



## Responses to climate change and farming policies by rural communities in northern China: A report on field observation and farmers' perception in dryland north Shaanxi and Ningxia

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### ABSTRACT

To address land degradation and rural poverty the Chinese government has put in place a series of land conversion programmes in the Loess Plateau area in northern China. In addition to problems arising from unsustainable land use, water resource availability driven in part by climatic forcing is also a threat to livelihoods in this region. To understand climate impacts on farming practice in poor areas of China, field observation and village reconnaissance took place in the summer of 2009 in three selected counties of Shaanxi and Ningxia Province, northern China. Semi-structured interviews were undertaken with householders in rural communities aiming to explore the impacts of recent climate and environmental changes and the role of land management practices on individual and community livelihood incomes as well as individual understanding and engagement with these concepts. The findings were complemented with secondary agricultural, economic and climatic data from the study regions. Respondents argued that land conversion programmes improved income potential, sustainability of livestock grazing and environmental quality in the region. However, water availability was thought to increasingly limit agriculture and human wellbeing in some of the regions with water resources becoming notably scarcer. Understanding of climate change as a concept varied amongst farmers potentially hampering the ability to adapt existing farming practices to maximise livelihood incomes sustainably. Positive effects of the government's land management schemes were unevenly distributed within villages and amongst regions, often linked to a lack of knowledge transfer and shared resources resulting in marginalised households and/or communities. Off-farm labour (in many cases relating to young adult rural to urban migration) appears a crucial source of income for households in the study region. Respondents in Ningxia expressed reservations about the future prospect of productive farming if the water availability continued to diminish.

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### Introduction

The Loess Plateau and surrounding dryland regions of northern China have suffered severe soil erosion and environmental degradation linked to farming practices (He et al., 2006). This degradation has impacted strongly on the livelihoods of the rural poor but also on the supply and quality of the water in the Yellow River (Yang, 2004; Wang et al., 2006; Shi et al., 2010). To cope with the above challenges, land management programmes for ecological restoration, including the Natural Forest Conservation Programme (NFCP) and 'The Grain for Green programme' (GGP), were initiated by the

Chinese Government in the late 1990s with the aim to reduce deforestation, erosion and flooding in the Yellow River and Yangtze River basins. The NFCP aimed to afforest 31 million hectares (ha) by 2010 and by 2005 this programme had already increased the forested areas by 11 million ha (Liu et al., 2008a,b) with the programme covering ca. 42% of the land surface in China by 2000 (Yang, 2004). The GGP had since its introduction in 1999 resulted in the conversion of ca. 20 million ha in 2005, the goal is to convert 32 million ha by 2010 (Liu et al., 2008a,b). The main methods for achieving this has been afforestation, the reduced use of marginal land and reduced grazing pressure (Cao et al., 2009a).

It has been argued that these land management programmes have positively affected a range of ecosystem services, e.g. landscape carbon sequestration, reduced soil erosion and pressure on water resources (Liu et al., 2008a,b). However, in arid and semi arid zones afforestation has been associated with soil ecosystem

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deterioration and reduced vegetation cover (Cao et al., 2011). In these areas improved ecosystem services such as reduction in sand storms and carbon sequestration may be more effectively achieved by protecting/restoring natural ecosystem (Cao, 2008; Wang and Cao, 2011). Furthermore, in arid and semi-arid areas tree planting reduced water availability compared to abandoned land areas populated with shrubby vegetation (Cao et al., 2009a). This indicates that care needs to be taken particularly in water stressed areas to ensure that the land conversion programmes meet their wider goals and does not exacerbate water stress in already dry regions (Cao et al., 2010a). Furthermore, the long term success for these conversion programmes depends on how rural communities decide to manage the land under conversion when government subsidies provided for uptake of land management schemes are withdrawn in 2018. Currently a large proportion (ca. 37%) of farmers in Shaanxi Province (Cao et al., 2009b) and more widely in other regions of China (Uchida et al., 2005) plan to recultivate converted land when government subsidy payments end. Plans to reconvert GGP land appear strongly linked to household income (Chen et al., 2009a,b) but also farmers' perception of the success of the programme (Cao et al., 2009a).

In addition to controlling land degradation and soil erosion, the GGP sought to provide a financial mechanism to alleviate poverty in rural communities. This has been achieved partly through compensation received by the farmers for the land conversions being greater than the income from the land under the original farming practice (Uchida et al., 2005), but also through increased income from livestock and increased value of their assets (Uchida et al., 2007). The GGP has also shaped on- and off-farm labour time with more time allocated to off-farm labour (Uchida et al., 2009) with potential impact on household income generation.

