AEA

Impacts of Climate Change on Chinese Agriculture – Phase II

Adaptation Framework and Strategy

Part 3: An Adaptation Strategy for Agriculture in Ningxia, Northwest China

Report to DEFRA (now DECC) and DfID

ED 02264
Issue 2
October 2008

University of East Anglia

Title	Impacts of Climate Change on Chinese Agriculture – Phase II Adaptation Framework and Strategy An Adaptation Strategy for Agriculture in Ningxia, Northwest China
Customer	DEFRA (transferred to the Department of Energy and Climate Change, DECC, in October 2008) and DfID
Customer reference	GAO1085
Confidentiality, copyright and reproduction	Copyright AEA Technology plc This report is the Copyright of Defra (transferred to the Department of Energy and Climate Change, DECC, in October 2008) and has been prepared by AEA Technology plc under contract to Defra dated 15 August 2005. The contents of this report may not be reproduced in whole or in part, nor passed to any organisation or person without the specific prior written permission of Defra/DECC. AEA Technology plc accepts no liability whatsoever to any third party for any loss or damage arising from any interpretation or use of the information contained in this report, or reliance on any views expressed therein.
File reference	N:\FES\Projects\International\ED02264 Impacts of CC on Chinese Agriculture 2\Deliverables\2008 deliverables
Reference number	ED02264 – Issue Draft 2

AEA
The Gemini Building
Fermi Avenue
Harwell International Business Centre
Didcot OX11 0QJ
United Kingdom

T: +44 (0) 870 190 1900
F: +44 (0) 870 190 6318

AEA is a business name of AEA Technology plc

AEA is certificated to ISO9001 and ISO14001

Author[1]	Name	Ju Hui, Declan Conway, Li Yue, Alex Harvey, Lin Erda, Susana Calsamiglia-Mendlewicz
Approved by	Name	Philippa Harris
	Signature	
	Date	October 2008

[1] This report should be cited as: Ju Hui , Conway D., Li Yue, Harvey A., Lin Erda and Calsamiglia-Mendlewicz S. (2008) *Adaptation Framework and Strategy Part 3: An Adaptation Strategy for Agriculture in Ningxia, Northwest China*. The Impacts of Climate Change on Chinese Agriculture. AEA Group, UK.

Project Background

The project *Impacts of Climate Change on Chinese Agriculture* (ICCCA) was funded by the UK Government's Department for Environment, Food and Rural Affairs (Defra – transferred to the Department of Energy and Climate Change, DECC, in October 2008) and Department for International Development (DFID), conducted in partnership with China's Ministry of Science and Technology (MOST).

Since 2001, the project has led the way in understanding how climate change can be expected to affect rural China.

The project was rolled out in two phases: Phase I (2001 to 2004) applied regional climate modelling to construct several possible future climate scenarios for China. These were subsequently fed into a suite of regional crop models adapted by the Institute of Environment and Sustainable Development in Agriculture (previously the Agrometeorology Institute) of the Chinese Academy of Agricultural Sciences (CAAS), in collaboration with UK climate-change researchers, to determine the potential impacts of climate change on crop yields in China up to 2100.

Building on Phase I, Phase II (2005 to 2008) refined and widened the national level analysis. CAAS also worked in collaboration with major regional implementers such as the Clean Development Mechanism Service Centre (Ningxia) and Meteorological Study Institute (Ningxia), and engaged a range of stakeholders to assess the impact of climate change on rural livelihoods. This led to the development of the first regional adaptation framework in China – for the northern province of Ningxia.

The key findings and approaches for the project are summarised in six pamphlets. These are:

- *Overall summary of results*
- Understanding how China's climate may change in the future
- *Modelling the impacts of climate change on cereal production in China*
- *Modelling the interaction of climate change - water availability and socio-economic scenarios on cereal production*
- *Rural livelihoods and vulnerability to climate hazards in Ningxia*
- *An adaptation framework and strategy for Ningxia*

The full technical reports from the project can be found at www.china-climate-adapt.org. These are:

- *National Level Study: The Impacts of Climate Change on Cereal Production in China*
- *Future Cereal Production in China: Modelling the Interaction of Climate Change,Water Availability and Socio-Economic Scenarios*
- *Climate and Livelihoods in Rural Ningxia*
- *Climate Change in Ningxia: Scenarios and Impacts. Technical Report.*
- *Adaptation Framework and Strategy:*
  - *Part 1 – A Framework for Adaptation*
  - *Part 2 – Application of the Adaptation Framework: A Case Study of Ningxia, Northwest China*
  - *Part 3 – An Adaptation Strategy for Agriculture in Ningxia, Northwest China*

Further details are available from:

AEA Group (Project Managers, UK)
Email: info@aeat.co.uk
Telephone: +44 (0) 870 190 1900/6374

Chinese Academy of Agricultural Sciences
Email: Professor Lin Erda
lined@ns.ami.ac.cn
Telephone: +86 10 8210 5998

Project Team

The project team comprised the Institute of Environment and Sustainable Development in Agriculture of the Chinese Academy of Agricultural Sciences (CAAS), AEA Group, who managed the project and provided technical input, and Dr. Declan Conway of the University of East Anglia as Scientific Advisor. The project has benefited from the contribution of numerous partners and stakeholders in both China and the UK. Collaborative research links have been forged resulting in new insights into the scientific and policy challenges posed by climate change in China over the next century.

