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Building a Line of Defense against Climate Change:

From *reactive coping to adaptive capacity* in China's irrigated agricultural development

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Climate change threatens to undermine decades of development achievements in China's Huang-Huai-Hai River Basin. Farmers in the 3H Basin have long been plagued by water scarcity and frequent droughts and floods. Development efforts have succeeded in relieving some of these pressures, but the effects of climate change put these achievements in jeopardy. The Mainstreaming Climate Change Adaptation in Irrigated Agriculture project, funded under the Special Climate Change Fund (SCCF) and integrated into the World Bank's Irrigated Agriculture Intensification III Project, has been building a line of defense against the looming consequences of climate change on agricultural communities in China. The project was recognized as good adaptation practice in the 2011 World Resources Report[1] as well as the SCCF evaluation of the independent GEF (Global Environment Facility) Evaluation Office.[2] This SmartLesson describes how the project created long-term adaptive capacity for affected communities to support sustainable irrigated agriculture in rural China.

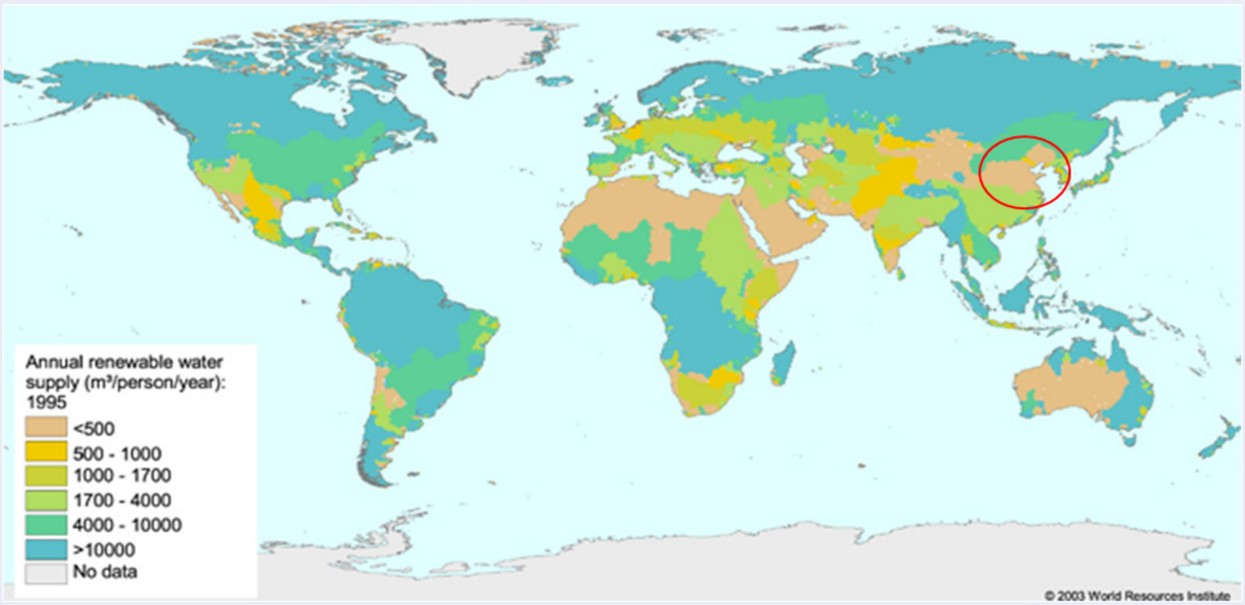
Background

Aspiration and reality have always been difficult to reconcile in China's 3H basin. On the one hand, the region is China's breadbasket, nurturing around a third of the country's population. On the other hand, it is vulnerable to severe droughts and floods and suffers from growing water demand, pollution, and inefficient water use, resulting in dramatic water scarcity. Per-capita water availability is one third of the national average, and only half of the UN standard for maintaining socioeconomic development. Even without climate change, farmers in the region face great challenges.

Efforts have been made to mitigate economic pressures on rural communities in the 3H basin, to improve living standards while safeguarding national food security. Since 1988, agricultural development initiatives have been streamlined under China's

[1] For additional information, see Wang & Li, Q. 2010. "Adaptation to Climate Change in Action in China's Agricultural Development". Case study for the World Resources Report 2010-2011. Washington, DC. Available online at http://www.worldresourcesreport.org/case-studies/chinas-agricultural-development-adaptation-action.

