

Adapting to climate change in China: achievements and challenges

With millions of people dependent on natural resources and agriculture, China is very vulnerable to climate change. The need to adapt to future changes is gaining importance in the country's political agenda. The government's latest five-year plan, for example, is the first to include a section on adaptation, and the development of a national adaptation strategy is under way. But there are still major gaps in the knowledge and processes required to develop effective adaptation policies at national and local levels. Some of the key challenges include a lack of accurate regional climate models and vulnerability assessments, little integration across sectors and disciplines, and limited stakeholder engagement. The Adapting to Climate Change in China (ACCC) project is focused on these issues and is expected to significantly contribute to developing effective adaptation planning processes.

Policy pointers

- **Climate Change adaptation** is gaining importance in China's national agenda.
- **While research on climate change impacts** has a long history in China, links with policy development are only now emerging.
- **Challenges to effective adaptation planning** in China include lack of evidence on local impacts, overreliance on sector-specific approaches, varying capacities at provincial level and limited stakeholder engagement.
- **Initiatives such as Adapting to Climate Change in China** are helping to improve region-specific climate science and developing an integrated approach to adaptation planning.

Changing climates

In China, where economic development relies heavily on natural resources and production, and employment in climate-sensitive sectors such as agriculture remains very important, hundreds of millions of people and livelihoods — particularly among poor and marginalised groups — are vulnerable to climate change.

The rural poor in China already face many environmental and developmental challenges, including extremely fragile ecological conditions, limited financial resources, weak access to ecosystem services, poor infrastructure, low levels of education and technology,

and remoteness from major markets. Climate change threatens to exacerbate many of these through impacts on food production, water availability, and ecosystem health.¹

Research on climate change has a long history in China. Throughout the 1990s, the Ministry of Science and Technology supported climate change research. The government has published several major reviews, including the recent National Climate Change Assessment Report² (see National assessment).

Indeed, there is a growing body of literature on climate change impacts across sectors in China. After decades

National assessment

The National Climate Change Assessment Report, published in 2007, provides an extensive review of existing climate change science across China, the potential impacts of climate change and the country's response policies so far.

The report indicates that natural ecosystems, both terrestrial and aquatic, and human systems — including agriculture, forestry, water resources, coastal regions, and human health — are all vital to sustainable development in China, and are all sensitive to climate change. It suggests that climate change could have some positive effects. But, for most ecosystems and economic sectors, the consequences of climate change — from rising temperature extremes to more frequent floods — are likely to be negative. For many rural poor communities, they could be disastrous.

Policymakers in China acknowledge the importance of adaptation

of research, the Chinese science community now has a relatively strong understanding of possible future changes and their potential impacts on the country's people, economy and environment.

For example, climate observations over the past fifty years show that average temperatures in China have risen by 1.2°C, with northern regions warming faster than southern ones. There is also evidence that extreme climatic events are becoming more frequent and intense in some parts of the country.

Rainfall patterns are changing too: there has been a general drop in the number of rain days across the country, with an increase of rainfall intensity in the southeast.³

Expected impacts

These changes are expected to impact both people and environment in China in many ways. When it comes to extreme events, it is not easy to establish a clear relationship with human-induced climate change but evidence of this connection is starting to emerge. And there is little doubt that droughts, storms, typhoons, heat waves, cold spells and snowstorms in recent years have caused considerable damage and led to large human and economic losses.

For example, the devastating 1998 flood in the Yangtze River region affected 21 million hectares, destroying five million houses and causing an economic loss of more than US\$20 billion.⁴ The recent drought across southwest China has affected roughly 77 million

hectares of farmland, with more than 24 million people and 15 million livestock facing difficulties accessing drinking water. In late 2010, direct economic losses in the five provinces affected were estimated to exceed US\$3.58 billion.²

Slower-onset changes such as rising temperatures and changing rainfall patterns are also impacting food production and water availability. Recent studies suggest a shift in agricultural production to more northern latitudes.⁵ Together with changes in soil water availability, increasing climate extremes and crop diseases, climate change could cause crop yields to fall by up to 10 per cent by 2030, and 37 per cent by the end of this century — which could result in serious food shortages across the country.

Water shortages could also become more common. In some regions, water withdrawal ratios — which show how much water is withdrawn compared with what is available — are already extremely high. For example, in the Heihe River Basin in northwestern China these ratios are estimated to be between 83 and 125 per cent, far exceeding the critical threshold levels set by both the World Meteorological Organization and the Chinese government. Conflicts over water along the Heihe have increased in the past decade, suggesting that water shortages during the growing season are becoming increasingly serious. In part, this is because of decreasing water supplies coupled with growing per capita water use;¹ climate change has the potential to exacerbate both.