Acknowledgments

Key collaborators

China

- Chinese Ministry of Science and Technology
- National Development and Reform Commission
- China Meteorology Administration
- Chinese Ministry of Agriculture
- Chinese Academy of Social Sciences
- Ningxia Department of Science and Technology
- Ningxia Bureau of Meteorology
- Ningxia Agriculture and Livestock Department
- Office of Environmental Protection, Ningxia
- Office for Poverty Alleviation, Ningxia
- Clean Development Mechanism Centre, Ningxia

UK

- Cranfield University
- Environment Agency
- Met Office Hadley Centre
- The Tyndall Centre for Climate Change Research, University of East Anglia
- UK Climate Impacts Programme (UKCIP)
- University of Reading

Additionally, the following organisations have provided invaluable support:

- ADAS, UK
- Centre for Ecology and Hydrology, Natural Environment Research Council, UK
- Cranfield University at Silsoe, UK
- East Malling Research, UK
- Environmental Change Institute, Oxford University, UK
- Forestry Commission, UK
- Greater London Authority, UK
- Institute of Arable Crops Research, Rothamsted Research, UK
- Institute of Grassland and Environmental Research, UK
- John Innes Centre, UK
- JSC/CLIVAR Working Group on Coupled Modelling (WGCM), UK
- Programme for Climate Model Diagnosis and Intercomparison (PCMDI), USA
- School of Earth, Environmental and Geographical Sciences, University of Edinburgh, UK
- Unit for Landscape Modelling, Cambridge University, UK

www.china-climate-adapt.org

Executive Summary

ICCCA Phase II developed the first framework for adaptation to climate change in China. This is a generic and transferable tool to help decision-makers develop a comprehensive and strategic approach to adaptation policy which can inform action on the ground. Although local conditions will vary, the framework identifies a number of key actions that should be undertaken in the development of an adaptation strategy and represents a useful means for decision-makers to structure their approach to climate change impacts and adaptation. ICCCA successfully applied its framework to the agricultural sector in the autonomous region of Ningxia Hui (northwest China) to produce the first regional adaptation strategy in China but the generic framework should be applicable to different areas and sectors.

ICCCA's research on adaptation during Phase II is presented in three reports:

- ***Part 1: A Framework for Adaptation***. This part outlines the generic, transferable tool developed by ICCCA to help decision-makers to structure their thinking about adaptation and to start develop their own adaptation strategy.

- ***Part 2: Application of the Adaptation Framework: A Case Study of Ningxia, Northwest China***. This part illustrates the practical application of ICCCA's framework to generate prioritised adaptation options – the first step towards the development of an adaptation strategy. It covers the methodology, results and lessons learnt from applying the framework, as well as the outcomes from the exercise.

- ***Part 3: An Adaptation Strategy for Agriculture in Ningxia, Northwest China***. This part concentrates on the outcomes of applying the adaptation framework to the agricultural sector in Ningxia by presenting the adaptation strategy arrived at through application of the framework.

This report is **Part 3** of ICCCA's research on adaptation, and illustrates the adaptation strategy arrived at through the application of ICCCA's adaptation framework to the agricultural sector in Ningxia.

The consultation processes undertaken with expert in local and regional governmental agencies under ICCCA identified three high-level responses relevant to the whole of Ningxia and across different sectors. These measures, considered to constitute the first steps towards building capacity for regional government level responses to climate risks, are:

1. Establish a **cross-departmental group** on climate change adaptation within regional government to cater for the need for **coordinated action on climate change**. The **Ningxia Climate Change Response Office** was established in early 2008 to promote both adaptation and mitigation programmes. An inception meeting will be held in October 2008 where a series of next steps towards mainstreaming adaptation in Ningxia will be discussed.

2. **Raising awareness on climate change** trends, potential impacts and adaptation activities across the region.

3. **Mainstream adaptation into development and poverty alleviation processes** to capitalise on potential synergies between the two.

These objectives translate into adaptation actions that are specific to each of Ningxia's sub-regions – north, central, and south. Table ES. 1 lists the main climate risks facing the region, and outlines the prioritised adaptation actions identified under the auspices of ICCCA by stakeholders and local communities to tackle the climate risks and opportunities facing the region's agricultural sector.