[2] For more information on GEF Evaluation Office's SCCF evaluation, please visit www.thegef.org/gef/eo_them_SCCF.



Comprehensive Agricultural Development (CAD) program serving as an umbrella for domestic and multilateral investments. One large-scale initiative under the CAD is the *Irrigated Agriculture Intensification Loan Project* (IAIL) series, implemented by the State Office for Comprehensive Agricultural Development (SOCAD) and partly financed through a World Bank loan. The completed IAIL1 and IAIL2 projects improved water availability for 2.6 million hectares of low- and medium-yield farmland, benefiting 7.3 million farm households. The recently completed IAIL3 project extended this effort by another 500,000 hectares and 1.3 million farm households.

But IAIL's contribution is being undermined by yet another challenge to the 3H basin: climate change. Climatic modeling identifies the 3H basin as one of the world's most vulnerable regions to climate change. Adding climate change impacts, from extreme weather events to shifting precipitation pattern, to an already unfavorable situation threatens to push the burden beyond what local communities can absorb.

The *Mainstreaming Climate Change Adaptation in Irrigated Agriculture* project, supported by the GEF-managed SCCF, has created a first line of defense in five provinces across the 3H basin by exploring and demonstrating how the achievements of IAIL3 and other CAD initiatives can be safeguarded against climate change impacts. The project, closely integrated with IAIL3, aimed to enhance adaptation in agriculture and water management through awareness-raising, capacity development, and demonstration activities. It introduced climate change adaptation activities into a wide range of ongoing IAIL3 activities and promoted the mainstreaming of adaptation into the CAD program.

Given the unpredictability of future climate threats, specific projects and adaptation activities will not be sufficient to overcome the climate change challenges in the long run. Ultimately, the key to resilience is increased local ability to react to changing circumstances. The following five lessons focus on how the project sought to change local perceptions and behaviors toward long-term adaptive capacity.

Lessons Learned

Lesson 1: Facing the uncertainty of climate change effects, investing in a comprehensive climate change impact analysis to create a scientifically sound project approach will pay off.

Uncertainty mars climate change adaptation activities: predictions on the nature, intensity, and frequency of climate change effects in any specific location remain imprecise and difficult to obtain. However, in the context of the SCCF project, investing in the generation of location-specific information on climate effects yielded enormous benefits for the choice of project locations, the design of targeted activities, and the engagement of affected communities.

The SCCF project made great efforts to reduce uncertainty through a comprehensive analysis carried out by national and international scientists and supported by a World Bank Analytical and Advisory Activity. Scientists assessed climate change impacts and the effectiveness of adaptation at the national, provincial, county, and village levels. The scientific climate change impact analysis combined downscaled regional climate models with water simulation models to discern water supply and demand changes under climate change conditions. Results were linked with agricultural projection models and Global Trade Analysis (GTAP) to predict concrete climate change impacts on water resources, irrigated agricultural production, and agricultural trade.

The assessment yielded high-quality predictions on how changes in precipitation and water flows are likely to impact different crops in specific locations. This allowed for the informed selection of project locations, to include locations that face different kinds of climate change effects (which would therefore allow for the demonstration of different adaptation activities), and would be representative of a larger region, illustrating the possibility for future scaling up (Lesson 2). In addition, specific information on climate effects was crucial for the design of adaptation activities targeting local vulnerabilities. Perhaps most important, specific information played an indispensable role in convincing local farmers of the urgency and necessity to implement adaptation activities (Lesson 3).

Lesson 2: To translate vulnerability assessments into on-the-ground activities, use an integrated project design that incorporates adaptation activities into an existing water and agricultural investment project.

Climate change adaptation is a new field for development interventions with no existing set of tried solutions. In translating threat assessments into concrete activities on the ground, the project benefited greatly from integration with the IAIL3 investment. IAIL3 was a perfect candidate for incorporating climate adaptation; while located in a region highly vulnerable to climate effects and already focused on irrigation and water scarcity, the original project design had not explicitly considered future effects of climate change.