In addition to the land degradation problems, the farmers on the Loess Plateau and surrounding dryland regions are facing water stress and increased temperatures. Climate change is predicted to create major stresses on the whole agricultural sector in China by 2100 (Xiong et al., 2009; Piao et al., 2010) mainly linked to changes in water availability. Indeed, the north of China holds only 18% of the total available water resources in China whilst having 65% of the arable land (Piao et al., 2010). On the Loess Plateau, the increased risk of drought and high intensity rainfall (Piao et al., 2010) will exacerbate existing erosion problems in the area (Zhang et al., 2009). Indeed, changes in the climate over the last 30 years have increased the crop water deficit in the north China Plain (Wang et al., 2008). So far farmers have attempted to alleviate this water deficit through increased irrigation. However, recent water shortages and reduced discharge in the Yellow River resulting from intensive irrigation up stream (Wang et al., 2006) have shifted farmer activities from securing water for enhancing growth of cereals towards improving the efficiency of irrigation practices, animal husbandry and off-farm income generation (Liu et al., 2008a,b). Such adaptation of farming systems is crucial to reduce the impacts of climate change on food production (Xiong et al., 2009).

To better understand how communities view climate change impacts on farming in dryland north China, we undertook field observations and community engagement in the summer of 2009 in three counties of Shaanxi and Ningxia which are characterised by: (i) a strong climatic gradient from the central Shaanxi to the north Ningxia associated with the decreasing incursion of the southeast Asian monsoon in summer, and (ii) reasonable uptake of the GGP (Fu et al., 2006; Zhou et al., 2009). Given existing ecological restoration and poverty alleviation programmes which have taken place across this region over the last decade, we sought to highlight the impact of government interventions on agricultural practice and farming communities in relation to the existing climate gradient and any perceived climate change. Individual households were visited and semi-structured interviews undertaken in Chinese

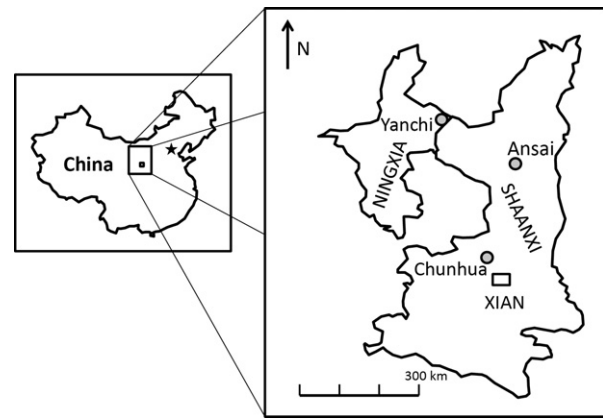


Fig. 1. Map of the study area in north Central China, showing the location of the three counties visited, Chunhua, Ansai and Yanchi.

and simultaneously translated. During the interviews farmers were questioned about their relationship with the land, the environment and the climate and how the policy initiatives over recent years have or have not impacted on practice. We explored with respondents whether they felt that government initiatives had impacted upon their livelihoods and/or the surrounding ecosystem services.

## Methods

### Study area

The fieldwork was undertaken in June 2009 and involved data collection from a series of communities across central-north Shaanxi and Ningxia Provinces, chosen to represent a range of climatic conditions and farming practice. The research sites included three villages in each of the following counties: Chunhua (central Shaanxi), Ansai (northern Shaanxi) and Yanchi (Ningxia Autonomous Region) [see Fig. 1]. At each site members of the research team (comprising a number of Chinese and UK based academics with a range of interdisciplinary interests including agriculture, climatology, ecology and economics) interviewed a combination of local government officers, village leaders, agricultural extension specialists and farmers; particular importance was given to the voice of farmers since communities respond to change through individuals. During the visits observational data were also collected and together with the available literature used as a method of placing the interviews in context. The research is therefore based on a sample size of 30 farmers in each of the three sites ( $n=90$ ) and meetings at each of the three sites with county governors and officers ( $n=30$ ).

### Data collection

The interviews were based on a standard proforma of key questions and were carried out with small groups of 1–5 respondents, depending upon household. During interviews, farm size, household income, crop or livestock holdings, environmental conditions, and the involvement in and perception of the success of the GGP were explored. Farmers' appreciation of recent and projected changes in climate, their perception of trends in the climate as well as their adaptation to changes in the climate were noted as well as their views of any changes to the environment within respondents' lifetime.

In each selected county, a meeting with a governor and relevant government department officers was arranged which allowed the research team to report preliminary findings from observations

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