variability, inequality and adaptation. Research on the influence of climatic variability and inequality on migration should be extended from driving/inhibiting different migration patterns at origin to shaping migrants' development at destination. The outcome of migration, such as changes in economic wellbeing and social capital, would serve as better indicators of the degree of effectiveness of migration as an adaptation strategy. It is expected that future research will throw more light on the influence of inequality on every phase of climatic variability-related migration – pre-migration, during migration, resettlement, and post-resettlement development. Further study also needs to investigate the influence of outcomes and the consequences of different migration patterns on changes in the class position of households and the class composition of communities at the site of origin. In addition to migration, in-situ adaptation patterns and their relationship to multiple inequalities need to be investigated more thoroughly. Future study should also examine how various dimensions of inequality differentiate people's choice of diverse means of in-situ adaptation, and how the outcomes of in-situ adaptation interact with those of migration to shape equity within the community. To answer the questions listed above, future research should gather longitudinal data that integrate comprehensive contextual, household, and individual information collected in both migrant sending and receiving areas.

9.6 Conclusion

This study has established that households' experience of, and adaptation to, climatic variability are differentiated by various dimensions of inequality, even when they are located in the same social context and exposed to the same natural environment. People sharing a specific locality

should not be considered a homogeneous group because they have unequal access to various resources and hold different class statuses in their community. This study employed class theory to understand inequality in a comprehensive way, which contributes to avoiding inaccurate or partial interpretations of the influence of inequality on the climate change-migration nexus. The class groups that are most vulnerable to climatic variability impacts include those with low social and political status, in addition to those ranking low in economic status. For adaptation policy to be effective it must recognise and address the particular needs of these class groups. In addition, both in-situ adaptation and migration are important adaptive strategies adopted at the household level. This suggests that policy intervention should focus on developing cohesive adaptation programs that enable people, especially vulnerable groups, to adapt in-situ or to migrate, rather than simply concentrating on encouraging or constraining migration. Moreover, specific arrangements of instruments, institutions and finance should be made in these programs to address the current multi-faceted dimensions of inequality and to prevent the occurrence of new inequality among households. It is expected that sustainable development – seeking and maintaining a balance between the environment, population, economic development, and social equity – can be ultimately achieved in Minqin, as well as in other areas that are particularly vulnerable to the adverse impacts of climatic variability.

Appendix

Appendix 1: Survey on climatic variability and adaptation in Minqin 2012

This survey is part of the research project Adaptation to Climate Change and Mobility of People in the Rural Areas of China conducted by Lanzhou University and the University of Adelaide titled. We would like you to spend some time for this survey. All information to be collected via this survey is for the purpose of research only. We will keep the family and individual information confidential and will Not be disclosed to any third part according to the regulations concerned. If you agree to participate in the survey, please tick ✓_____.

Chinese Rural Residents' Perception of and Adaptation to Climate Change

Code of the survey		Name of the principal respondent		Contact address and phone No. of the respondent		Name/code of the interviewer	
Province/County(City)		Town		Village		Date of the interview (yyyy/mm/dd)	

Part I Family Background and Movement

A1 Family Members

A1a	Are you the household head?	1 Yes <input type="checkbox"/>		2 No <input type="checkbox"/>					
A1b	Codes of all people living in the same household: <i>Serial number 1 refers to the respondent; from Serial number 2 to 8 people are sorted in a descending order from the oldest to the youngest age.</i>	1	2	3	4	5	6	7	8
	Relationship to the household head or de facto household head: 0.Yourself 1.Spouse 2.Child 3.Parent 4.Parent in law 5.Grandparent 6.Child in law 7.Grandchild 8.Brother or sister 9.Other								
A1c	Gender: 1.Male 2.Female								
A1d	Year of birth: (yyyy)								
A1e	The place of your current Hukou: <i>(When you select 2-7, please give the names of places.)</i> 1. the same town where you are living Now 2.other town within the same county/city 3.other counties within the same city/district 4.other cities/counties/districts within the same province 5.the cities/counties/districts in other provinces 6.Hong Kong, Macau, or Taiwan 7.other countries								
A1f	Your current Hukou status: 1.Agricultural Household 2.Urban Resident Household 3. Hong Kong, Macau, or Taiwan 4.Other countries (please specify which country)								
A1g	Marital status: 1.Married 2.Divorced/Separated 3.Widowed 4.Single								
A1h	Ethnicity: 1.Han 2.Hui 3.Tibetia 4.Dongxiang 5.Tujia 6.Man 7.Yugu 8.Bao'an 9.Inner Mongolia 10.Sala 11.Kazak 12.Zhuang 13.Miao 14.Uyghur 15.Yi 16.Other								
A1i	Education: 1.Never been to school 2.Primary School 3.Middle School 4.Senior High School 5.College Diploma 6.Bachelor Degree 7.Masters Degree 8.PhD								
A1j	Students pursuing studies: 1.Yes 2.No								
A1k	Political affiliation: 1. Communist Party member 2.Democratic Party member 3.Non party affiliated								

A2 Movements in 2008-2012

(Movement: whole family or family members live outside of the original town for six months and above. If did Not move → A3)

Codes of all people living in the same household: : the same as A1b	a. How many times did you migrate between 2006 and 2012?	Order of movement: from the earliest to the latest	b. When did you move? (yyyy/mm-yy/yy/mm; if have Not returned: yyyy)	c. Type of movement: 1.Move in Hukou 2.Move out Hukou 3.Live in the family for 6 months and above without moving in Hukou 4.Live outside the family for 6 months and above without moving out Hukou	d1.Move in Hukou	d2.Move out Hukou	d3. Live in the family for 6 months and above without moving in Hukou	d4. Live outside of the family for 6 months and above without moving out Hukou	e. Way of movement: 1.self-arranged 2.government arranged 3.government and company arranged 4.company and rural household arranged 5.government, company and rural households arranged 6.company recruitment 7.recruitment agent 8.to join the army 9.to pursue education 10. move with other family members 11.other: _ _ _ _ _ _ _ _ _ _	f. How much subsidy/compensation was provided by government or companies? (Yuan)	
					The place of your previous Hukou before it was transferred to the current household (please give the names of places): 1.other town within the same county/city 2.other counties within the same city/district 3.other cities/counties/districts within the same province 4.the cities/counties/districts in other provinces 5.Hong Kong, Macau, or Taiwan 6.other countries	Your Hukou status before it was transferred to the current household: 1.Agricultural Household 2.Urban Resident Household 3. Hong Kong, Macau, or Taiwan 4.Other countries (please specify which country)	The Hukou was transferred to (please give the names of places): 1.other town within the same county/city 2.other counties within the same city/district 3.other cities/counties/districts within the same province 4.the cities/counties/districts in other provinces 5.Hong Kong, Macau, or Taiwan 6.other countries	Came from (please give the names of places): 1.other town within the same county/city 2.other counties within the same city/district 3.other cities/counties/districts within the same province 4.the cities/counties/districts in other provinces 5.Hong Kong, Macau, or Taiwan 6.other countries			Went to (please give the names of places): 1.other town within the same county/city 2.other counties within the same city/district 3.other cities/counties/districts within the same province 4.the cities/counties/districts in other provinces 5.Hong Kong, Macau, or Taiwan 6.other countries
A 2 a 1	1	1									
		2									
		3									
		4									
		5									
A 2 a 2	2	1									
		2									
		3									
		4									
		5									