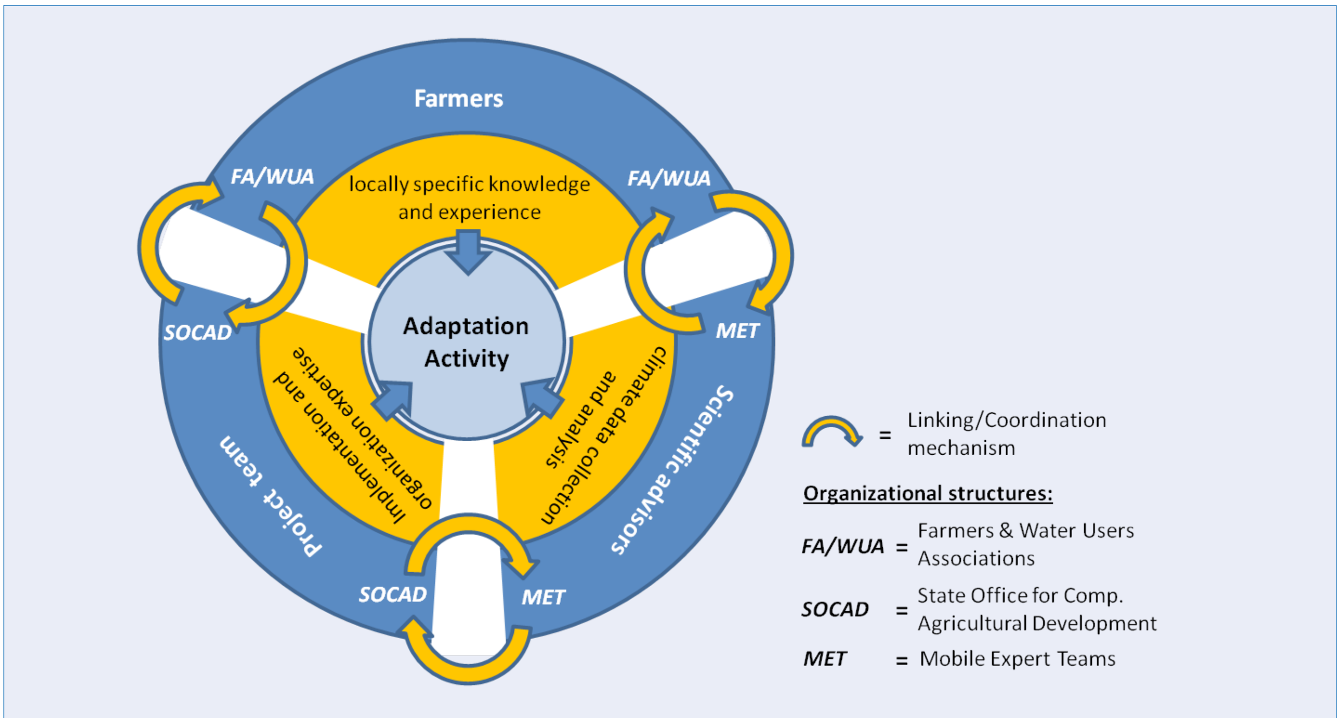
The SCCF project translated climate modeling information into a gap analysis of existing IAIL3 investment components, revealing their vulnerabilities to climate change and concrete deficiencies to be corrected. These weak spots of IAIL3 provided the SCCF project with a testing ground for the design and implementation of climate change adaptation activities, ranging from improved water-saving capacity to agronomic adaptive techniques and resilient cropping systems. In addition, the selection of IAIL3 locations with distinctive climate conditions allowed for the testing of a wide spectrum of activities.