Table ES. 1 Priority adaptation by sub-region.

Risk or opportunity	Risk priority	Possible adaptations for supporting agricultural production	Responsible organisations
North			
Drought	M	Improvements in early warning (seasonal forecasting) Improvements in intra-regional (and sectoral) allocation of water (review irrigation policies) during drought – responsive mode for management Provide training and support for agricultural technology instruction to reduce economic losses	Yellow River Commission Ningxia Water Resource Dept. Ningxia Dept for Science and Technology Ningxia Dept. for Agriculture and Livestock
Surprises / Extreme events	M	Improvements in early warning (weather forecasting), skill and dissemination Improve weather modification technology	Ningxia Met. Bureau
Drying / desiccation of landscape	H	Periodic review of anti-desertification strategies in view of recent trends Monitoring of soil moisture conditions, revise policies as appropriate	Land and Resources Department
Change in Yellow River flows	H	Improvements in intra-regional (and sectoral) allocation of water (review irrigation policies) – respond to emerging trends (wetting/drying) Long-term promotion of water saving in agriculture (demand management)	Yellow River Commission Ningxia Water Resource Dept. Dept Science and Technology
Central			
Drought	H	Ensuring reliability of supply from Yellow River during drought Review emergency relief procedures (compensation, water supply) Improve early warning of drought/other extremes Strategic review of long-term feasibility for agricultural livelihoods in increasingly marginal areas	Ningxia Water Resource Dept. Ningxia Dept. for Agriculture and Livestock Ningxia Development and Reform Commission
Surprises / Extreme events	M	As for Northern sub-region Establish public aid system both short term and long-term	Ningxia Met. Bureau
Drying / desiccation of landscape	H	Monitoring and review of grazing conditions and policies Monitoring and review of sustainability of land management policies, e.g. Grain for Green Increase support for water harvesting saving technologies	Ningxia Dept. for Agriculture and Livestock Ningxia Development and Reform Commission
Change in Yellow River flows	M	Ensuring long-term reliability of Yellow River supply (across different scales of use)	Ningxia Water Resource Dept.
South			
Drought	H	As for Central sub-region except Yellow River allocation	As for Central sub-region
Surprises / Extreme events	H	As for Northern sub-region Periodic review of flash flood frequency and damages, review potential for forecasting and early warning	Ningxia Water Resource Dept.
Drying / desiccation of landscape	M	Improve water use efficiency for both agriculture and ecosystem through water conservancy programme and technologies Land use change according to soil moisture	Ningxia Water Resource Dept. Ningxia Dept. for Agriculture and Livestock

Table of contents

Tables

Figures

1 Introduction

This report summarises the main climate change risks and recommendations for adaptation for the agricultural sector in Ningxia, Northwest China. The work forms a key part of the project Impact of Climate Change on Chinese Agriculture (ICCCA). Other outputs from the project are available separately from the project website (www.china-climate-adapt.org).

China recognises climate change as a major global issue of international concern. The *Eleventh Five-year Development Plan* and the *National Government Report* have both clearly mentioned that adaptation abilities need to be improved to make new contributions to combating climate change. China's National Climate Change Programme identifies climate change as a major global issue of common concern to the international community.

The report aims to make a practical contribution to China's rapidly emerging engagement with adaptation by presenting an example adaptation strategy for the agricultural sector in Ningxia. This assessment concentrates on short (5-10 years) and medium term (out to 2050) timescales, identified by stakeholders as critical for planning and decision-making. Our approach first outlines recent and future climate risks in Ningxia and then highlights the main opportunities for institutional level adaptation with a detailed example of how this could work in the Department of Agriculture and Livestock. We end with key recommendations to take forward adaptation in Ningxia, and more widely in China.

1.1 What is adaptation?

Climate change will alter local weather conditions, including rainfall and temperature, and lead to changes in the frequency and severity of climate hazards, such as droughts. Some level of climate change is now inevitable so that society and individuals will need to adapt to the changes which will occur, either to avoid negative impacts or to take advantage of new opportunities.

Adaptation aims to ensure that people's livelihoods, public and private enterprises, assets, communities, infrastructure and the economy are resilient to the realities of a changing climate.

Adaptation should be seen as a ***process*** not a one-off activity: a changing climate will require ongoing activities by institutions and individuals to adjust their behaviour either in anticipation of predicted impacts or in response to emerging trends and extreme events.

1.2 Ningxia Hui Autonomous Region

Ningxia is located in the northwest part of China and is one of the five autonomous regions in China (Figure 1.1 left). Ningxia's climate is dry and highly seasonal; annual mean temperature ranges from 5-9℃, the mountainous area in the south record annu al precipitation of 600mm, which decreases from south to north, with only 100mm in the northern area, with an overall average of 262mm. Winters are dry and very cold, summers are hot and receive most of the precipitation (Figure 1.1 right). Per capita water resources are only one tenth of the national average. The Yellow River is the main water source in the region.