Adaptation matters

If China is not to compromise the impressive economic development it has achieved over the past three decades, it will clearly have to adapt to climate change. Only with effective adaptation, for example, will the country's agricultural production be able to cope with likely climate change impacts and meet increasing demand over the next century.

Policymakers in China increasingly acknowledge the importance of climate adaptation (see Government committed to adaptation). The government's latest five-year plan, published in 2011, includes for the first time a whole section on adaptation; and the country is now preparing its first national adaptation strategy.

The government has already introduced some adaptation measures to rural China. For example, a range of policies have been implemented to tackle water shortages, including overall water supply control, water permits, water right certificates, farmer water use associations, water pricing adjustment and improved water allocation policies.

But these efforts are not well coordinated and the country still lacks an overarching strategy to bring climate change concerns into decision-making processes about water use.

Government committed to adaptation

Over the past seven years, the Chinese government has paid increasing attention to the need to adapt to climate change in key official policy documents.

- China's first national communication to the UNFCCC, published in 2004, acknowledges climate change impacts on water resources, agriculture, terrestrial ecosystem and coastal zones. While adaptation efforts are not structured in an overall strategy, some sector-specific policies have been identified, including for example, the expansion of paddy-rice fields in northeast China.
- In 2007, China published its National Climate Change Programme,⁶ which envisages the development of policies to both mitigate and adapt to climate change, boost science and technology research, and increase public awareness.
- At the same time, a National Leading Group to Address Climate Change, headed by Premier Wen Jiabao, was established as a super-ministerial mechanism to coordinate complex climate policymaking processes.
- China's current five-year plan, which sets socioeconomic development guidelines for key sectors and regions, is the first to include a full paragraph on adaptation. It emphasises the need to build capacity for addressing extreme events, expand research and development and focus efforts on both key sectors such as agriculture, forestry and water, as well as key areas such as coastal and fragile ecosystems.

Table. How ACCC is working to address key adaptation planning challenges

Challenge	How ACCC is helping to address it
Lack of regional climate models	Development of first set of multiple regional climate models for China.
Limited access to climate data	Development of a website to disseminate data, alongside guidelines for use for researchers and policymakers
Knowledge gaps for impacts in key sectors	Improved impact assessments on agriculture, water, grasslands, health and climate-related disasters
No coherent framework for doing climate vulnerability and risk assessments, and adaptation planning	Integrated vulnerability and risk assessments developed to a common framework, in three pilot provinces Introduction of the concept of uncertainty in the identification and selection of adaptation options Development of adaptation roadmaps in three pilot provinces
Lack of interdisciplinary approaches	Promotion of an interdisciplinary research framework and approach Development of a 'common language' and a shared glossary of key terms such as climate impacts, vulnerability and risks
Limited interinstitutional collaboration	Development of a wide partnership bringing together research and policy organisations at provincial, national and international levels Support to interdisciplinary research linking climate science, biophysical sciences and social sciences
Gaps in research and policy development capacity	Training workshops for researchers and policymakers on a wide range of subjects, including: climate science, qualitative research methods, participatory methods, vulnerability and risk assessments, and adaptation planning
Limited sharing of lessons learnt with the international community	Linking with global and regional adaptation networks such as the UNFCCC Nairobi Work Program and the Asia Pacific Adaptation Network Development of policy briefs for international audience Collaboration in developing South-South learning programmes
Policies only partially developed with evidence-based approaches	Strengthening the knowledge available and improving the way it is communicated to decision makers through tailored communication approaches

Main challenges

Indeed, China faces many challenges when it comes to effectively planning and implementing adaptation.

While global climate models clearly indicate ongoing warming in China in decades to come, the precise magnitude and dynamics of this are uncertain. Uncertainty is even higher when it comes to predicting changes in rainfall.⁷ The lack of regional climate models is a major obstacle to the development of impact studies and risk assessments at national and local scales.

This gap is now being addressed by some national and international research projects. But producing climate scenario data is just a first step; access to easy-to-use data for researchers conducting impact assessments must also be addressed.

There are similar gaps in adaptation research and sector-specific impacts. It is true that a large body of literature documents the vulnerability of individual sectors, ecological systems or crops to specific climate change scenarios. But this knowledge is fragmented, with little integrated assessment of how sectoral sensitivities, uneven vulnerabilities and climate adaptation options affect sustainable development. And there are still major gaps in key areas, including separating human-induced from climate-related changes

in water resources, and understanding future impacts on agriculture and health.

