



Ensuring water resource security in China; the need for advances in evidence-based policy to support sustainable management



Gu Shuzhong^{a,*}, Alan Jenkins^{b,*}, Shi-Ji Gao^a, Yonglong Lu^c, Hong Li^{b,t}, Yuanyuan Li^d, Robert C. Ferrier^e, Mark Bailey^b, Yiwen Wang^f, Yuan Zhang^g, Xuebin Qi^h, Lili Yu^d, Liuqian Dingⁱ, Tim Daniell^{e,j}, Richard Williams^b, Jamie Hannaford^b, Mike Acreman^b, Stuart Kirk^k, Hongxian Liu^f, Zhengtao Liu^g, Liangguo Luo^l, Denghua Yan^m, Xuejun Liuⁿ, Fang Yu^o, Dong Wang^o, Bing Zhang^p, Aizhong Ding^q, Xiangrong Xie^r, Jing Liu^s, Chao Ma^e, Anita Jobson^b

^a Institute for Resource and Environmental Policies, Development Research Center of the State Council of the People's Republic of China, No.225 Chao Yang Men Nei Da Jie, Beijing 100010, PR China

^b Centre for Ecology & Hydrology, Maclean Building, Benson Lane, OX10 8BB, UK

^c Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, 18 Shuangqing Road, Haidian District, Beijing, 100085, PR China

^d General Institute of Water Resources and Hydropower Planning and Design, Ministry of Water Resources, Beijing Xicheng District, Liupukang Beixiaojie, No. 2-1 Zip: 100120, PR China

^e James Hutton Institute, Craigiebuckler, Aberdeen AB15 8QH, Scotland, UK

^f Development Research Centre of the Ministry of Water Resources, No.3 YuYuanTan South Road, Haidian District, Beijing, 100038, PR China

^g Chinese Research Academy of Environmental Sciences, 8 Dayangfang BeiYuan Road, Chaoyang District, Beijing 100012, PR China

^h Farmland Irrigation Research Institute, Chinese Academy of Agricultural Science and the Ministry of Water Resources, 380 East Hongli Road, Xinxiang City, Henan Province, 453003, PR China

ⁱ Research Centre on Flood and Drought Disaster Reduction, Institute of Water Resources and Hydropower Research, A-1 Fuxing Road, Haidian District, 100038, Beijing, PR China

^j Department of Animal and Plant Sciences, University of Sheffield, Western Bank, Sheffield S10 2TN, UK

^k Environment Agency, UK. currently on secondment to European Commission, DG Research and Innovation, Science Advisory Mechanism Unit, B-1049 Brussels, Belgium

^l Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences, 12 Zhongguancun South Street, Beijing, 100081, PR China

^m Department of Water Resources, China Institute of Water Resources and Hydropower Research, A-1 Fuxing Road, Haidian District, 100038 Beijing, PR China

ⁿ College of Resources and Environmental Sciences, China Agricultural University, 2 Yuanmingyuan W Rd., Beijing, PR China

^o Chinese Academy for Environmental Planning, No. 8, Da Yang Fang, Chaoyang District, Beijing, PR China

^p Nanjing University, 22 Hankou Rd, Gulou, Nanjing, Jiangsu, PR China

^q Beijing Normal University, 19 Xijiekou Outer St, Haidian, Beijing, 100875, PR China

^r Changjiang Institute of Survey, Planning, Design and Research, 1863 Jiefang Avenue, Wuhan, Hubei, PR China

^s Institute of Agricultural Economics and Development, Haidian District, Beijing Zhongguancun South Street, 100081, PR China

^t Lancaster Environment Centre, Lancaster University, Library Avenue, Lancaster University, Lancaster LA1 4YQ, UK

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ABSTRACT

China currently faces a water resource sustainability problem which is likely to worsen into the future. The Chinese government is attempting to address this problem through legislative action, but faces severe challenges in delivering its high ambitions. The key challenges revolve around the need to balance water availability with the need to feed a growing population under a changing climate and its ambitions for increased economic development. This is further complicated by the complex and multi-layered government departments, often with overlapping jurisdictions, which are not always aligned in their policy implementation and delivery mechanisms. There remain opportunities for China to make further progress and this paper reports on the outcomes of a science-to-policy roundtable meeting involving scientists and policy-makers in China. It identifies, in an holistic manner, new opportunities for additional considerations for policy implementation, continued and new research requirements to ensure evidence-based policies are designed and implemented and identifies the needs and

* Corresponding authors.

E-mail addresses: gsz@drc.gov.cn (G. Shuzhong), jinx@ceh.ac.uk (A. Jenkins).

opportunities to effectively monitor their effectiveness. Other countries around the world can benefit from assessing this case study in China.