Ningxia has three main types of agricultural production system each related to a different set of climatic and other factors, particularly the availability of water from the Yellow River:

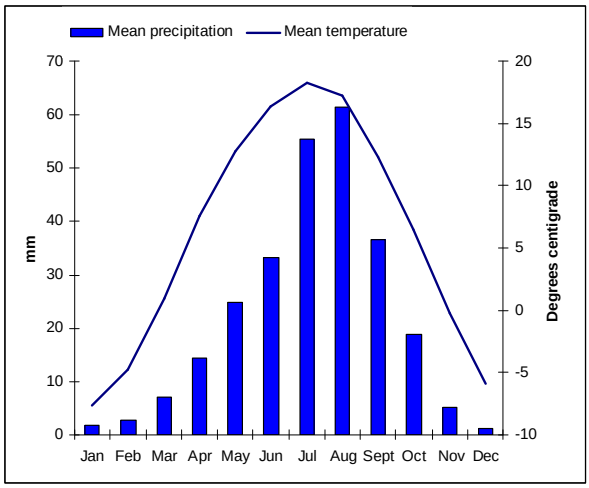
- Southern area: rainfed cultivation in the more humid, but still fairly dry;
- Central area: a mix of irrigation with some rainfed and extensive grazing in the middle part; and
- Northern area: primarily irrigation.

Each sub-region has specific vulnerabilities and risks related to climate change and therefore we identify priorities for action at the regional and sub-regional levels.

Figure 1.1 Left: Ningxia in China. Right: Ningxia's precipitation and temperature.

Ningxia is located in North-West China

Precipitation occurs mainly in summer



1.3 Recent and future climate risks in Ningxia

To get a better understanding of the risks from climate change that Ningxia might face in the future and the region's capacity to respond appropriately, the project first undertook a scoping study to determine the degree to which the region is currently affected by climate. This covered climatic observations, background socio-economic conditions and some preliminary consultation with rural communities and government officials. This information is available in two ICCCA reports: *Scoping Study Report*[2] (see Section 2 therein) and '*Climate and rural livelihoods in rural Ningxia: Final report*' (Yue et al., 2008).

Table 1.1 Recent climate variability and extremes in Ningxia

Climate factor	Evidence of local impacts
Recent warming: Minimum and maximum temperatures have warmed, particularly since the 1980s	Positive impacts include winter wheat has migration northward, harvest time has increased, frost free days have increased, and cold and frost disasters have decreased. Negative impacts involve more plant disease and insects; conventional field technology lost positive effects; more fertilizer and more irrigation needed; field material invest increase.
Rainfall: long-term variability has been fairly modest and is similar across the whole region. [Some larger monthly and sub-regional trends]	Of all three agro-ecosystems surveyed, drought is the most recognized meteorological disaster, especially in the middle arid area and southern rainfed mountainous area. Most respondents in the middle arid area believe that it has become increasingly difficult to acquire drinking water. Decline in ground water levels and greater difficulty in pumping water.
Major drought 2004-06: Rainfall lowest on record in some areas	Local experiences suggest an increase in frequency and intensity of droughts with negative impacts on livelihoods[3] in some parts of Ningxia. Crop failure experienced in some areas, significant economic impacts, especially in the central and southern areas. Some farmers, who depend on rainwater collection cellars, had to buy water at great expense during the drought period.
Extreme weather hazards such as hail, frost, sandstorm and hot dry winds: show no clear recent trends	During 1994-2006 meteorological hazards caused economic loss RMB 940 million. Since 2000, such losses have gone up to RMB 1.27 billion. Community surveys highlight significant negative effects of these events on livelihoods.
Recent decline in Yellow River flows	Annual Yellow River flow was 30.5 billion cubic metres (BCM) from 1956 to 1980; 29.6 BCM (1956 to 2000) and 24 BCM (1995 to 2005).

[2] Available upon request.
[3] Observations do not show this clearly. Differences may be due to how people perceive and experience drought and changing vulnerability.

1.4 Which agencies are vulnerable and/or responsible for adaptation in Ningxia?

Ningxia Hui Autonomous Regional Government has the responsibility for the regional political, economic and cultural development plan, running management and implementation activities. It is comprised of more than 30 separate institutions, such as Ningxia Development and Reform Commission, Ningxia Financial Department, Ningxia Agricultural and Livestock Department, Water Resource Department and Meteorological Bureau. Many of these have responsibilities or activities that may be impacted by climate change. Table 1.2 lists the organisations and their level of exposure in relation to climate change categorised into macro-management, direct and indirect exposure.