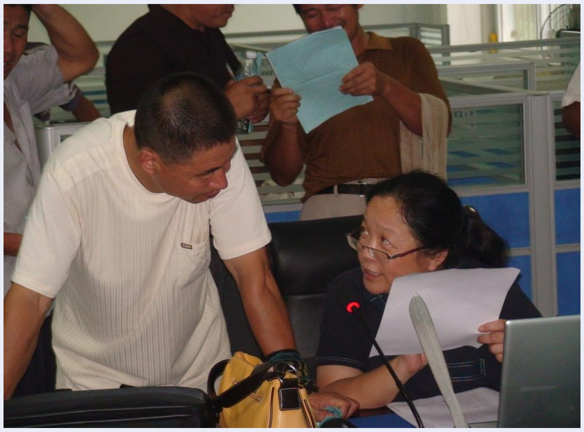
Through the integration of the two projects, SCCF activities were directly applicable to the wider IAIL3 project area, providing a straight path for replication and scaling up. In addition, timing proved to be important: the SCCF project was implemented around the IAIL3 midterm review, demonstrating first success in a phase of project readjustment. This facilitated the immediate application of demonstrated activities to other parts of IAIL3. In this way, the small $5 million SCCF grant led to a readjustment of the use of the $460 million of IAIL3 resources toward a systematic consideration of climate change effects.

Lesson 3: A reciprocal working relationship between farmers and scientific advisers is the key to overcome farmers' reluctance to react to climate change by adjusting agricultural practices.

Xuzhou Wheat No. 31, a crop variety, has been specifically developed to be more resistant to drought. But when we first proposed to farmers that they use it, the notion was greeted with intense skepticism. For the farmers it was, first and foremost, a seed they did not know and that posed a risk.

Farmers in the 3H basin live under high economic pressure. They have limited capacity to absorb setbacks, creating a prudent reluctance to change tried agricultural practices. In consequence, their coping strategies react primarily to loss of harvest instead of addressing the underlying reasons. Facing climate change, however, reactive coping is not a sustainable option; intensifying water stresses will aggravate economic pressure and further decrease local ability to bear the uncertainty of alternative options. Eventually, this cycle will lead to the breakdown of reactive coping capacity, destroying livelihoods.





The question was how farmers could be given the confidence that adaptation can be successful despite the lack of certainty on climate change effects and limited experience on adaptation measures. For the SCCF project, the crucial factor of success turned out to be a reciprocal working relationship between farmers and scientific advisers. Facilitated by the project team, farmers-scientist cooperation started with a series of workshops and trainings to inform affected communities about the results of the vulnerability assessment and possible adaptation activities. The workshops, through surveys and consultations, gave communities an opportunity to discuss their preferences on proposed adaptation activities and their suggestions on measures' feasibility and technological soundness.

Building on this initial dialogue, the SCCF project went beyond standard participatory practices. Throughout project implementation, scientific advisers organized in Mobile Expert Teams collaborated with local farmers in on-the-ground experimentation with different adaptation measures to jointly identify the most promising options. A total of 256 practical application studies were conducted to test different approaches under real-life conditions. The scientific advisers contributed the results of their vulnerability analysis; local farmers described how strategies could or could not be implemented on a practical level.

The application studies allowed for the direct comparison between agricultural areas with and without application of adaptation measures under equal conditions. During the testing phase, farmers and scientists applied measures — from adjusted sowing schedules to switching from wheat to groundnut or vegetables — in parts of the project community, and measured results against other fields in the same community that did not apply adaptation activities. These joint experimentation exercises proved powerful in overcoming farmers' reluctance to change agricultural practices. For example, the demonstrated success of Xuzhou Wheat No. 31 in surviving a season of high water stress was the key to farmers' acceptance of the new crop variety.

Uncertainty about the long-term effectiveness of these activities remained. However, the process of collaborative testing made the risks, rationale, and likelihood of success fully transparent for the local farmers. Farmers' ability to assess these risks and make decisions accordingly was greatly increased, allowing them to take full ownership of the implemented activities.

Lesson 4: Create organizational structures and harness existing structures to strengthen continuous collaboration between stakeholders.

Box 1: Main achievements of project activities

- Project areas in Huaiyuan County (Anhui) weathered the devastating drought of 2009 practically unscathed due to the use of a resistant alternative crop variety.
- In Ningxia, 223 small-scale rainfall catchments were constructed with total water storage of over 15,000 m3, resolving drinking water shortages and mitigating drought.
- The Xinyi project area introduced water-stopping walls and sluice gates as an adaptive water-saving measure that increased water productivity from 1.14 kg to 1.5 kg/ per m3.
- Increase of agricultural outputs and restructuring of cropping mix greatly facilitated increase of farmer incomes. The average Per capita net income of farmers in the project area increased to 5138 yuan from 3,406 yuan at appraisal, accounting for 150.9% of that at appraisal.