A 2 a 3	3	1									
		2									
		3									
		4									
		5									
A 2 a 4	4	1									
		2									
		3									
		4									
		5									
A 2 a 5	5	1									
		2									
		3									
		4									
		5									
A 2 a 6	6	1									
		2									
		3									
		4									
		5									
A 2 a 7	7	1									
		2									
		3									
		4									
		5									
A 2 a 8	8	1									
		2									
		3									
		4									
		5									

A2b	For the households which moved the residential place of the whole family since 2008 (If did Not move the whole family → A3)	1	2	3	4	5	
A2b1	When did you move the residential place of the whole family? (yyyy/mm)						
A2b2	Moved from: Province/City/County (District)/Town						
A2b3	Moved to: Province/City/County (District)/Town						
A2b4	Way of movement: 1.self-arranged 2.government arranged 3.government and company arranged 4.company and rural household arranged 5.government, company and rural households arranged 6.other: _____						
A2b5	Way of resettlement: 1.large size centralised resettlement (more than 10 households) 2.saml size centralised resettlement (2-10 households) 3.individual household resettlement						
A2b6	Ethnic Character of the resettlement village/community: 1.one ethnicity 2. Han and minor ethnicity 3.different minor ethnicities						
A2b7	What support did your family receive when moving residential places? Please tick and fill the amounts of the subsidies/compensation/loan (Yuan, a-e only)	a. compensation for infrastructure (e.g. water and electricity facilities, road construction, etc.)	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____
		b. compensation/subsidy for housing	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____
		c. subsidy for production	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____
		d. living allowance	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____
		e. loan from government/bank	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____
		f. production and vocational training	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____
		g. to arrange employment	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____
		h. other: _____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____	<input type="checkbox"/> ____

A3 Movement Plan in Next Two Years (Now-2014)

A3a	The possibility of movement of your family or some members in next two years: please circle the selected number. If there is No plan of movement, please skip to A4 after answer this question.	a. removal of entire family: 0(very unlikely) 1 2 3 4 5(neutral) 6 7 8 9 10(very likely)							
		b. removal of some family members: 0(very unlikely) 1 2 3 4 5(neutral) 6 7 8 9 10(very likely)							
		c. No moving plan: 0(very unlikely) 1 2 3 4 5(neutral) 6 7 8 9 10(very likely)							
A3a1	If there is a plan to move the WHOLE HOUSEHOLD , where do you plan to move to? Please tick and give names of places. <input type="checkbox"/> 1.other town within the same county/city: _____ <input type="checkbox"/> 2.other counties within the same city/district : _____ <input type="checkbox"/> 3.other cities/counties/districts within the same province : _____ <input type="checkbox"/> 4.the cities/counties/districts in other provinces : _____ <input type="checkbox"/> 5.Hong Kong, Macau, or Taiwan : _____ <input type="checkbox"/> 6.other countries: _____								
A3a2	Which kind of location do you prefer to move to? <input type="checkbox"/> 1.rural village <input type="checkbox"/> 2.urban outskirt <input type="checkbox"/> 3.town centre <input type="checkbox"/> 4.county capital <input type="checkbox"/> 5.medium or big city								
A3b	Removal plan of FAMILY MEMBERS								
A3b1	Codes of all people living in the same household: Same as A1b	1	2	3	4	5	6	7	8
	Which family members plan to move? Please tick	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A3b2	Where do you plan to move? (please fill the number and give the names of places) 1.other town within the same county/city 2.other counties within the same city/district 3.other cities/counties/districts within the same province 4.the cities/counties/districts in other provinces 5.Hong Kong, Macau, or Taiwan 6.other countries								

A4 Perception of movement

A4a	Is there new migrant moving into your village since 2008?	<input type="checkbox"/> 1.Yes	<input type="checkbox"/> 2.No	
A4b	Please indicate the voluntary degree of your family and family members' past movement(s): <i>Please circle the selected number. If did Not move, please skip to A4c</i>	0(completed forced) 1 2 3 4 5(neutral) 6 7 8 9 10(completely voluntary)		
A4c	Are your family and family members willing to move in the future? <i>Please circle the selected number.</i>	0(very reluctant to) 1 2 3 4 5(neutral) 6 7 8 9 10(very willing to)		
A4d	Under what kind of situation, your family or family members will consider leaving original residential place for 6 months and above? <i>Please tick 1 or 2; if 1 is chose, please answer: under what kind of situation, your family and family members will move; if 2 is chose, please skip to next question.</i>			
a	Will your family or family members move when facing climatic hazards (e.g. drought, flood, land slid/mud flow, heat wave, sand storm, etc.)?	<input type="checkbox"/> 1.Yes <input type="checkbox"/> 2.No		
	If choose 'Yes', your family or family members will move when within one year, climatic hazards happen: 1.once 2.twice 3.three times 4.four times and above	(1) removal of entire family		
		(2) removal of family members		
b	Will your family or family members move when climatic hazards last for a considerable long time in one year?	<input type="checkbox"/> 1.Yes <input type="checkbox"/> 2.No		
	If choose 'Yes', your family or family members will move when within one year, climatic hazards last for: 1.less than a month 2. 1-3 months 3. 4-6 months 4. 7 months and above	(1) removal of entire family		
		(2) removal of family members		
c	Will your family or family members move when climatic change causing reduction in production?	<input type="checkbox"/> 1.Yes <input type="checkbox"/> 2.No		
	If choose 'Yes', your family or family members will move when the reduction reach to: 1.less than 20% 2. 20%-40% 3. 40%-60% 4. 60%-80% 5.more than 80%	(1) removal of entire family		
		(2) removal of family members		
d	Will your family or family members move when climatic change causing reduction in income?	<input type="checkbox"/> 1.Yes <input type="checkbox"/> 2.No		
	If choose 'Yes', your family or family members will move when the reduction reach to: 1.less than 20% 2. 20%-40% 3. 40%-60% 4. 60%-80% 5.more than 80%	(1) removal of entire family		
		(2) removal of family members		
e	Will your family or family members move when climatic change causing fatality or health problems of family members?	<input type="checkbox"/> 1.Yes <input type="checkbox"/> 2.No		
	If choose 'Yes', your family or family members will move when climate change causing someone in your family: 1.feel uncomfortable but do Not need to seek medical treatment 2.need to seek medical treatment but is completely treatable 3.have post effects after treatment but can work and perform daily life activities 4.lose certain ability to work but can perform daily life activities 5. Completely lose ability to work but can perform daily life activities 6.canNot independently perform daily life activities 7.pass away	(1) removal of entire family		
		(2) removal of family members		
f	Will your family or family members move when climatic change causing decrease of resources (e.g. water, electricity, fuel, etc.)?	<input type="checkbox"/> 1.Yes <input type="checkbox"/> 2.No		
	If choose 'Yes', your family or family members will move when climate change causing: 1.increased price of resources 2.resources cannot fully meet the needs of production and daily life 3.resources completely cannot meet the basic needs of production and daily life	(1) removal of entire family		
		(2) removal of family members		