Table 1.2 Key stakeholder institutions in relation to adaptation in Ningxia

Macro-management	Direct exposures	Indirect exposures
Development and Reform Commission	Agriculture and Livestock Department	Office of Poverty Alleviation and Development
Financial Department	Water Resource Department	Environmental Protection Administration
Science and Technology Department	Meteorology Administration	Construction Department
	Land and Resources Department	Health Department Transportation Department

1.5 What are the main risks of future climate change for agriculture in Ningxia?

In order to inform stakeholders about the potential risks that climate change represents to their assets and activities, ICCCA provided estimates about the projected rate and magnitude of future climate change over the short and medium term. ICCCA also provided an indication of confidence levels associated with projections of future change. The future climate was described using computer generated 'scenarios'. Scenarios are projections of future climate. As such, they entail large uncertainties. For Ningxia, most climate models show increases in precipitation although the magnitude of change varies from one model to another. This suggests reasonably high confidence in the direction of change even if there can be less confidence for individual scenarios.

Changes in Ningxia include shifts in the average conditions (such as warmer average temperatures) as well as changes in the frequency and severity of more extreme weather events (e.g. heatwaves, rainstorms). The latter are likely to cause greater socio-economic impacts. Expert assessment of future climate projections was combined with detailed local knowledge of Ningxia's sub-regions to identify four main areas of climate risks important to Ningxia according to likelihood, confidence in projection and significance of impact (based on stakeholder views and expert judgement[4]). These were:

- **Drought:** Drought was widely identified as a key concern by individual and institutional stakeholders in Ningxia due to the significance of its current impacts and threat of greater impacts in the future;
- **Surprises/Extremes:** These include weather extremes such as windstorms and heatwaves as well as agricultural pests and disease. Although very hard to predict, these were identified by stakeholders as being of high importance due to the significance of their current and potential impacts;
- **Drying/high temperatures:** this refers to a regional scale gradual drying of the landscape related to increases in soil moisture evaporation (due to higher temperatures) leading to stress on natural

[4] See stakeholder workshop details: http://www.china-climate-adapt.org/en/chapter.php/action .

and farmed vegetation leading to enhanced desertification. The latter is already a major problem in Ningxia. Drying and higher temperatures was deemed a key climate risk given the high confidence that warming will continue in the future;

- **Shifts in the river flow regime of the Yellow River:** Upstream changes in precipitation and evaporation are likely to lead to changes in downstream flows available to Ningxia given Ningxia's dependence on Yellow River water for irrigation, domestic and industrial use.

1.6 Assessing the risks of climate change for sub-regions of Ningxia

We used a simple method for ranking risks across sub-regions, shown in Table 1.3. Risk-based approaches combine an assessment of the likelihood of a particular event or outcome occurring with the magnitude of the event in terms of physical or socio-economic impact. The aim is to generate information on climate change risks that can be readily be considered by decision-makers for planning and investment. The method involves some expert judgment because it is not known with certainty how the future frequency and intensity of extreme events will change and neither what their precise impacts will be. It also means that decision-makers need to explicitly acknowledge their appetite for risk as this will determine the range of potential actions.

Table 1.3 Climate risk prioritisation by sub-region

Main climate risks/sub-region of Ningxia	Drought	Surprises / Extreme	Drying	Changes in Yellow River flows
North	M	M	H	H
Central	H	M	M	M
South	H	M	M	L
All Ningxia	H	M	M	H

Note: Colour coding as follows: red – high risk; brown – medium risk; and green – low risk.

1.7 Integrating regional development and adaptation goals

Each sector or region has its own mid-to-long term development plans, many aspects of which may be affected by climate change. By cross-referencing development goals with assessments of climate risks, the threat of climate change affecting the delivery of development targets can be identified and integrated within regional development priorities. Such analysis is critical for developing core adaptation targets, i.e. **adaptation needs to be firmly rooted in current institutional management objectives and processes**.

In Ningxia the process was to identify key development objectives, consider how these might be affected by the climate risks identified in Stage 1 and then identify the objectives for adaptation. ICCCA used Ningxia's Five Year agricultural development plan (2006-2010)[5]. The major goals for agriculture are listed below.

