DROUGHT CONDITIONS AND MANAGEMENT STRATEGIES IN CHINA

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Background

Drought in China is the most severe natural disaster for socioeconomic development and natural ecosystem due to the domination of typical East Asian Monsoon climate. The temporal-spatial distribution of annual precipitation induces a 26.7% of national land territorial area to arid and semiarid climate in northwestern China where drought is normal and frequent. Besides that, there exist spring drought in northern China and summer drought in southern China temporally, and drought/flood seesaw between south and north China spatially.

In recent decade, under the scenario of global climate change, China had suffered a serious of extreme droughts, such as spring-summer drought in northern China in 2000 and 2001, spring drought in Yunnan in 2005, spring-summer drought in Sichuan an Chongqing in 2006, summer drought in southern China in 2007, summer drought in Chongqing in 2008, spring-summer drought in five southwest provinces in 2010, etc. it is obviously that drought in China occurred extension trend to south and southwest region where has humid climate, and significant increment in frequency and strengthen.

Such drought occurrences had induced the livelihoods difficulty and socioeconomic losses, particularly in the agricultural, industrial and ecological sectors. In past decade (2000~2012), droughts hit 22.29 million hectares (18% of cultivated land) of cropland annually, and resulted in a grain losses up to 30.83 billion kilograms (6% of gross production), 24.75 million people and 16.62 million livestock had difficulty to drinking water (The State Flood Control and Drought Relief Headquarters, 2012). The rural area is the most drought-prone area, and the rural poor are the most vulnerable group to drought.

Drought monitoring and early warning systems

National meteorology service has built the long-term meteorological monitoring network for temperature, precipitation, relative humidity, wind's speed and soil moisture observation and assessment. In recent years, the significant progress has been made on the application of satellite remote sensing for regional drought monitoring. China Meteorological Administration (CMA) has developed the national drought grading indices, early warning and assessment systems. Based on national meteorology service,

China Climate Observation System(CCOS, Beijing) and Arid Climate Observation System (ACOS, Lanzhou), the National Center for Arid Climate Monitoring and Warning (NCACMW) has built a unified, responsive, and efficient drought warning system, include drought warning model, numerical weather prediction model, disaster assessment criteria and decision management. Currently, the daily report of soil moisture monitoring, real-time report of integrated agricultural drought monitoring, and weekly report of agricultural drought forecasting are released nationwide accordingly.

National water resource service has set up the hydrological monitoring network for ground water table, rivers and lakes water levels, water flow discharge, rainfall, evaporation and soil moisture. The drought monitoring report is released bases on the precipitation anomaly index.

China Flood Control and Drought Relief Headquarters organized national departments of meteorology, water, agriculture and civil administration to implement the drought reduction, mitigation and relief by joint effort. As a result, data exchange and disaster consultation mechanism have existed between meteorological department and water resource department, so that the two departments should cooperate in joint drought monitoring and early warning.

Vulnerability assessment

Drought delivers negative impacts on almost all socioeconomic sectors in China. In view of the importance to socioeconomic development, the vulnerable ranks of the sectors are food production, clean drinkable water, forestry and grassland production, industry, service, hydraulic power, water carries and environment.

“Depend on heaven for food” describes the agricultural circumstance in China. However, agriculture and food production have been the most vulnerable sector to drought. For example, drought in 2000 covered, affected and destroyed 40.54, 26.78 and 8.01 million hectares of crops respectively, and consequently induced 60 million tons of grain losses (over 10% of gross). In 2001, the grain losses also reached 55 million tons.

Since 2010, drought-prone area and grain losses have shown a decrement trend (figure 1) due to drought-prone area has been shifting to southwestern China, where less cropland and grain production. But the national number of population and livestock head in difficulty of accessing drinkable water has been maintaining stable by 33.33 million and 24.41 million respectively (figure 2).