Part II Effects of Climate Change and Measures for Adapting to Climate Change

B1 Effects of Climate Change

B1a	a. Did local people experience remarkable climate change (e.g. decrease in rainfall, desertification, sand storm, drought, flood, landslide, heatwave, cold injury, etc.) by 2007? <i>(please circle the selected number)</i>	0(very rare) 1 2 3 4 5(neutral) 6 7 8 9 10(very often)
	By 2007, did local climate change adversely impact on: <i>(please circle the selected number)</i>	
	b. agricultural production	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
	c. land quantity	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
	d. soil fertility	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
	e. water quantity	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
	f. water quality	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
	g. living cost	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
	h. income	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
	i. health conditions	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)
j. housing	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)	
k. transportation and communication	0(not at all) 1 2 3 4 5(neutral) 6 7 8 9 10(most severe impacts)	

B2 Measures for Adapting to Climate Change

B2a	How do you agree with the statements about adapting to climate change? <i>(please circle the selected number)</i>	a. with appropriate measures, human could effectively adapt to climate change	0(strongly disagree) 1 2 3 4 5(neutral) 6 7 8 9 10(strongly agree)
		b. my family has adequate adaptive capacity to cope with the adverse impacts of climate change and bear all the loss brought about by climate change	0(strongly disagree) 1 2 3 4 5(neutral) 6 7 8 9 10(strongly agree)
		c. migration is one of the most effective strategies strengthening adaptive capacity to climate change	0(strongly disagree) 1 2 3 4 5(neutral) 6 7 8 9 10(strongly agree)
		d. in-situ adaption is one of the most effective strategies strengthening adaptive capacity to climate change	0(strongly disagree) 1 2 3 4 5(neutral) 6 7 8 9 10(strongly agree)
		e. my family will adopt migration only when in-situ adaptation measures are carried out but fail.	0(strongly disagree) 1 2 3 4 5(neutral) 6 7 8 9 10(strongly agree)

B2b	Has your household adopted the following means to adapt to adverse impacts of climate change? <i>Please tick</i>					
		(1) Have adopted	(2) Will adopt		(1) Have adopted	(2) Will adopt
	a. improving irrigation	<input type="checkbox"/>	<input type="checkbox"/>	h. using renewable energy (e.g. solar energy, wind energy, hydropower, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
	b. adopting water-saving cultivation	<input type="checkbox"/>	<input type="checkbox"/>	i. reinforcing house	<input type="checkbox"/>	<input type="checkbox"/>
	c. improving access to weather information	<input type="checkbox"/>	<input type="checkbox"/>	j. permanent migration (5 years and more)	<input type="checkbox"/>	<input type="checkbox"/>
	d. planting drought-resistant crops	<input type="checkbox"/>	<input type="checkbox"/>	k. using air-conditioning facilities	<input type="checkbox"/>	<input type="checkbox"/>
	e. protecting and improving soil fertility	<input type="checkbox"/>	<input type="checkbox"/>	l. decreasing usage of electricity and water	<input type="checkbox"/>	<input type="checkbox"/>
	f. land reclamation	<input type="checkbox"/>	<input type="checkbox"/>	m. long-term migration (more than 1 year but less than 5 years)	<input type="checkbox"/>	<input type="checkbox"/>
	g. family members taking short-term migration (6 months to 1 year)	<input type="checkbox"/>	<input type="checkbox"/>	n. planting cash crops	<input type="checkbox"/>	<input type="checkbox"/>
B2c	To what extent does your family benefit from the local institutional adaptations to climate change? 0(no benefit) 1 2 3 4 5(neutral) 6 7 8 9 10(the greatest benefit)					
	a. climate forecasting systems and emergency plans on disaster relief			f. renewable energy program		
	b. ecological rehabilitation projects			h. training on agricultural technology		
	c. protection of water resources			i. subsidies to agricultural production		
	d. development of irrigation systems			j. promoting sale of agricultural products		
	e. planting drought resistant crops			k. investment in local educational and medical services		
				l. investment in local infrastructure		

B3 Perception of and Participation in Climate Change Adaptation Related Policies and Strategies