In order to realize the full benefits of the farmer-scientist partnership, organizational structures to ensure continuous interaction between the two groups were needed. To organize farmers' collaboration with the scientific advisers and coordinate the experimentation activities and later implementation of full adaptation measures, the project supported the creation and expansion of farmer associations (FAs) and water users associations (WUAs). The SCCF project provided these associations with a clear function and responsibilities regarding the selection and implementation of proposed adaptation measures. More than 1,000 WUAs, 209 FAs, and 20 specialized farmer cooperatives were established under the overall IAIL3 project.

To ensure the continuous engagement of scientists, the IAIL3 project established Mobile Expert Teams (METs), comprising national scientists from the Chinese Academy of Sciences and Agriculture Science, as well as provincial and county experts from water and agriculture research institutes, to regularly provide expert assistance to the farmers on project activities. This guaranteed the constant involvement of scientific advisers in the implementation process, ensured the congruence of scientific data and on-the-ground activities and strengthened the crucial working partnership between farmers and scientists.

The project management team played a crucial role in facilitating the collaborative approach. It benefited from the existing organizational structure of China's longstanding CAD program. CAD units are established administrative bodies at the national, provincial, and county levels. Selected individuals within these CAD units that were already engaged in the IAIL3 project were selected to constitute the Project Management Office (PMO) for the *Mainstreaming Adaptation Project*. As part of the IAIL3 project, these individuals already received extensive training in project management, significantly strengthening individual and institutional capacity for project implementation and supervision. Through the SCCF project, the PMO staff received additional training on the conceptual and technical dimensions of climate change adaptation. The PMO thus became an effective interlocutor facilitating the farmer-scientist partnership and provided the project's organizational backbone for introducing climate change adaptation in the context of the SCCF project as well as the larger IAIL3 project.

Lesson 5: Following the lessons above can facilitate the mainstreaming of climate change adaptation into the broader political context, ensuring sustainability, replication, and scaling up.

The characteristics of the SCCF project made it into a vehicle for mainstreaming climate change adaptation into the large-scale CAD program: the vulnerability assessment illustrated climate change effects on the entire 3H basin; the testing of adaptation activities in representative locations demonstrated their feasibility and practicability; and the IAIL3 organizational structure, already deeply embedded in the CAD administration on all government levels, provided the direct connection to relevant government agencies.

Accordingly, the SCCF project was successful in introducing climate change considerations into the CAD program, changing the underlying assumptions that guide future CAD land improvement investments, and integrating climate change adaptation activities into ongoing CAD initiatives. The project helped streamline climate change adaptation into SOCAD's regular work and assisted the development of regulations and policies needed to mainstream adaptation in the CAD program. The SCCF and IAIL3 projects paved the way for introducing climate change adaptation into a new, full-fledged agricultural modernization project in additional six provinces that is now being prepared by the World Bank. They also catalyzed investment projects on the provincial level — in Anhui alone, climate change adaptation activities will be scaled up from 16 to 93 counties, extending the number of farmers who benefit from the activities from 1 to 31 million. A scaling up study (analysis on CC impact and their related adaptation measures) covering all key grain production regions in China has been completed to mainstream CC adaptation measures. The formulation of a climate change adaptation policy and action plan for the overall national comprehensive agricultural investment program is under way. An online climate change information and data platform has been established in SOCAD at the national level (assisted by CAS scientists) as well as the provincial level.

Conclusion

Facing a challenge that will unfold over decades, the implementation of adaptation activities today can only be the beginning. What will ultimately be more important than the installation of greenhouses or rainwater catchments is the project's contribution to changing local populations' fundamental approach to agricultural and water resources management practices in a context of climate change.

Through the SCCF and IAIL3 projects, communities are better informed about climate threats — but, more important, their ability to keep and raise that level of information and use it as a basis for future coping choices is increased. They are equipped with a toolkit of immediate instruments to protect their livelihood, and better prepared to expand this toolkit in accordance with changes in climatic circumstances and increased knowledge. This represents the beginning of an adaptive capacity that rural communities across the developing world will need in order to safeguard their livelihoods against the effects of global warming. The best response to climate change effects we can give today is to provide affected communities with the knowledge, support structures and, confidence to come up with an even better response tomorrow.