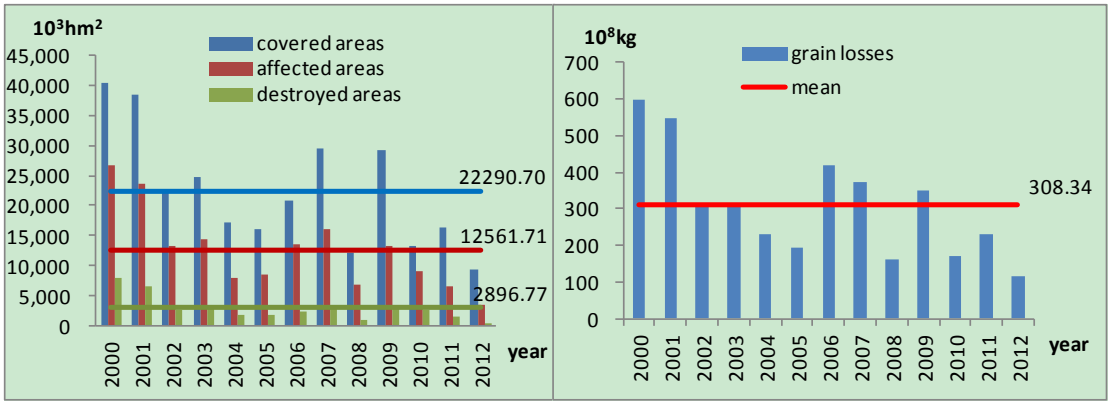

Figure 1. Drought covered, affected and destroyed crop areas, and grain losses.

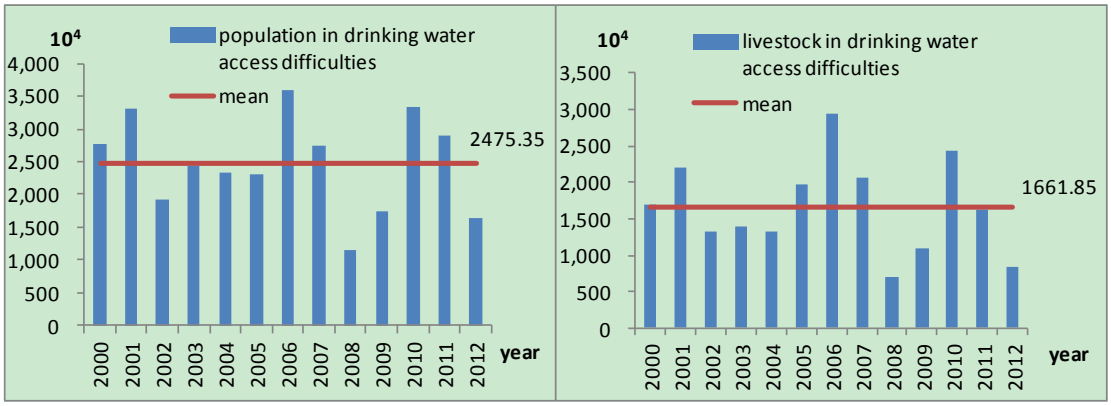

Figure 2. Population and livestock in drinking water access difficulties

In 2010, according to the Bulletin of Drought and Flood Disaster issued by the State Flood Control and Drought Relief Headquarters, severe drought caused 150.92 billion RMB (about 23.6 billion USD) of national immediate economic losses, in which of five provinces in southwestern China accounted to 98.20 billion RMB (15.3 billion USD), almost 2/3 of the total and 2.1% of local GDP. Drought in the region also induced 4.36 million tons of grain losses, 12.97 million population of suffering from temporal food shortage, 394.67 thousand hectares of cash crop destroyed, and 20.15 billion RMB of accordingly economic losses. Meanwhile, the number of population and livestock head in drinking-poverty accounted to 70.0% and 66.6% of the whole nation respectively. 14.22 million people in small villages had to transport daily life water by human or animal from several to dozens of kilometers for more than half year.

Drought impacts on forestry and grassland are not only the production, but also the risk increment to fire. For other sectors, the major impacts are reducing the capacity of production or service.

Emergency relief and drought response

There are numbers of types used for disaster relief in China, include central and local government disaster relief fund, reinsurance and commercial insurance, as well as public donation, etc.

The central and local government responds the major duties for emergency relief through the relief fund. The local government should mainly dominate the emergency relief following the principle of hierarchical duties and responsibilities. Regarding the different natural disasters, with the framework of mutual coordination lead by Ministry Civil Affairs (MCA) with Ministry of Finance (MOF) and the National Reform and Development Commission (NDRC), the central finance arranges the special relief fund for extreme disasters based on the actual expenditure last year follow the Budget Law.