		2007
B3a	Please answer following questions regarding your perception of and participation in climate change adaptation related policies and strategies. <i>Please select from 0 to 10</i>	
	a. How much help did government provide to your family when you facing difficulties? 0(very little) 1 2 3 4 5(neutral) 6 7 8 9 10(very much)	
	b. How much did your family benefit from governments' anti-poverty or economic development policies and programs? 0(very little) 1 2 3 4 5(neutral) 6 7 8 9 10(very much)	

	c. How do you agree with the statement ‘households in my community equally benefit from government’s environment protection and economic development policies and programs’? 0(strongly disagree) 1 2 3 4 5(neutral) 6 7 8 9 10(strongly agree)	
	d. Are your family willing to join in government-arranged migration? 0(very reluctant to) 1 2 3 4 5(neutral) 6 7 8 9 10(very willing to)	Ecological migration/anti-poverty relocation
		Labour export
		Project-induced relocation
	e. How would you like to participate in policy-making process of climate change adaptation? 0(very reluctant to) 1 2 3 4 5(neutral) 6 7 8 9 10(very willing to)	
	f. How satisfied (or dissatisfied) you are with your chance to participate in the policy-making processes? 0(Not satisfied at all) 1 2 3 4 5(neutral) 6 7 8 9 10(very satisfied)	
	g. How do you rate the conditions of public medical and educational services in your community? 0(very insufficient) 1 2 3 4 5(neutral) 6 7 8 9 10(very sufficient)	
	h. Does your family receive adequate information of climate change and disaster preparation and relief? 0(very insufficient) 1 2 3 4 5(neutral) 6 7 8 9 10(very sufficient)	
	i. How frequent does your family use public assets and facilities of your community (e.g. public irrigation equipment, public recreational facilities, etc.)? 0(very rarely) 1 2 3 4 5(neutral) 6 7 8 9 10(very often)	
B3b	Which projects were implemented in your community? <i>(please use ‘,’ to separate different choices)</i> 1.ecological migration/anti-poverty relocation 2. labour export 3. project-induced relocation 4.water-saving agriculture 5.development of renewable energy 6.cooperative marketing	
B3c	Which projects did your family participate in? <i>(please use ‘,’ to separate different choices)</i> 1.ecological migration/anti-poverty relocation 2. labour export 3. project-induced relocation 4.water-saving agriculture 5.development of renewable energy 6.cooperative marketing	
B3c1	Which project brings the greatest influence on your family?	
B3d	How does each stakeholder share the burden of coping with adverse impacts brought about by climate change on your family? <i>(please fill the percentages for each stakeholder, which sum up to be 100%)</i>	/
	a. local government at and above county level	
	b. local government at township level and village committee	
	c. employers	
	d. Non-government organisations	
	e. household and individuals	
	f. other social stakeholders (e.g. government of other cities and districts, industry, other people, etc.)	

Part III 2007-2011: Conditions of Different Aspects of the Family
C Employment Status, Livelihood condition and Economic Condition
C1 Employment and Social Security

C1a	Codes of all people living in the same household: <i>Same as A1b</i>	1	2	3	4	5	6	7	8
	Has any person aged 16 or older in your family taken up paid jobs at this moment? 1.Yes 2.No								
C1b	Which family members are seeking jobs at the moment? <i>(tick ✓)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C1c	How many times did you change your jobs since 2008? <i>(If you did Not change any job, please fill in '0'.)</i>								
C1d	Please indicate the occupation type of your family members 1. agricultural, forestry, husbandry and fishery production 2. small private business 3. labour work in manufacturing, construction and transportation industry 4. labour work in service industry 5. sales in business industry 6. business administration and management 7. technical or professional work 8. enterprise operation 9. service in public institutions (e.g., education, science and technology, culture, health work) 10. government officers 11. Other: _____	2007							
C1e	Please provide the information of annual income of each people taking up paid jobs. <i>(Yuan)</i>	2007							
C1f	For family members who took up paid work over the period from 2007 to 2011: How satisfied (or dissatisfied) you are with your job? 0(Not satisfied at all) 1 2 3 4 5(neutral) 6 7 8 9 10(very satisfied)	2007							
C1g	What kinds of social security do your family members have? <i>(please use ';' to separate different choices)</i> 1.social security of government and public institution 2.social security of urban employee 3.social security of urban resident 4.new rural pension insurance 5.new rural cooperative medical insurance 6.comprehensive insurance for migrants 7.other: _____ 8.No social security at all	2007							

C2 Production, Marketing and Land Use

		2007
C2a	How many contracted land did your family have in 2007? <i>Please tick if you own this type of land and fill the quantity (acre) of the land.</i>	<input type="checkbox"/> ___
	a. dry land	<input type="checkbox"/> ___
	b. irrigable land	<input type="checkbox"/> ___
	c. livestock husbandry land	<input type="checkbox"/> ___
	d. other: _____	<input type="checkbox"/> ___
C2b	How does your family use the land? <i>Please tick if you use the land in this way and fill the quantity (acre) of the land.</i>	<input type="checkbox"/> ___
	a. used by self	<input type="checkbox"/> ___
	B .rent to others	<input type="checkbox"/> ___
	c. land vacancy	<input type="checkbox"/> ___
	d. land acquisition by government	<input type="checkbox"/> ___
	e. reallocation to new in-migrants	<input type="checkbox"/> ___
	f. lose it to land consolidation	<input type="checkbox"/> ___

C2c	What production types are adopted by your family? <i>(please use ',' to separate different choices)</i> 1.crops 2.animal husbandry 3.working off-farm 4.samll business 5.to cooperate with industry 6.high returns plants and fruits 7.high returns livestock and poultry 8.forestry 9.vegetables 10.medical plants 11.fishery 12.other: _____	
C2c1	Which is the main production type of your family?	
C2d	Is there any public land in your community? 1.Yes 2.No	
C2d1	How often do you use the public land? <i>Please select from 0 to 10: 0(very rarely) 1 2 3 4 5(neutral) 6 7 8 9 10(very often)</i>	
C2e	Which marketing channel does your family adopt to sell your products? 1.self-selling 2.small scale cooperative marketing 3.big scale cooperative marketing 4.government-arranged purchase/selling	
C2f	How are your products selling? <i>Please select from 0 to 10: 0(very poor) 1 2 3 4 5(neutral) 6 7 8 9 10(very good)</i>	
C2g	Does your family receive adequate support and training on agricultural production? <i>Please select from 0 to 10 0(very insufficient) 1 2 3 4 5(neutral) 6 7 8 9 10(very sufficient)</i>	
C2h	Does your family receive adequate support and training on off-farm skills? <i>Please select from 0 to 10 0(very insufficient) 1 2 3 4 5(neutral) 6 7 8 9 10(very sufficient)</i>	