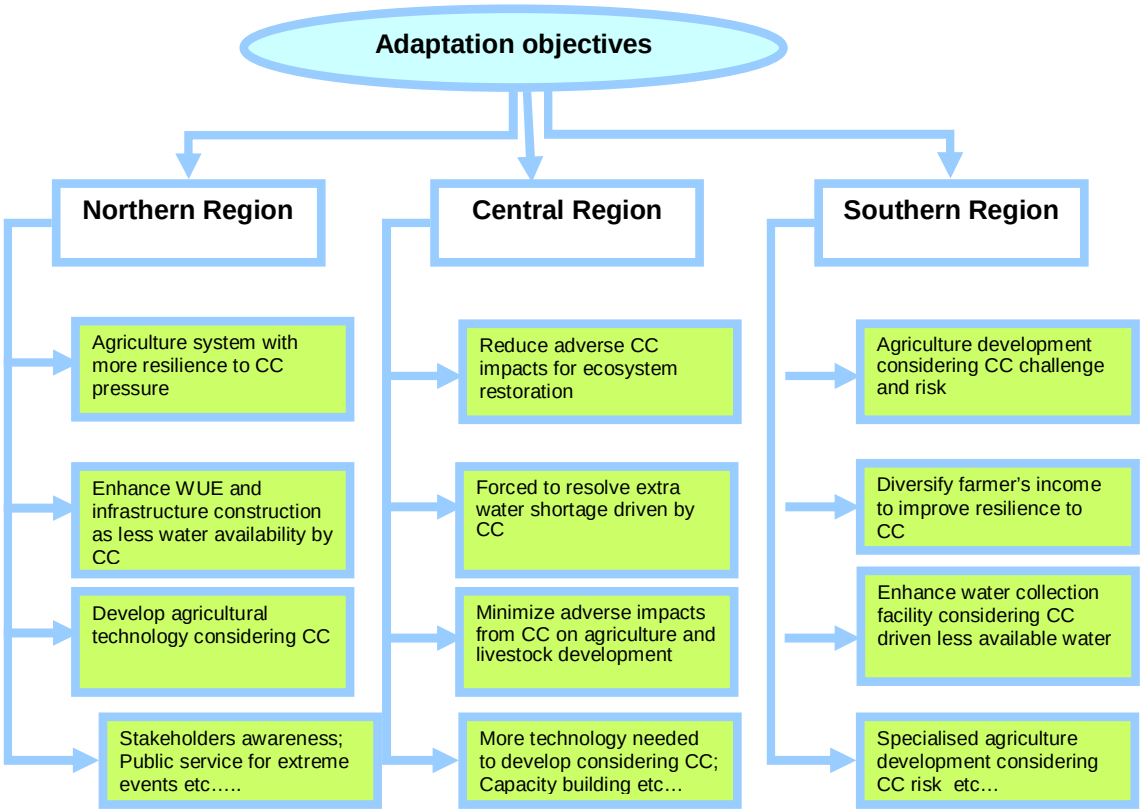
- Ensure grain production
- Develop specialised agricultural industries

[5] Agriculture and Rural Economic Eleventh–Five Year Development Plan in Ningxia Hui Autonomous Region (2006-2010), Ningxia Administration Council, 2006

- Strengthen water conservancy and develop infrastructure construction
- Ecosystem reconstruction
- Enhance public welfare and social service in rural areas

Using the sub-regional development strategies and consultation with local experts and policy makers, sub-regional objectives for adaptation were identified as shown in Figure 1.2.

Figure 1.2 Adaptation objectives for the three main sub-regions of Ningxia (CC=climate change)



After consultation, possible adaptation options were divided into three types: Strategic and Planning, Structural and Non-structural. For examples, see Table 1.4 below.

Table 1.4 A typology and full range of adaptation options in agriculture in Ningxia identified through stakeholder consultation.

Strategic and Planning
Regional development plans and strategies (i.e. the eleventh-five year plan)
Department plans and options for addressing disasters
Improving enforcement and regulation of existing guidelines (e.g. *Grain to Green* policy)
Structural
Investment in new agricultural technology and agricultural extension services:
Practical agriculture technique training
Technology dissemination for dry land farming system
Crop management practices:
Technologies to reduce climate risk for agricultural systems (e.g. new varieties)
Adjustment of agriculture planting structure
Reducing spring wheat areas
Increasing potato and mulching maize areas
Decrease rice area and instead with fruit and melon

Two harvests in one year
Vintage wine development
Shrink summer grain area but increase autumn's
Shifting spring sowing to summer
Slope field shift to terrace
Reduced tillage
Development of stock raising sector
Water saving techniques:
Promotion of water saving methods in agriculture
Drought resistant varieties
Deep ploughing
Soil moisture retention techniques (gravel mulching, film and straw)
More effective irrigation regime and water use efficiency for rice
Yellow River Extension Project: from north to the middle arid region of Ningxia. (Big willow Water Conservancy Project)
Drip and sprinkler irrigation
Water cellar and reservoir
Poverty alleviation programmes:
Subsidize farmers who return crop land to grass or forestry
Village resettlement
Export of labour
Help and support agricultural leading factory development
Capacity building in farming communities
One million farmers training: government invest 10 million Yuan to help farmers get qualified certification for off-farm job;
Countryside labour migration— government encourage and help 100 thousands farmer to look for temporal job in city (three month each year).
Other:
Technology or projects for agricultural development (e.g. ecological system protection)
Weather modification programmes: hail defence and artificial rainfall stimulation
Develop climate friendly techniques
Methane project in rural area: reduce fire-wood consumption and GHG emissions
Solar energy utilisation (for cooking or house warming)
Non-Structural
Raising awareness about climate change issues
Strengthening appropriate programmes for vulnerability reduction (e.g. livelihood diversification)
Research, monitoring and data collection (e.g. improve knowledge of existing risk and vulnerability, economic costs of climate hazards)
Education, training, and dissemination about climate change risks (experts and communities)
Introducing / strengthening early warning systems
Weather forecasting
Build capacity to respond to climate hazards at individual and institutional level

