



## Assessing climate vulnerability and risks: challenges and first lessons from China

### Key messages

- Given the variety of contexts and the fact that climate change is a global phenomenon with highly differential and localized impacts, there are no standardized methods for conducting vulnerability and risk assessments. Which method is selected depends on spatial and temporal scales, resources available, data availability and accessibility and requirements of decision makers. This is well supported by the evidence emerging from the experience of the ACCC project in China.
- Conducting comprehensive climate change vulnerability assessments requires interdisciplinary research collaboration. The process of establishing partnerships and building a common methodological research framework is challenging and adequate time should be allocated for this step. Developing a common language and agreeing on definitions of key concepts, such as risk and vulnerability, is essential to ensure effective collaboration. This should be done at the start of the research process.
- Quantitative models of vulnerability and risk can be difficult to construct if appropriate data for indicators are missing or are of low quality. Furthermore, quantitative models are can be cumbersome to apply to simulate information on how rules, policies, culture, and social norms influence behavior and vulnerability to multiple stressors beyond climate change. These factors need to be evaluated through qualitative vulnerability assessments. Using such methods in an interdisciplinary research context in China is challenging, as most researchers are more familiar with quantitative methods.
- Vulnerability and risk assessments become more meaningful and likely to lead to change when they are linked to real-life governance and policy processes, and to community interests. This requires researchers conducting vulnerability and risk assessments to engage with stakeholders before the assessments begin and ensure their involvement in the assessment processes.

### Overview

Climate related hazards, such as floods and droughts, have contributed to significant socio-economic losses and environmental damage throughout China in the past decades. Climate change will alter the frequency, intensity, spatial, and temporal distribution of both extreme climate events and slow-onset, creeping events like shifts in seasons. Discerning the potential impacts of climate change and developing appropriate adaptation strategies is challenging in China due to the country's vast size, diverse cultures, landscapes, and resources.

As one of the key steps in supporting the development of effective climate change adaptation policies in China, the Adapting to Climate Change in China (ACCC) Project is investigating the conditions contributing to vulnerability to current climate hazards in three provinces, Guangdong, Ningxia, and Inner Mongolia, and examining likely climate change risks. The three pilot provinces reflect the diversity of China and the range of current climate hazards. Ningxia is a semi-arid province relying on an extensive irrigation system to support agriculture. Guangdong province, on the southeast coast, is highly urbanized with concentrations of population, infrastructure, and import/export industries exposed to storm and sea hazards. Inner Mongolia is a province with extensive grasslands ecosystems; in recent years, it has undergone a dramatic transformation of the economy, with the rapid development of the energy sector, including both coal mining and renewables (wind). At the same time the traditional livelihoods patterns of nomadic herder populations have changed; these processes are leading to widespread grassland and water resources degradation.

This brief is aimed at sharing some of the challenges and first lessons emerging from the implementation of vulnerability assessments. Since research and policy development are still ongoing, the brief will focus on processes rather than on final results, which will be presented at a later stage.

## Vulnerability Assessments in the context of a wide partnership: challenges and approaches

The ACCC project relies on a wide partnership including over 25 partners at national, local and international levels. The Chinese Academy of Social Sciences (CASS) together with researchers from the three provinces have formed teams to examine the factors contributing to vulnerability of specific groups of people or livelihoods in each province, examine the impacts of historical climate hazards, and learn more about the adaptive strategies people traditionally took to cope with historical and present climate challenges. At the same time, research teams from the Chinese Academy of Agricultural Sciences (CAAS) are investigating the potential impacts of climate change on ecosystems, water resources, livestock and crops, and the Chinese Meteorological Administration (CMA) is developing climate projections using a number of general and regional circulation models. CAAS' research into biophysical vulnerability at the provincial and national scales will be combined with CASS' research on socio-economic vulnerability at the same scales to develop adaptation responses. The research results and the adaptation options identified are expected to inform the ongoing formulation of adaptation strategies and plans both at provincial and national levels.