C3 Economic Conditions

		2007
C3a	What was your household's annual income? <i>(Yuan : (including all sources of income before tax and insurances are taken). For a-e, how many percentages does each income source contribute to the total annual income of your family? Please fill the percentages for each income source, which sum up to be 100%.</i>	
	a. primary industry production (including farming, animal husbandry, fishery, forestry)	
	b. Non-agricultural production and business (including mining, manufacturing, construction, tourism and services, etc.)	
	c. wages and salaries	
	d. social security, subsidy and compensation from government	
C3b	Please estimate your family's total annual consumptive expenditure <i>(Yuan) :</i> For a-f, how many percentages does each category contribute to the total annual expenditure of your family? <i>Please fill the percentages for each category, which sum up to be 100%.</i>	
	a. daily life consumption (including food, clothes, Non-food groceries, etc.)	
	b. housing and family equipment	
	c. education, sports, leisure and entertainment	
	d. medical and health services	
	e. investment into production or business	
C3c	If you selected 'e' in C3b, Please tick the industries to which you invested and fill the percentages for each ticked industry, which sum up to be 100%.	a. primary industry production (including farming, animal husbandry, fishery, forestry) <input type="checkbox"/> ()
		b. private industry/factory <input type="checkbox"/> ()
		c. tourism, catering, service and retailing <input type="checkbox"/> ()
C3d	Accumulative total family savings <i>(Yuan):</i>	
C3e	Accumulative total family debts <i>(Yuan):</i>	
D3g	Please rate the gap between rich and poor in our village: <i>Please select from 0 to 10 0(very small) 1 2 3 4 5(neutral) 6 7 8 9 10(very large)</i>	
D3h	Please indicate the economic ranking of your family in the village: <i>Please select from 0 to 10 0(very low) 1 2 3 4 5(neutral) 6 7 8 9 10(very high)</i>	
D3i	Please rate the rich-poor gap between your village and other nearby villages: <i>Please select from 0 to 10 0(very small) 1 2 3 4 5(neutral) 6 7 8 9 10(very large)</i>	

D Housing and Transportation

		2007
D1	Source of the property: 1. rent housing 2. temporary but free accommodation provided by the government, employer, relatives or friends 3.self-built 4.cooperatively built 5.pay for others to build 6.purchased second hand property 7.others: _____	
D2	Construction structure of the property: 1.mud 2.wood 3.brick 4.concrete 5.tent 6.thatch 7.other: _____	
D3	How large was your house? (m2):	
D4	Please tick if your property has the facilities.	<input type="checkbox"/>
	a. tap water	<input type="checkbox"/>
	b. electricity	<input type="checkbox"/>
	c. renewable energy (e.g. solar power, wind power, bio-gas, etc.)	<input type="checkbox"/>
	d. toilet	<input type="checkbox"/>
	e. separated room for livestock and poultry	<input type="checkbox"/>
	f. air-conditioning equipment	<input type="checkbox"/>
D5	How do you agree with the statement 'my house is totally resistant to various disasters': <i>Please select from 0 to 10</i> 0(strongly disagree) 1 2 3 4 5(neutral) 6 7 8 9 10(strongly agree)	
D6	How satisfied (or dissatisfied) you were with your house? Please select from 0 to 10 0(Not satisfied at all) 1 2 3 4 5(neutral) 6 7 8 9 10(very satisfied)	
D7	Please indicate, Normally, the average time taken to reach the destinations from your home (minutes):	
	a. (if No tap water) the nearest water resource	
	b. the most distant workplace	
	c. school	
	d. market usually visited	
	e. the nearest public transportation	

E Social Capital

		2007
E1	Who provided help when your family faced difficulties? (please use ',' to separate different choices) 1.relatives and friends 2.neighbors and village fellows 3.colleagues and classmates 4.government 5.Non-government organizations 6.others: _____	
E1a	Who provided the main support?	
E2	What kinds of help did your family receive? (please use ',' to separate different choices) 1. money and goods loan 2. money and goods donation 3.assistance in production or housework 4. providing information 5. emotional support 6. assistance in family member care 7. providing transportation 8. providing accommodation 9. other : _____	
E2a	Which is the biggest help to your family?	

E3	Please rate the social relationship of your family: <i>Please select from 0 to 10</i> 0(very poor) 1 2 3 4 5(neutral) 6 7 8 9 10(very good)	
	a. relationship between family members	
	b. relationship with neighbours and village fellows	
	c. relationship with relatives and friends	
	d. relationship with colleagues	
	e. relationship with government cadres	
f. relationship with other ethnicities		
E4	How often did your family participate in the following affairs? <i>Please select from 0 to 10</i> 0(never) 1 2 3 4 5(neutral) 6 7 8 9 10(always)	
	a. discussion of public affairs in your village	
	b. organising public activities in your village	
	c. providing advice to other villagers	
d. solving conflicts between other villager		
E5	Is any of your relatives and good friends a cadre of the village, township or county? 1.Yes 2.NO	
E6	Is any of your relatives and good friends a successful entrepreneur? 1.Yes 2.NO	
E7	Do your family and family members join in any production and marketing cooperative organisation? 1.Yes: _____ 2.NO	
E8	What information sources are accessible for your family? <i>(please use ',' to separate different choices)</i> 1.internet 2.mobile phone 3.land line phone 4.TV 5.radio broadcast 6.newspaper 7.told by relatives/friends/neighbours 8.Notice from workplace/school/village committee 9.report and advocacy activities from government 10.other: _____	
E8a	Which is the main information source of your family?	
E9	What kinds of help did your family provide to others? <i>(please use ',' to separate different choices)</i> 1.gaving money and goods 2.lending money and goods 3.providing housing 4. taking care of family members 5.helping with production and housework 6.provided transportation 7.relieing mental pressure 8.providing information of employment, production and marketing 9.other : _____	What kinds of help did you provide?
		Which is the biggest help?
		In cash equivalent
E10	Were any of your relatives and good friends living in other counties within the same city? 1.Yes 2.NO	
E11	Were any of your relatives and good friends living in other cities/counties/districts within the same province? 1.Yes 2.NO	
E12	Were any of your relatives and good friends living in other provinces? 1.Yes 2.NO	

F Health Status

F1	Codes of all people living in the same household: <i>Same as A1b</i>		1	2	3	4	5	6	7	8
F2	In general, would you say your family members' health is: <i>Please select from 0 to 10</i> 0(very poor) 1 2 3 4 5(neutral) 6 7 8 9 10(very good)	2007								
F3	Do your family members have following health conditions? <i>(please use ',' to separate different choices)</i> 1.sensory 2.intellectual 3.physical 4.psychological 5.No health condition	2007								
F4	What degree of limitation on core-activity (communication, mobility and self-care) is caused by the health conditions? 1.mild core-activity limitation 2.moderate core-activity limitation 3.severe core-activity limitation 4.profound core-activity limitation	2007								
F5	Please indicate the daily hours used in caring the family members having health conditions.	2007								