A second challenge is thrown up by the sheer size of China. Stretching across an estimated 960 million hectares, China is home to a tremendously diverse set of ecosystems, territories and cultures, which face a wide range of climatic hazards and changes. Climate research and policymaking capacity is very advanced in many areas but can vary substantially across the country, with the strongest institutions concentrated at the central level and in the most developed regions.

The limited capacity to assess climate change and link evidence to policy in some provinces is but one of a wider set of challenges that lies at the research-policy-capacity interface. These include a lack of adaptation finance and the existence of potentially conflicting policy frameworks. Limited engagement of stakeholders, including women, in decision-making processes poses another problem, possibly hindering the identification and uptake of adaptation measures in local contexts.

A key hurdle to effective adaptation is that in China, as elsewhere, it is particularly difficult to establish coherent responses across different ministries and levels of government. Institutions often focus narrowly on their own mandates, and compete to protect their spheres of influence in ways that make it difficult to work across

sectors and professional, geographic and political boundaries.

Addressing key hurdles

Addressing the challenge of planning effective adaptation requires a new approach for integrating climate change policies into development strategies and plans. This means reinforcing the links between research and policy. It means rooting policy development more firmly in the results of interdisciplinary research that draws on both quantitative and qualitative methods. And it means developing participatory approaches that engage a wide range of stakeholders to adapt responses to the country's diverse range of local contexts.

Several national and international adaptation initiatives have already begun working within China to help tackle the challenges and achieve more effective policies. The Adapting to Climate Change in China (ACCC) project⁹ — started in 2009 as a collaboration between China, the United Kingdom and Switzerland — builds on a long-standing China-UK research partnership and is addressing key gaps in the adaptation planning processes.

It does this through integrated research that embraces multiple disciplines, from climate science and physical impact studies to socioeconomic and policy analyses at both national and provincial levels. ACCC is linked to key policy development processes, and is supporting the development of the national adaptation strategy. The project's three pilot provinces — Guangdong, Ningxia and Inner Mongolia — reflect the diversity of China and a range of climate threats. Activities are carried out by a collaborative network of more than 25 provincial, national and international organisations.

Two years in, the project is already helping to address the challenges to adaptation planning across China (see Table, on previous page).

Adaptation in China is still an emerging field. But the growing research and political will behind it make it an area of fast learning. Given the range of ecosystems and complexity of climate change impacts being faced and studied, the solutions and approaches developed in China by the ACCC partners offer an invaluable contribution to the global adaptation knowledge base, and provide useful experiences for developing countries facing similar challenges.

As evidenced in its 2011 white paper on international cooperation, China is committed to strengthening global and South-South collaboration.⁹ Climate change, including adaptation and mitigation, forms one of the eight focus areas in which the country will develop activities to support this goal. International sharing activities — including communications, training workshops, conferences and a fellowship programme — have already begun within the ACCC and will hopefully catalyse partnerships that can grow beyond the scope of this individual project.

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The International Institute for Environment and Development (IIED) is an independent, nonprofit research institute working in the field of sustainable development. IIED provides expertise and leadership in researching and achieving sustainable development at local, national, regional and global levels. The 'Lessons from adaptation in practice' series has been produced with generous support from the Japan International Cooperation Agency (JICA).

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Notes

■ ¹ Yin *et al.* 2006 *Integrated Assessments of Vulnerabilities and Adaptation to Climate Variability and Change in the Western Region of China*. Final Technical Report of the AS25 Project. ■ ² Li Yue, Conway, D. *et al.* 2011. Effects of climate variability and change on Chinese agriculture: a review. *Climate Research* 50, 83–102. ■ ³ Shilong, P. *et al.* 2010. The impacts of climate change on water resources and agriculture in China. *Nature* 467, 43–51 ■ ⁴ Zong, Y. Q., Chen, X. Q. 2000. The 1998 flood on the Yangtze. *Natural Hazards* 22, 165–184. ■ ⁵ Lin Erda *et al.* 2006. National Assessment Report of Climate Change (II): Climate change impacts and adaptation. *Advances in Climate Change Research* 2, 51–56. ■ ⁶ National Development and Reform Commission (NDRC). 2007. China's National Climate Change Programme. Government of the People's Republic of China, Beijing. ■ ⁷ Meehl, G. A. *et al.* 2007. Global Climate Projections. In Solomon, S. *et al.* (eds). *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, UK. ■ ⁸ See: www.ccadaptation.org.cn ■ ⁹ Information Office of the State Council, People's Republic of China. 2011. White Paper on China's Foreign Aid.

Corrigendum: A new reference has been added as note 2 in this version of the briefing, to replace notes 3 and 6 of the original briefing.