2 Prioritised adaptation options for Ningxia

ICCCA proposed three different tiered approaches to identifying and prioritising adaptation options:

1. An approach for prioritising policy type options at regional government level
2. A risk-based approach to identifying options at sector and sub-regional level
3. Multi-criteria analysis to prioritise specific activities by organisation

The results and recommendations from each approach are outlined below.

2.1 Adaptation recommendations at regional government level

By using insights and experience from local/regional experts and processes of consultation, we identified a set of three high-level responses relevant to the whole of Ningxia and across different sectors. These measures were considered very much as the first steps towards building capacity for regional government level responses to climate risks.

1. Establish a **cross-departmental group** on climate change adaptation within regional government. Consultation with government agencies clearly highlighted the cross-sectoral nature of climate risks and adaptation responses demonstrating **a need for coordinated action on climate change**.
   Recognizing climate change is a cross-institutional issue and in order to effectively implement responses, **Ningxia established a loose steering committee *"Climate Change Response Office"* in early 2008 to promote both adaptation and mitigation programmes.** The committee is to act as a counter-partner of the National Climate Change Coordinating Group of the National Development and Reform Commission.

2. **Raising awareness on climate change** trends, potential impacts and adaptation activities across the region. Consultation clearly demonstrated a lack of awareness of risks, levels of confidence in future impacts and in the identification and design of appropriate measures of response.

3. **Mainstream adaptation into development and poverty alleviation processes** - Because of the close alignment at the community and household level between adaptation (reducing vulnerability to climate change) and more generic individual and institutional aims for development there exists **good potential to mainstream adaptation into development plans and poverty alleviation processes** – local and regional expertise is essential to inform good decision-making.

2.2 Adaptation recommendations at sector and sub-regional level

The four main prioritised risks related to climate change across Ningxia were reviewed against the main agricultural activities and development goals in each of the three sub-regions of Ningxia. Adaptations were identified in relation to the risks and the organisations with responsibility for implanting the responses are highlighted in the final column of Table 4. This approach does not attempt to prioritise specific actions but can provide insights to local and provincial decision-makers about what measures are appropriate to particular risks. The information can then be used in combination with other considerations important to the whole process of management and investment decisions.

Table 2.1 Priority adaptation by sub-region

Risk or opportunity	Risk priority	Possible adaptations for supporting agricultural production	Responsible organisations
North			
Drought	M	Improvements in early warning (seasonal forecasting) Improvements in intra-regional (and sectoral) allocation of water (review irrigation policies) during drought – responsive mode for management Provide training and support for agricultural technology instruction to reduce economic losses	Yellow River Commission Ningxia Water Resource Dept. Dept Science and Technology Dept. Agri. and Livestock
Surprises / Extreme events	M	Improvements in early warning (weather forecasting), skill and dissemination Improve weather modification technology	Ningxia Met. Bureau
Drying / desiccation of landscape	H	Periodic review of anti-desertification strategies in view of recent trends Monitoring of soil moisture conditions, revise policies as appropriate	Land and Resources Department
Change in Yellow River flows	H	Improvements in intra-regional (and sectoral) allocation of water (review irrigation policies) – respond to emerging trends (wetting/drying) Long-term promotion of water saving in agriculture (demand management)	Yellow River Commission Ningxia Water Resource Dept. Dept Science and Technology
Central			
Drought	H	Ensuring reliability of supply from Yellow River during drought Review emergency relief procedures (compensation, water supply) Improve early warning of drought/other extremes Strategic review of long-term feasibility for agricultural livelihoods in increasingly marginal areas	Ningxia Water Resource Dept. Dept. Agri. and Livestock Ningxia Development and Reform Commission
Surprises / Extreme events	M	As for Northern sub-region Establish public aid system both short term and long-term	Ningxia Met. Bureau
Drying / desiccation of landscape	H	Monitoring and review of grazing conditions and policies Monitoring and review of sustainability of land management policies, e.g. Grain for Green Increase support for water harvesting saving technologies	Dept. Agri. and Livestock Ningxia Development and Reform Commission
Change in Yellow River flows	M	Ensuring long-term reliability of Yellow River supply (across different scales of use)	Ningxia Water Resource Dept.
South			
Drought	H	As for Central sub-region except Yellow River allocation	As for Central sub-region
Surprises / Extreme events	H	As for Northern sub-region Periodic review of flash flood frequency and damages, review potential for forecasting and early warning	Ningxia Water Resource Dept.
Drying / desiccation of landscape	M	Improve water use efficiency both agriculture and ecosystem through water conservancy programme and technologies Lang use change according to soil moister	Ningxia Water Resource Dept. Dept. Agri. and Livestock Ningxia