G Perception of the Significance of Each Aspect of the Family Life

H1	How do you rate the significance of different aspects of life? <i>Please select from 0 to 10</i> 0(Not important at all) 1 2 3 4 5(neutral) 6 7 8 9 10(very important)		
		2007	2007
	a. agricultural production		g. health status of family members
	b. household income		h. good relationship between family members
	c. career development and education of family members		i. social capital
	d. conditions of infrastructure , education and medical services		j. government's policies of agriculture, economy and environment
	e. housing condition		k. religion, culture and customs
	f. climatic condition and natural environment		l. other: _____
H2	In general, how satisfied (or dissatisfied) you are with your life? <i>Please select from 0 to 10</i> 0(Not satisfied at all) 1 2 3 4 5(neutral) 6 7 8 9 10(very satisfied)		

 The End, Thank You

Appendix 2: Interview with the village officials on the impacts of climate change on migration of rural residents in Minqin

This survey is part of the research project Adaptation to Climate Change and Mobility of People in the Rural Areas of China conducted by Lanzhou University and the University of Adelaide. We would like you to spend some time for this interview. All information to be collected via this survey is for the purpose of research only. We will keep the information confidential and will not be disclosed to any third part according to the regulations concerned. If you agree to participate in the survey, please tick ✓_____.

**The Impacts of Climate Change on Migration of Rural Residents
Interview with Village officials**

Name of Respondent		Age		Sex	
County/City		Town		Village	
Employer		Occupation		Ethnicity	
Name/code of the interviewer		Date of the interview (yyyy/mm/dd)		Code of Survey	

Part A. Effects of climate change and adaptation to Climate Change

1. What kind of climate change has the most severe impacts on your village?
2. How has climate change impacted on economic, social and environmental conditions in your village?
3. Please estimate the direct and indirect economic loss caused by events associated with climate change. (Yuan/Year)
4. What measures has your village adopted, and will adopt, to cope with the adverse impacts of climate change?
5. In what ways did villagers participate in planning and operating these adaptation programs?

Part B. Population and migration

6. Please provide the number of: (1) registered population; (2) residential population; (3) in-migrants; and (4) out-migrants.
7. What support did your village provide to in-migrants and out-migrants respectively?
8. What are the influences of in-migration and out-migration on your village?

Part C. Conditions of different aspects of the village

9. Please estimate net income per capita in your village.
10. What is the absolute poverty ratio in your village?
11. What are the main income sources of the villagers?
12. How many acres of usable land in your village?
13. How much is the per capita water capacity in your village? (m3)
14. How much is the per capita power capacity in your village? (watt)
15. Please describe the development of new energy in your village.
16. Please provide the information of cooperative organisation in your village.
17. Please describe the participation of households in rural pension system and new rural cooperative medical insurance system.
18. Which institutions have been involved in adaptation programs in your village?
19. How did your village spend its public funding?

_____ **The End, Thank You** _____

Appendix 3: Questions and coding of explanatory and control variables

Appendix 3.1: Questions and coding of measures of household's economic status in Minqin

Name of measure	Survey questions	Coding
Household income	<p>What was your household's annual income in 2007?</p> <p>How many members did your family have in 2007?</p>	Numerical number: the annual income per capita (Yuan)
Income diversity	<p>Please indicate the occupation type of your family members in 2007?</p> <ol style="list-style-type: none"> 1. agricultural, forestry, husbandry and fishery production 2. small private business 3. labour work in manufacturing, construction and transportation industry 4. labour work in service industry 5. sales in business industry 6. business administration and management 7. technical or professional work 8. enterprise operation 9. service in public institutions (e.g., education, science and technology, culture, health work) 10. government officers 11. other 	For each income source, the responses are coded 1 if the family had this source and 0 otherwise. Then the coding values of each income source are summed up to get the total number of income sources owned by the family, ranging from 0 to 11.
Land size	<p>How many contracted land did your family have in 2007? (mu)</p> <p>How many members did your family have in 2007?</p>	Numerical number: the quantity of land per capita (mu)
Living size	<p>How large was your house in 2007? (m2)</p> <p>How many members did your family have in 2007?</p>	Numerical number: the living size per capita (m2)
Satisfaction with housing	How satisfied (or dissatisfied) you were with your house in 2007?	The responses are coded from 0 (least satisfied) to 10 (most satisfied). 0 and 1 are recoded to 'very unsatisfied'; 2 and 3 are recoded to 'unsatisfied'; 4, 5 and 6 are recoded to 'neutral'; 7 and 8 are recoded to 'satisfied'; 9 and 10 are recoded to 'very satisfied'.

Appendix 3.2: Questions and coding of measures of household's social status in Minqin

Name of measure	Survey questions	Coding
Relationship	<p>Please rate the relationship between family members in 2007.</p> <p>Please rate the relationship of your family with neighbours and village fellows in 2007.</p> <p>Please rate the relationship of your family with relatives and friends in 2007.</p> <p>Please rate the relationship of your family with colleagues in 2007.</p> <p>Please rate the relationship of your family with government cadres in 2007.</p>	<p>The responses are coded from 0 (the poorest relationship) to 10 (the best relationship). 0 and 1 are recoded to 'very poor'; 2 and 3 are recoded to 'poor'; 4, 5 and 6 are recoded to 'neutral'; 7 and 8 are recoded to 'good'; 9 and 10 are recoded to 'very good'.</p>
Connection with government officer or entrepreneur	<p>Is any of your relatives and good friends a cadre of the village, township or county in 2007?</p> <p>Is any of your relatives and good friends a successful entrepreneur in 2007?</p>	<p>The responses are coded 1 if yes and 0 otherwise</p>
Spatial connection (connection with people living outside the original township)	<p>Were any of your relatives and good friends living in other counties within the same city in 2007?</p> <p>Were any of your relatives and good friends living in other cities/counties/districts within the same province?</p> <p>Were any of your relatives and good friends living in other provinces?</p>	<p>For each question, the responses are coded as 1 if yes and 0 otherwise. Then the coding values of each question are summed up to get the total number of other places where the family's relatives and good friends living in, ranging from 0 to 3.</p>
Assistance received	<p>What kinds of help did your family receive by 2007?</p> <ol style="list-style-type: none"> 1. money and goods loan 2. money and goods donation 3. assistance in production or housework 4. providing information 5. emotional support 6. assistance in family member care 7. providing transportation 8. providing accommodation 9. others 	<p>For each kind of help/assistance, the responses are coded 1 if the family received this kind of help/assistance and 0 otherwise. Then the coding values of each kind of help/assistance are summed up to get the total number of types of help/assistance received by the family, ranging from 0 to 9.</p>

Appendix 3.3: Questions and coding of measures of households' cultural status in Minqin

Name of measure	Survey questions	Coding
Education	Please indicate your family members' educational attainment.	The highest educational attainment in a family is coded as 1=no schooling, 2=primary school, 3=middle school, 4=high school, 5=college diploma, 6=undergraduate degree, and 7=postgraduate degree.