Given the variety of contexts and the fact that climate change is a global phenomenon with highly differential and localized impacts, there are no standardized methods for conducting vulnerability and risk assessments.

The specificities of each province required the research teams to employ different research approaches and practical definitions of vulnerability and risk. The partners experienced a number of challenges in conducting vulnerability and risk assessments across such diverse cultural and geographic areas. However, the challenges that they faced are not unique to ACCC but are quite common in programmes worldwide that aim to build disaster and climate resilience.

Each team initially used varied definitions of vulnerability; it was not until a significant portion of work had been completed that teams could agree on a common definition of vulnerability and risk. During a workshop held in June 2011 for integrating results from the various work areas, the partners agreed that vulnerability is a characteristic of people and human systems, depending on their exposure to a particular hazard and how susceptible to harm by that hazard they are given their sensitivity and capacity to adapt or cope with that hazard. The following conceptual definitions of vulnerability and risk, were adopted to frame the joint research work:

Vulnerability =  $f$ (exposure, sensitivity, adaptive capacity)

Risk =  $f$ (hazard(likelihood and impact), vulnerability)

Quantitative models of vulnerability and risk can be difficult to construct if appropriate data for indicators are missing or are of low quality. Furthermore, quantitative models do not

provide any information on how rules, policies, culture, and social norms influence behavior and vulnerability to multiple stressors beyond climate change; these need to be evaluated through qualitative vulnerability assessments.

Quantitative research methodologies are generally more widespread in China than qualitative approaches. The complex nature of the climate change adaptation research and the lack of data has forced ACCC partners to explore qualitative methodologies that were new to them.

The teams found that it was difficult to separate indicators of sensitivity from capacity. In practice, the teams conceptualized the factors contributing to vulnerability as falling into five categories – social, physical, economic, environmental, and human. Indicators for each category have been selected to describe vulnerability using a framework similar to DfID's Sustainable Livelihood Approach; different methods are being tested for weighting and ranking the indicators to obtain a combined assessment of vulnerability.

In both Ningxia and Inner Mongolia, the populations are sparse with great distances between settlements. Researchers in those provinces found that it was more appropriate to pull techniques from community-based vulnerability assessments, including surveys, interviews, focus group discussions and transect walks.

These techniques, in addition to reviews of statistical data and consultations with local experts, were used to build a picture of the factors contributing to the vulnerability of the herders in Inner Mongolia and farmers in Ningxia. Statistical data on demographics, GDP, and historical hazard losses were difficult to acquire and needed to be cross-checked with information gathered at the community level.

Guangdong is one of the most populous and densely populated provinces in China. Rapid urban expansion has led to significant losses of agricultural land and smaller towns and cities. The resulting megacities, such as Shenzhen and Guangzhou, and other large urban areas with populations just shy of 10 million, represent extreme concentrations of people, infrastructure and assets that are highly exposed to storms, storm surges, and ultimately sea level rise. Provincial level community-based vulnerability and risk assessments were simply not feasible in the time allotted. Instead, the Guangdong team focused on identifying indicators from census data and other statistical data sources, which would allow them to construct a provincial-level quantitative profile of vulnerability. In the health sector, the general approach was complemented by innovative work based on participatory research methods.





## Moving from Vulnerability to Risk and Policy

Research teams are currently transitioning from the assessments of current vulnerability to assessments of future risk. The three work area teams – socio-economic, physical impacts, and climate projections – are integrating their research results to develop the risk assessments. The CASS teams are developing future socio-economic scenarios (SES) that will be combined with climate projections to produce scenarios of future risk for the period of 2010-2050. Currently, the research teams are grappling with the issue of how to reduce the number of indicators for each factor describing current vulnerability to develop the scenarios of future socio-economic change. Research partners are hoping that identifying critical thresholds at which various groups, like the herders in Inner Mongolia or the farmers in Ningxia, suffer harm will help them to narrow the number of indicators.

