

# Legislation & Science: Radiance on the challenging path to sustainable groundwater management



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On 1<sup>st</sup> December 2021, the Chinese Ordinance on Groundwater Management (the [Ordinance](#) hereafter) will come into force. It took a decade for the Ordinance to be formulated, indirectly influenced by the 8 years Sino-Swiss cooperation on groundwater over-pumping. Such a lengthy drafting process comes to no surprise. In China, various pilots are needed to design a Law from a perspective of technological preparation, institutional arrangement, feasibility and sustainability of economical instruments, in addition to political and social considerations. This paper presents the core elements of the recently adopted Ordinance highlighting the institutional, technological and economical challenges and the contribution of the Sino-Swiss cooperation project.

## Institutional Challenges

Worldwide, the water sector suffers from a **lack of coordinated governance**. China is no exception. The water is said to be managed by “nine dragons”. This new ordinance is specifically trying to tackle the issue by clarifying the roles and responsibilities of the respective line ministries. For example, currently issues linked to groundwater resources quantity are under the administration of the China Geological Survey (CSG) in the Ministry of Natural Resources (MNR), while groundwater quality is the responsibility of the Ministry of Ecology and Environment (MEE). The use of groundwater as a potential geothermal energy is directly managed by local governments and the private sector. The overall groundwater management is, however, the responsibility of the local department of water resources in line with the comprehensive planning and coordination of the Chinese Ministry of Water Resources (MWR). Such an institutional set-up is the result of the historical strengths of each line ministry and their affiliated research academies.

The Sino-Swiss collaboration invested tremendous efforts on data-sharing between the Geological Survey department, electricity supply companies and the various water resources management departments at all levels of central, provincial and local government.

## Technological Challenges

In order to sustainably manage groundwater, **data on availability and extraction** has to be collected to model the resources. However, this would imply that all water wells are equipped with modern smart meters, which would correspond to around 8000 wells in the county of Guanto, where the Sino-Swiss project is located, and close to 1 million wells in the Hebei province. In addition to the cost of installing such a network of meters (each meter costs between CHF 700 and CHF 1'200), the operation and maintenance costs would make such an endeavour unrealistic.

Instead, the Swiss supported pilot project introduced an alternative and innovative approach: using electrical consumption as a proxy for the volume of water pumped. With solid pumping tests conducted in partnership with the local Hebei University, an average Electricity-to-Groundwater conversion factor for both shallow groundwater and deep groundwater was proposed for water management and later on promoted in the Hebei province.

## Economic Challenges

In the past decade, the central government has tested various **economic instruments** to ensure the sustainable management of groundwater resources, such as reforming the groundwater pricing system by introducing a fee and a tax on groundwater, or the popular water trading system that incorporates groundwater rights, quotas and limitations. Among these various instruments, the real-time groundwater model built by the Sino-Swiss project showed **fallow policy** to be the most effective one. Groundwater depletion is indeed mainly caused by the double cropping system of winter wheat and summer maize in the North China Plain. The government provided subsidies to farmers to fallow their land. A farmers' survey conducted during the project indicated that when governmental subsidy drops below a certain amount (300 CNY/mu, about 600CHF/ha), farmers are not willing any more to practice fallowing.

The Sino-Swiss project also carried out research on various scenario analysis for the sustainable agriculture production in the North China Plain, taking climate change into consideration.

In 2014, the Swiss Agency for Development and Cooperation (SDC) and the Ministry of Water Resources of the People's Republic of China co-launched the project [Rehabilitation and management strategies of over-pumped aquifers in a changing climate](#), in partnership with the China Geological Survey.

The leading project implementation partners on the China side was the General Institute of Water Resources and Hydropower Planning Design (GIWP), while the lead implementation partner on the Swiss side was the Swiss Federal Institute of Technology (ETH) Zürich.

For more information:

- **E-lectures** in English ([YouTube](#)) and Chinese ([Youku](#))
- **E-book** [Groundwater Overexploitation in the North China Plan: A Path to Sustainability](#), Kinzelbach, W., Wang, H., Li, Y., Wang, L. & Li, N. 2022.