Appendix 3.4: Questions and coding of measures of households' symbolic status in Minqin

Name of measure	Survey questions	Coding
Symbolic status		
Occupational prestige	<p>Please indicate the occupation type of your family members in 2007?</p> <ol style="list-style-type: none"> 1. agricultural, forestry, husbandry and fishery production 2. small private business 3. labour work in manufacturing, construction and transportation industry 4. labour work in service industry 5. sales in business industry 6. business administration and management 7. technical or professional work 8. enterprise operation 9. service in public institutions (e.g., education, science and technology, culture, health work) 10. government staff 	<p>Based on Li (2005)'s occupational prestige ranking system of China, occupation type 1 and 4 are recoded to ranking score 2, occupation type 2, 3, 5 are recoded to ranking score 3, occupation type 6, 7, 8, 9 are recoded to ranking score 4, occupation type 10 are recoded to ranking score 5. The highest ranked occupation in a family is coded as from 0 (the lowest ranking score) to 7 (the highest ranking score).</p>
Local reputation	<p>How often did your family participate in discussion of public affairs in your village by 2007?</p> <p>How often did your family members organise public activities in your village by 2007?</p> <p>How often did your family members provide advice to other villagers by 2007?</p> <p>How often did your family members solve conflicts between other villagers by 2007?</p>	<p>The responses are coded from 0 (never) to 10 (always). 0 and 1 are recoded to 'very rare'; 2 and 3 are recoded to 'rare'; 4, 5 and 6 are recoded to 'neutral'; 7 and 8 are recoded to 'often'; 9 and 10 are recoded to 'very often'.</p>

Appendix 3.5: Questions and coding of measures of household's political status in Minqin

Name of measure	Survey questions	Coding
Political affiliation	Do you have a family member who is a member of CPC?	The responses are coded 1 if yes and 0 otherwise
Government officer	Do you have a family member who is a government officer?	The responses are coded 1 if yes and 0 otherwise
Government assistance	How much help did government provide to your family when you facing difficulties by 2007?	The responses are coded from 0 (very little) to 10 (very much). 0 and 1 are recoded to 'very little'; 2 and 3 are recoded to 'little'; 4, 5 and 6 are recoded to 'neutral'; 7 and 8 are recoded to 'much'; 9 and 10 are recoded to 'very much'.
Satisfaction with participation	How satisfied (or dissatisfied) you were with your chance to participate in the policy-making processes?	The responses are coded from 0 (least satisfied) to 10 (most satisfied). 0 and 1 are recoded to 'very unsatisfied'; 2 and 3 are recoded to 'unsatisfied'; 4, 5 and 6 are recoded to 'neutral'; 7 and 8 are recoded to 'satisfied'; 9 and 10 are recoded to 'very satisfied'.

Appendix 3.6: Questions and coding of demographic factors that influence the impacts of climate change on households

Name of measure	Survey questions	Coding
Health	Does any family member have disability or chronic disease in 2007?	The responses are coded 1 if yes and 0 otherwise.
Male ratio	Please indicate the gender of each of your family members.	The ratio of male aged 15 years or older to the total number of the household members aged 15 years or older.
Household size	How many members did your family have in 2007?	The number of people in the household.
Age of household head	Which year was the household head born?	The household head's age.
Household with elderly member(s)	Which year were the family members born?	The responses are coded 1 for each family member aged 60 years or older and 0 otherwise. Then the coding values are summed up to get the total number of aged people in the family.
Dependency ratio	Which year were the family members born?	The responses are coded 1 for each family member aged 60 years or older and 14 years or younger and 0 otherwise. The coding values are summed up to get the total number of dependent people in the family. Then the ratio of dependent people to the total number of the household members is calculated.

Appendix 4: The policies that consider inequality

Policy	Issued by	Time	Source
Climate change			
<i>National</i>			
China's Policies and Actions for Addressing Climate Change (2008)	National Development and Reform Commission	2008	http://www.gov.cn/zwggk/2008-10/29/content_1134378.htm
China's Policies and Actions for Addressing Climate Change (2009)	National Development and Reform Commission	2009	http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File572.pdf
China's Policies and Actions for Addressing Climate Change (2010)	National Development and Reform Commission	2010	http://www.fdi.gov.cn/1800000121_21_3394_0_7.html
China's Policies and Actions for Addressing Climate Change (2011)	National Development and Reform Commission	2011	http://www.scio.gov.cn/zxbd/tt/Document/1052047/1052047.htm
China's Policies and Actions for Addressing Climate Change (2012)	National Development and Reform Commission	2012	http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File1323.pdf
China's National Climate Change Programme	National Development and Reform Commission	2007	http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File189.pdf
<i>Regional</i>			
Gansu Province's Climate Change Programme	Gansu Province Government	2009	http://www.forestry.gov.cn/portal/thw/s/1807/content-162789.html
Ecology and environment			
<i>National</i>			
Key Management Planning for Shiyang River Basin	National Development and Reform Commission, Ministry of Water Resources	2007	http://www.sdpc.gov.cn/fzgggz/fzgh/ghwb/115zxgh/200806/P020080721336132336246.pdf
China's 12 th Five-Year Plan for Ecology Protection	Ministry of Environment Protection	2012	http://www.gov.cn/gongbao/content/2013/content_2396624.htm . Accessed Oct 2014

Local

Minqin county's Post-Management Plan for Shiyang River Basin	Minqin County Government	2012	http://www.minqin.gansu.gov.cn/(S(tlyf3p454sybHH45cuotidvc))/Government/PublicInfoList.aspx?DepartmentId=42&page=16
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water and land**National**