Note: Change in Yellow River flows given low priority for south sub-region. Risk priority: L = Low, M = Medium, H = High.

2.3 Multi-Criteria Analysis for prioritising adaptation options

There is general agreement that decision-makers need policy-relevant indicators to assess the effectiveness of adaptation actions. ICCCA used a Multi-Criteria Analysis (MCA) approach as a means of assessing different options. MCA enjoys wide application as different weightings (coefficients) can be set for different stakeholders to provide a comparable means of ranking alternative options according to different preferences.

Generally, the MCA and scoring system worked well in that they were not too complex and permitted an active debate on adaptation effectiveness. The methodology can easily generate the priority order of different technologies for one or several government departments. Note that the value of the mark serves only as a reference, not the ultimate decision-making result. ***In fact, it is the process of going through the discussion that generates the most useful insights as this enables stakeholders to learn about the climate risks, and the adaptation experts to learn about the other relevant considerations in an institution's decision-making.***

Several government agencies were invited to rate these criteria, including Ningxia's Science and Technology Department, the Water Conservation Department, and the Agriculture and Husbandry Department. They were first requested to select and rate the two options that in their opinion constituted the most effective option.

3 Concluding remarks and lessons learnt

The aim of this work was to raise awareness and develop a practical means to take forward the adaptation agenda in Ningxia. The process of developing and applying a framework for adaptation has been an extremely useful two-way learning experience for the research team and the regional institutions involved. There has been considerable capacity development as a result of this joint venture and there have been concrete developments within Ningxia. It is important to note that adaptation in China, as in the UK and elsewhere, is a relatively new issue and institutions are still grappling with the challenge of mainstreaming emerging climate risks into their existing management systems.

Climate change is still a new concept for decision-makers in Ningxia and local people tend to lack both a scientific understanding of the issue and a longer-term perspective on management and decision-making that could incorporate climate change. To date, no specific practical measures have been consciously undertaken on the ground in relation to adaptation in the agriculture sector although spontaneous adaptation has occurred. However there have been a number of actions at a policy level and climate change is starting to be 'mainstreamed' into existing policy. For instance, the *Ningxia Eleventh Five-Year Development Plan* explicitly mentions the need to strengthen climate change adaptation.

Drivers for further action on adaptation lie primarily with the newly established ***Ningxia Climate Change Response Office***. The Ningxia Climate Change Response Office will hold an inception meeting in October 2008 where a series of next steps towards mainstreaming adaptation in Ningxia will be discussed.

Where adaptation options rely on new techniques, it is likely these will need to be trailed to demonstrate and evaluate their potential to decision-makers and stakeholders. The most suitable route for such measures will be through existing research and development capacity (e.g. through MOST) and delivery systems supported by the Ministry of Agriculture, Ningxia's Agriculture and Livestock Department and other relevant agencies. There will also be a role for the rapidly growing private sector to enhance these processes of change either through response to emerging trends and extreme events or through opportunistic anticipation of longer-term changes.

Until more distinct signals of climate change emerge (e.g. through increased warming, more frequent or clearer signals emerge in precipitation patterns), adaptation is most likely to be pursued through existing strategies to cope with existing climatic hazards and raising agricultural productivity. Some measures to cope with current drought and high temperature are already in place. Some of these could be improved and applied in future to cope with a warmer climate and extreme weather.

References

Gigli, S. and S. Agrawala (2007), Stocktaking of Progress on Integrating Adaptation to Climate Change into Development Co-operation Activities, COM/ENV/EPOC/DCD/DAC(2007)1/FINAL, OECD, Paris.

Tanner TM, Hassan A, Islam KMN, Conway, D, Mechler R, Ahmed AU, and Alam, M (2007) ORCHID: Piloting Climate Risk Screening in DFID Bangladesh. Summary Research Report. Institute of Development Studies, University of Sussex, UK.

AEA
The Gemini Building
Fermi Avenue
Harwell International Business Centre
Didcot OX11 0QJ
United Kingdom

T: +44 (0) 870 190 1900
F: +44 (0) 870 190 6318
E: info@aeat.co.uk