1. Introduction

Globally, the issue of insufficient future water resource availability (here defined as the difference between rainfall and water use with no assumption included for environmental allocation) has been highlighted as being critical in several regions (Gleick, 2003) and this has been linked to potential fears around global food security (Hanjra and Qureshi, 2010). In China, the concerns over future sustainability of current water use continue to grow (Fant et al., 2016; Zuo and Liu, 2015) as a result of increased pressure from population growth, which is becoming increasingly urbanised (Gong et al., 2012), and climate change (Piao et al., 2010). In addition to the potential lack of an adequate quantity of water, there is evidence of growing problems related to water quality, largely resulting from sewage treatment discharges, industrial outfalls and agricultural sources (Tao and Xin 2014; Lu et al., 2015a). This is despite the ambition in the most recent, 13th Plan for Science and Innovation, which states, as one of 5 targets, the aim that ‘Ecological environment be improved with green, low carbon production and life style, cutting pollution and carbon emissions as well as use of energy, water, land and mineral resources’ (People’s Republic of China, 2016).

To achieve the challenging ambition set by this target, there are many opportunities that need to be considered, including: the potential management options for dealing with this looming water crisis, the potential policy solutions that are available and can be implemented, potential changes to policy implementation and opportunities for China to take advantage of the issues and solutions that have been implemented elsewhere. At a unique roundtable meeting held in Beijing in March 2016, the possibilities for enhancing science/evidence-based policy-making and implementation with respect to water resource protection and water use in China were examined by senior Chinese policy makers from a wide range of ministries and scientists from China and the UK. Here we summarise the current and ongoing issues around water resources policy development in China and present the conclusions of the roundtable as a series of recommendations for further policy development to help deliver sustainable water resource availability and ensure water security in China. The issue of current and future water security and its ‘solution’ in China has clear relevance to countries around the world.

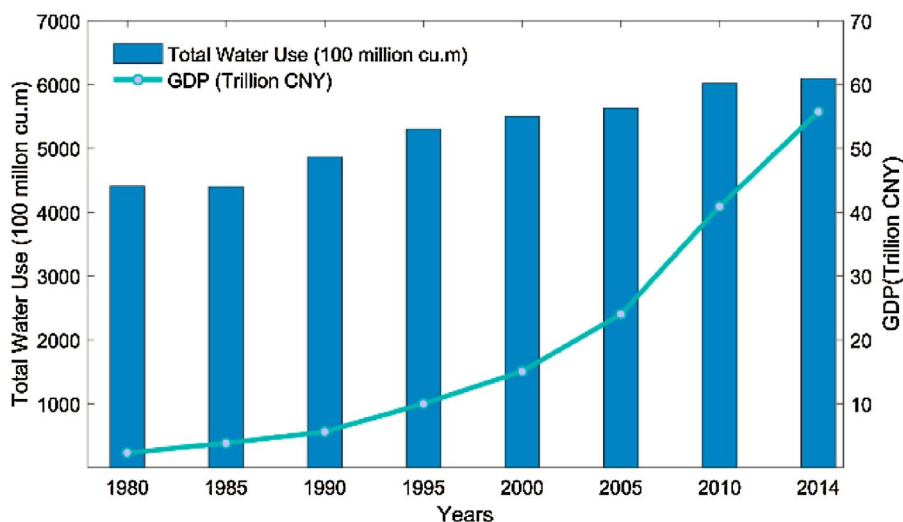


Fig. 1. Total water use and GDP (price base year of 2010) in China since 1980 (data source: General Institute of Water Resources and Hydropower Planning and Design, Ministry of Water Resources, unpublished).

2. The current water situation in China

China is a rapidly changing country with the largest population in the world and prestigious industrial and economic growth. Water resources are abundant, but the per capita water resources equate to only 2100 m³ compared to a global average of 7342 m³, leading to a ranking of 125th in the world (Global Water Partnership, 2015; The World Bank, 2016). Nationally, the total water use has risen by almost 150 billion m³ since 1980 and this possibly reflects the sharp and dramatic increase in GDP over the same period (Fig. 1). An expanding population, increasing urbanisation and changing lifestyles all contribute to the increase in water resource use (Lu et al., 2015a,b).

There also exists a significant difference in the hydrological regime regionally from south to north across China. This uneven distribution of water resources in China presents a major challenge because spatial patterns of water availability do not match those of water resources demand and economic and social development. Currently, 47% of the total national population are located in northern areas (Fig. 2) where agriculture use accounts for 65% of land area and GDP is 45% of national total, but only 19% of national water resources are available. In the south, population is 53% of the total national population, agriculture accounts for 35% of the land area GDP is 55% of the national figure and water resources are 81% of the national available. As a result, significant engineering schemes have been instigated to transfer water from the south to the north, but their ultimate success remains a question (Barnett et al., 2015).

3. Current water policy in China

By 2030 it has been estimated that China’s total available water resource availability will be 619 billion m³, which falls significantly short of the projected aggregate demand of 818 billion m³—a deficit of 25% (2030 Water Resources Group, 2009). At this time, 8 of 10 major water basins will experience water shortages. Agriculture is the largest water use sector in China, currently consuming an estimated 65% of total water resources and although this is likely to reduce to c. 50% by 2030, the overall water resources deficit will increase if action to improve the situation is not taken and food production is to be increased (2030 Water Resources Group, 2009). To address these issues, there is a wide range of water policy from high-level national policy to administrative laws and regulations and regulatory documents and rules

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