Key Management Planning for Shiyang River Basin	National Development and Reform Commission, Ministry of Water Resources	2007	http://www.sdpc.gov.cn/fzgggz/fzgh/ghwb/115zxgh/200806/P020080721336132336246.pdf
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Regional

Gansu's Pilot Plan to Accelerate Water Reform	General Office of People's Government of Gansu Province	2012	http://www.gansu.gov.cn/gtb/index2.jsp?url=http%3A%2F%2Fwww.gansu.gov.cn%2Fart%2F2012%2F7%2F24%2Fart_4843_206851.html
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Guidance for Water Allocation and Perfection of Water Right System in 2010	Wuwei City Party Committee	2009	http://www.wuwei.gansu.gov.cn/zwgk/gkml/fggw2/zfwj/23131.htm
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Local

Minqin county's Plan for Water Allocation in 2010	Minqin County Government	2009	http://www.minqin.gansu.gov.cn/(S(sfj5mny51doogr55noxvy0by))/Government/PublicInfoShow.aspx?ID=433
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Minqin county's Plan for Water Allocation in 2012	Minqin County Government	2011	http://www.minqin.gansu.gov.cn/(S(sfj5mny51doogr55noxvy0by))/Government/PublicInfoShow.aspx?ID=433
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Minqin county's Management Plan of Agricultural Water Price	General Office of Minqin County Government	2011	http://gkdt.minqin.gov.cn/Item/22440.aspx
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Agriculture development and adjustment

National

Several Opinions of the General Office of the State Council of the People's Republic of China, on Further Supporting Economic and Social Development of Gansu Province	General Office of the State Council	2010	http://www.gov.cn/zwqk/2010-05/06/content_1600275.htm
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Regional

Gansu Province's 12 th Five-Year Plan for Agricultural Development	General Office of People's Government of Gansu Province	2011	http://www.yc.jckj.gov.cn/ghyjh/detail.php?n_no=157021
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Wuwei City's 12 th Five-Year Plan for Under-Forest Economy	Wuwei City Government	2012	http://ww.gsly.gov.cn/content/2012-12-11/6754.html
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Local

Minqin County's Implementation Plan for Improved Varieties Subsidy Program in 2012	General Office of Minqin County Government	2012	http://www.minqin.gansu.gov.cn/Item/20324.aspx
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Minqin County's Implementation Plan for Direct subsidies for grain producers and general subsidies for purchasing agricultural supplies in 2012	General Office of Minqin County Government	2012	http://www.minqin.gov.cn/Government/PublicInfoShow.aspx?ID=599
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Minqin County's Implementation Plan for Direct subsidies for grain producers and general subsidies for purchasing agricultural supplies in 2011	Minqin County Government	2011	http://www.minqin.gansu.gov.cn/(S(ucffdv45yms0cc45itbkpa55))/Government/PublicInfoShow.aspx?Id=253
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Minqin County's Development Plan for Grass Planting and Animal Husbandry 2008-2010	Minqin County Government	2008	http://gkdt.minqin.gov.cn/Item/9695.aspx
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Migration***National***

Key Management Planning for Shiyang River Basin	National Development and Reform Commission, Ministry of Water Resources	2007	http://www.sdpc.gov.cn/fzgggz/fzgh/ghwb/115zxgh/200806/P020080721336132336246.pdf
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Regional

Gansu Province's 12th Five-Year Plan for Anti-Poverty by Relocating	General Office of People's Government of Gansu Province	2011	http://www.gansu.gov.cn/module/download/downfile.jsp?classid=0&filename=1401241559119087319.doc
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Local

Plan of Post-Migration Management for Migrant Receiving Areas in Minqin	General Office of Minqin County Government	2009	http://www.minqin.gansu.gov.cn/Item/19190.aspx
Implementation Plan for Ecological Migration Pilot in Zhengxin Village of Donghu Township	General Office of Minqin County Government	2008	http://www.minqin.gansu.gov.cn/Government/PublicInfoShow.aspx?ID=188
Implementation Plan for Construction of Migrants Receiving Areas on Farmland of Datan Township	General Office of Minqin County Government	2008	http://www.minqin.gansu.gov.cn/Government/PublicInfoShow.aspx?ID=186

Education***National***

Several Opinions of the General Office of the State Council of the People's Republic of China, on Further Supporting Economic and Social Development of Gansu Province	General Office of the State Council	2010	http://www.gov.cn/zwgk/2010-05/06/content_1600275.htm
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The Outline of the National Plan for Medium and Long-Term Education Reform and Development	Ministry of Education	2010	http://www.gov.cn/jrzq/2010-07/29/content_1667143.htm
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Regional

The Outline of Gansu Province's Plan for Medium and Long-Term Education Reform and Development	Department of Education, Gansu Province	2010	http://www.gsedu.gov.cn/Article/Article_5032.aspx
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Local

The Outline of Minqin county's Plan for Medium and Long-Term Education Reform and Development	Minqin County Party Committee, Minqin County Government	2011	http://www.mqjy.minqin.gov.cn/ZWGK/ShowArticle.asp?ArticleID=860
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Disaster prevention and relief

Local

Emergency Notification on Precaution for Temperature Fall, Snowfall and Strong Winds	General Office of Minqin County Government	2012	http://gkdt.minqin.gov.cn/(S(idiff5upl4dbby45byavnj2))/Government/Search.aspx?page=16
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Plan for Work Distribution of Geological Disaster Prevention	General Office of Minqin County Government	2012	http://www.minqin.gov.cn/Government/PublicInfoShow.aspx?ID=727
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Minqin County's Plan for Rapid Responding to Sand Storms	Minqin County Government	2011	http://www.minqin.gov.cn/Government/PublicInfoShow.aspx?ID=202
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Emergency Notification on Precaution for Fire Hazards Caused by Strong Wind	General Office of Minqin County Government	2010	http://www.minqin.gansu.gov.cn/Government/PublicInfoShow.aspx?ID=153
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New energy***National***

China's 12th Five-Year Plan for Energy Development	State Council	2012	http://www.gov.cn/zwggk/2013-01/23/content_2318554.htm
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Regional

Gansu Province's 12th Five-Year Plan for New Energy and Renewable Energy Development	General Office of People's Government of Gansu Province	2012	http://www.gansu.gov.cn/art/2013/5/30/art_484_189583.html
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Local

Minqin County's Plan for Biogas Construction in Rural Areas	General Office of Minqin County Government	2009	http://www.minqin.gansu.gov.cn/Government/PublicInfoShow.aspx?ID=79
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