The socio-economic scenarios will be used as descriptors of future vulnerability and combined with the climate projections produced by CMA and the physical impacts projections produced by CAAS to future climate risks. The research teams will then investigate a number of adaptation options and explore how each option might reduce risk for certain populations, livelihoods or ecosystems. The results of the risk assessments, which will also include costing assessments of some of the options, will be used to develop provincial level adaptation roadmaps and make recommendations for the 5-Year Plans at both the provincial and national levels.

## First Lessons for Replication

The research teams involved in ACCC have learned that identifying and acknowledging the challenges of conducting vulnerability and risk assessments are almost as important to the resilience process as the assessments themselves. These challenges forced the ACCC teams to evaluate their own assumptions about defining and measuring vulnerability and risk. An agreed upon conceptual definition of vulnerability and risk could not be developed until after the physical and social science teams had begun their respective research and developed a working relationship that allowed them to respect and appreciate the challenges each faced. Furthermore, the teams found that flexibility in selecting and modifying vulnerability methodology was necessary to account for the contextual differences of each province.

Climate change, on top of ongoing processes of social, political, economic, and environmental change, presents unique policy and research challenges. Many researchers becoming involved in climate change work are academic experts in their respective fields – but they are not used to thinking and working in an interdisciplinary manner or communicating their findings in language that is relevant to policy makers, businesses, or the general public. The ACCC research teams are comprised of economists, climate scientists, public health experts, and physical impacts modelers. ACCC is the first large-scale adaptation project of its kind in China, and is requiring experts with diverse backgrounds to work together for the first time. Their experiences offer lessons for other countries wishing to develop and implement climate adaptation programmes:

- Integration of research ideas and practices across disciplines and a diverse array of actors takes time. Hindsight in ACCC demonstrates that it is best to take a few months for:
  - All the involved researchers to build strong relationships;
  - Development of shared language and concepts for doing the work;
  - Articulation of the types of data – units of analysis, timeframe, geographic focus, and format – each partner requires to do her/his respective work piece.

Without taking time to build this foundation, any adaptation project will suffer delays and additional frustration as researchers from different disciplines struggle along during the research process.

- ACCC partners have found that vulnerability and climate risks are extremely complex issues to tackle, which require new research approaches and tools. Vulnerability is influenced by the policies, economic development trajectories, land use changes, and societal choices occurring in each province. In short, vulnerability is a condition of people, livelihoods, and ecosystems, for example, that is separate from climate change. The severity of impacts of current and future climate hazards is largely determined by human behaviors. While climate change will alter the frequency, intensity, and spatial distribution of climate hazards, their impacts on people and livelihoods in each of the three provinces can be reduced if resilient, sustainable choices are made today.
- An adaptation programme is more likely to be successful in influencing a community's, a province's, or a country's development and economic policies if decision makers are involved in the programme from its inception. Decision makers at all levels need to be able to work with researchers to investigate potential climate impacts and explore ways of building climate resilience. If decision makers are not involved at the beginning of a programme, it is very challenging to try and translate vulnerability and risk assessment results to decision contexts and ensure their uptake by policy makers. At the same time, policy makers are often not aware of the complex factors and relationships between factors that give rise to current vulnerability. It is up to researchers to investigate vulnerability and climate risk, and bring it to policy makers' attention, even if the results are politically challenging or not a current priority.

## About the ACCC Project



ACCC is an innovative policy research initiative focusing on linking climate change research with policy making and development. This 3 years project started in June 2009 as a collaboration between UK, China and Switzerland; it is funded by the UK Department for International Development (DFID), the Swiss Agency for Development Cooperation and the UK Department for Energy and Climate Change.

For more information and updates visit the project web site:

[www.ccadaptation.org.cn](http://www.ccadaptation.org.cn)

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