Beside the relief fund, emergency goods and materials, such as drinking water, food, cash, seeds, forages, agricultural machines, substances for drought resistance, technologies for disaster reduction, and technical trainings, are delivered by government. The drought resistant allowances are used for maintaining the least living stand and restoring agricultural production.

As a complement of drought relief in food production, the agriculture insurance has been pushed forward from policy making discussion (2004) to legislation (2012). From 2007 to 2011, a total 26.21 billion RMB had been paid by central finance for agricultural insurance premium subsidy. Meanwhile, the commercial insurance had been developed for agricultural disaster relief by using the insurance premium subsidy. The advanced Weather Index methodology for agricultural insurance had been developed and applied by IEDA of CAAS, which supported and cooperated with WFP and IFAD.

The emergency relief system is cost but effective to recovery from disaster rapidly.

Practices to alleviate drought impacts

Governments take the major responsibilities for alleviating drought impacts in concerted effort following regulation guidance implement. The **Emergency Plan**s for national meteorological disasters, national disaster relief and reduction, major agricultural natural disasters, and National Flood Control and Drought Contingency Plan have been issued by relative departments.

Meteorological department responds to monitor and forecast the drought occurrence and operate artificial precipitation in time. Agricultural and forestry departments guide drought management technology to promote production. Water department responds to allocate water supply for irrigation and drinking based on soil moisture analysis. Health department takes measures to prevent and cope with the public health emergencies caused by drought in drinking water safety. Civil administration prepares rescuers and relief goods, and provides essential living relief.

Since 2008, an effort of drought reduction and mitigation for food production has been launched by technology subsidies. The central government arranges certain budget annually for winter wheat drought prevention by applying the 1 spray for 3 preventions technology, i.e. spray mixed liquid (pesticide, fungicide, plant regulator, leaf feed and micro-element fertilizer) once, prevent pests and diseases, dry/hot wave, and lodging. Such effort aims at reducing losses from various natural and biological disasters, and functions positively.

The need for knowledge and skills on drought management

Consequently, effective leadership of government in China plays key roles in ensuring essential living condition for vulnerable population, reducing drought impacts, and recovering production. But current drought management focuses on emergency rather than pre-preparation management, such as lack of drought risk assessment and drought insurance products.

Since drought emergency and development takes a relative long duration, the hazardous impacts of drought on socioeconomic sectors are very often blanked or ignored. Therefore, the awareness of drought risk and its management should be strengthened. Historical drought scenarios and real-time occurrences, drought-prone-object based monitoring and risk assessment are essential knowledge bank, but still weak and need to be well developed.

Furthermore, information, knowledge and experience exchange and sharing should be improved among meteorological, water, agricultural, civil administration and health department, so that the integrated assessment, early warning and preparation mechanism should be perfected to improve drought risk management, and provide accurately and timely service for drought reduction, mitigation and relief.

References:

He Hui. 2010. China gauging station network. *Advances in Water Science*, 4(005):460-465.

Ju W. M, Sun Han, Tang Zhicheng. 1996. Application of meteorological satellite remote sensing to drought monitoring. *Journal of Catastrophology*, 11(4):25-29.

Kuang Zhaomin, Zhu Weijun, Ding Meihua, Tan Zongkun, Sun Han. 2007. Application of Multi-sources Satellite Data in Monitoring Sugarcane Droughts. *Chinese Journal of Agrometeorology*, 28(1):93-96.

Lin N, Tang J. 2001. Study on the environmental evolution and the causes of desertification in arid and semiarid regions in China. *Scientia Geographica Sinica*, 21(1): 24-39.

Oron G, Campos C, Gillerman L, et al.1999. Wastewater treatment, renovation and reuse for agricultural irrigation in small communities[J]. *Agricultural Water Management*, 38(3): 223-234.

Qiu Haijun, Cao Mingming, Hao Junqing, Wang Yanlin, Wang Yanmin. 2013. Relationship Between Frequency and Magnitude of Drought Damage in China in 1950-2010. *Science Geographica Sinica*, 33(005):576-580.

The State Flood Control and Drought Relief Headquarters，Ministry of Water Resources of People's Republic of China. 2010. *Bulletin of Flood and Drought Disasters in China*.

The State Flood Control and Drought Relief Headquarters，Ministry of Water Resources of People's Republic of China. 2012. *Bulletin of Flood and Drought Disasters in China.*